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MINNESOTA POLLUTION CONTROL AGENCY
520 Lafayette Road North
St. Paul, MN 55155-4194

Notice of Availability of Final Supplemental Environmental Impact Statement

Burnsville Sanitary Landfill Expansion Project

Doc Type: Public Notice

Public comment information

DSEIS public comment period begins: December 7, 2021

DSEIS public comment period ends: 4:30 p.m. on December 24, 2021

Notice published in the EQB Monitor: December 7, 2021

Facility specific information

Facility name and location:
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2650 West Cliff Road
Burnsville, MN 55337
952-656-5003
888-960-0008

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MPCA contact information

MPCA contact person:

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Resource Management and Assistance Division
Minnesota Pollution Control Agency
520 Lafayette Road North
St. Paul, MN 55155
Phone: 651-757-2746
Email : steve.sommer@state.mn.us

Admin staff phone: 651-757-2098

General information

The Minnesota Pollution Control Agency (MPCA) is distributing this Burnsville Sanitary Landfill (BSL) Final Supplemental Environmental Impact Statement (FSEIS) for review and comment pursuant to the Environmental Quality Board (EQB) rules. Interested persons may submit written comments on the adequacy of the BSL FSEIS during the comment period. Following the comment period, the MPCA Commissioner will make a determination of adequacy decision regarding the BSL FSEIS.

An electronic version of the BSL DSEIS is available on the MPCA Environmental Review webpage at https://www.pca.state.mn.us/regulations/projects-under-mpca-review.

Description of proposed project

The BSL is a mixed municipal solid waste (MMSW) disposal facility that is proposing to increase its capacity by approximately 23.6 million cubic yards by reconfiguring its existing waste limits and raising the top elevation of the landfill. This proposed BSL expansion project (Project) requires preparation of a mandatory Environmental Impact Statement (EIS) under Minnesota Rules (Minn. R.) 4410.4400 subp. 13.E. because it would be an expansion by 25% or more of previous capacity of a MMSW land disposal facility for 100,000 cubic yards or more of waste fill per year.

The BSL has undergone previous environmental review, which included preparation of EISs in 1981, 1991 and 2005. The MPCA, as the designated Responsible Governmental Unit (RGU) for environmental review for the Project, has determined that a Supplemental Environmental Impact Statement (SEIS) may be prepared because the Project is a phased action of the existing landfill, pursuant to Minn. R. 4410.3000 subp. 3(C).

To submit written comments on the adequacy of the BSL FSEIS

Written comments on the BSL FSEIS must be received by the MPCA contact person within the comment period listed above.

NOTE: All comment letters are public documents and will be part of the official public record for this project.

Determination of BSL FSEIS adequacy

The MPCA Commissioner will consider the public's comments when making a determination of adequacy on the BSL FSEIS. The MPCA will notify all persons receiving copies of the BSL FSEIS of its adequacy decision. Public notice of the decision will also be published in the EQB Monitor.

MINNESOTA POLLUTION CONTROL AGENCY

520 Lafayette Road North | St. Paul, Minnesota 55155-4194 | 651-296-6300

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December 7, 2021

TO: INTERESTED PARTIES

RE: Final Supplemental Environmental Impact Statement for Burnsville Sanitary Landfill Expansion Project

The Minnesota Pollution Control Agency (MPCA) has prepared a Final Supplemental Environmental Impact Statement (FSEIS) for the Burnsville Sanitary Landfill (BSL), Dakota County, Minnesota. The BSL FSEIS includes responses to timely substantive comments on the BSL Draft Supplemental Environmental Impact Statement (DSEIS).

The BSL FSEIS is a revised version of the BSL DSEIS, which was published in the Environmental Quality Board (EQB) Monitor on June 1, 2021. Additions to the BSL DSEIS are underlined and deletions are shown as a ~~strikethrough~~. The following table describes the DSEIS revisions:

REVISIONS TO BSL DSEIS	
REVISION	**REASON**
Updated the Table of Contents	To reflect the new attachments to the FSEIS.
Copied a sentence from section 6.1.3.7 into section 1.1.2.1. Regarding new waste on top of the existing unlined waste at BSL may impede any future corrective action.	To highlight this information in the summary.
Added language to sections 1.1.2.4 and 6.4.2.2 to identify potential mitigation measures for the Project's visual impacts.	Required by BSL SEIS Scope for impacts that have the potential for adverse effects.
Added language to sections 1.1.2.6 and 6.6.3 regarding additional Federal Aviation Administration information gathered since publication of the BSL DSEIS regarding blinking lights.	To respond to comments received on BSL DSEIS.
Added language to the end of section 1.1.2.7 to identify MPCA's preferred choice among project alternatives.	Required by EQB Rules.
Added language to sections 1.4 and 6.0 to identify that Attachment J has been added to the BSL FSEIS.	To identify the new BSL FSEIS attachment regarding Environmental Justice.
In section 4.0, List of Governmental Approvals, changed status of BSL's Industrial Stormwater Permit (ISW) from "issued" to "Application forthcoming".	The original statement indicating that an ISW permit was issued was an error in the BSL DSEIS. BSL currently holds an Industrial Stormwater permit for its current operation and does not hold a permit for the proposed alteration of the landfill (i.e., its proposed Project). The proposed alteration of the footprint of the sanitary landfill and the increase of elevation above 820 feet are not currently permitted under MNR0539WY, as this proposed project is currently undergoing the environmental review process. BSL must apply for a permit modification 180 days prior to beginning the

REVISIONS TO BSL DSEIS	
REVISION	**REASON**
	Project and only apply after the environmental impact statement is deemed adequate in order to change the historical footprint of the sanitary landfill or to exceed the height of 820 feet above mean sea level, which would impact the management of stormwater on site.
In section 4.0, List of Governmental Approvals, corrected the name of the permit that BSL's Project requires from the Lower Minnesota River Watershed District.	To correct an error in the BSL DSEIS.
Revised Figure 6-4 in section 6.2.2.2 to identify the landfill levee location and the 100-year floodplain elevation at BSL (pre-Project).	To respond to a comment received on the BSL DSEIS.
Revised Figure 6-5 in section 6.2.2.2 to identify the landfill levee location and the 100-year floodplain elevation at BSL (post-Project).	To respond to a comment received on the BSL DSEIS.
Changed the term "floodway fringe" to "flood fringe" in section 6.3.2.	To respond to a comment received on the BSL DSEIS.
Added section 6.6.5 to provide information regarding wildlife and natural features in the BSL Project area.	To respond to a comment received on the BSL DSEIS.
Added section 6.6.6 to provide information regarding cultural resources in the BSL Project area.	To respond to a comment received on the BSL DSEIS.
Added Attachment J (Environmental Justice) to explain how the MPCA determined that the BSL Project area is an area of concern for environmental justice. Introduced Attachment J into the FSEIS in sections 1.4 and 6.0	To respond to comments received on the BSL DSEIS.
Added Attachment K (DNR Natural Heritage Letter) to provide information regarding wildlife or other significant natural features in the BSL Project area. Introduced Attachment K into the FSEIS in section 6.6.5.	To respond to comment received on the BSL SEIS.
Added Attachment L (Cultural Resources Management – Phase I Investigation) to provide information regarding cultural resources in the BSL Project area. Introduced Attachment L into the FSEIS in section 6.6.6.	To respond to comment received on the BSL SEIS.
Added Attachment M (Transcript of public comments received at BSL DSEIS June 23, 2021 public meeting).	BSL FEIS is required to include public comments on the BSL DSEIS.
Added Attachment N (Response to public comment received at BSL DSEIS June 23, 2021 public meeting).	BSL FSEIS is required to include MPCA responses to public comments on BSL DSEIS.
Added Attachment O (Written Public Comments on BSL DSEIS).	BSL FEIS is required to include public comments on the BSL DSEIS.
Added Attachment P (Response to Written Public Comments on BSL DSEIS).	BSL FSEIS is required to include MPCA responses to public comments on BSL DSEIS.

The complete BSL FSEIS can be found at https://www.pca.state.mn.us/regulations/projects-under-mpca-review.

The FSEIS was prepared in response to BSL's proposal to increase its capacity by approximately 23.6 million cubic yards by reconfiguring its existing waste limits and raising the top elevation of the landfill. This proposed BSL expansion project (Project) requires preparation of a mandatory Environmental Impact Statement (EIS) under Minnesota Rules (Minn. R.) 4410.4400 subp. 13.E. because it would be an expansion by 25% or more of previous capacity of a mixed municipal solid waste land disposal facility for 100,000 cubic yards or more of waste fill per year. BSL is located at 2650 Cliff Road West, Burnsville, Dakota County, Minnesota.

During the BSL SEIS preparation process, the MPCA identified potential additional Project impacts and/or information needs that must be addressed during the course of permitting/Project decision making, but are beyond what is legally required to be included in the SEIS by the Final Scoping Decision Document (Scope) adopted by the MPCA on September 30, 2019. Although not legally required to be included in the FSEIS, the MPCA is providing this information (Future Permitting Needs Document) as Attachment I of the FSEIS. The purpose of Attachment I is to identify those additional potential Project issues and information needs and describe how they will be addressed and resolved by the MPCA during the Project's permitting process.

A public notice of the availability of the BSL FSEIS is being published in the EQB Monitor on December 7, 2021, pursuant to Minn. R. 4410.2700, subps. 4-6. Pursuant to Minn. R. 4410.2800, subp. 2, publication of the public notice begins a public review period during which any person may submit comments on the adequacy of the FSEIS to the MPCA. Comments on the FSEIS must be submitted to the MPCA before 4:30 p.m. on December 24, 2021.

Please send any comments on the adequacy of the FSEIS to Steve Sommer, MPCA, 520 Lafayette Road, St. Paul, MN 55155, or steve.sommer@state.mn.us.

The MPCA Commissioner will consider the BSL FSEIS and all timely, substantive comments received, prior to making a Determination of Adequacy on the BSL FSEIS. The MPCA will notify all persons receiving copies of the BSL FSEIS of its adequacy decision. In addition, the adequacy decision will be published in the EQB Monitor.

Sincerely,

Dan R. Card

This document has been electronically signed.

Dan R. Card, P.E.
Supervisor
Environmental Review Unit
Resource Management & Assistance Division

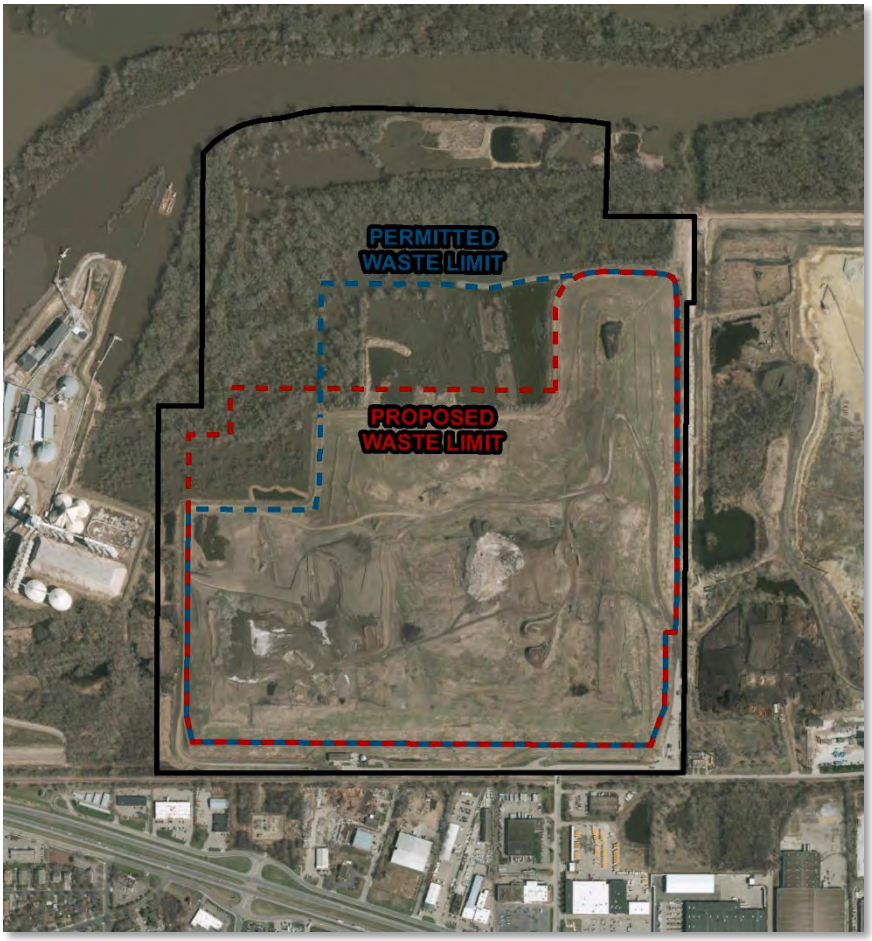
DRC: mb/rs

Burnsville Sanitary Landfill

Expansion Project

FINAL SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT

DECEMBER 2021



Burnsville Sanitary Landfill, Inc.

MINNESOTA POLLUTION CONTROL AGENCY

Cover Sheet

(1) **RGU:** **Minnesota Pollution Control Agency**

(2) **Project Title:** **Burnsville Sanitary Landfill Expansion Project**

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Mike Miller, Senior District Manager
2650 West Cliff Road
Burnsville, Dakota County, Minnesota 55337
Phone: (952) 656-5014

(5) **Final Supplemental Environmental Impact Statement (FSEIS)**

Abstract

(6) **The Burnsville Sanitary Landfill (BSL) is a mixed municipal solid waste (MMSW) disposal facility that is proposing to increase its capacity by approximately 23.6 million cubic yards by reconfiguring its existing waste limits and raising the top elevation of the landfill. This proposed BSL expansion project (Project) requires preparation of a mandatory Environmental Impact Statement (EIS) under Minnesota Rules (Minn. R.) 4410.4400, subp. 13.E. because it would be an expansion by 25 percent or more of previous capacity of a MMSW land disposal facility for 100,000 cubic yards or more of waste fill per year.**

The BSL has undergone previous environmental review, which included preparation of EISs in 1981, 1991 and 2005. The Minnesota Pollution Control Agency (MPCA), as the designated Responsible Governmental Unit (RGU) for environmental review for the Project, has determined that a supplemental environmental impact statement (SEIS) may be prepared because the Project is a phased action of the existing landfill, pursuant to Minn. R. 4410.3000, subp. 3(C).

(7) **FSEIS comments deadline date: December 24, 2021**

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ACRONYMS/ABBREVIATIONS

Acronyms/Abbreviations	Definition
ADA	Annex Development Area
AGL	Above Ground Level
AUF	Airspace Utilization Factor
BSL	Burnsville Sanitary Landfill
C&D	Construction and Demolition
CFR	Code of Federal Regulations
CH4	Methane
CO2	Carbon Dioxide
CO	Carbon Monoxide
CSW	Construction Stormwater
DEIS	Draft Environmental Impact Statement
DNR	Minnesota Department of Natural Resources
DWPOD	Drinking Water Protection Overlay District
DWSMA	Drinking Water Supply Management Areas
EGU	Electric Generating Units
EIS	Environmental Impact Statement
EPA	Environmental Protection Agency
ET	Evapotranspiration
FEIS	Final Environmental Impact Statement
FIS	Flood Insurance Study
GCCS	Gas Collection and Control System
GCL	Geosynthetic Clay Liner
GES	Graham Environmental Services
GHG	Greenhouse Gas
GIA	Groundwater Impacts Analysis
HAP	Hazardous Air Pollutants
HERC	Hennepin Energy Recovery Center
HDPE	High Density-Polyethylene
HRL	Health Risk Limit
IL	Intervention Limit
KSL	Keystone Sanitary Landfill

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ACRONYMS/ABBREVIATIONS

Acronyms/Abbreviations	Definition
LandGEM	Landfill Gas Emissions Generation Model
LFG	Landfill Gas
LLDPE	Linear-Low Density Polyethylene
KMM	Kraemer Mining Materials
MAAQS	Minnesota Ambient Air Quality Standards
MAC	Metropolitan Airports Commission
MCES	Metropolitan Council Environmental Services
MCL	Maximum Contaminant Level
MDH	Minnesota Department of Health
MMSW	Mixed Municipal Solid Waste
MPCA	Minnesota Pollution Control Agency
MPH	Miles per Hour
MRQ	Minnesota River Quadrant
MSL	Mean Sea Level
N2O	Nitrous Oxide
NAAQS	National Ambient Air Quality Standards
NESHAP	National Emission Standards for Hazardous Air Pollutants
NDA	North Development Area
NMOC	Non-Methane Organic Compounds
NO2	Nitrogen Dioxide
NOx	Nitrogen Oxides
NPDES	National Pollutant Discharge Elimination System
NSPS	New Source Performance Standards
NWL	Normal Water Level
OCP	Odor Control Plan
PFAS	Polyfluoroalkyl Substances
PM	Particulate Matter
$PM_{2.5}$	Particulate matter less than 2.5 microns in diameter
PM_{10}	Particulate matter less than 10 microns in diameter

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ACRONYMS/ABBREVIATIONS

Acronyms/Abbreviations	Definition
PSA1	Park Search Area 1
PSI	Pounds per Square Inch
PTE	Potential to Emit
PUD	Planned Unit Development
RCRA	Resource Conservation and Recovery Act
RDF	Refuse-Derived Fuel
REC	Recycling Energy Center
RGU	Responsible Governmental Unit
ROD	Restriction on Disposal
SCFM	Standard Cubic Feet per Minute
SDS	State Disposal System
SO2	Sulfur Dioxide
SEIS	Supplemental Environmental Impact Statement
TCMA	Twin Cities Metropolitan Area
USACE	U.S. Army Corps of Engineers
VOC	Volatile Organic Compounds
WCA	Wetland Conservation Act

1.0 SUMMARY

The Burnsville Sanitary Landfill (BSL) is a mixed municipal solid waste (MMSW) land disposal facility that is proposing to increase its capacity by approximately 23.6 million cubic yards by reconfiguring its existing waste limits and raising the top elevation of the landfill. This proposed BSL expansion project (Project) requires preparation of a mandatory Environmental Impact Statement (EIS) under Minnesota Rules (Minn. R.) 4410.4400 Subp. 13.E. because it would be an expansion by 25% or more of previous capacity of a MMSW land disposal facility for 100,000 cubic yards or more of waste fill per year.

The BSL has undergone previous environmental review, which included preparation of EISs in 1981, 1991 and 2005. The Minnesota Pollution Control Agency (MPCA), as the designated Responsible Governmental Unit (RGU) for environmental review for the Project, has determined that a Supplemental Environmental Impact Statement (SEIS) must be prepared because the Project is a phased action of the existing landfill, pursuant to Minn. R. 4410.3000 Subp. 3(C).

The content of this SEIS was prepared in accordance with Minn. R. 4410.2300 and fulfills all scope and analysis requirements documented in the September 30, 2019, Final Scoping Decision Document adopted by the MPCA.

Specifically, this Summary section presents major findings, including impacts from the Project and mitigation measures, areas of controversy, and issues to be resolved. Subsequent sections 2 through 7 present more detailed information and analysis applicable to the following specific topics listed in the Final Scoping Decision Document:

Section 2	List of Preparers
Section 3	Project Description
Section 4	List of Government Approvals
Section 5	Waste Volume and Composition
Section 6	Environmental Impacts
Section 7	Alternatives

1.1 Major Findings

1.1.1 Waste Volume and Composition

The following major findings were identified during analysis of the waste volume and composition associated with the Project:

1.1.1.1 Waste Volume

- The proposed additional capacity resulting from the Project is 23.6 million cubic yards, which includes the waste materials, daily, intermediate, and final cover soils. The cover soils constitute a volume of approximately 500,000 cubic yards, which means the amount of

airspace (i.e., volume of space within the landfill) available for waste disposal is 23.1 million cubic yards.

- The number of tons of waste that can be disposed within a given volume of airspace is dependent upon the density of the waste materials. For the purposes of this SEIS, a long-term average value of 0.95 tons per cubic yard is used as a representative density for the entire landfill. Using a value of 0.95 tons per cubic yard results in total of approximately 21.9 million tons of waste that will fit in the additional capacity provided by the Project.

1.1.1.2 Waste Composition

- A waste characterization study of the MMSW being delivered to BSL was conducted during December 2019. The study included sorting and categorizing the materials present in the waste. The different material types were weighed and the relative percent of the total sample was recorded for each material. The table below lists the percent by weight of each major waste type.

Table 1-1
MMSW Composition Summary

Material Category	Percent of Total Weight
Paper	13.03%
Plastic	14.92%
Household Hazardous Waste	0.18%
Metal	3.59%
Glass	1.91%
Electronics	1.60%
Organics	49.13%
Other Wastes	15.64%

20.35% of this material is recyclable and 49% is organic that could be composted. 69% of the landfilled material could be recovered if it were not discarded as trash. Additional description of the waste characterization study and a detailed breakdown of specific materials in each waste category are presented in Section 5.2 of this SEIS.

1.1.2 Environmental Impacts and Mitigation Measures

1.1.2.1 Groundwater Impacts

The following major findings were identified during the analysis of groundwater impacts associated with the Project:

- Groundwater Monitoring during the period from 2014 through 2019 has not identified impacts to groundwater for the monitored parameters (as per the 2015 permit modification) resulting from the BSL. Manganese detections above the Intervention Limit (IL) and Health

Risk Limit (HRL) have been detected at both upgradient and downgradient monitoring wells and appear to be related to naturally occurring manganese and/or background concentrations. There were no other IL exceedances reported during the monitoring period. Sporadic detections of Volatile Organic Compounds (VOCs) have been observed at concentrations lower than applicable ILs.

- As part of the solid waste permitting process, the MPCA will require that BSL update its groundwater Sampling and Analysis Plan to include current standard parameters and monitoring limits based on Minnesota Department of Health (MDH) HRLs or similar health standards, as appropriate, and evaluate additional contaminants of concern for potential inclusion into BSL's permit. The specific contaminants of concern that will be evaluated during the permitting process may include per- and polyfluoroalkyl substances (PFAS) and 1,4-dioxane. Additional permitting requirements include identifying contingency actions to be taken if groundwater impacts are detected, as well as establishment of financial assurance that will provide funding for contingency actions and/or mitigation activities.

- Predictive modeling indicates the potential for the water table to be in contact with the base of the unlined area at BSL if dewatering at the neighboring Kraemer Mining and Materials quarry ceases in the future. Potential groundwater quality impacts associated with this condition are unknown at least in part due to plans for the future quarry lake being unknown. However, water level monitoring at BSL has shown the water table periodically exceeds the base elevation of the unlined area during periods of flooding on the Minnesota River, and no significant changes in groundwater quality are evident for the monitored parameters following flood events. The proposed Project does not change the depth or span of the unlined area relative to currently permitted conditions, so the Project would not result in increased potential for impacts from the unlined area related to future water table conditions. <u>However, if future groundwater monitoring indicates corrective action is needed related to the unlined area, having new waste on top of the unlined area may impede corrective action.</u>

- Potential impacts to water supplies are as follows:
    a. <u>Quarry Water Supply</u> - There are currently no identified landfill-related impacts to the existing quarry water supply, nor are there impacts observed at the quarry dewatering outfall (or downgradient monitoring wells) based on permit-required monitoring. Impacts to the existing quarry water supply are not expected as a result of the Project. Under a future scenario with the post-mining quarry lake at elevation 690, some groundwater from underneath the BSL is predicted to discharge to the anticipated future quarry lake. Potential impacts from the BSL to a future quarry lake are not known, for reasons such as indeterminate municipal plans for the future quarry lake, but will be further investigated through the permitting process.
    b. <u>Water Supply Wells</u> – Existing and future groundwater flow scenarios do not result in groundwater flow from the landfill towards any other known potable water supply wells.

- The additional weight of the expanded landfill is not expected to significantly impact groundwater quality at the BSL. The waste in the unlined area has already undergone over 30 years of settlement.

1.1.2.2 Surface Water

The following major findings were identified during analysis of the surface water impacts associated with the Project:

- The Project would result in an increase in stormwater runoff volume from the landfill of 3.7% and a 47% increase in peak discharge rate from a 500-year storm event because the post-Project design has more sloped area that is less conducive to infiltration. This would lead to increased erosion and sediment load discharged from the site compared to pre-expansion conditions. There would be no significant change in runoff volume, and decreases in peak discharge rates and sediment discharge from the site for smaller storm events.
- No adverse impacts are expected to result from the post-Project buildout compared to the pre-expansion buildout for the 2-year and 10-year storm events
- The increased sediment capture rate in post-Project conditions would likely necessitate more frequent maintenance (i.e. sediment removal) in the sedimentation ponds over the life of the landfill.
- The 500-year storm event produces runoff volumes, rates, and velocities that exceed the design basis (i.e., the 100-year storm event) of the surface water control system, and would result in erosion-related impacts under both pre-expansion and post-Project conditions.
- Mitigation for impacts related to the 500-year storm would include redesigning the surface water control system with higher sideslope berms, deeper downslope structures, larger culverts, and additional engineered erosion control products.
- Mitigation measures targeted at minimizing the post-event effects consist of conducting regular inspections of the surface water control system, and being prepared to implement emergency response actions to contain and repair adverse effects.
- The following changes in drainage to wetlands B and C, which are adjacent to the north and west of the landfill (see Figure 6-5), are predicted as a result of the Project:
    - Wetland B will experience similar inflow rates and total volumes for both the pre-expansion and post-Project conditions.
    - Wetland C will receive a larger total volume of water and lower inflow rate under the post-Project condition than in the pre-expansion condition.

- The discharge of stormwater ponds to adjacent wetlands for the 2-year, 10-year and 25-year storm events does not exceed any local, state or federal threshold, and the changes in drainage are not expected to result in significant impacts to the wetlands.

1.1.2.3 Liner/Leachate Collection

The following major findings were identified during analysis of the liner and leachate collection systems for the Project:

- The landfill contains lined cells with leachate collection, as well as unlined areas that pre-date federal Resource Conservation and Recovery Act (RCRA) laws and regulations which contain design criteria for Municipal Solid Waste Landfills under 40 CFR Part 258, Subpart D (Subpart D) of the Code of Federal Regulations. Subpart D regulations require solid waste facilities to install composite liners.
- Final cover has been constructed over portions of the landfill where waste has reached final elevation, including over the unlined area.
- The Project will involve installation of composite liner and final cover systems conforming to federal and state rules.
- The unconstructed portion of the flood protection levee around the north and west sides of the landfill will be realigned and moved farther away from the Minnesota River channel.
- There is no effect on performance of the liner and leachate collection systems from river flow conditions arising from a 100-year storm event as required by design regulations.
- Potential impacts of the 500-year flood event on the liner and leachate collection system are related to surface water and groundwater.
    - Impacts related to surface water include overtopping of the flood levee, erosion of the flood levee, and instability of the flood levee. Mitigation measures for overtopping the levee include temporarily raising the crest elevation by placing sandbags or installing other flood barrier devices. Mitigation measures for erosional impacts include use of erosion control products such as non-degradable turf reinforcement mat.
    - Impacts related to groundwater include liner uplift due to hydrostatic pressure resulting from a high water table. The weight of the waste on the liner counteracts the hydrostatic pressure, so the liner uplift is only a concern immediately following liner construction. Mitigation of liner uplift would involve monitoring groundwater levels and implementing emergency actions to counteract the uplift pressure. Such actions could include placement of additional soil in the cell or increasing pumping at quarry dewatering wells.

- The half-life of geomembranes used in the landfill liner is estimated at approximately 400 years, and the clay or geosynthetic barrier layer is not expected to lose effectiveness, barring a significant shift in the landfill foundation soils.
- Major failure of the liner due to slope failure or large tear in the liner at complete buildout is unlikely. Mitigation strategies to limit the impacts of a major liner failure at complete buildout would include ensuring the leachate is contained in the waste disposal area and is continuously maintained at or below the 12-inch regulatory limit above the base liner floor, in order to minimize the volume of leachate that could escape the lined area.

1.1.2.4 Visual

The following major findings were identified during analysis of visual impacts associated with the Project:

- Photo renderings showing the landfill buildout scenarios from different vantage points were prepared and are included in Attachment E-1.
- The modeled lighting intensity associated with the Project is not expected to cause a nuisance condition to receptors.
- Operating equipment and associated lighting could be seen from farther away due to the increased height of the landfill but will be farther from the property boundary and therefore lighting intensity observed by neighboring properties would decrease.
- The visual impacts of the Project could be mitigated by measures such as landscaping (screening) as well as by reducing the height of the proposed landfill expansion.

1.1.2.5 Air Quality

The following major findings were identified during analysis of air quality impacts associated with the Project:

- Landfill Gas Generation and Collection
    - Pre-Project (current)
        - BSL currently generates a maximum of 2,924 standard cubic feet per minute (scfm) of landfill gas (maximum occurred in 2019).
        - BSL's actual landfill gas capture rate is approximately 87% and the other 13% is assumed to be emitted to the atmosphere. However, for determining BSL's potential to emit, a capture rate of 75% (average value provided by AP-42) is assumed as a conservative estimate.
            - Based on 2019 measured flow rates, approximately 52% of the captured gas was sent to BSL's electric generating units (EGUs); and
            - Approximately 48% of the captured gas is sent to BSL's flare.
    - Post-Project (future)
        - BSL is predicted to generate a maximum of 5,863 scfm of landfill gas at full build-out of the Project (in the year 2068).
        - A landfill gas capture rate of 75% is assumed for BSL after the Project. This is an average value provided by AP-42 that is used as a conservative estimate to calculate BSL's potential to emit. BSL's landfill gas collection system will not be changed by the Project.
            - 52% of the captured gas is anticipated to be sent to BSL's EGUs; and
            - 48% of the captured gas is anticipated to be sent to BSL's flare.
- Air Emissions - Total facility potential air emissions change from the Project at full build-out, during maximum future waste acceptance and gas generation rates are as follows (compared to current conditions):
    - Carbon monoxide: no change

  - Nitrogen oxides: no change
  - Particulate matter (PM) less than 2.5 microns in diameter ($PM_{2.5}$): increase by 0.2 tons per year (tons/year)
  - Particulate matter less than 10 microns in diameter (PM_{10}): increase by 1.9 tons/year
  - Total particulate matter: increase by 7.3 tons/year
  - Sulfur dioxide (SO_2): no change
  - Volatile organic compounds (VOC): increase by 10.2 tons/year
  - Total hazardous air pollutants (HAPs): increase by 5.4 tons/year
  - Total carbon dioxide equivalent (greenhouse gas [GHGs]: increase by 86,542 tons/year
- GHGs and Climate Change - As indicated in Table 6-11, the Project's annual maximum GHG emissions are estimated to increase from 233,859 to 320,401 tons per year. There are no Minnesota Ambient Air Quality Standards (MAAQS) or National Ambient Air Quality Standards (NAAQS) for CO_2 or any other GHG. The assessment of GHG emissions and climate change is extremely complex. Currently, it is not possible to model the physical impacts of global or regional climate change, such as storm frequency/intensity or temperature increases caused by incremental GHG emissions. In other words, while solid waste landfills contribute to climate change generally, existing scientific tools do not allow the MPCA to quantify the specific impacts of a particular project on climate change. Some of the landfill gas associated with the Project will be captured and combusted and used to produce electricity. This has a positive impact on climate change because this landfill gas is used rather than being wasted by burning in a flare. BSL's use of landfill gas also reduces the electricity demand from sources that burn coal or natural gas.
- Ability to Comply with Air Quality Regulations – Air dispersion modeling was conducted to predict whether applicable NAAQS and MAAQS would be met or exceeded for both the pre-Project and post-Project scenarios. The following are the modeled results:
  - <u>Pre-Project</u>
    - Exceedances are predicted for the following pollutants
      - Nitrogen Dioxide (NO_2),
      - $PM_{2.5}$,
      - PM_{10}, and
      - Sulfur dioxide (SO_2)
    - Compliance is predicted for hydrogen sulfide MAAQS
    - Risks from air toxics emissions are below suggested health guidance values.
  - <u>Post-Project</u>
    - Compliance is predicted with all applicable NAAQS/MAAQS (after an increase of 10 feet in height of EGU stack height).
    - Risks from air toxics emissions are below suggested health guidance values.
- Mitigation Measures for Air Emissions – BSL will utilize the following mitigation measures for its Project:
  - Landfill gas emissions will continue to be minimized by placing daily, intermediate, and final soil cover on the waste. This will help prevent gases from migrating out of the landfill.

- Air toxics, VOCs, odors and methane emissions will continue to be mitigated through a well-operated gas collection and control system (GCCS, per New Source Performance Standards (NSPS) regulations) and the combustion of the captured landfill gas.
- BSL will continue to employ the proactive odor control measures listed in the odor control plan (OCP) such as burying malodorous wastes immediately, minimizing excavations into the waste, and placing daily cover in order to minimize odors from the landfill working face.

1.1.2.6 Sociological

The following major findings were identified during analysis of sociological impacts associated with the Project:

- The Project is not expected to cause adverse impacts that would affect the usability of existing nearby recreational resources or hinder the development of planned recreational areas.
- The proposed end use of the Project is recreational, which is consistent with the current zoning classification of "CRD – Commercial Recreation", and the currently permitted end use type (i.e. recreational use).
- BSL is located approximately 6.5 miles away from the nearest airport (i.e., the Minneapolis-St. Paul International Airport) and meets state and federal regulations for separation distance. ~~The Project will require submittal of a notification form to the Federal Aviation Administration (FAA) due to the increased height of the landfill.~~
- The Project is not expected to result in significant impacts resulting from bird interactions with airplanes when compared to pre-expansion conditions.
- The Federal Aviation Administration (FAA) has reviewed the Project and conducted an aeronautical study to determine whether the Project would be a hazard to air navigation. The study determined that the Project will not exceed obstruction standards and would not be a hazard to air navigation provided it is marked with a red obstruction light. The FAA hazard determination letter is attached to this FSEIS as Attachment E-3. The red obstruction light is not expected to result in significant impacts and would be one of several other such lights in the vicinity of the BSL Project.

1.1.2.7 Alternatives and Economics

The following major findings were identified during analysis of Project alternatives and economic impacts associated with the Project:

Reduced Size of the Landfill Expansion

- Examination of a reduced landfill expansion size resulting from increasing recycling and preprocessing of waste produced the following results:
    - If a 52% recycling and preprocessing rate is achieved (compared to the current 47% rate) and is phased in over a 10-year period, the size of the expansion could be reduced to from 23.6 million cubic yards to 21.2 million cubic yards. This would result in a reduction in height of the expansion from elevation 1082 feet to 973 feet using the same expansion footprint. If the footprint is reduced, a height reduction may also occur but is not guaranteed.
    - If a 75% recycling and preprocessing rate is achieved by year 2030, the size of the expansion could be reduced from 23.6 million cubic yards to 11.9 million cubic yards resulting in a reduction in height of the expansion to elevation 862 feet using the same expansion footprint. Alternatively, if the Annex Development Area (ADA) footprint is not developed and waste is placed only over existing waste, the height would be reduced to elevation 1005 feet.

- Examination of a reduced landfill expansion size resulting from increasing waste compaction produced the following results:
    - Baling of waste prior to disposal in the landfill would not significantly increase the compaction rate over what is currently being achieved.
    - Shredding of waste prior to disposal in the landfill could reduce the waste volume by up to 75% according to manufacturers of shredding equipment. Shredding of the high-volume throughput at the BSL is not commonly conducted in the US.
    - Use of smart technology to monitor equipment movement and conducting more frequent surveys using drone equipment may increase the efficiency of compaction operations but is not expected to significantly increase the existing compaction rate.

No-Build Alternative

- An inventory of all solid waste management facilities in Minnesota, Wisconsin, and Iowa identifies 10 alternative facilities to BSL that could reasonably manage waste diverted from BSL.
- From the list of Identified Alternative Facilities, Pine Bend Landfill located in Inver Grove Heights, Minnesota is identified as the receiving facility for 55% of the waste diverted from the BSL . Central Disposal located in Lake Mills, Iowa is identified as the receiving facility for 45% of the waste diverted from the BSL based upon its affiliation with Waste Management. This is a business decision by Waste Management in order to preserve capacity at Spruce Ridge and Elk River, which are much closer to the Twin Cities Metropolitan Area (TCMA).
- All Minnesota landfills presently providing disposal services for TCMA waste have reached their design capacities and are running deficit capacities by year 2030 under both the No-Build and Project scenarios.

- Examination of the No-Build alternative for years 2020 through 2030, in which the landfill expansion does not occur and waste is diverted to Identified Alternative Facilities, and for comparison the Project scenario in which the expansion occurs, produces the following results:
    - 3.45 million tons of waste is diverted from the BSL to Pine Bend Landfill and Central Disposal under the No-Build alternative, compared with 0.25 million tons of diversion under the Project scenario. Waste diversion from the BSL occurs during years 2020-2023 under either scenario.
    - The diversion under the No-Build alternative results in 405.2 million ton-miles of transportation to alternative facilities, compared with 41.4 million ton-miles under the Project scenario.
    - The diversion results in $23.4 million in diversion costs to the general public under the No-Build alternative compared with $2.32 million under the Project scenario. Seeing as how the decision to divert the waste to Central Disposal is a business decision by Waste Management we would expect to see only a portion of this being applied to the general public.
    - Pine Bend Landfill receives 1.76 million tons of waste diversion from the BSL under the No-Build alternative and has a deficit capacity of 2.42 million tons at the end of 2030, compared with receiving zero tons of waste diversion under the Project scenario and has a deficit capacity of 0.60 million tons at the end of 2030.
    - Central Disposal receives 1.57 million tons of waste diversion from the BSL under the No-Build alternative and has remaining capacity of 27.2 million tons at the end of 2030, compared with receiving 0.13 million tons under the Project scenario and has a remaining capacity of 28.8 million tons.
    - Elk River Landfill and Spruce Ridge Landfill receive 0.05 and 0.07 million tons of waste diversion from BSL during 2020-2023 under both scenarios. As stated above, Waste Management is choosing to divert the material to Central Disposal in Iowa in order to preserve landfill space at Spruce Ridge and Elk River landfills.

- If the No-Build Alternative is selected, the following beneficial and adverse economic and employment effects were identified:

  <u>Beneficial Effects</u>
    - Increase in tax/fee revenue for the cities of Inver Grover Heights, Minnesota ($13.0 million) and Lake Mills, Iowa ($0.18 million), Winnebago County, Iowa ($0.94 million) and the State of Iowa ($5.4 million), the hosts of the Identified Alternative Facilities.
    - Added employment (8 positions) at transfer stations, hauling, and Identified Alternative Facilities.

  <u>Adverse Effects</u>
    - Increased cost ($21.1 million) for disposal, a portion of which would be passed on to the general public.
    - Loss of tax/fee revenue for the City of Burnsville ($-13.8 million), Dakota County (-$15.5 million), and State of Minnesota (-$9.6 million).
    - Reduction in jobs (8 positions) at BSL.

- A literature search was conducted for published studies, reports, and other information on the effect on property values of MMSW landfills within the five-state area (i.e., Minnesota, North Dakota, South Dakota, Iowa, and Wisconsin).
    - Some literature, including several studies of Minnesota landfills, indicates negative effects on property values due to proximity of landfills while other literature indicates neutral or positive effects.
    - No studies of impacts to property values due to expansion of a Minnesota MMSW landfill were obtained. One study of a Pennsylvania MMSW landfill vertical expansion concluded there was no market evidence to support any negative impact on real estate value as a result of the planned expansion.

Choice among Alternatives

The MPCA prefers the alternative that requires the least amount of land disposal and highest recycling and composting rate being achieved. However, actually reaching the higher recycling and composting rates will be the result of more than the MPCA's preference. It will be the sum of past and future individuals, public and private entities' actions. The MPCA is currently working on the development of the Metro Solid Waste Policy Plan, where the primary focus of the plan is developing strategies to minimize our reliance on land disposal facilities. The Policy Plan will focus on sustainable materials management, food waste reduction initiatives, organics collection programs and maximizing the collection of recyclable materials. In addition, MPCA will continue to work with the Minnesota Legislature, public and private entities on efforts (policy changes, resources, technical assistance) to increase waste reduction, reuse, recycling, and composting, including education of individuals to make their own changes. Even with all of these efforts, land disposal will still be necessary and therefore the MPCA must take that into consideration, even as it plans to reduce this activity.

1.2 Areas of Controversy

The use of publicly available contract rates and/or posted gate rate tipping fees for analysis of the Identified Alternative Facilities. One of the key considerations in the Draft Environmental Impact Statement (DEIS) preparation was to use data that is available in the public domain. Some haulers at some of the Identified Alternative Facilities may receive rates less than the posted gate rate. However, these hauler rates are not part of the public domain and can vary greatly at facilities. Thus, the publically available rate is appropriate to provide a comparative analysis of the Identified Alternative Facilities studied.

1.3 Issues to be Resolved

During the BSL SEIS preparation process, the MPCA identified potential additional Project impacts and/or information needs that must be addressed during the course of permitting/project decision-making, but are beyond what is legally required to be included in the SEIS by the Final Scoping Decision Document adopted by the MPCA on September 30, 2019.

The BSL FSEIS, includes Attachment I, "Future Permitting Needs for BSL Expansion Project," that lists several items related to air quality and water quality that will be addressed during Project permitting. The following is a summary of the information included in Attachment I:

- Air Quality – BSL's October 10, 2019, application for an air quality major permit amendment indicates that BSL is considering the *option* of transferring waste from the nearby Freeway Landfill to its landfill, and this would include construction of a new unpaved road between the two facilities. Analysis of emissions associated with waste transfer was not required by the Final Scoping Decision Document, and the MPCA will require BSL to conduct an appropriate analysis if and when the facility proposes to construct the road.
- Groundwater – among other requirements, the MPCA will require during Project permitting that BSL update its groundwater Sampling and Analysis Plan to include current standard parameters and monitoring limits based on MDH HRLs or similar health standards, as appropriate, and evaluate additional contaminants of concern for potential inclusion into BSL's permit. The specific contaminants of concern that will be evaluated during the permitting process may include PFAS and 1,4-dioxane. Additional or increased requirements include identifying contingency actions to be taken if groundwater impacts are detected, as well as establishment of increased financial assurance that will provide funding for contingency actions and/or mitigation activities.

A complete listing of the requirements can be found in the Future Permitting Needs document, which is attached to this SEIS as Attachment I.

1.4 Environmental Justice

The Project is located within an area of concern for environmental justice. For that reason, the environmental impacts associated with the Project that were outlined in the Scoping Decision Document were assessed within the context of whether said impacts would result in disproportionate exposure to pollution within the identified area of environmental justice concern. The assessment indicated that no such disproportionate exposures would be expected to result from the Project.

Attachment J provides information on how the MPCA determined that the BSL Project area is an area of concern for environmental justice.

2.0 LIST OF PREPARERS

The following individuals were primarily responsible for preparing the content of this SEIS:

Carlson McCain, Inc.

Name, Formal Education	Professional Experience	Project Responsibilities
Nicholas R. Bonow, P.E., P.G. B.S. Geological Engineering B.S. Geology	16 years experience in solid waste engineering, permitting and hydrogeology.	Project manager and client liaison; Engineering and hydrogeologic analysis; Document preparation and editing.
John R. McCain, P.E. B.S. Civil Engineering	36 years experience in solid waste engineering, permitting, operations and planning.	Engineering analysis, technical writing and review on multiple topical areas.
Isaac J. Fuhr, P.E. B.S. Civil Engineering	12 years experience in solid waste engineering; 3 years in environmental compliance.	Engineering analysis for stormwater, liner and leachate collection. Design engineer of record.
James de Lambert, P.G. B.S. Earth Science	38 years experience in hydrogeology and groundwater resources.	Hydrogeologic analysis and technical writing for Groundwater Impacts Analysis document.
Ryan J. Ruttger, PLA M.S. Landscape Architecture B.S. Environmental Design	5 years experience in professional landscape architecture; 10 years as landscaping business owner.	Visual impacts analysis and renderings.
Megan A. Lindstrom, E.I.T., G.I.T B.S. Geological Engineering B.S. Geology	7 years experience in solid waste regulation, engineering, and monitoring.	Engineering analysis for waste capacity and alternatives.
Brannon L. Peterson, E.I.T B.S. Civil Engineering	5 years experience in solid waste engineering.	Engineering analysis for stormwater and sociological impacts.

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Name, Formal Education	Professional Experience	Project Responsibilities
Raymond A. Ramos M.S. Atmospheric Science B.S. Atmospheric Science	20+ years experience in air quality permitting, compliance and dispersion modeling.	Technical coordinator for Air Quality Impacts analysis.
Scott D. Miller MBA M.S. Environmental Studies B.S. Atmospheric Science	20+ years experience in air quality permitting, compliance, and dispersion modeling.	Air modeling technical support and quality control

3.0 PROJECT DESCRIPTION

The BSL is a MMSW disposal facility that is proposing to increase its capacity by reconfiguring its existing waste limits and raising the top elevation of the landfill.

The BSL is owned and operated by Burnsville Sanitary Landfill, Inc. (BSLI), a Minnesota corporation and wholly-owned subsidiary of Waste Management of Minnesota, Inc. (WMI). The BSL is located at 2650 Cliff Road West in the City of Burnsville, Dakota County, Minnesota. The BSL is situated within the Minnesota River valley and abuts the floodplain on the south side of the river. Land use adjacent to the east, west, and south of the BSL is predominantly commercial and industrial. The BSL has operated at this location in northwest Burnsville since the early 1960s, and first received a solid waste permit from the MPCA in 1971. BSL's most recent solid waste permit was issued by the MPCA in 2011. The permit authorizes BSL to accept MMSW, construction and demolition (C&D) debris, and industrial waste, as well as operation of a solid waste transfer area. The BSL is also licensed by Dakota County and has an existing Planned Unit Development (PUD) agreement with the City of Burnsville.

The attached Figure 3-1 is a site layout map showing the BSL and surrounding area. The BSL property consists of approximately 362 acres. Within the BSL property boundary, 181 acres are currently developed as land disposal areas. An additional approximately 35 acres of the property known as the North Development Area (NDA) are permitted for land disposal but are not yet developed. The developed and permitted-but-undeveloped areas total approximately 216 acres. This combined area is also referred to as the BSL footprint, and the permitted solid waste limit associated with this footprint is shown on Figure 3-1.

The BSL's currently permitted ultimate design capacity is 28.6 million cubic yards, which includes approximately 18.7 million cubic yards for MMSW, 2.6 million cubic yards for C&D debris, and 7.2 million cubic yards for industrial waste. The ultimate design capacity is the amount of volume (i.e., airspace) between the base liner and the top of the final cover surface and represents the amount of space available for disposal of MMSW, along with daily, intermediate, and final cover materials, landfill gas piping, and any other structures or utilities constructed within the waste. The proposed expansion would provide approximately 23.6 million cubic yards of additional MMSW capacity by creating 16.4 million cubic yards of new airspace and converting the 7.2 million cubic yards of industrial capacity to MMSW. This will result in a total ultimate design capacity of approximately 45 million cubic yards. BSL anticipates that this capacity increase would allow it to continue to accept waste through the year 2062. This estimate is based on anticipated future disposal rates, which are expected to be similar to current rates adjusted for population growth.

The proposed expansion would involve modifying the currently-permitted waste limit by eliminating all but the southernmost portion of the NDA and instead developing an area off the northwest corner of the existing BSL footprint known as the Annex Development Area (ADA). The location of the NDA and the ADA relative to the currently-permitted waste limit is illustrated on Figure 3-1. The reconfigured waste limit results in a reduction in the area used for waste disposal from approximately 216 acres to 204 acres. The proposed expansion would also increase the finished height of the BSL from the currently permitted top elevation of 821.5 feet to a peak elevation of 1,082 feet, an increase of approximately 260 feet.

Bloomington
Minnesota River
Hennepin County
Dakota County
North Development Area (Undeveloped)
Annex Development Area (Proposed)
Burnsville Sanitary Landfill
Cargill
Kraemer Mining & Materials
Scott County
Dakota County
Savage
13
Burnsville
Sanitary Landfill Property Boundary
Permitted Waste Limit
North Development Area
Annex Development Area
County Boundary
State Highway
1:12,000
0
1,000
Feet
N
P:\Projects\WM\BSL\GIS\SE\S\Figure 3-1 Site Layout.mxd
March 2021
CARLSON McCAIN
ENGINEERING \ LAND SURVEYING \ ENVIRONMENTAL
15650 36th Ave N, 110
Plymouth, MN 55446
Phone: (952) 346-3900
www.carlsonmccain.com
BURNSVILLE SANITARY LANDFILL, INC
2650 CLIFF ROAD W
BURNSVILLE, MN 55337
SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT
BURNSVILLE SANITARY LANDFILL (SW-56)
FIGURE 3-1
SITE LAYOUT

Development of the site would occur in phases. During the initial phases, new waste would be filled over existing waste in lined areas of the landfill. Subsequent phases would involve construction of new liner in the ADA, followed by filling the ADA and filling over previously capped waste on the north slope. Currently 28.5 acres of capped unlined areas have been overlain with new lined waste areas. This expansion would increase this amount to 60.25 acres. After project completion 27.5 acres of existing capped unlined waste areas will remain with no waste overlain on top. As areas are filled to final permitted grades, final cover would be constructed over the waste. Upon conclusion of landfill operations and post-closure activities, the site will be developed for public recreation and nature conservancy uses. Additional details and engineering analysis for the proposed BSL development are presented in the Application for Solid Waste Permit Modification, dated April 12, 2019, which is on file and publicly available at the MPCA.

This proposed BSL expansion project requires preparation of a mandatory EIS under Minn. R. 4410.4400 Subp. 13.E. because it would be an expansion by 25% or more of previous capacity of a MMSW land disposal facility for 100,000 cubic yards or more of waste fill per year. BSL has had EIS's prepared for expansion projects in the past:

- Metropolitan Council prepared an EIS in 1991 and made a determination of adequacy that was published in 1992
- MPCA prepared an EIS and made a determination of adequacy in 2005

The MPCA, as the designated RGU for environmental review for the proposed project, has determined the Project will require an SEIS and is a phased action pursuant to Minn. R. 4410.3000 subp. 3(C) "*whenever an EIS has been prepared for one or more phases of a phased action or one or more components of a connected action and a later phase or another component is proposed for approval or implementation that was not evaluated in the initial EIS and will prepare a supplemental environmental impact statement."*

4.0 LIST OF GOVERNMENTAL APPROVALS

Unit of Government	Type of Permit/Approval	Status
Minnesota Pollution Control Agency	Certificate of Need	Application submitted
Minnesota Pollution Control Agency	Solid Waste Facility Permit	Application submitted but awaiting CON determination
Minnesota Pollution Control Agency	Air Emissions Permit	Application submitted
Minnesota Pollution Control Agency	National Pollutant Discharge Elimination System (NPDES) / State Disposal System (SDS) Industrial Stormwater Permit	~~Issued~~ Application forthcoming
Minnesota Pollution Control Agency	NPDES/SDS Construction Stormwater Permit	Application forthcoming
Minnesota Pollution Control Agency	Section 401 Water Quality Certification	If required, application forthcoming
Federal Emergency Management Agency	Letter of Map Revision	Application forthcoming
U.S. Army Corps of Engineers	Section 404 Permit Amendment	Application submitted
City of Burnsville	Wetland Conservation Act Permit Amendment	Application submitted
City of Burnsville	Concept-Stage Planned Unit Development	Approved
City of Burnsville	Development-Stage PUD	Application forthcoming
City of Burnsville	Conditional Use Permit for work in the floodplain	Application forthcoming
Lower Minnesota River Watershed District	~~Flood Plain Filling Permit~~ Individual Project Permit	Application forthcoming
Dakota County	Solid Waste Facility License	Application forthcoming
Dakota County	Monitoring Well Permit	Application forthcoming
Federal Aviation Administration	Notice of Proposed Construction Form 7460-1	Submittal forthcoming

5.0 WASTE VOLUME AND COMPOSITION

5.1 Waste Volume and Tonnage

This section provides information on the number of tons of waste that will be disposed within the additional capacity proposed for the Project. The Scoping Decision Document lists the proposed capacity as 26 million cubic yards; however, this is incorrect. The actual proposed capacity, or "airspace", is 23.6 million cubic yards, which includes the waste materials and final cover soils. The cover soils constitute a volume of approximately 500,000 cubic yards, which means the amount of airspace available for waste disposal is 23.1 million cubic yards.

The number of tons of waste that can be disposed within a given volume of airspace is dependent upon the density of the waste materials, and the density is dependent upon the types of materials in the waste and the degree of compaction achieved within the landfill. Materials such as paper, cardboard, plastics, and packaging materials generally have a lower density than materials such as glass, metal, soil, and processing residuals. The maximum density of compacted MMSW within a landfill is difficult to ascertain due to the variable makeup of the waste and the difficulty in conducting in-situ density measurements. Published values vary widely, and a review of the literature resulted in a maximum reported value of approximately 1.1 tons per cubic yard for solid waste in a landfill under overburden pressure (Tchobanoglous et al., 1993).

In accordance with Minnesota solid waste rules, the BSL conducts annual surveys of the waste mass to determine the volume of waste placed in a given year, and reports the results in its annual operations report to the MPCA. Table 5-1 shows a comparison of the surveyed waste volumes to the gate tonnages received over the five-year period from 2014 to 2018:

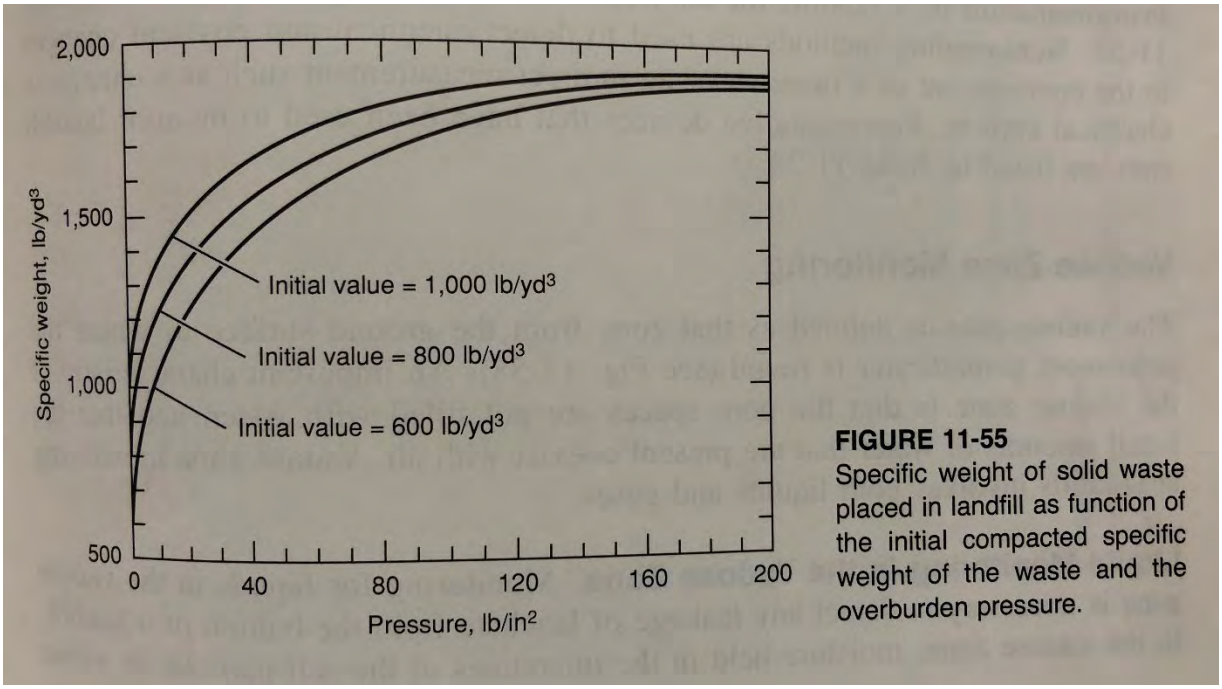
Table 5-1
MMSW Received and Capacity Used 2014-2019

Reporting Year	2014	2015	2016	2017	2018	2019
MMSW Received (tons)	245,946	268,926	328,349	355,494	336,165	264,214
MMSW capacity used – incl. final cover (CY)	320,150	296,219	244,938	509,615	460,972	185,598
Final cover built (CY)	0	0	0	0	0	0
MMSW capacity used - waste only (CY)	320,150	296,219	244,938	509,615	460,972	185,598
Calculated waste density (ton/CY)	0.77	0.91	1.34	0.70	0.73	1.42

The average of the calculated waste densities over the six-year period is 0.98 tons per cubic yard.

As the waste is buried beneath new waste and cover soils, it becomes denser as a result of consolidation due to overburden pressure and volume reduction due to decomposition. The relationship between waste density (i.e. specific weight) and overburden pressure is illustrated by Figure 5-1.

Figure 5-1
Waste Density vs. Overburden Pressure



Reprinted from: Tchobanoglous et al., 1993

Although the three example wastes shown in Figure 5-1 exhibit variable initial densities, all converge on a maximum density of close to 1.0 tons per cubic yard.

The waste in the BSL volume reports has undergone typical placement and compaction activities, which are not expected to change substantially with the proposed Project. As such, it is assumed that for waste of similar composition to that currently received at the BSL, the proposed Project will continue to result in a density of at least 0.7 tons per cubic yard during the first year following initial disposal. As additional waste is added, the overburden pressure will increase and the buried waste is anticipated to approach a maximum density of 1.0 tons per cubic yard.

The number of tons of waste that will fit in the additional capacity proposed for the Project is therefore estimated as a range using endpoints of 0.7 and 1.0 tons per cubic yard, as shown in the calculations below:

Waste density of 1.0 tons per cubic yard

$$23.1M\ yd^3\ \times 1.0\ \frac{tons}{yd^3}\ = 23.1M\ tons$$

Waste density of 0.7 tons per cubic yard

$$23.1M\ yd^3\ \times 0.7\ \frac{tons}{yd^3}\ = 16.2M\ tons$$

For the purposes of this SEIS, a value of 0.95 tons per cubic yard is used as a representative density for the entire landfill. It is a long-term average which accounts for the compaction of the waste over the anticipated life of the facility. The value of 0.95 tons per cubic yard is within the estimated range of 1,700 to 2,000 pounds per cubic yard reported by the United States Environmental Protection Agency (EPA) (2016) for compacted MMSW at large landfills with best management practices (e.g. repeated compaction, placement in lifts, engineered fill plans, etc.), and is similar to the average of 0.98 tons per cubic yard at BSL for the years 2014 through 2019. Using a value of 0.95 tons per cubic yard results in total of approximately 21.9 million tons of waste that will fit in the additional capacity provided by the Project, as shown below:

Waste density of 0.95 tons per cubic yard

$$23.1M\ yd^3\ \times 0.95\ \frac{tons}{yd^3}\ = 21.9M\ tons$$

5.2 Waste Composition

A waste characterization study of the MMSW being delivered to BSL was conducted from December 9 through December 13, 2019, by Foth Infrastructure and Environment, LLC, of Lake Elmo, Minnesota. The study included sorting a total of 52 samples over the course of one working week (Monday-Friday), and categorizing the materials present in the waste. Sorting methodology generally followed ASTM D5231-92, *Standard Test Method for Determination of the Composition of Unprocessed Municipal Waste*, with some deviations that are further described in the Waste Characterization Study report (Foth, 2019). The sampling procedure generally involved using a wheeled front-end loader to mix and segregate specific incoming loads of MMSW at the landfill working face, and bringing representative sub-samples back to the landfill garage for manual inspection and sorting. Sorted waste materials were inspected and placed into different categories based on material type (e.g. paper, plastic, metal, organics, etc.). The different material types were weighed and the relative percent of the total sample was recorded for each material. 20.35% of this material is recyclable and 49% is organic that could be composted. 69% of the landfilled material could be recovered if it were not discarded as trash. Table 5-2 presents the composition percentages for all material categories found in the waste sorted at BSL. The table has been reproduced from Table 4-6 of the Waste Characterization Study report (Foth, 2019). The Waste Characterization Study report is attached as Attachment A and contains other summary tables showing composition percentages for sub-classifications of MMSW such as “residential” and “commercial,” as well as additional information on the waste study methodology and results, including photographs of the individual samples.

Table 5-2
Waste Composition for All Material Categories
(Percent of Total by Weight)

Material Category	Percent of Total	Material Category	Percent of Total
Paper	**13.03%**	**Metal**	**3.59%**
Boxboard	1.45%	Aluminum Beverage Containers	0.58%
Compostable Paper	0.00%	Other Aluminum	0.52%
Corrugated Cardboard & Kraft Bags	3.59%	Other Metal	0.40%
Gable Top/Aseptic Containers/Cartons	2.04%	Steel/Tin (Ferrous) Containers	2.09%
High Grade Office Paper	0.89%		
Magazines/Catalogs	1.76%	**Glass**	**1.91%**
Mixed Recyclable Paper	1.59%	Beverage Container Glass	0.95%
Newsprint	0.51%	Glass Containers	0.96%
Non-Recyclable Paper	1.20%	Other (Non-Container) Glass	0.00%
Phone Books	0.00%		
		Electronics	**1.60%**
Plastic	**14.92%**	All Other Electronic Items	1.60%
Bags and Film Plastic	6.29%	Computer Monitors	0.00%
HDPE Bottles/Jars - #2	0.41%	Laptops/Cell Phones	0.00%
LDPE (Rigids; no bags/wrap) - #4	0.25%	Printers	0.00%
Other #7 Plastics	0.50%	Televisions	0.00%
Other HDPE - #2	1.52%		
Other PET (e.g. jars and clamshells) - #1	0.38%	**Organics**	**49.13%**
Other Plastic (nonpackaging)	2.47%	Food Waste	22.58%
PET Beverage Containers - #1	0.79%	Other Organic Material	21.71%
PLA & Compostable Plastics	0.00%	Wood	3.65%
Polypropylene - #5	1.55%	Yard Waste	1.20%
Polystyrene - #6	0.75%		
PVC - #3	0.01%	**Other Wastes**	**15.64%**
		Appliances & Furniture	1.10%
Household Hazardous Waste (HHW)	**0.18%**	Carpet	0.19%
Batteries	0.12%	Liquids	1.15%
Mercury Containing Lamps	0.00%	Mattresses/Box Springs	0.00%
Oil Containers & Filters	0.03%	Other Not Elsewhere Classified (Misc. Fines)	4.14%
Other HHW	0.04%	Sharps & Infectious Waste	0.00%
Paint Containers	0.00%	Textiles & Leather	4.40%
Smoke Detectors	0.00%	Added	4.66%

From Foth, 2019

6.0 ENVIRONMENTAL IMPACTS

This section describes the potential environmental impacts associated with the Project that were outlined in the Scoping Decision Document. The following major topical areas are discussed:

- Groundwater
- Surface Water
- Liner and Leachate Collection
- Visual Impacts
- Air Quality
- Sociological Impacts

For each major topical area, the SEIS presents analysis and discussion to fulfill the requirements of the Final Scoping Decision Document, including identification of potential impacts and mitigation measures.

The MPCA is committed to making sure that pollution does not have a disproportionate impact on any group of people — the principle of environmental justice. This means that people of color, Indigenous communities and low-income residents benefit from equal levels of environmental protection and have opportunities to participate in decisions that may affect their environment or health.

As part of the BSL draft SEIS development process, the MPCA reviewed the proposed Project using its "Understanding environmental justice in Minnesota" interactive map, which shows areas of environmental justice concern in Minnesota. The MPCA uses U.S. Census tracts as the geographic unit to identify these areas, considering a tract to be an area of concern for environmental justice if it meets one or both of the following demographic criteria: the percentage of people of color is 50% or greater or at least 40% of people report a household income less than 185% of the federal poverty level. The MPCA also considers communities within Tribal reservation boundaries as areas of concern for environmental justice.

The Project is located within an area of concern for environmental justice. For that reason, the environmental impacts associated with the Project that were outlined in the Scoping Decision Document were assessed within the context of whether said impacts would result in disproportionate exposure to pollution within the identified area of environmental justice concern. The assessment indicated that no such disproportionate exposures would be expected to result from the Project; findings are included in specific impact sections below.

It is important to recognize that even where pollution burdens may not fall disproportionately on a community of environmental justice concern, disproportionate health/welfare effects may still occur due to underlying vulnerabilities in such communities. Where project environmental impacts might be especially significant and/or would result in disproportionate exposures to areas of environmental justice concern, further analysis may be needed. Given the magnitude and distribution of environmental impacts associated with this Project, however, no additional analysis was included.

Attachment J provides information on how the MPCA determined that the BSL Project area is an area of concern for environmental justice.

6.1 Groundwater Impacts

This section consists of a summary of a separate document titled "Groundwater Impacts Analysis, Burnsville Sanitary Landfill, Inc. (SW-56), Burnsville, Minnesota" (GIA) (Carlson McCain, 2021), which was prepared for this SEIS to address the following items in the Final Scoping Decision Document related to potential groundwater impacts of the proposed Project:

- Groundwater regulations applicable to the Project.
- Current and proposed groundwater quality standards as they relate to solid waste disposal facilities.
- Soils and geologic conditions at the BSL.
- Groundwater quality and areas of impact in the vicinity of the Project.
- The existing groundwater monitoring plan for the BSL and, conceptually, the groundwater monitoring plan for the Project.
- Predicted future groundwater levels and flow direction under the BSL using existing and updated information such as the 2005 EIS, existing modeling reports, etc.
- The base grade elevation of the unlined landfill area at BSL, and comparison to predicted groundwater elevations if the Kraemer Quarry stops dewatering.
- Potential impacts to nearby drinking water wells.
- Potential changes in impacts to groundwater resulting from the additional weight of the expanded landfill.
- Identify potential impacts and mitigation measures associated with the above topics.

The GIA document is included in its entirety in Attachment B of this SEIS, and includes the following main sections:

1. A summary of Groundwater Regulations that apply to the Project.
2. A description of site Geology and Hydrogeology.
3. A Groundwater Assessment with specific sections on Groundwater Quality, Groundwater Flow Conditions, Base Grade Elevations of the Unlined Area, Area Water Supplies, Potential Groundwater Impacts from Weight of Vertical expansion, Groundwater Monitoring and Summary of Groundwater Impacts

Since the BSL began receiving waste in approximately 1962, and was initially permitted in 1971, there have been numerous investigations of the hydrogeological conditions associated with the site, and the BSL has been the subject three previous EISs. Two were conducted for the Metropolitan Council, in 1981 and 1991; however, a complete copy of the 1981 EIS could not be located. A third EIS was prepared by MPCA as the RGU in 2005, and the 2005 EIS is what is being supplemented by this current SEIS. Additional documents include geotechnical investigations, development plans, and hydrogeological investigations associated with phased development of the BSL over a period of approximately 50 years. Also included are permit-required items such as the Sampling and Analysis

Plan and annual water quality monitoring reports. The existing documents that were obtained and reviewed as part of the SEIS are listed and briefly described in Section 1 of the GIA and are included as References in Section 5 of the GIA.

6.1.1 Groundwater Regulations

6.1.1.1 Solid Waste Facility Rules

Minnesota Rules governing solid waste facilities are codified in Chapter 7035. The primary section pertaining to groundwater is Part 7035.2815 (Specific Technical Requirements at Mixed Municipal Solid Waste Land Disposal Facilities), which includes "Ground water performance standards" in Subpart 4. The specific technical requirements state that "The owner or operator must design, construct, operate, and maintain the facility to achieve compliance with [ground water performance standards]." The groundwater performance standards, and associated intervention limits ILs, are developed during the permitting process and are applied at the compliance boundary. At the BSL, a surface water compliance boundary has been established because some groundwater flowing beneath the landfill ultimately discharges to the Minnesota River. Therefore, the current ILs are based on water quality standards for the Minnesota River.

If an IL is exceeded, the permittee must take specific action to evaluate the source, the significance, and the need for action to prevent the pollutant from approaching or exceeding the standard at the compliance boundary. Other actions described in the facility's permit-required contingency action plan may also be required. Even if an IL has not been exceeded, the MPCA commissioner has the authority to require corrective action under the following circumstances: 1) in the event of a substantial release of leachate that the commissioner may reasonably expect to result in a violation of water quality standards, or 2) based on the additive carcinogenicity or toxicity of a combination of pollutants in the ground water, in lieu of the limits for individual substances.

6.1.1.2 Drinking Water Regulations

The ILs are based, in part, on MDH HRLs and health-based values for drinking water. If the MCL is lower than the corresponding IL, the EPA's maximum contaminant levels (MCLs) for public water supplies may also be used if the quality of a public water supply is potentially affected by migration of leachate from a facility.

Groundwater protection areas have been established for public water supplies under MDH rules that require establishment of Drinking Water Supply Management Areas (DWSMAs) and, based on communication from MDH, MDH will be reviewing the DWSMA in Burnsville. While the BSL does not lie within a DWSMA, a portion of the BSL does lie within a Drinking Water Protection Overlay District (DWPOD) that has been established by the City of Burnsville for a portion of its water supply that is obtained from intakes located at the Kraemer Quarry. The DWPOD strategy includes water quality monitoring and management activities in a broad area surrounding the quarry intake.

6.1.1.3 Proposed Regulations

Currently, there are no known changes proposed for the existing regulations or proposed new regulations for the technical requirements or groundwater performance standards for MMSW facilities. Updates to the applicable standards will be incorporated into the permit when reissued.

6.1.2 Site Geology and Hydrogeology

6.1.2.1 Site Geology

The BSL lies on the south side of the Minnesota River, which occupies a relatively large valley that was formed by the Glacial River Warren during the last glacial advance. The Glacial River Warren was much larger than the modern Minnesota River and eroded most of the overlying unconsolidated sediments and softer bedrock formations within the river valley to expose the resistant Prairie de Chien Group dolomitic bedrock formations at the site. This is also the bedrock formation that is being quarried at the adjacent Kraemer Mining and Materials (KMM) rock quarry. The Prairie du Chien Group is underlain by the Jordan Sandstone and additional, deeper bedrock formations.

6.1.2.2 Site Hydrogeology

Groundwater generally moves horizontally from the upland areas south of the BSL towards the river valley, discharging to the Minnesota River. Near the river, the water table has historically been close to the land surface due to the upwelling of groundwater from the Prairie du Chien-Jordan Aquifer. The area between the base of the bluffs south of the landfill and the river is known for the occurrence of springs, flowing wells, and a particular type of wetland known as a calcareous fen.

Prior to development of the BSL, quarrying operations began on the adjacent parcel that is the current KMM quarry. The quarry currently extracts and processes the limestone and dolomite of the Prairie du Chien Group, which is also a robust aquifer, for use as building and landscape material. Over the years as the quarry developed, it became necessary to manage increasing groundwater inflows by conducting year-round dewatering operations permitted through the Minnesota Department of Natural Resources. Dewatering operations have a pronounced effect on the hydraulic gradients within the Prairie du Chien-Jordan Aquifer and depress the water table and aquifer water levels across a broad area, including the BSL property. A reservoir or sump-like structure is used to facilitate the withdrawal of water from the quarry, and this pumping creates drawdown sufficient to capture shallow groundwater from beneath the BSL and reverse groundwater gradients between the quarry and the river. A second reservoir and sump-like structure, located on the southeastern portion of the quarry, has been configured to safely supply water to Burnsville's surface water treatment plant, which provides treatment that produces water suitable for domestic consumption.

6.1.3 Groundwater Assessment

6.1.3.1 Groundwater Quality and Areas of Impact in Vicinity of the Project

Groundwater quality at the BSL is monitored by a series of wells located and designed to monitor groundwater flow conditions and groundwater quality associated with the facility. The network is designed to monitor groundwater quality upgradient and down gradient of the landfill area. For the SEIS, water quality data for the years 2014 through 2019 have been reviewed. Of the inorganic

parameters, only manganese has been detected above the IL of 75 ug/l. The reported manganese results at the BSL ranged from <20 to 3,910 ug/l with most values less than 1,000 ug/l. Manganese does not have a federal MCL but does have a federal health advisory level of 300 ug/l and an MDH HRL of 100 ug/l. Manganese is both a potential contaminant and naturally occurring groundwater component. Manganese has been observed at both upgradient and downgradient monitoring wells and appears to be related to naturally occurring manganese and/or background concentrations. Manganese does not appear to correlate with other landfill indicator parameters.

During the six-year review period, three organic compounds (i.e., ethyl ether, benzene, and chloroethane) have been detected intermittently at concentrations less than the ILs. These compounds are mostly anthropogenic (i.e., caused/induced by humans) and may serve as indicators of landfill impacts if detected at higher concentrations.

Water quality impacts attributable to the BSL, defined as exceedances of applicable ILs, have not been observed during permit-required monitoring in the vicinity of the Project.

As part of a wider PFAS evaluation conducted by the MPCA at solid waste facilities in the late 2000s, groundwater samples were collected from four monitoring wells at BSL in 2007 and 2008. PFAS were detected in all four of the monitoring wells sampled, which included three wells down-gradient and one well up-gradient from the landfill. The PFAS concentrations were below the ILs used at the time the data were collected, but PFAS standards have become more stringent and the concentrations would be above current drinking water standards. Further sampling and analysis would be needed to assess current site conditions against current standards. Potential future PFAS sampling requirements are discussed in Section 6.1.3.6.

6.1.3.2 Groundwater Flow Conditions

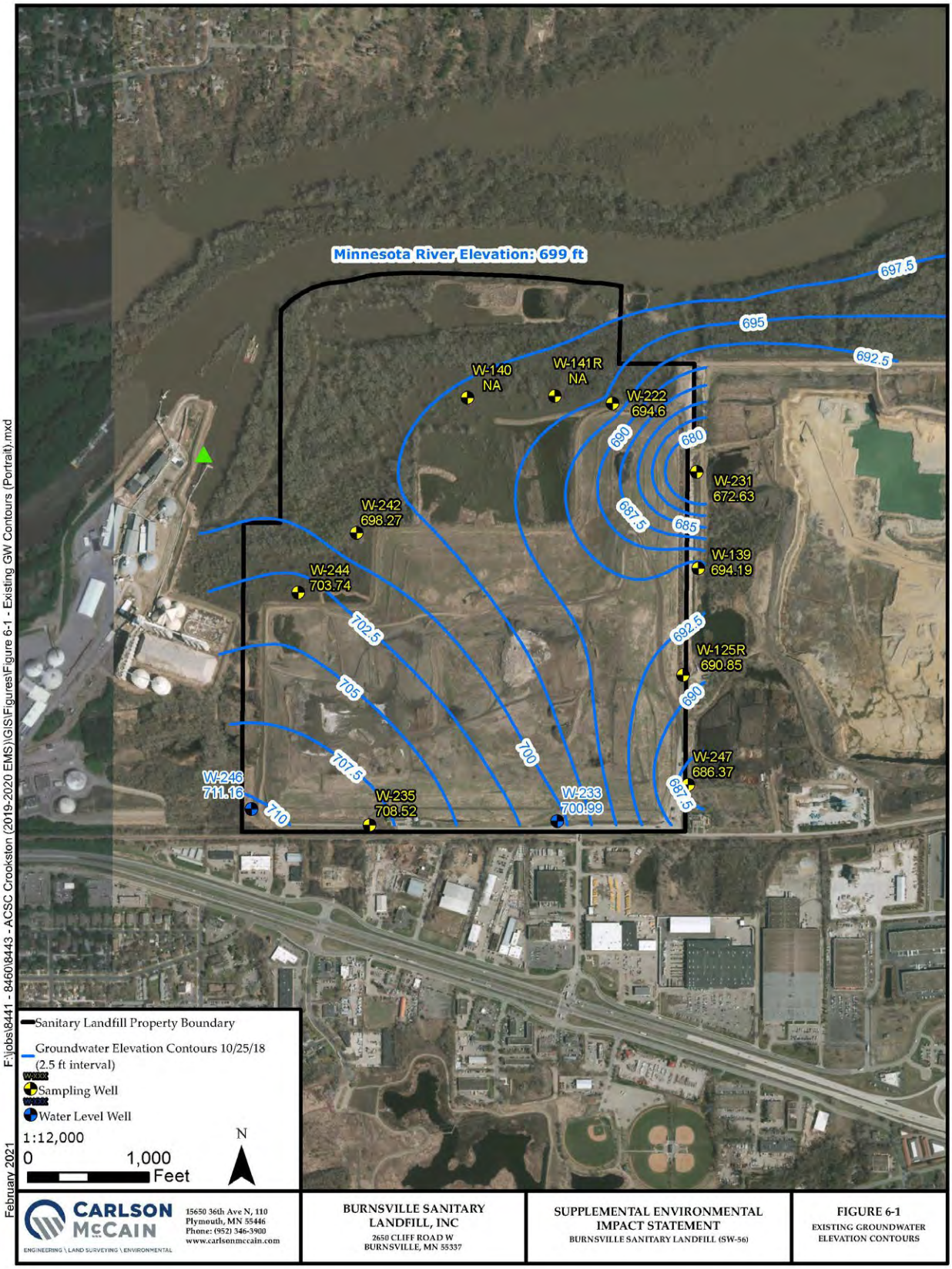
Groundwater flow at the BSL is currently controlled by dewatering for quarry operations, which captures nearly all water flowing beneath the landfill. Groundwater currently flows toward the east and is captured by the quarry sump and subsequently discharged to the Minnesota River as KMM continues to mine the Prairie de Chien Group. This is illustrated in Figure 6 of the GIA, which is reproduced in this summary as Figure 6-1. There will eventually be a time when KMM stops quarrying operations and will no longer need to dewater the quarry. In general, when quarrying (and dewatering) stops, it is anticipated that groundwater flow will revert to the north, towards the Minnesota River. Various scenarios have been modelled during permitting of the BSL and as part of the work at the KMM quarry. The results of these efforts, to predict future groundwater flow conditions, are largely dependent on assumptions regarding the configuration and use of the quarry after quarry operations cease. Even after quarrying ends, it is likely that some degree of dewatering will continue, as the future plans for the quarry involve re-development of the site. If the quarry dewatering sump were simply turned off, it is likely that the water level in the quarry would rise to an elevation of 700 feet, or more, depending on the future configuration of the existing flood protection dike and numerous other factors.

Three scenarios were previously modelled and examined in the GIA. Each scenario utilized differing assumptions including whether the future quarry lake was included in the model and whether there was any post-mining quarry dewatering considered in the model. The most likely appears to be Scenario 3, which included continued quarry dewatering to maintain a quarry lake elevation of 690 feet.

A quarry lake elevation of 690 feet has also been used in planning for the future quarry recreational area, as documented in the City of Burnsville KMM Burnsville Quarry PUD Amendment and KMM Burnsville Quarry PUD Amendment Environmental Assessment Worksheet, both completed in 2020. Under this scenario, groundwater flow beneath the landfill shifts more to the north, with future groundwater flow from the southeast portion of the landfill going towards the future quarry lake. This is illustrated in Figure 10 of the GIA, which is reproduced in this summary as Figure 6-2. Groundwater modeling estimated that an average rate of approximately 6.5 million gallons per day would need to be pumped to maintain a quarry lake elevation of 690 feet (Barr, 2015).

6.1.3.3 Base Grade Elevation of the Unlined Area

The site was initially developed by Ed Kraemer & Sons and was operated as on open dump between 1962 and 1971. In 1971 development plans were prepared, and between 1971 and approximately 1992 the site accepted MMSW in unlined waste cells. The unlined waste cells include an area of approximately 98.4 acres. From this point forward, landfilling operations have involved engineered covers, liners, and leachate and gas management systems. The base grade elevation (bottom of the waste) of the unlined landfill area has been estimated at 700 feet based on pre-development mapping, initial development plans, and site investigation reports.


Minnesota River Elevation: 699 ft
W-140
NA
W-141R
NA
W-222
694.6
W-231
672.63
W-242
698.27
W-244
703.74
W-139
694.19
W-125R
690.85
W-247
686.37
W-246
711.16
W-235
708.52
W-233
700.99
697.5
695
692.5
690
680
687.5
685
702.5
705
700
707.5
710
Sanitary Landfill Property Boundary
Groundwater Elevation Contours 10/25/18
(2.5 ft interval)
Sampling Well
Water Level Well
1:12,000
0
1,000
Feet
N
F:\Jobs\8441 - 8460\8443 - ACSC Crookston (2019-2020 EMS)\GIS\Figures\Figure 6-1 - Existing GW Contours (Portrait).mxd
February 2021
CARLSON McCAIN
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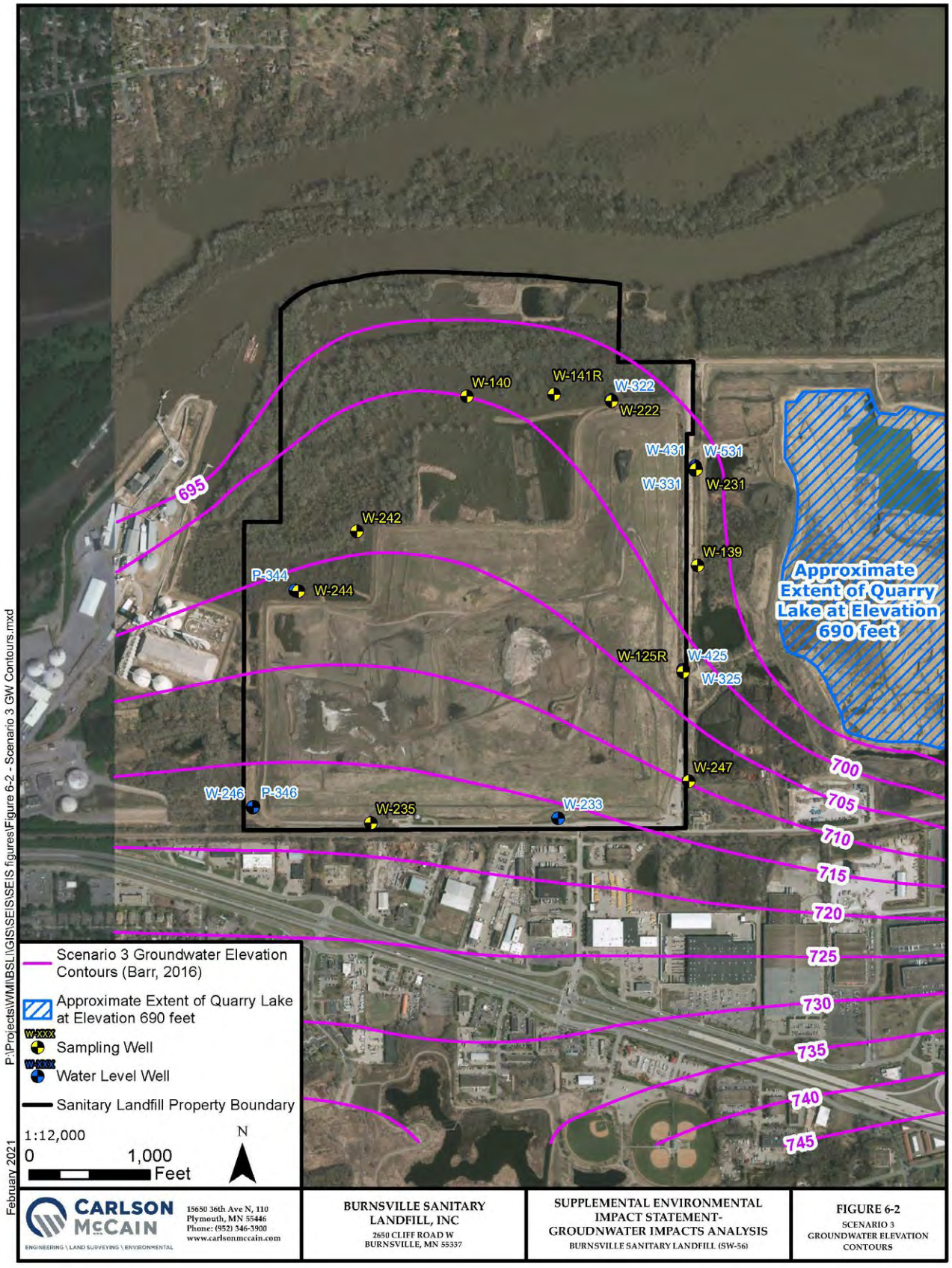
BURNSVILLE, MN 55337
SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT
BURNSVILLE SANITARY LANDFILL (SW-56)
FIGURE 6-1
EXISTING GROUNDWATER ELEVATION CONTOURS


W-140
W-141R
W-322
W-222
W-431
W-531
W-331
W-231
W-242
W-139
P-344
W-244
Approximate Extent of Quarry Lake at Elevation 690 feet
W-125R
W-425
W-325
W-247
W-246
P-346
W-235
W-233
695
700
705
710
715
720
725
730
735
740
745
Scenario 3 Groundwater Elevation Contours (Barr, 2016)
Approximate Extent of Quarry Lake at Elevation 690 feet
W-XXX
Sampling Well
W-XXX
Water Level Well
Sanitary Landfill Property Boundary
1:12,000
0
1,000
Feet
N
P:\Projects\WM\BSL\GIS\SEIS\SEIS figures\Figure 6-2 - Scenario 3 GW Contours.mxd
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SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT-
GROUDNWATER IMPACTS ANALYSIS
BURNSVILLE SANITARY LANDFILL (SW-56)
FIGURE 6-2
SCENARIO 3
GROUNDWATER ELEVATION
CONTOURS

This base grade elevation was then compared to existing and future water table scenarios. In each case, the simulated future water table elevation is above a portion of the unlined area base grade (i.e., the waste is predicted to be partially in water), particularly in the central and southern portion of the unlined area. The base grade elevation of the unlined area was also compared to recent flood elevations. Water table measurements indicate that the water table periodically exceeds an elevation of 700 feet in the unlined area during flood events.

The purpose of this comparison was to examine potential impacts related to interaction between the groundwater and the waste at the base of the unlined area under future water table conditions. Changes to groundwater quality could occur as it passes through the unlined area due to the possibility of contact between groundwater and waste. The proposed Project does not change the depth or span of the unlined area relative to currently permitted conditions, so the Project would not result in increased potential for impacts resulting from interaction between the future water table and the unlined waste area.

Based on BSL groundwater monitoring data, there have not been notable impacts to groundwater quality observed following flood events.

Whether the future water table conditions would result in exceedances of permit limits or water quality standards is unknown, at least in part because future plans for the quarry lake are not known. If impacts to groundwater quality as a result of the landfill are observed under future water table conditions, one mitigation strategy would be to lower the water table by pumping near the unlined area. Based on the lack of impacts observed under current conditions with the quarry dewatering, it would be expected that reverting to a lower water table beneath the unlined area would eliminate the observed impacts. Additional studies and permitting would be required prior to implementing a pumping system.

6.1.3.4 Area Water Supplies

A search for public and private water supply wells within a two-mile radius of the BSL was conducted using a variety of sources. Locations for the public supply wells have not been precisely identified for security reasons; however, the corresponding DWSMAs are illustrated in Figure 16 of the GIA. The City of Burnsville has also established a DWPOD for its quarry water supply that includes a portion of the BSL.

Potential impacts to water supplies are limited to the immediate vicinity of the BSL property. Under the existing conditions, groundwater at the BSL is collected by the quarry-dewatering sump, and there is little opportunity for groundwater to migrate elsewhere and impact water supplies. Under a future scenario, without active dewatering in support of quarrying operations, groundwater flow at the landfill will at least partially revert to the north. Depending on future plans for the post-mining quarry lake, groundwater originating from beneath the landfill may flow north towards the Minnesota River and towards a future quarry lake (a potential future water supply). If the quarry lake is managed to maintain an elevation of 690 feet, shallow groundwater from underneath the BSL would be captured similar to the current situation. A lower quarry lake elevation will result in greater

capture of groundwater from the area surrounding the former quarry, including the BSL, whereas a higher quarry lake elevation will result in less capture of surrounding groundwater.

Current water quality data from the BSL monitoring network do not indicate landfill-related impacts at the quarry dewatering discharge point (S-5) or downgradient monitoring wells between the BSL and the quarry (W-125R, W-139, W-247 and W-231), and no landfill-related impacts have been reported by the City of Burnsville at the existing quarry water supply. The proposed Project is not expected to impact groundwater flow conditions at the BSL, and therefore is not expected to impact the quarry water supply system as it is currently configured based on current groundwater monitoring parameters.

The existing and predicted future groundwater flow patterns do not result in capture of groundwater from beneath the BSL by any currently-existing drinking water wells, therefore no impacts to drinking water wells are anticipated. For a future water supply well to be in-line with potentially impacted groundwater, it would need to be located on or adjacent to the BSL property. High capacity pumping, capable of reversing groundwater gradients, would also need to be relatively close to the landfill.

6.1.3.5 Potential Groundwater Impacts from Weight of Vertical Expansion

Adding weight to the landfill will cause some degree of consolidation and compaction of the underlying waste mass. This may reduce the void space in the waste, leaving less available space for liquid to occupy and potentially increase the drainage of liquid (i.e. leachate) from the waste. In the lined areas, this additional leachate would be collected in the leachate collection sumps and pumped out as part of normal landfill operations. In unlined areas, the additional leachate would not be captured by the liner system and could potentially migrate to groundwater. However, leachate generation in the unlined areas is not expected to be significant as a result of the proposed Project due to the existing final cover (which restricts infiltration) and gas extraction system (which removes moisture along with landfill gas) in these areas. Because of the limited potential for additional leachate generation from the unlined area under current groundwater conditions, the additional weight of the expanded landfill is not expected to significantly impact groundwater quality at the BSL.

6.1.3.6 Groundwater Monitoring

An analysis of the existing groundwater monitoring system and a conceptual groundwater monitoring network, based on the Project, are provided in the GIA. The full groundwater monitoring plan will be developed during the MPCA solid waste permitting process. The MPCA has provided a document titled “Future Permitting Needs for BSL Expansion Project,” which is attached to this SEIS as Attachment I, and lists several items related to water quality that will be addressed during permitting. Among other requirements, the MPCA will require during Project permitting that BSL update its groundwater Sampling and Analysis Plan to include current standard parameters and monitoring limits based on MDH HRLs or similar health standards, as appropriate, and evaluate additional contaminants of concern for potential inclusion into BSL’s permit. The specific contaminants of concern that will be evaluated during the permitting process may include PFAS and 1,4-dioxane. Additional requirements include identifying contingency actions to be taken if

groundwater impacts are detected, as well as establishment of financial assurance that will provide funding for contingency actions and/or mitigation activities.

6.1.3.7 Summary of Groundwater Impacts

The following is a summary of Groundwater Impacts, as presented in the GIA:

- Groundwater monitoring, during the period from 2014 through 2019, has not identified impacts to groundwater for the monitored parameters resulting from the BSL. Manganese detections above the HRL and IL have been detected at both upgradient and downgradient monitoring wells and appear to be related to naturally occurring manganese and/or background concentrations. There were no other IL exceedances reported during the monitoring period. Sporadic detections of VOCs have been observed at concentrations lower than applicable ILs.

- Predictive modeling indicates the potential for the water table to be in contact with the base of the unlined area if quarry dewatering ceases in the future. Potential groundwater quality impacts associated with this condition are unknown at least in part due to plans for the future quarry lake being unknown. However, water level monitoring at BSL has shown the water table periodically exceeds the base elevation of the unlined area during periods of flooding on the Minnesota River, and no significant changes in groundwater quality are evident for the monitored parameters following flood events. The proposed Project does not change the depth or span of the unlined area relative to currently permitted conditions, so the Project would not result in increased potential for impacts from the unlined area related to future water table conditions. However, if future groundwater monitoring indicates corrective action is needed related to the unlined area, having new waste on top of the unlined area may impede corrective action.

- Potential impacts to water supplies are as follows:
    a. Quarry Water Supply - There are currently no identified landfill-related impacts to the existing quarry water supply, nor are there impacts observed at the quarry dewatering outfall (or downgradient monitoring wells) based on permit-required monitoring. Impacts to the existing quarry water supply are not expected as a result of the Project. Under a future scenario with the post-mining quarry lake at elevation 690, some groundwater from underneath the BSL is predicted to discharge to the quarry lake. Potential impacts from the BSL to a future quarry lake are not known but will be further investigated through the permitting process.
    b. Water Supply Wells – Existing and future groundwater flow scenarios do not result in groundwater flow from the landfill towards any other known potable water supply wells.

- The additional weight of the expanded landfill is not expected to significantly impact groundwater quality at the BSL. The waste in the unlined area has already undergone over 30 years of settlement

6.1.3.8 Potential for Disproportionate Impacts

The Project is not predicted to significantly impact groundwater quality or nearby water supplies and therefore disproportionate impacts would not be expected to occur within this identified Environmental Justice Areas of Concern.

6.2 Surface Water Impacts

This section includes the following items required by the Final Scoping Decision Document:

1) A comparison of the pre-expansion surface water discharge rates to the post-Project surface water discharge rates for 2-year, 10-year, and 500-year storm events, and identification of potential impacts and suggested measures to mitigate those impacts.
2) An assessment of the change in drainage to wetlands located within the new development area for the Pre-Expansion and Post-Project conditions.
3) An examination of mitigation measures for an extreme (over 500-year) flood (i.e. rainfall) event.

In order to complete these assessments, modeling and analyses were performed for pre-expansion and post-Project conditions of the Facility. The pre-expansion condition represents the features of the landfill after final closure as presented in the Engineering Reports submitted with the Application for Permit Modification, Demolition/Construction Debris Landfill, North Development Area (McCain and Associates, 2002) and the Application for Permit Modification, MSW Landfill, West Development Area (McCain and Associates, 2003). The 2002 and 2003 designs were previously evaluated in the 2005 EIS. The post-Project condition represents the physical features of the landfill upon final closure, as presented in the Design Report submitted with the Application for Permit Modification (Carlson McCain, 2019). The Pre-Expansion and Post-Project conditions were evaluated using HydroCAD 10.0 software. In order to compare the surface water impacts of the Post-Project condition to the Pre-Expansion condition, the original 2005 EIS evaluation was updated to include current rainfall predictions used by the National Oceanic and Atmospheric Administration for various frequencies of precipitation events. A complete description of the HydroCAD modeling methodology is attached to this SEIS in Attachment C-1.

Background

The surface water control system for both pre-expansion and post-Project conditions is designed to collect surface water runoff from the final cover of the landfill and route it to sedimentation ponds located on the perimeter of the landfill. Such collection and routing are designed to minimize erosion and protect the final cover system against potential damage. The surface water control system consists of the following major components:

- Sideslope Terraces and Berms. These features are constructed along the side slopes of the landfill at intervals of approximately 40 vertical feet, and are designed to intercept runoff flowing down the slope of the landfill. The 40-vertical-feet interval intercepts runoff while in a non-erosive sheet flow mode, before the sheet flow converts to a potentially erosive channelized flow mode. Runoff collected behind the sideslope berms is routed to down-slope structures.
- Down-Slope Structures. Down-slope structures convey runoff from the collection points on the sideslope terraces and berms down the slope to the base of the landfill and discharge the runoff into sedimentation ponds. Down-slope structures at BSL consist of concrete-mat-lined swales and culverts to convey runoff from swales to sedimentation ponds.
- Sedimentation Ponds. Sedimentation ponds receive discharge of stormwater runoff from the down-slope structures and provide detention time to allow sediment carried by the runoff to settle out of the water before the water is discharge to the ultimate receiving body. The ultimate receiving bodies at BSL consist of wetlands located in the flood plain and the Minnesota River.

Minnesota solid waste rules require the surface water control system for a landfill to manage the runoff from the 25-year, 24-hour storm event (4-percent-annual-chance storm), which produces 5.32 inches of rainfall in a 24-hour period. The surface water control system for BSL has been designed to manage the runoff from the 100-year, 24-hour storm event (1-percent-annual-chance storm), which produces 7.44 inches of rain in a 24-hour period. The 500-year, 24-hour storm event (0.2-percent-annual-chance storm) analyzed in this section produces 10.50 inches of rain in a 24-hour period.

A Minnesota NPDES Construction Stormwater Permit (CSW Permit) will be required for any ground disturbance of 1 acre or more. If ground disturbance exceeds 50 acres in one construction event, a 30-day MPCA review will be required prior to the site receiving a CSW Permit. Due to the site's location being less than a mile from the impaired Minnesota River, the site will be required to meet more stringent permit requirements such as completing stabilization within 7 days when a portion of construction ceases. Due to the site's location in near proximity to wetlands, under the CSW Permit, redundant perimeter control must be provided for any land disturbance within 50 feet of a wetland.

6.2.1 Comparison of Surface Water Discharges

For both the pre-expansion and post-Project models, discharges were calculated for the 2-year, 10-year, and 500-year precipitation events. Values for total runoff volume, peak runoff rate, and sedimentation pond performance were tabulated for each model and storm event, and are presented within the following sections.

6.2.1.1 Total Runoff Volume

Total runoff volume was determined by adding together the outflow volumes calculated in the HydroCAD models from each sedimentation pond. Total runoff volumes from the landfill for the 2, 10, and 500-year storms are tabulated in Attachment C, and are summarized in Table 6-1.

Table 6-1
Runoff Volumes Summary

Storm Event	Total Runoff Volume (cu. ft.)		Percent Change Post-Project to Pre-Expansion
	Pre-Expansion	Post-Project	
2-year	511,220	512,353	0.2%
10-year	1,225,386	1,220,682	-0.4%
500-year	5,291,015	5,488,386	3.7%

Total runoff area of the landfill under pre-expansion conditions is 228.6 acres, whereas the post-Project total runoff area is 221.5 acres. While the post-Project design has a slightly smaller footprint, is also has more sloped area that is less conducive to infiltration. Consequently, with the increase in slope area, the net amount of runoff is approximately the same. As shown above, the total runoff from the site in the post-Project condition for the 2 and 10-year storms is 0.2% more and 0.4% less, respectively, than the pre-expansion condition. These differences are insignificant. The 500-year storm resulted in a relatively small increase of 3.7% in total runoff volume for the post-Project condition, which corresponds to approximately 200,000 cubic feet more runoff than pre-expansion conditions.

6.2.1.2 Peak Runoff Rate

Peak runoff rates were determined by adding together the outflow rates calculated for each sedimentation pond in the models. Pre-expansion and post-Project total peak runoff rates from the landfill for the 2, 10, and 500-year storms are tabulated in Attachment C, and are summarized in Table 6-2.

Table 6-2
Runoff Rates Summary

Storm Event	Peak Runoff Rates (cu. ft./sec.)		Percent Change Post-Project to Pre-Expansion
	Pre-Expansion	Post-Project	
2-year	55.10	22.71	-58.8%
10-year	148.96	63.62	-57.3%
500-year	962.33	1,413.70	+46.9%

The peak runoff rates for the post-Project conditions are significantly lower than the pre-expansion conditions for the 2-year and 10-year storm events. In general, this leads to lower erosion potential at the pond outlets. All ponds are overwhelmed and overtop during the 500-year storm event in both the pre-expansion and post-Project conditions, and therefore do not provide any outflow rate control in this scenario. As such, the increased runoff due to the increased slope area noted in Section

6.2.1.1 results in significantly higher runoff rates resulting from the 500-year storm event under the post-Project conditions.

6.2.1.3 Sedimentation Pond Performance

Sedimentation pond performance was evaluated by assessing the pre-expansion versus post-Project sediment removal efficiency. Sediment load (transported off the landfill cover soils), estimated sediment removal efficiency of the combined ponds, and estimated escaped sediment for the combined ponds are summarized below. The numbers are based on annual estimates of erosion, and are appropriate for "typical" precipitation events such as the 2-year and 10-year storms. Individual results for each pond are described and tabulated in Attachment C, and combined pond performance is summarized in Table 6-3.

Table 6-3
Sedimentation Pond Performance

	Sedimentation Pond Performance		Percent Change Post-Project to Pre-Expansion
	Pre-Expansion	Post-Project	
Sediment Load off Landfill (tons/year)	2.6	4.9	+88.5%
Average Estimated Sediment Removal Efficiency	51%	74%	+44.7%
Estimated Escaped Sediment (tons/year)	1.5	1.2	-20.0%

For more frequent storm events (2 and 10-year frequency), there is a significant improvement in the sediment removal efficiency, and a significant decrease in the amount of escaped sediment under the post-Project conditions as compared to the pre-expansion conditions. A greater amount of sediment runs off the landfill due to the increase in slope area in the post-Project conditions; however, stormwater is routed to more effective sedimentation ponds and detained longer.

6.2.1.4 Potential Impacts Due to Surface Water Discharge

Due to the decreased runoff rate and improved sedimentation pond performance, no adverse impacts are expected to result from the post-Project buildout compared to the pre-expansion buildout for the 2-year and 10-year storm events. The increased sediment capture rate would likely necessitate more frequent maintenance (i.e. sediment removal) in the sedimentation ponds over the life of the landfill in order to maintain required pond storage volumes.

The 500-year storm event produces runoff volumes, rates, and velocities that exceed the design basis (i.e., the 100-year storm event) of the surface water control system for both pre-expansion and post-Project conditions, and will likely cause localized failures of various components of the control system. Specific locations of predicted failure based upon stormwater modeling are identified in

Attachment C-1. A summary description of potential impacts is provided below. It is noted that the potential impacts are generally the same for both pre-expansion and post-Project conditions.

In general, runoff from the 500-year storm event may result in overtopping of sideslope berms and resultant cascading effects downslope. Such effects would result in erosion of soils from the final cover and surface water collection systems and deposition of eroded materials (sediment) at the base of the landfill. Depending upon the overtopping locations, sediment deposition may occur along the south side of the site between the landfill and the site access road, along the east side between the landfill and the adjacent quarry property, along the west and north sides between the landfill and the adjacent flood plain and wetlands.

More specific failure modes from the 500-year storm event are described below. If runoff collected behind a sideslope berm ponds to a depth greater than the height of the berm, water will flow over the top of the berm and may erode the berm crest. If the magnitude and duration of overtopping is extreme, erosion of the berm crest may result in a complete breach of the berm and produce a channelized flow of stormwater downslope over the final cover soils rather than in the designated down-slope structures. Such channelized flow would likely erode the final cover soils, expose the underlying geomembrane, and result in sediment deposition at the base of the landfill. The geomembrane underlying the final cover soils is not erodible in the manner of the cover soils, and is unlikely to be damaged by the stormwater runoff; waste materials are not likely to be exposed.

If the flow depth of runoff being conveyed in down-slope structures exceeds the height of the concrete-mat-lined swale, erosion of final cover soils adjacent to the swale may occur. If the magnitude and duration of the swale overtopping is extreme, the sides of the swale may be undercut and the concrete mat may collapse resulting in channelized flow of stormwater downslope outside of the swale with the same erosion and sediment deposition effects as described for overtopping of a sideslope berm. The collapsing concrete mat may produce localized punctures of the underlying geomembrane, however large-scale tears in the geomembrane are unlikely and it is unlikely that waste materials would be exposed.

The runoff being conveyed downslope outside of designated down-slope structures as described in the two preceding paragraphs would likely overtop the landfill levee rather than be conveyed through the levee in designated culverts. If the magnitude and duration of the levee overtopping is extreme, the crest of the levee may erode and could potentially undercut the landfill base liner and final cover geomembrane that are anchored into the levee. The geomembranes have significant tensile strength and may bridge such an undercut. However, tearing of the geomembranes is possible and would result in waste being exposed and potentially carried with the runoff and sediment and deposited in the adjacent flood plain and wetlands.

Downstream impacts associated with the 500-year precipitation event potentially include erosion caused by discharge from the sedimentation ponds. Details of the pond outfall locations (included with the Design Report) include riprap plunge pools which are designed to dissipate energy, and slow the velocity of the pond discharge prior to entering adjacent wetlands. Nevertheless, the magnitude of a 500-year storm event has the potential to create erosive velocities (greater than 5 feet per second)

even after the outfall protection. Depending on river stage and area flooding caused by the event, water may be already ponded at the discharge, which would reduce the impact of the concentrated discharge. However, under normal conditions, it is likely that the 500-year storm event will cause erosion downstream of the outfall location. More information on potential impacts to adjacent wetlands, associated with more frequently experienced storm events, is included in Section 6.2.2.

6.2.1.5 Potential for Disproportionate Impacts

The impacts of potential erosion and sediment deposition resulting from an extreme storm event would be experienced to the greatest degree in areas along the Minnesota River, and similar impacts would be observed for long distances both upstream and downstream of the BSL and outside of the Environmental Justice Area of Concern that includes the BSL. Due to the widespread nature of the potential impacts outside of the immediate vicinity of the BSL, disproportionate impacts would not be expected to occur within this identified Environmental Justice Area of Concern.

6.2.1.6 Mitigation for Impacts Due to Surface Water Discharge

Mitigation measures targeted at preventing the potential adverse effects from the 500-year storm event consist of redesigning the surface water control system components for increased volumes, rates, and velocities of stormwater flows (i.e. higher sideslope berms, deeper down-slope structures, larger culverts). The surface water control system for the Project already includes installation and maintenance of erosion protection features including proper vegetation on landfill cover soils, engineered erosion control products such as erosion blankets, turf reinforcement mats, and tied concrete block mats.

Based on the predicted failure scenarios described above, the following design modifications would provide the most value in terms of cost/benefit for mitigating the most severe impacts:

- Installing the tied concrete block mat up onto the flow line transition from each side-slope berm to the down-slope swale, so that higher velocities can be accommodated at the point where flow direction changes.
- Increasing the capacity of culverts conveying runoff from the down-slope swales to the sedimentation ponds in order to minimize the potential for levee overtopping.
- Providing additional erosion protection/armoring of the levee crest and outboard levee slope to minimize the potential for undercutting of the landfill base liner.

Mitigation measures targeted at minimizing the post-event effects consist of conducting regular inspections of the surface water control system so that maximum performance can be achieved at the time of occurrence of an extreme event, and being prepared to implement emergency response actions to contain and repair adverse effects. Future permits which may be issued by governmental agencies for the Project should ensure that site inspections, contingency action plans, and emergency response plans include provisions for pre-event planning, preparation, and training for, and post-event response to, an extreme storm event.

6.2.2 Drainage to Wetlands and Wetland Impact Comparison

6.2.2.1 Background Information

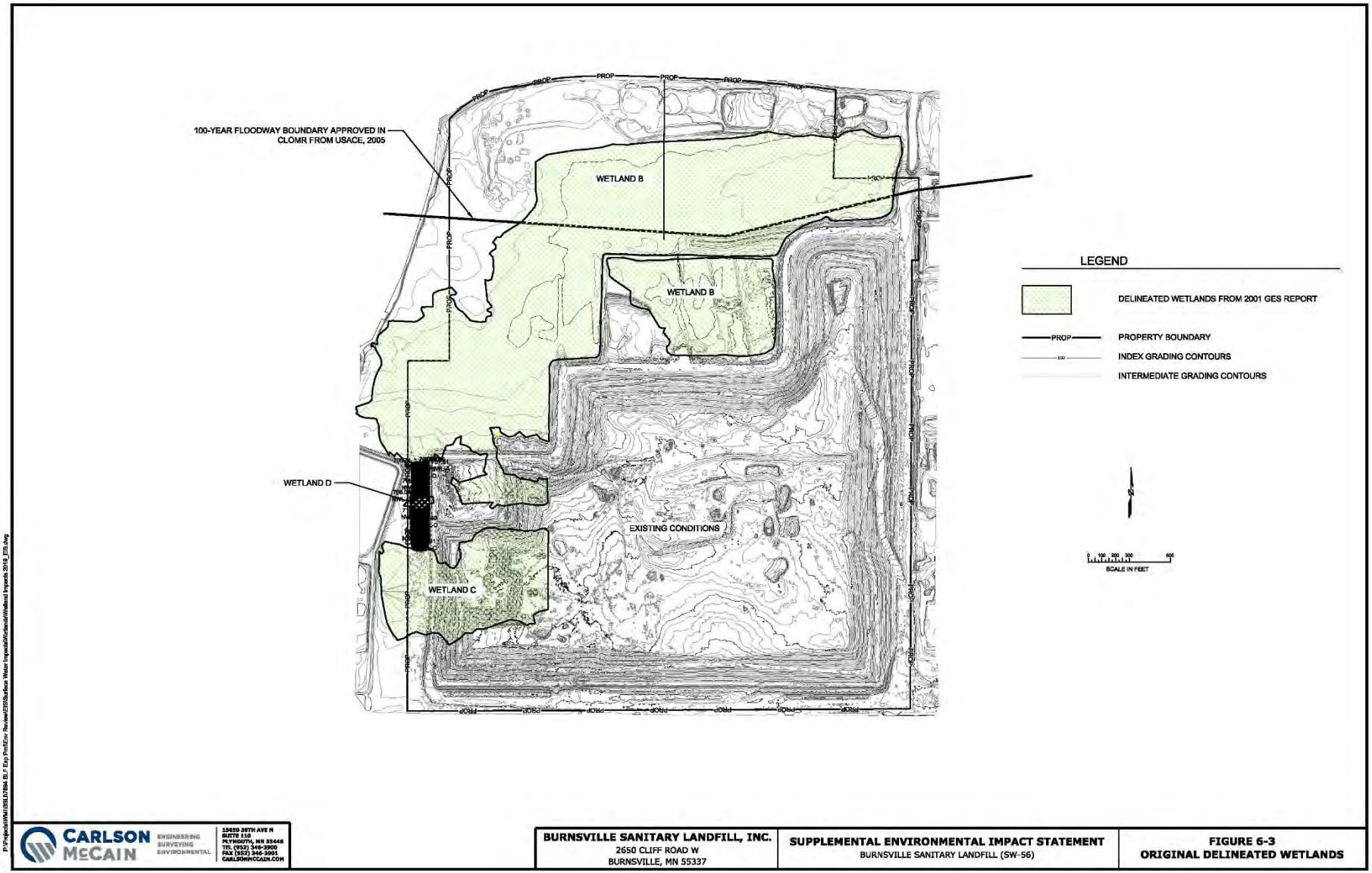
BSL is surrounded by existing natural and constructed wetlands. The facility obtained a 404 Wetland Permit from the U.S. Army Corps of Engineers (USACE) and a separate Wetland Conservation Act (WCA) Permit from the City of Burnsville. The permits allow for 30.61 acres of wetland to be impacted by development beyond the current landfill footprint, in exchange for credits obtained through mitigation. The currently permitted landfill footprint includes development of the NDA, and this development is included in the Pre-Expansion conditions. The requested modification to the solid waste permit eliminates the NDA in exchange for the smaller ADA footprint, referred to as the post-Project conditions. The pre-expansion and post-Project conditions, along with associated impacts to the respective wetlands are shown on Figures 6-3, 6-4, and 6-5.

Pre-expansion conditions represent the hydrologic model used in the 2005 EIS. It should be noted that one significant change in the permitted site design occurred since the evaluation of that model, and was incorporated into a 2011 Permit Modification: the proposed location of the north stormwater pond moved to the west levee of the NDA, so that the pond would be out of the floodway of the Minnesota River. In this case, the physical location of the stormwater pond has little impact on the change in drainage. However, slight differences in pre-expansion wetland acreages may be noted when comparing this document to other documents submitted to USACE and the City of Burnsville for wetland permit modifications. Nevertheless, the evaluation specified in the scoping document is to compare the model in the 2005 EIS to the post-Project condition. Therefore, this section of the SEIS includes the original design of the north stormwater pond in the evaluation of the pre-expansion wetland hydrology.

6.2.2.2 Evaluation of Differences in Wetland Size and Location between the Pre-Expansion and Post-Project Conditions

The change in wetland drainage between pre-expansion and post-Project conditions is directly related to the change in physical size and location of the wetlands present for each condition. While each condition's approximate area of wetland impacts is relatively similar to each other overall, individual wetland sizes differ according to the layout of the landfill footprint in each case. Using the 2005 EIS's pre-expansion condition, the area of wetlands outside of the existing landfill footprint that will be impacted is expected to be approximately 29.6 acres. The post-Project condition is expected to impact 29.0 acres. As part of the application process for BSL's existing wetland permits issued in 2004 (i.e. USACE permit 2002-01819-TEC; City of Burnsville permit NR04-02), Graham Environmental Services conducted a wetland delineation across the property. Several separate wetlands were identified, and are shown on Figure 6-3. As shown on the figure, Wetland B is located north of the landfill footprint. A portion of Wetland B has been filled in preparation for construction of the NDA. A comparison between the pre-expansion and post-Project wetland impacts is shown on Figure 6-6. The affected areas that were filled are hatched regions labeled "5" and "7B" in the figure, and are proposed to be left as-is in the post-Project condition – even though the footprint of the ADA does

not overlap these areas. Individual wetland areas identified on Figures 6-4 and 6-5 are summarized in Table 6-4. A wetland permit amendment application detailing currently-permitted and proposed wetland impacts and mitigation was submitted to the USACE and the City of Burnsville in 2020 (Wenck, 2020).


100-YEAR FLOODWAY BOUNDARY APPROVED IN CLOMR FROM USACE, 2005
WETLAND B
WETLAND B
WETLAND D
WETLAND C
EXISTING CONDITIONS
LEGEND
DELINEATED WETLANDS FROM 2001 GES REPORT
PROPERTY BOUNDARY
INDEX GRADING CONTOURS
INTERMEDIATE GRADING CONTOURS
SCALE IN FEET
CARLSON McCAIN
ENGINEERING SURVEYING ENVIRONMENTAL
15650 36TH AVE N
SUITE 110
PLYMOUTH, MN 55446
TEL (952) 346-3900
FAX (952) 346-3901
CARLSONMCCAIN.COM
BURNSVILLE SANITARY LANDFILL, INC.
2650 CLIFF ROAD W
BURNSVILLE, MN 55337
SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT
BURNSVILLE SANITARY LANDFILL (SW-56)
FIGURE 6-3
ORIGINAL DELINEATED WETLANDS

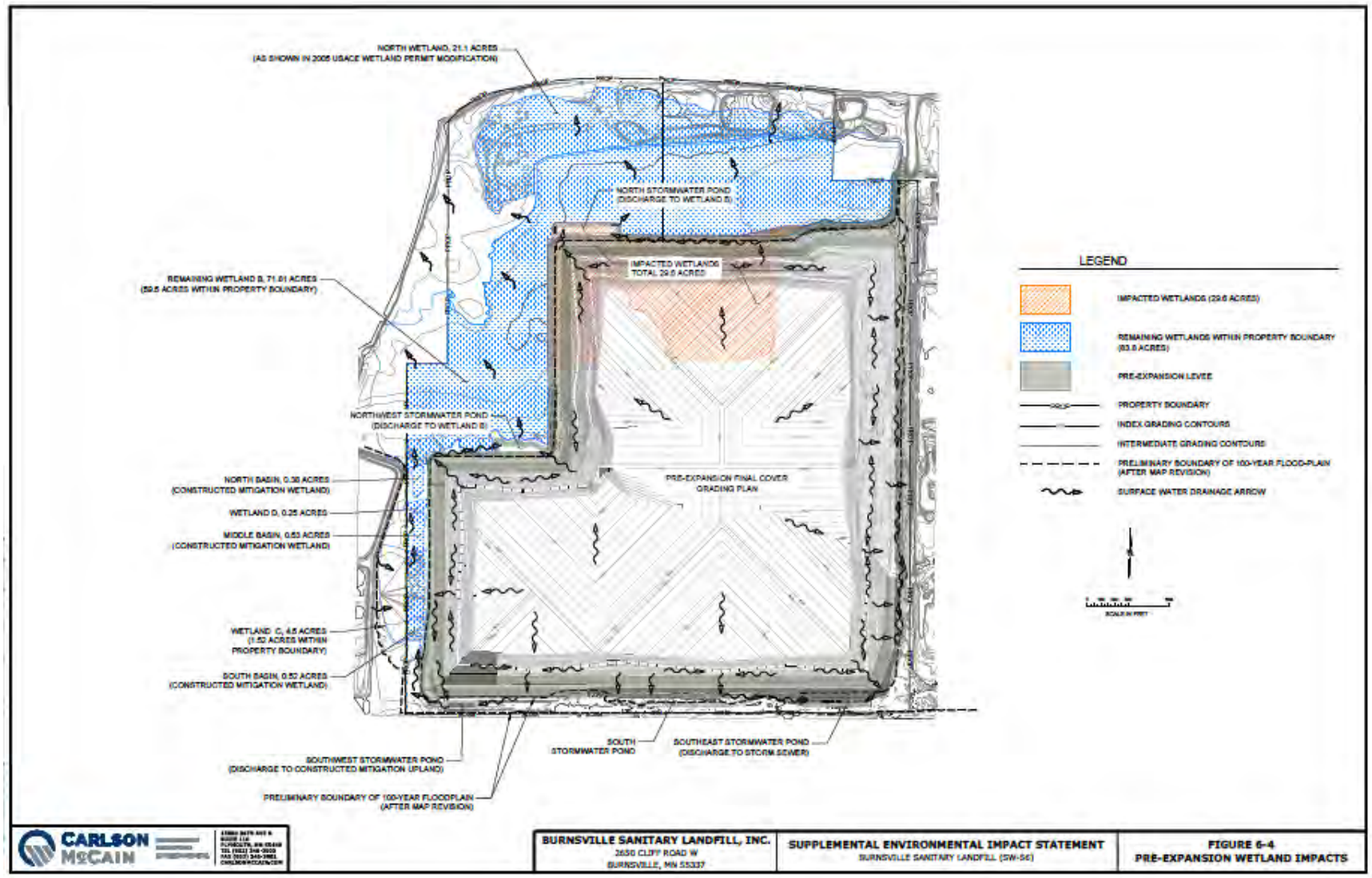

NORTH WETLAND, 21.1 ACRES
(AS SHOWN IN 2005 USACE WETLAND PERMIT MODIFICATION)
NORTH STORMWATER POND
(DISCHARGE TO WETLAND B)
IMPACTED WETLANDS
TOTAL 29.6 ACRES
REMAINING WETLAND B, 71.01 ACRES
(59.5 ACRES WITHIN PROPERTY BOUNDARY)
NORTHWEST STORMWATER POND
(DISCHARGE TO WETLAND B)
NORTH BASIN, 0.38 ACRES
(CONSTRUCTED MITIGATION WETLAND)
WETLAND D, 0.25 ACRES
MIDDLE BASIN, 0.63 ACRES
(CONSTRUCTED MITIGATION WETLAND)
WETLAND C, 4.5 ACRES
(1.52 ACRES WITHIN
PROPERTY BOUNDARY)
SOUTH BASIN, 0.52 ACRES
(CONSTRUCTED MITIGATION WETLAND)
PRE-EXPANSION FINAL COVER
GRADING PLAN
SOUTHWEST STORMWATER POND
(DISCHARGE TO CONSTRUCTED MITIGATION UPLAND)
SOUTH
STORMWATER POND
SOUTHEAST STORMWATER POND
(DISCHARGE TO STORM SEWER)
PRELIMINARY BOUNDARY OF 100-YEAR FLOODPLAIN
(AFTER MAP REVISION)
LEGEND
IMPACTED WETLANDS (29.6 ACRES)
REMAINING WETLANDS WITHIN PROPERTY BOUNDARY
(63.6 ACRES)
PRE-EXPANSION LEVEE
PROPERTY BOUNDARY
INDEX GRADING CONTOURS
INTERMEDIATE GRADING CONTOURS
PRELIMINARY BOUNDARY OF 100-YEAR FLOOD-PLAIN
(AFTER MAP REVISION)
SURFACE WATER DRAINAGE ARROW
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FIGURE 6-4
PRE-EXPANSION WETLAND IMPACTS

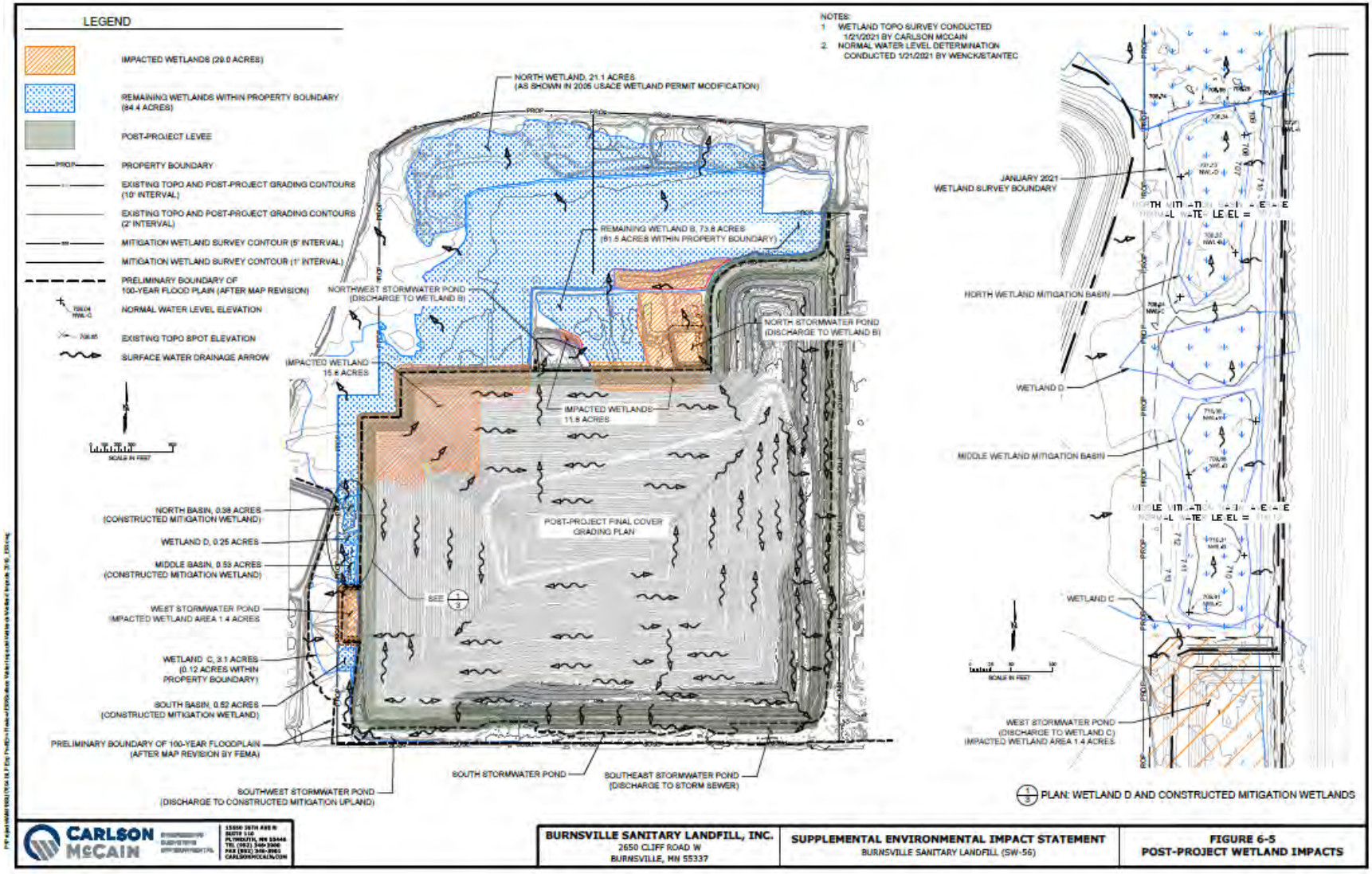
LEGEND
IMPACTED WETLANDS (29.0 ACRES)
REMAINING WETLANDS WITHIN PROPERTY BOUNDARY (64.4 ACRES)
POST-PROJECT LEVEE
PROPERTY BOUNDARY
EXISTING TOPO AND POST-PROJECT GRADING CONTOURS (10' INTERVAL)
EXISTING TOPO AND POST-PROJECT GRADING CONTOURS (2' INTERVAL)
MITIGATION WETLAND SURVEY CONTOUR (5' INTERVAL)
MITIGATION WETLAND SURVEY CONTOUR (1' INTERVAL)
PRELIMINARY BOUNDARY OF 100-YEAR FLOOD PLAIN (AFTER MAP REVISION)
NORMAL WATER LEVEL ELEVATION
EXISTING TOPO SPOT ELEVATION
SURFACE WATER DRAINAGE ARROW
NOTES:
1. WETLAND TOPO SURVEY CONDUCTED 1/21/2021 BY CARLSON MCCAIN
2. NORMAL WATER LEVEL DETERMINATION CONDUCTED 1/21/2021 BY WENCK/STANTEC
NORTH WETLAND, 21.1 ACRES (AS SHOWN IN 2005 USACE WETLAND PERMIT MODIFICATION)
REMAINING WETLAND B, 73.8 ACRES (61.5 ACRES WITHIN PROPERTY BOUNDARY)
NORTHWEST STORMWATER POND (DISCHARGE TO WETLAND B)
NORTH STORMWATER POND (DISCHARGE TO WETLAND B)
IMPACTED WETLAND 15.6 ACRES
IMPACTED WETLANDS 11.8 ACRES
POST-PROJECT FINAL COVER GRADING PLAN
NORTH BASIN, 0.38 ACRES (CONSTRUCTED MITIGATION WETLAND)
WETLAND D, 0.25 ACRES
MIDDLE BASIN, 0.53 ACRES (CONSTRUCTED MITIGATION WETLAND)
WEST STORMWATER POND IMPACTED WETLAND AREA 1.4 ACRES
WETLAND C, 3.1 ACRES (0.12 ACRES WITHIN PROPERTY BOUNDARY)
SOUTH BASIN, 0.82 ACRES (CONSTRUCTED MITIGATION WETLAND)
PRELIMINARY BOUNDARY OF 100-YEAR FLOODPLAIN (AFTER MAP REVISION BY FEMA)
SOUTHWEST STORMWATER POND (DISCHARGE TO CONSTRUCTED MITIGATION UPLAND)
SOUTH STORMWATER POND
SOUTHEAST STORMWATER POND (DISCHARGE TO STORM SEWER)
JANUARY 2021 WETLAND SURVEY BOUNDARY
NORTH WETLAND MITIGATION BASIN
WETLAND D
MIDDLE WETLAND MITIGATION BASIN
WETLAND C
WEST STORMWATER POND (DISCHARGE TO WETLAND C) IMPACTED WETLAND AREA 1.4 ACRES
1/3 PLAN: WETLAND D AND CONSTRUCTED MITIGATION WETLANDS
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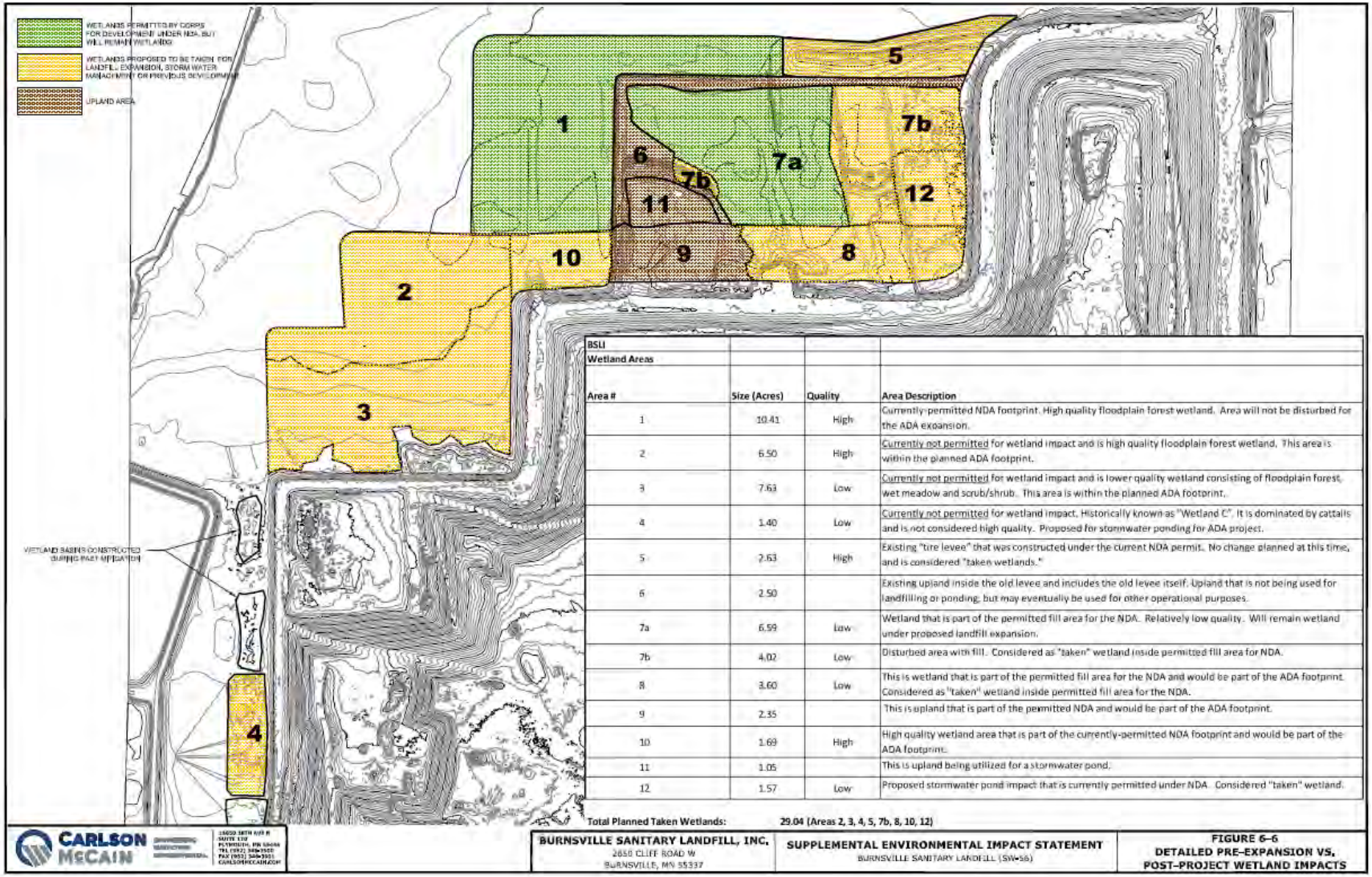
FIGURE 6-5
POST-PROJECT WETLAND IMPACTS



BSLI Wetland Areas			
Area #	Size (Acres)	Quality	Area Description
1	10.41	High	Currently-permitted NDA footprint. High quality floodplain forest wetland. Area will not be disturbed for the ADA expansion.
2	6.50	High	Currently not permitted for wetland impact and is high quality floodplain forest wetland. This area is within the planned ADA footprint.
3	7.63	Low	Currently not permitted for wetland impact and is lower quality wetland consisting of floodplain forest, wet meadow and scrub/shrub. This area is within the planned ADA footprint.
4	1.40	Low	Currently not permitted for wetland impact. Historically known as "Wetland C". It is dominated by cattails and is not considered high quality. Proposed for stormwater ponding for ADA project.
5	2.63	High	Existing "tire levee" that was constructed under the current NDA permit. No change planned at this time, and is considered "taken wetlands."
6	2.50		Existing upland inside the old levee and includes the old levee itself. Upland that is not being used for landfilling or ponding, but may eventually be used for other operational purposes.
7a	6.59	Low	Wetland that is part of the permitted fill area for the NDA. Relatively low quality. Will remain wetland under proposed landfill expansion.
7b	4.02	Low	Disturbed area with fill. Considered as "taken" wetland inside permitted fill area for NDA.
8	3.60	Low	This is wetland that is part of the permitted fill area for the NDA and would be part of the ADA footprint. Considered as "taken" wetland inside permitted fill area for the NDA.
9	2.35		This is upland that is part of the permitted NDA and would be part of the ADA footprint.
10	1.69	High	High quality wetland area that is part of the currently-permitted NDA footprint and would be part of the ADA footprint.
11	1.05		This is upland being utilized for a stormwater pond.
12	1.57	Low	Proposed stormwater pond impact that is currently permitted under NDA. Considered "taken" wetland.

Total Planned Taken Wetlands: **29.04 (Areas 2, 3, 4, 5, 7b, 8, 10, 12)**

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SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT
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FIGURE 6-6
DETAILED PRE-EXPANSION VS. POST-PROJECT WETLAND IMPACTS

Table 6-4
Pre-Expansion vs. Post-Project Wetland Areas (acres)

Condition	Wetland B	Wetland C	Wetland D	South Basin	Middle Basin	North Basin	North Wetland	Total
Pre-Expansion	71.81	4.5	0.25	0.52	0.53	0.38	21.1	99.1
Post-Project	73.8	3.1	0.25	0.52	0.53	0.38	78.6	99.7

(Wetland sizes include area outside property boundary)

6.2.2.3 Evaluation of the Changes in Drainage to Pre-Expansion vs. Post-Project Wetlands

Hydrologic inputs to wetlands in the pre-expansion and post-Project conditions include discharge from the stormwater ponds, runoff from uplands adjacent to the wetlands, and direct precipitation on the wetland itself. Inputs to wetlands under each condition were modeled under the 2-year, 10-year and 25-year, 24-hour duration storm events. The most significant inputs during a precipitation event to the wetlands surrounding the landfill are discharge from the stormwater ponds that treat run-off from the finished slopes of the landfill cover.

The flow regime for surface water flow under each condition is shown with arrows indicating general flow direction on Figures 6-4 and 6-5. For the pre-expansion condition, the north and northwest ponds discharge into Wetland B; and the southwest pond discharges into a constructed mitigation wetland known as the South Basin. For the post-Project condition, the north and northwest ponds have moved to new locations but still discharge to Wetland B. The southwest pond is in the same location as the pre-expansion condition and discharges into the South Basin. The west pond, which is not present in the pre-expansion conditions, discharges into the north end of Wetland C. The South Basin is hydraulically connected to Wetland C, and Wetland C is hydraulically connected to a series of three more wetlands to the north: Wetland D, and two constructed mitigation wetlands known as the Middle Basin and North Basin. The nature of the hydraulic connectivity of this series of wetlands is dependent on several factors including groundwater levels, shallow bedrock stratigraphy, seasonal river flooding events, and precipitation events, and analysis of wetland hydrology is outside the scope of this SEIS.

Tables 6-5, 6-6, and 6-7 summarize the modeled peak flows and total inflow volumes to each wetland for each storm event, along with an inflow per acre of wetland. Because of the interconnectedness of both the natural and constructed mitigation wetlands along the western property boundary of the landfill, the hydrologic models for each condition consider them collectively as a single basin, Wetland C. As such, the area used for the inflow per acre includes Wetland C, Wetland D, and the South, Middle and North mitigation basins. Because the west stormwater pond is constructed within Wetland C, the post-Project area of Wetland C is reduced by 1.4 acres, which is the size of the west stormwater pond.

Table 6-5
Peak and Total Inflow: 2-Year Storm Event

	Pre-Expansion Conditions			Post-Project Conditions		
Wetland Unit	Peak Flow (cfs)	Total Inflow (acre-feet)	Inflow (acre-feet, per acre)	Peak Flow (cfs)	Total Inflow (acre-feet)	Inflow (acre-feet, per acre)
Wetland B	297	21.0	0.35	307	21.4	0.35
Wetland C	23	1.5	0.25	12	3.8	1.36

Table 6-6
Peak and Total Inflow: 10-Year Storm Event

	Pre-Expansion Conditions			Post-Project Conditions		
Wetland Unit	Peak Flow (cfs)	Total Inflow (acre-feet)	Inflow (acre-feet, per acre)	Peak Flow (cfs)	Total Inflow (acre-feet)	Inflow (acre-feet, per acre)
Wetland B	462	36	0.61	472	36.9	0.6
Wetland C	38	4.2	0.7	23	9.8	3.5

Table 6-7
Peak and Total Inflow: 25-Year Storm Event

	Pre-Expansion Conditions			Post-Project Conditions		
Wetland Unit	Peak Flow (cfs)	Total Inflow (acre-feet)	Inflow (acre-feet, per acre)	Peak Flow (cfs)	Total Inflow (acre-feet)	Inflow (acre-feet, per acre)
Wetland B	606	49.7	0.84	607	50.1	0.81
Wetland C	50	6.7	1.12	37	15.5	5.54

Wetland B will experience similar inflow rates and total volumes for both the pre-expansion and post-Project conditions for all the precipitation events.

Wetland C will receive a larger total volume of water and lower inflow rate under the post-Project condition than in the pre-expansion condition. The reason for the higher volume is that the landfill final cover catchments that drain to the west stormwater pond will consist of larger and steeper areas than in the pre-expansion condition. The reason for the lower inflow rate is that the west stormwater pond was designed to more efficiently control the discharge for sediment removal purposes.

Flow between Wetland C, Wetland D, the South, the Middle and the North Basins will vary depending on multiple factors, as described earlier in this section.

Attachment C-2 includes a tabulation of individual wetland inputs calculated by the HydroCAD models for each storm event. The HydroCAD models from the landfill's stormwater evaluation were updated with wetland information in each condition. The purpose of this evaluation is to determine the inflow to the wetlands – not the effective treatment capacity of the wetlands - and therefore the storage of each wetland was generally defined to be larger than actual conditions to prevent flow from being discarded in the model. Additionally, it should be noted that Wetland B is partially separated by remnants of a previously constructed levee – although the two halves are hydraulically connected in at least one area at an elevation of approximately 700. The wetland was treated as one catchment for direct precipitation, and one singular pond for inflow.

Minnesota Rules Chapter 8420.0526 Subp. 7C requires that constructed mitigation wetlands that are the second cell of a two-cell system cannot have greater than a 24-inch rise above the normal water level (NWL) resulting from the 10-year, 24-hour storm event. The landfill's ability to comply with this requirement could be affected by change in drainage to the mitigation wetlands. A topographic survey and normal water level determination were conducted for the North and Middle Basins during January 2021 and demonstrate that the 24-inch rise above the NWL would not occur in either basin in either the pre-expansion or post-Project conditions. As shown on Figure 6-5, the normal water level in the North Basin is at an average elevation of 707.9 and the overflow elevation of the North Basin is approximately 708.3. During the 10-year, 24-hour storm the North Basin will overflow prior to the water level reaching 24 inches above the NWL, and thus will comply with WCA requirements.

In order for the facility to maintain wetland credits for any of the wetlands – either natural or constructed – it will need to comply with both Section 404 and WCA wetland permits, which define criteria to maintain plant life to support the wetland type of each basin. USACE and the City of Burnsville have been apprised of the proposed changes to the landfill that are contained within the application to modify the solid waste permit. Amendments under the existing USACE and City of Burnsville wetland permits will be required to authorize the proposed wetland impacts resulting from construction of the ADA, and the wetland mitigation plan.

6.2.2.4 Potential Impacts Due to Change in Drainage

The volumes and rates of stormwater draining to the Wetland B are similar under post-Project conditions relative to the pre-expansion conditions, while Wetland C will receive increased drainage volume but lower inflow rates under the post-Project conditions. The discharge of stormwater ponds to adjacent wetlands in the flood-fringe of the Minnesota River for the 2-year, 10-year and 25-year storm events does not exceed any local, state or federal threshold, and the changes in drainage are not expected to result in significant impacts to the wetlands.

6.2.3 Mitigation Measures for Extreme (over 500-year) Flood Event

Impacts due to an extreme flood event on the Minnesota River and potential mitigation measures are discussed in Section 6.3.2 of this DSEIS. Such a flood event would presumably be accompanied by an extreme rainfall event that would result in impacts similar to those described above in Section 6.2.1.4., but potentially at additional locations and increased magnitude, resulting in more widespread erosion impacts and a greater mass of sediment discharge offsite or into adjacent wetlands. Erosion of the landfill levee at the base of the final cover system will be of greater concern, which would indicate a higher potential for undermining and damaging the base liner, and in turn a higher potential for releasing waste.

The same mitigation measures discussed in Section 6.2.1.6, including emergency response actions, apply to a storm event even more extreme than the 500-year storm event, with an adjustment for scale.

6.3 Liner and Leachate Collection System

This section of the SEIS addresses the following items from the Scoping Decision Document:

1. Evaluate the liner and leachate collection system for the Project and how it will perform under normal flow conditions and during a 500-year flood event of the Minnesota River.
2. Discussion of the expected life of the existing waste cell liners vs. the new waste cell liners.
3. Determine flow conditions at the water table during normal flow of the Minnesota River. Additionally, the potential for a hydrostatic head to develop on the proposed liner shall be determined for the 500-year flood event of the Minnesota River.
4. Analyze the potential impacts should a major failure of the liner system occur for the Project at complete buildout.

A description of existing and proposed liner and leachate collection systems and existing and proposed flood levees is provided below in order to provide context for the analysis of the four scope items following thereafter.

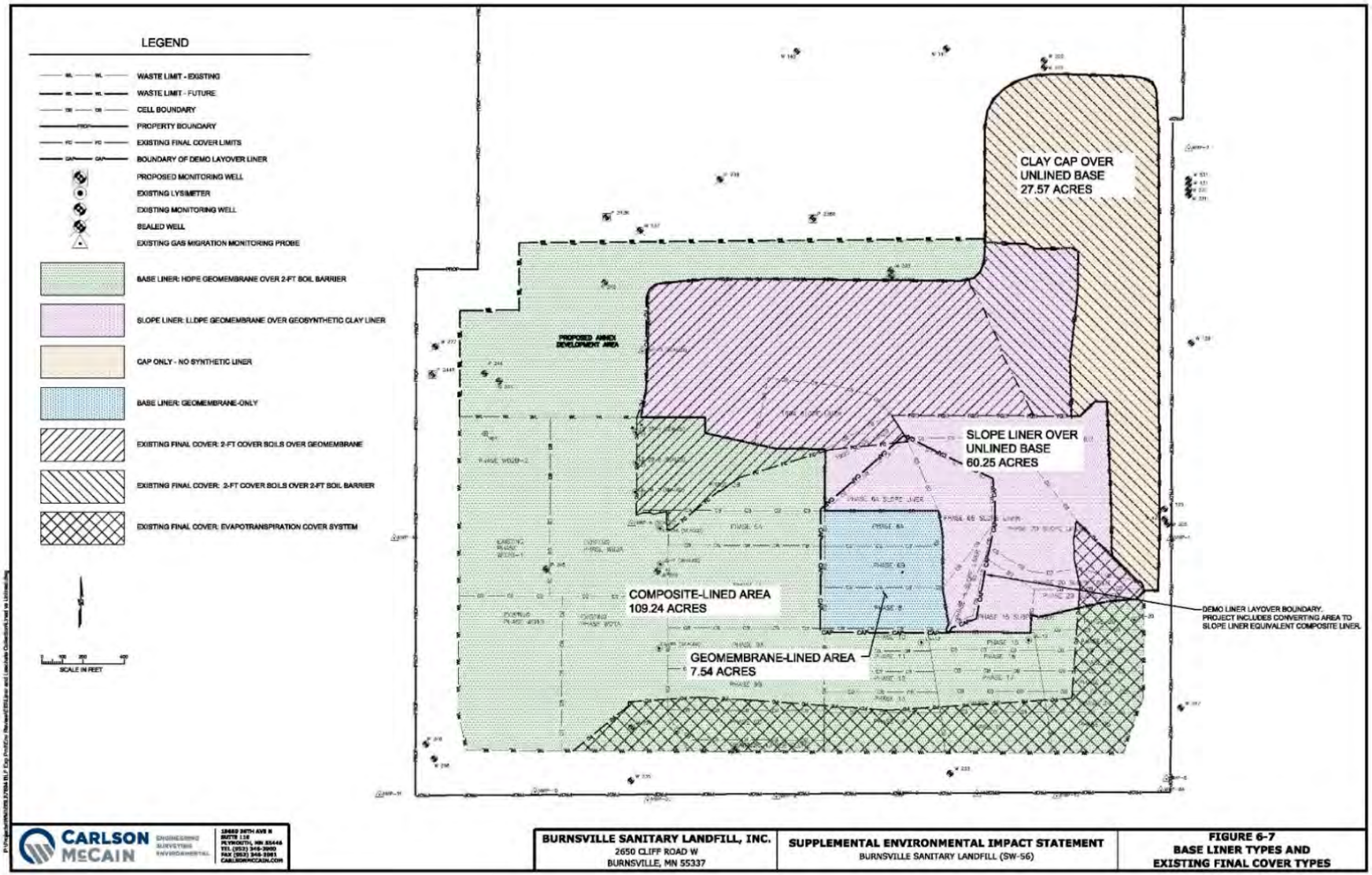
6.3.1 Existing and Proposed Liner and Leachate Collection System

Liner System

The liner system of a landfill provides a barrier between the waste and the underlying ground and prevents water that has percolated through the waste (i.e. leachate) from reaching groundwater. The components and geometric design of the landfill liners are essentially the same for both existing liners and new liners for the Project. Liner systems are constructed from two components: 1) a low-permeability soil layer; and 2) an essentially impervious polyethylene geomembrane layer, creating what is known as a composite liner. The low permeability soil layer for the floor and slopes of the base liners consists of two feet of natural clay placed and compacted in lifts under controlled moisture conditions to achieve very low permeability that is characteristic of clay soils. The maximum

compacted lift thickness specified in the solid waste permit for clay liner construction is 8-inches, which would result in a minimum of three lifts for a two-foot thick liner.

The existing landfill contains unlined areas that were constructed prior to the creation of federal sub-title D regulations requiring solid waste facilities to install composite liners. Portions of the proposed expansion will piggyback onto existing closed, but unlined, areas of the landfill. The closed areas have been capped with a final cover system consisting of a compacted clay or synthetic membrane barrier layer and cover soils. In order to place new MMSW on top of these closed areas, a liner meeting the requirements for MMSW base liner must be installed on top of, or in place of, the existing final cover. Historically, construction of new MMSW base liner on top of previously placed waste at the BSL has been referred to as “slope liner,” as opposed to “base liner,” which is the term used for liner installed on the base grade of previously unfilled areas. A visual depiction of the base liner and slope liner areas under the proposed expansion is shown on Figure 6-7. The figure indicates a total of 60.25 acres of slope liner (of which 31.9 acres will be new). In addition to the 60.25 acres, a 7.54-acre area that was originally installed for construction and demolition debris will also be overlain by the proposed slope liner.


LEGEND
WASTE LIMIT - EXISTING
WASTE LIMIT - FUTURE
CELL BOUNDARY
PROPERTY BOUNDARY
EXISTING FINAL COVER LIMITS
BOUNDARY OF DEMO LAYOVER LINER
PROPOSED MONITORING WELL
EXISTING LYSIMETER
EXISTING MONITORING WELL
SEALED WELL
EXISTING GAS MIGRATION MONITORING PROBE
BASE LINER: HDPE GEOMEMBRANE OVER 2-FT SOIL BARRIER
SLOPE LINER: LLDPE GEOMEMBRANE OVER GEOSYNTHETIC CLAY LINER
CAP ONLY - NO SYNTHETIC LINER
BASE LINER: GEOMEMBRANE-ONLY
EXISTING FINAL COVER: 2-FT COVER SOILS OVER GEOMEMBRANE
EXISTING FINAL COVER: 2-FT COVER SOILS OVER 2-FT SOIL BARRIER
EXISTING FINAL COVER: EVAPOTRANSPIRATION COVER SYSTEM
SCALE IN FEET
CLAY CAP OVER
UNLINED BASE
27.57 ACRES
SLOPE LINER OVER
UNLINED BASE
60.25 ACRES
COMPOSITE-LINED AREA
109.24 ACRES
GEOMEMBRANE-LINED AREA
7.54 ACRES
DEMO LINER LAYOVER BOUNDARY.
PROJECT INCLUDES CONVERTING AREA TO
SLOPE LINER EQUIVALENT COMPOSITE LINER.
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BURNSVILLE SANITARY LANDFILL, INC.
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BURNSVILLE, MN 55337
SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT
BURNSVILLE SANITARY LANDFILL (SW-56)
FIGURE 6-7
BASE LINER TYPES AND
EXISTING FINAL COVER TYPES

The low permeability soil layer for slope liners (i.e. liners constructed over old unlined areas of the landfill) consists of a geosynthetic clay liner (GCL), which is a manufactured clay blanket containing bentonite clay encapsulated between two geotextile layers. GCLs have a permeability of approximately 20 times less than the compacted clay liners due to the inherent low permeability of bentonite clay. Thus, the GCL barrier layer, although thinner than the compacted clay liner, provides equivalent performance to that of a two-foot thick compacted clay liner under conditions present in the landfill. The geomembrane liner layer is constructed over the top of, and in intimate contact with, the soil barrier layer or GCL. Different types of geomembrane are used in different areas of the landfill. For the base liner, a 60-mil thick high-density polyethylene (HDPE) geomembrane is used because its chemical resistance and durability are well-suited for preventing degradation by leachate and abrasion by overlying waste and drainage layers. For the slope liners, a 60-mil thick linear-low density polyethylene (LLDPE) geomembrane is used because its greater flexibility is more suitable for areas prone to differential settlement.

Minn. R. 7035.2815 subp. 7.E. requires a two-foot natural soil barrier layer beneath the geomembrane liner, so use of GCL will require a variance for an alternative liner design. The variance process is described in Minnesota Rules 7000.7000, and is administered through the MPCA solid waste permitting process. A composite slope liner with a GCL barrier layer and 60-mil LLDPE geomembrane has been permitted and used during multiple previous phases of slope liner construction at the BSL. For the purposes of this SEIS, it is assumed that the alternative GCL barrier layer will be used.

The geomembrane liners are composed of approximate 20-foot wide by 500-foot long panels that are heat-welded together to form a continuous liner. Smooth geomembrane is installed on base grades flatter than 10%, and textured geomembrane is installed on slopes of 10% or steeper. For base liner, a 12-inch thick layer of drainage sand is installed over the geomembrane. The drainage sand provides a permeable layer that transmits leachate and also protects the geomembrane and soil barrier layer from damage during initial waste placement activities. For slope liners, a 12-inch thick layer of sandy soil is installed over a synthetic drainage net. The synthetic drainage net provides conveyance of leachate, and the sandy soil layer provides a protective buffer layer over the liner system.

The base liner systems of both the existing landfill and the proposed expansion are located at elevations near or below the surrounding ground surface, and above the “design-basis water table.” The design-basis water table is an estimate of the historic-high water table under pre-development conditions, with normal flow conditions of the Minnesota River, and assuming that adjacent quarry dewatering has ceased. The design basis water table was established and reviewed as part of the 2005 EIS for BSL. The design-basis water table was used as the basis for designing base liner elevations for the previous expansion as well as for this Project. The estimated water table levels from the 2015 groundwater model (Barr, 2015) would be above a portion of the proposed liner base grades for the Project, and these base liner grades may need to be reevaluated in future permitting activities once the elevation of the future pit lake has been determined.

A map showing the lined vs. unlined area is shown in Figure 6-7. The unlined portion of the landfill received waste from 1964 until 1992. Since 1992, waste has been placed over the base liners and slope liners described above to comply with the composite liner requirements of RCRA under 40 CFR Part 258, Subpart D. Cells 6A, 6B and 8 contain a single geomembrane barrier, without a soil barrier, and have been used for disposal of construction and demolition debris only, rather than MMSW. The Project includes construction of new composite liner over these cells.

Final Cover System

The final cover system for the landfill, constructed over the top of waste in areas that have reached final elevation, also contains a barrier layer. Final cover has been constructed over the unlined portion of the existing landfill and on slope areas located on the east and south sides of the lined portion of the landfill as shown in Figure 6-7. The unlined portion of the landfill comprises areas referred to as the "north arm" and "west arm." The final cover system constructed over the north arm consists of a two-foot thick compacted clay barrier layer covered by a two-foot thick soil layer which includes drainage sand, rooting soil, and topsoil to support vegetative growth. The final cover system constructed over the north slope and top area of the west arm consists of a 40-mil thick polyethylene geomembrane barrier layer covered by a two-foot thick soil layer, also containing drainage sand, rooting soil, and topsoil to support vegetative growth. The south slope of the west arm is covered by a geomembrane and GCL barrier layer which serves as both final cover for the unlined landfill and as a base liner for waste which piggybacks that slope. The final waste slopes on the east and south sides of the lined area are covered by an evapotranspiration (ET) cap system, consisting of one foot of lightly compacted fine-grained soil, overlain by a 2-foot layer of lightly compacted sandy lean clay, and a one-foot thick layer of loose topsoil. The ET cap system is designed to shed runoff when the soil layers become saturated, and evaporate and transpire moisture (via vegetative uptake) from the waste and soil layers when dry conditions prevail. An ET cap system allows for deeper-rooted native plants to populate the final cover surface, which promote the absorption and evaporation of water. The post-Project conditions of the final cover system are shown on Figure 6-8.

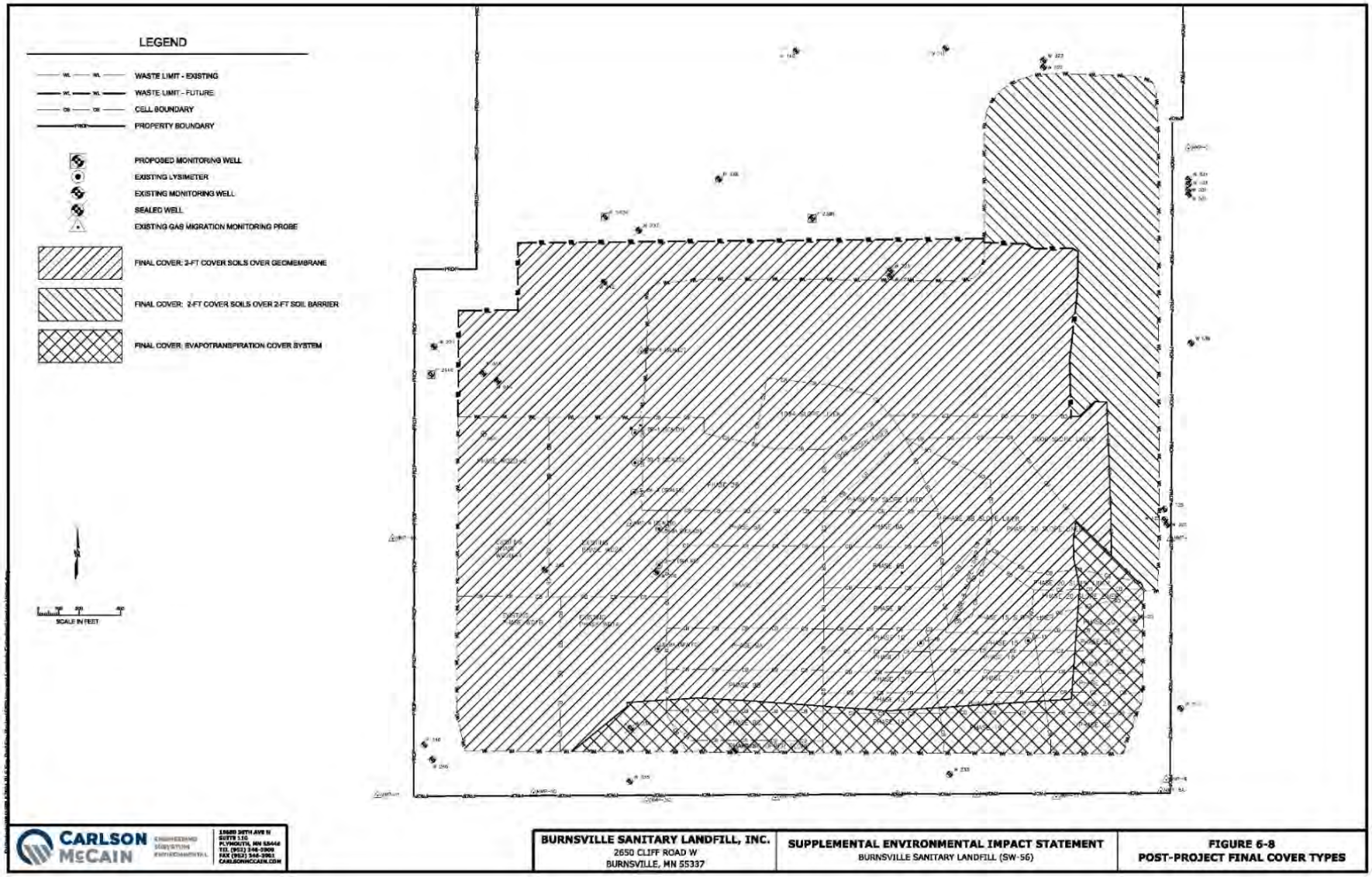
LEGEND
WASTE LIMIT - EXISTING
WASTE LIMIT - FUTURE
CELL BOUNDARY
PROPERTY BOUNDARY
PROPOSED MONITORING WELL
EXISTING LYSIMETER
EXISTING MONITORING WELL
SEALED WELL
EXISTING GAS MIGRATION MONITORING PROBE
FINAL COVER: 2-FT COVER SOILS OVER GEOMEMBRANE
FINAL COVER: 2-FT COVER SOILS OVER 2-FT SOIL BARRIER
FINAL COVER: EVAPOTRANSPIRATION COVER SYSTEM
SCALE IN FEET
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FIGURE 6-8
POST-PROJECT FINAL COVER TYPES

Leachate Collection System

The leachate collection system transmits leachate across the top of the landfill liner to sumps, from where the leachate is pumped out of the landfill and conveyed to the City of Burnsville sanitary sewer system and ultimately to a Metropolitan Council Environmental Services (MCES) treatment plant. The components and geometric design of the leachate collection system are essentially the same for both existing liners and new liners proposed for the Project. Leachate collection system components consist of a drainage layer over the liner, perforated leachate collection pipes, and sumps with pumps. The geometry of the base liner is designed to work in conjunction with the leachate collection system to allow leachate to be collected and removed from the landfill.

The base liner is shaped in accordion-fashion and sloped so that leachate drains across the liner to perforated collection pipes located in the folds of the accordion shape, which in turn drain to sumps, from which the leachate is pumped and removed from the landfill. The base liner is covered with a 12-inch thick drainage sand layer, which serves as a drainage medium to transmit leachate across the top of the liner to the collection pipes and sumps. The slope liners are covered with a manufactured synthetic drainage layer, which is designed to provide an equal or better permeability rate as that of drainage sand. Dedicated pumps are installed in the sumps for removal of leachate.

Previously constructed areas of the landfill that are unlined do not have an engineered liner or leachate collection system to prevent migration of leachate to groundwater. Leachate generation in the waste above the groundwater in the unlined areas is expected to be relatively low because the final cover restricts infiltration of water into the underlying waste.

Flood Levee

The perimeter berm around the north and west sides of the landfill serves as a flood levee which removes the landfill footprint from the Minnesota River flood plain. A portion of the flood levee that was evaluated in the 2005 EIS has been constructed on the west side of the site. The Project will realign the remaining unconstructed portion of the levee in the northwest corner and north side of the site by moving the levee approximately 700 feet to the south, farther away from the river channel than originally permitted by the USACE. A plan view of the revised levee alignment is shown on Figure 6-5, and a comparison of the cross sections between the pre-expansion vs. post-Project levees are shown on Figure 6-9. The flood levee is constructed from compacted soil materials and vegetated on the river side to provide resistance to erosion. The landfill base liner is constructed directly on the inland side of the levee. The levee crest elevation is 722.0 feet mean sea level (MSL). The 100-year flood (regulatory flood event) elevation at the location of the site is 716.9 feet MSL, therefore the levee provides 5.1 feet of freeboard for this event.

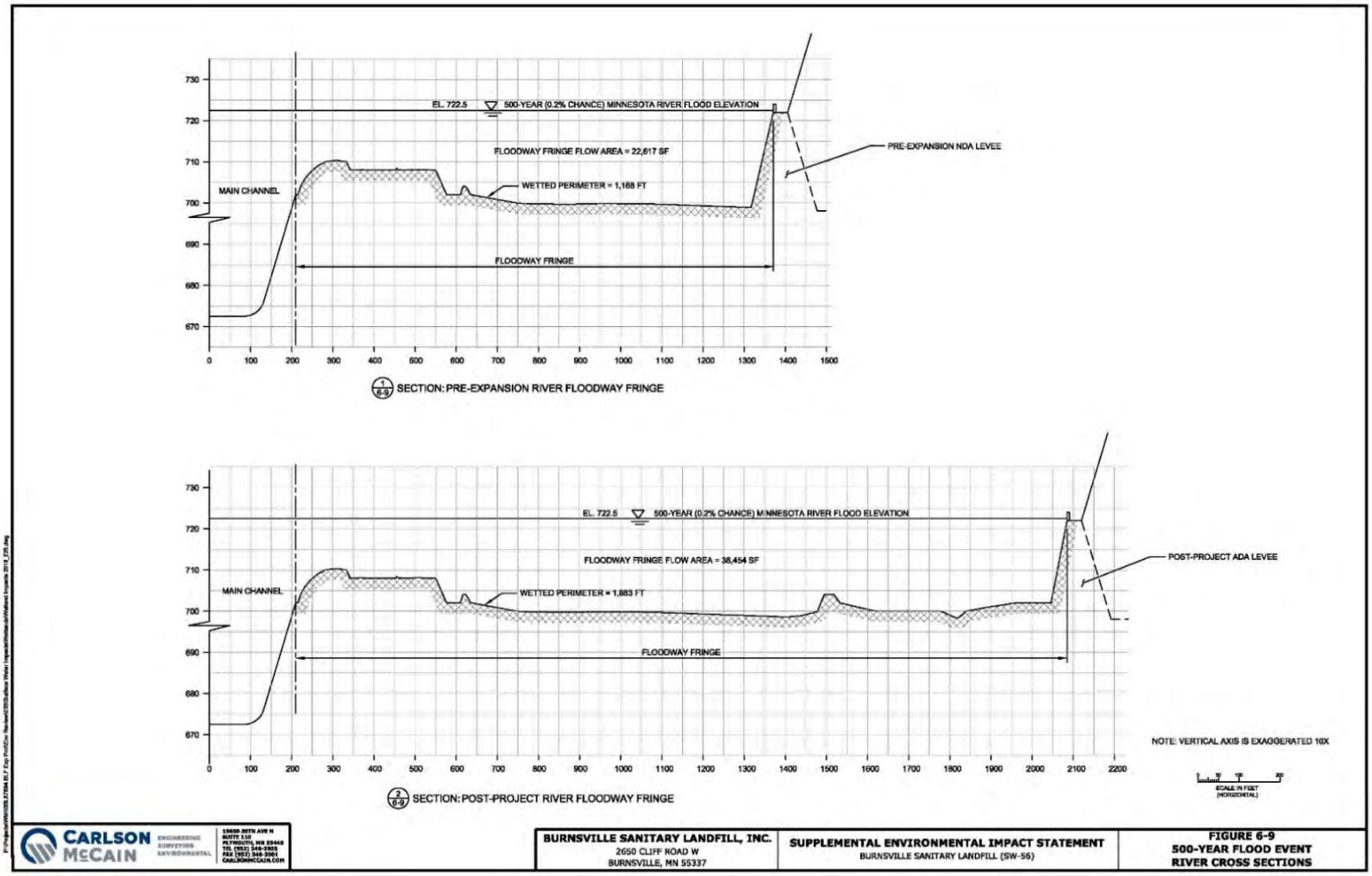
EL. 722.5
500-YEAR (0.2% CHANCE) MINNESOTA RIVER FLOOD ELEVATION
FLOODWAY FRINGE FLOW AREA = 22,617 SF
PRE-EXPANSION NDA LEVEE
WETTED PERIMETER = 1,168 FT
MAIN CHANNEL
FLOODWAY FRINGE
730
720
710
700
690
680
670
0
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
1400
1500
1/6-9 SECTION: PRE-EXPANSION RIVER FLOODWAY FRINGE
EL. 722.5
500-YEAR (0.2% CHANCE) MINNESOTA RIVER FLOOD ELEVATION
FLOODWAY FRINGE FLOW AREA = 38,454 SF
POST-PROJECT ADA LEVEE
MAIN CHANNEL
WETTED PERIMETER = 1,883 FT
FLOODWAY FRINGE
1600
1700
1800
1900
2000
2100
2200
NOTE: VERTICAL AXIS IS EXAGGERATED 10X
SCALE IN FEET (HORIZONTAL)
2/6-9 SECTION: POST-PROJECT RIVER FLOODWAY FRINGE
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FIGURE 6-9
500-YEAR FLOOD EVENT
RIVER CROSS SECTIONS

6.3.2 Evaluation of Liner and Leachate Collection Systems under Normal Flow and 500-year Flood of the Minnesota River

6.3.2.1 Normal River Flow Conditions

Under normal flow conditions, the water surface of the Minnesota River is at approximate elevation 690 feet MSL adjacent to the landfill. The river flow is entirely within the river banks under this condition (not in the flood~~way~~ fringe) and is located approximately 1,000 feet to the north and northwest of the existing and proposed landfill levees. Normal river flow does not affect the design-basis water table upon which the liner elevation is based. Since the river and associated groundwater is in contact with neither the landfill levee nor the landfill base liner under normal river flow conditions, there is no effect on the performance of liner and leachate collection systems.

6.3.2.2 500-Year Flood Event

Modeled flood conditions on the Minnesota River are taken from the March 16, 2016, revision of the "Flood Insurance Study (FIS) for Dakota County, Minnesota and Incorporated Areas" (FIS), published by the Federal Emergency Management Agency. The term "500-year flood event" is presented as the "0.2-percent-annual-chance flood" in the FIS. The 500-year flood event (once in 500 years) is more accurately described as having a 0.2 percent chance of occurring in any given year. Likewise, the 100-year flood event referred to below is presented as the 1-percent-annual-chance flood in the FIS. For reference, the Minnesota River at the Savage gauging station has met or exceeded the 100-year flood elevation (716.9 ft MSL) two times in the last 70 years.

The 500-year flood event on the Minnesota River has a river elevation of approximately 722.5 feet MSL adjacent to the landfill. Under this condition, the flood~~way~~ fringe will be inundated, floodwaters will be in full contact with and 6" higher in elevation than the crest of the landfill levee that separates the landfill from the floodway, and the water table will likely be elevated and in contact with the base liner. It is noted that the regulatory requirement is that a landfill cannot be located in the 100-year floodplain. The landfill levee has been designed to meet that criterion. The 500-year flood event is being evaluated herein in order to gain an understanding of potential effects from an extreme event beyond the regulatory thresholds.

6.3.2.3 Potential Impacts Due to Flow in the Minnesota River

Potential impacts of the 500-year flood event on the liner and leachate collection system consist of the following three issues:

1. Overtopping of the flood levee
2. Erosion of the flood levee
3. Instability of the flood levee

Each of these issues is evaluated below. Potential impacts on the liner and leachate collection system resulting from flood-related groundwater pressure (uplift pressure on the base liner and infiltration of groundwater through liner defects) are evaluated in Section 6.3.4.3.

Overtopping of Flood Levee

If a 500-year flood occurs during the filling phase of waste cells inside the levee, and no action is taken to temporarily raise the levee elevation (e.g. sandbagging), floodwater would overtop the levee and inundate the open landfill cell. Floodwater entering the cell would likely erode the sand drainage layer from the geomembrane liner surface, but would not damage the liner itself. Floating debris in the floodwater that could potentially damage the geomembrane liner would not likely enter the cell, rather would snag on the levee crest since the flood elevation is only 6" higher than the levee crest. Lightweight wastes that have been disposed within the waste cell, such as plastics, Styrofoam, etc. would potentially float to the surface of the floodwaters and be carried downstream by the river current.

If waste has been placed to elevations above the levee crest, intermittent and/or intermediate cover soils would be present, depending on waste placement activity on the particular affected slope. The cover soils may or may not have vegetation established depending upon how long the soil has been in place. If unvegetated or poorly vegetated, the cover soils could be eroded by the floodwater, which would expose and potentially erode the underlying waste. Such eroded waste would be carried downstream by the river current.

After the floodwaters subside below the levee crest, the floodwater trapped inside the cell would be considered leachate since it has been in contact with waste inside the landfill cell, and would be handled as such. The length of time required to pump the water down is dictated by the volume of the lined cell and the pumping rate of the landfill leachate pumps, but would likely take months. Consideration could be given to utilizing larger pumps and temporary piping to remove free water at a faster rate than could be accomplished using the leachate pumps, however this action would need to be coordinated with the City of Burnsville and the MCES, as the capacity of municipal treatment systems will dictate the maximum allowable leachate discharge rates.

After floodwater has been removed from the waste cell, the exposed liner would be inspected, repaired if damaged, and the sand drainage layer would be replaced.

If waste has been placed to elevations above the levee crest and final cover has been constructed over the waste at the time the flood occurs, floodwater would be prevented from entering the waste cell. The final cover system includes a geomembrane barrier layer as described in Section 6.3.1, which is seamed to the base liner at the levee crest, and would seal the waste cell from floodwater intrusion. It is unlikely that vegetated final cover soils overlying the geomembrane barrier layer would be susceptible to erosion because floodwater present over the levee crest would have very low flow velocity due to the shallow depth (6") and frictional resistance to flow provided by the levee crest surfacing. If erosion of the final cover soils were to occur nonetheless, the geomembrane barrier layer could be exposed but the geomembrane itself would not be erodible. If the

geomembrane barrier layer is exposed due to erosion of the final cover soils, it is unlikely that floating debris in the floodwaters would damage the geomembrane for the same reason stated above regarding damage of the base liner.

Erosion of Flood Levee

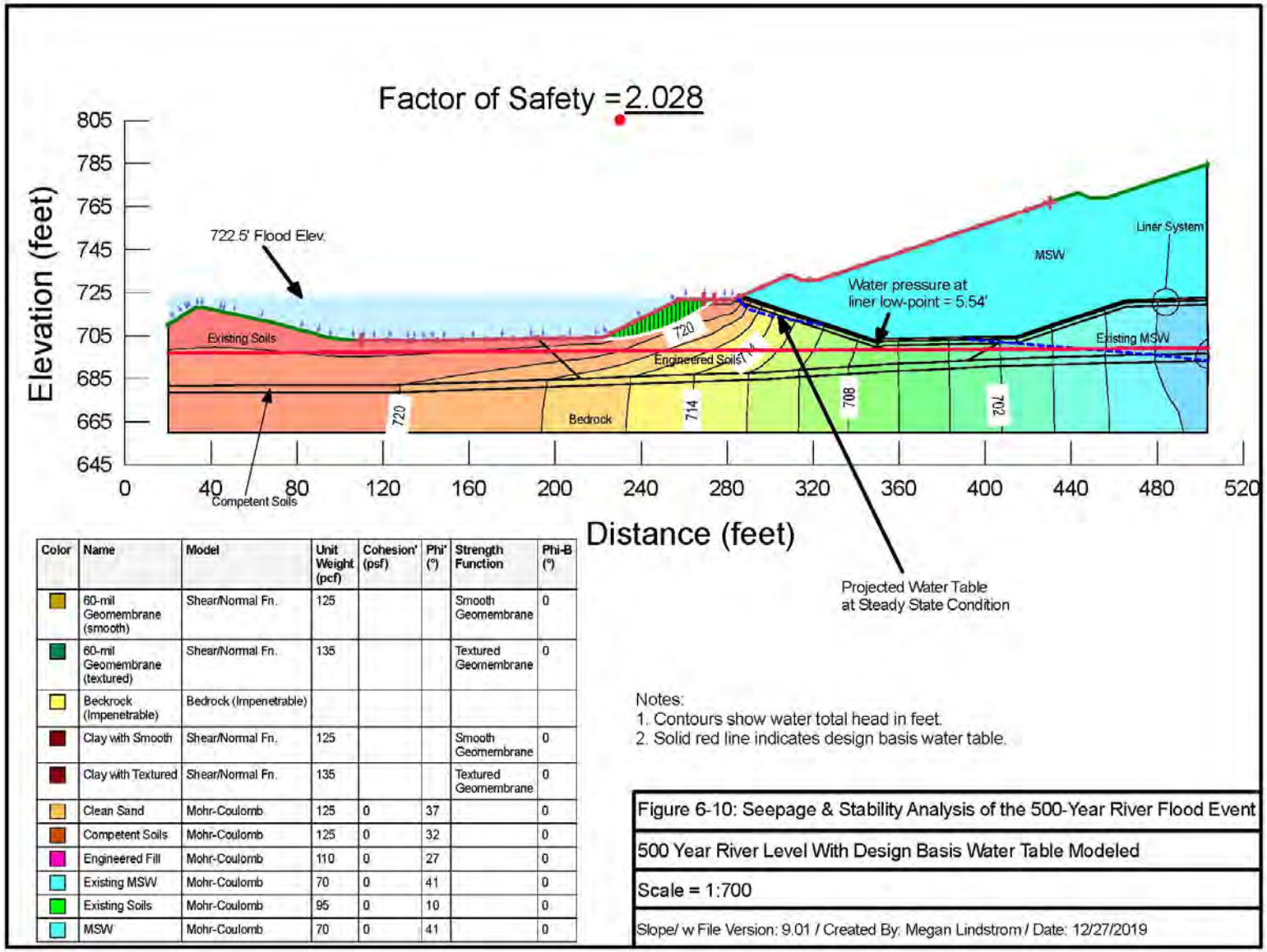
Potential impacts to the flood levee caused by erosion can be evaluated from the expected velocity of water in the flood~~way~~ fringe, adjacent to the levee, during the flood event. The estimated flow velocity in the flood~~way~~ fringe during the 500-year flood event is 1.43 feet per second (see Attachment D-1).

Erosion of the flood levee can occur when the erosive force of the river flow exceeds the resisting force of the levee. The amount of erosion depends on the relative magnitude of the two opposing forces and the frequency with which they occur. As described in the surface water modeling discussion presented in Attachment C-1, the maximum flow velocity for maintaining stable stream banks vegetated with long native grasses is 4 to 6 feet per second. This published maximum velocity applies to short-term flows (less than a couple of hours). For longer-term exposure, a factor of safety 2 to 3 times greater is recommended. The velocity of the 500-year flood (1.43 feet per second) provides a safety factor of 2.8 to 4.2 relative to the short-term velocity limits of 4 to 6 feet per second. Erosion of the flood levee during the 500-year flood is thus unlikely to occur.

Instability of Flood Levee

Slope stability analyses for several conditions were presented in the "Design Report," submitted with the Application for Solid Waste Permit Modification for Burnsville Sanitary Landfill (Carlson McCain, 2019) using Slope/W and Seep/W software programs. The flood stage of the river, set at the 100-year event (EL. 716.9 feet MSL) was used in the analysis, along with the normal seasonal-high water table at approximate EL. 700 feet MSL. The factors of safety against an instability failure ranged from 2.21 to 2.83, which indicate that slope failure is unlikely to occur. A factor of safety of 1.5 or greater is considered to be protective against failure.

The stability analysis has been repeated for this SEIS to evaluate stability of the levee during the 500-year river flood stage. The effect of a sustained flood elevation of 722.5 on the design-basis water table was first evaluated using Seep/W. The stability evaluation was then repeated for the 500-year flood using Slope/W to evaluate the potential for slope failure under these conditions. The resulting factor of safety against levee failure is 2.03, which indicates that slope failure is unlikely to occur. The location of the failure surface for the 2.03 safety factor is located entirely on the outboard slope and a portion of the crest of the flood levee, indicating that even if a stability failure were to occur, the landfill base liner and final cover systems would not be affected. A failure surface that intersects the base liner and final cover would have an even higher safety factor and is less likely to occur than the more-shallow failure indicated in the analysis. The results of the seepage and stability analyses are shown on Figure 6-10.



Color	Name	Model	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)	Strength Function	Phi-B (°)
	60-mil Geomembrane (smooth)	Shear/Normal Fn.	125			Smooth Geomembrane	0
	60-mil Geomembrane (textured)	Shear/Normal Fn.	135			Textured Geomembrane	0
	Beckrock (Impenetrable)	Bedrock (Impenetrable)					
	Clay with Smooth	Shear/Normal Fn.	125			Smooth Geomembrane	0
	Clay with Textured	Shear/Normal Fn.	135			Textured Geomembrane	0
	Clean Sand	Mohr-Coulomb	125	0	37		0
	Competent Soils	Mohr-Coulomb	125	0	32		0
	Engineered Fill	Mohr-Coulomb	110	0	27		0
	Existing MSW	Mohr-Coulomb	70	0	41		0
	Existing Soils	Mohr-Coulomb	95	0	10		0
	MSW	Mohr-Coulomb	70	0	41		0

Notes:
1. Contours show water total head in feet.
2. Solid red line indicates design basis water table.

Figure 6-10: Seepage & Stability Analysis of the 500-Year River Flood Event

500 Year River Level With Design Basis Water Table Modeled

Scale = 1:700

Slope/ w File Version: 9.01 / Created By: Megan Lindstrom / Date: 12/27/2019

6.3.2.4 Potential for Disproportionate Impacts

As noted in Section 6.2.1.5, above, erosion caused by extreme storm events is expected to result in widespread impacts both upstream and downstream of the BSL, and disproportionate impacts would not be expected to occur within the identified Environmental Justice Area of Concern.

6.3.2.5 Mitigation Measures for River Flow Impacts

Flood events on a major river such as the Minnesota are generally forecast with sufficient time to execute mitigative measures. The potential adverse impacts related to overtopping of the flood levee can be fully mitigated by temporarily raising the crest elevation by placing sand bags or installing other flood barrier devices. Installation of such flood control measures to a height of 2.5 feet above the levee crest (i.e. to elevation 724.5) would provide levee-overtopping protection with 2 feet of freeboard for the 500-year flood. The final cover system can be essentially viewed as an extension of the flood levee. Once the lower 2.5 vertical feet (approximately 7.5 feet of slope length) of final cover has been constructed along the entire length of the levee, the site becomes self-protected against levee overtopping from the 500-year flood. Alternatively, as a more permanent mitigation measure against the 500-year river flood event, the levee could be raised at least 6-inches to the 500-year flood stage (EL 722.5).

Mitigation for erosional impacts to the flood levee could be provided by use of erosion control products such as a non-degradable turf reinforcement mat.

6.3.3 Expected Life of Existing Waste Cell Liners vs. New Waste Cell Liners

The expected life of the landfill liners in existing lined waste cells vs. new waste cells is discussed below. Existing waste cell liners have been constructed using the same designs, materials, construction methods, and construction quality assurance oversight and testing as the new waste cell liners for the Project. Therefore, the expected liner life is the same for both existing lined waste cells and all new waste cells. The required service life of landfill liners is discussed first in order to provide context, and a discussion of the expected life of the liners is presented thereafter.

6.3.3.1 Required Service Life of Landfill Liners

Existing and new waste cell liners have been/will be constructed in conformance with the requirements of Minnesota solid waste rules and federal RCRA regulations under 40 CFR Part 258, Subpart D. Minnesota rules require the combination of the cover system and liner system to reject and/or collect 98.5% of precipitation that falls on the disposal area. The liner systems are therefore designed for operation of the landfill as a “dry tomb.” The dry tomb landfill concept recognizes that release of leachate from the landfill to the environment is the source of potential contamination from a landfill. The liquids inside the landfill that have leached contaminants from the solid waste are mobile in the environment, the solid waste itself is not. The liner systems are designed to capture and remove leachate from the landfill and prevent release of leachate to the environment. Only solid waste is allowed to be disposed in a landfill, liquid wastes are prohibited. The source of leachate

generated with a landfill is precipitation that falls on and soaks into exposed waste during the time that a waste cell is open. As the amount of precipitation that soaks into and is absorbed by the solid waste increases and exceeds the "field capacity" of the waste, gravity pulls the water downward, percolating through the waste until it reaches the liner and leachate collection system.

When a waste cell is filled to capacity, the final cover system, which includes a barrier layer, is constructed over the waste. The final cover system is designed to prevent additional precipitation from entering the waste cell. The source of leachate is thus cut off, and new leachate generation ceases. At this point, there is a finite amount of leachate still contained within the waste cell, and over time, this remaining leachate percolates downward and is collected and removed by the liner and leachate collection system. After a number of years, estimated to range from 5 to 10 years after placement of final cover, depending upon the depth of the waste and the amount of time the waste cell was open and exposed to precipitation, the leachate that can drain from the waste has done so, and leachate production ceases. At this point, the landfill is considered a dry tomb. The solid waste within the cell is not mobile and does not present a threat to the environment, and the mobile liquids (i.e. leachate) have been removed and are not being regenerated.

The service life for the base liner of a landfill constructed above the groundwater table can be described as starting at the time that the liner was first constructed and ending at the time that leachate production ceases. Typically, a waste cell is designed to be filled in 3 to 5 years and receive final cover within a few years after it is filled, resulting in a required liner service life of less than 20 years. Many geomembrane manufacturers offer material warranties of up to 25 years, which would cover this typical required service life. For most landfills, this timeframe is appropriate for cells located on the perimeter of the lined area, as they are usually the first to be filled to final elevation due to lower permitted waste height in these areas. Conversely, waste cells located in the interior of a landfill generally have the highest permitted elevations and take longer to build to final elevation. For a landfill like the BSL where some interior cells were constructed in the early 2000's and will not receive final cover until the complete buildout of the Project (projected to occur in the year 2062 for BSL) the required service life of the base liner would be on the order of 70 to 80 years.

The scenario described above represents a typical landfill setting where the base liner is constructed above the water table. At some landfills, the water table may be elevated due to natural or man-made conditions such that it is in contact with, and exerting hydrostatic pressure on, the underside of the base liner. If the hydrostatic pressure exceeds the head pressure of the leachate on top of the base liner, the potential exists for seepage of groundwater through the liner and into the waste mass if; the geomembrane is no longer impermeable due to damage or degradation. This upward seepage of groundwater would actually prevent the migration of leachate downward through the liner, but would result in continued leachate generation following final cover construction, and ongoing need for operation of the leachate collection and removal system. In order to prevent seepage into the waste, the liner would need to function as long as the groundwater is in contact with the base liner. Hydrostatic pressure on the liner is discussed in further detail in Section 6.3.4 of this SEIS.

The required service life of the final cover system is essentially for as long as the underlying waste remains in place since it is the final cover system that maintains the dry tomb status of the landfill.

The final cover is a near-surface feature that can be monitored, maintained, and repaired (as opposed to the base liner, which is buried and inaccessible).

6.3.3.2 Expected Life of Liners

The expected life of landfill liners has been studied and evaluated for the past several decades. There are two distinct liner components that are discussed separately below: geomembranes and soil barriers.

The geomembrane component of the liner systems has reached the end of its useful life when the engineering properties of the material, such as shear strength, puncture strength, tear resistance, etc., have been reduced to 50% of the design values. A complete evaluation of the expected life span of the liner systems is included in Attachment D-2. Over time, the effects of oxidation cause the engineering properties of the geomembrane to diminish. The studies presented in Attachment D-2 estimate the half-life of geomembranes exposed to the temperature and oxidation conditions present in the landfill at approximately 400 years.

The soil barrier liners consist of natural clays. The compacted clay liner constructed on the base and berm slopes are constructed from clay till soils that are the product of weathering of rocks and were deposited by glaciation going back 10,000 years or more. These inorganic mineral clay soils are not expected to change or lose effectiveness as a barrier for the foreseeable future, barring a significant shift in the landfill foundation soils, which is unlikely based on geotechnical analysis conducted as part of MPCA solid waste permitting. The GCL liner is manufactured from bentonite clays, which are the product of weathering of volcanic ash and were formed millions of years ago. There is likewise no expectation that the barrier-layer properties of bentonite will diminish in the foreseeable future. The bentonite in GCLs is sandwiched between geotextile layers which confine the bentonite for transportation and installation, and provide shear resistance during waste placement operations. The engineering properties of the geotextiles will diminish over time similar to the geomembranes. However, when waste placement operations are concluded, the functions of the geotextiles are no longer needed and the bentonite is confined by the surrounding materials.

6.3.4 Water Table Conditions During Normal River Flow and Hydrostatic Head on Liner during 500-Year Flood

6.3.4.1 Normal River Flow

Water table conditions during normal river flow are represented by the previously described design-basis water table. The base liner is located at elevations above the design basis water table. Therefore, no hydrostatic head on the liner is expected during normal river flow.

6.3.4.2 500-Year Flood

Water table conditions during the 500-year flood were calculated as part of the levee stability analysis presented in Section 6.3.2.3 and Figure 6-10. The water table is predicted to rise above the design-basis elevations during the 500-year flood event and exert hydrostatic pressure at various locations and in varying magnitudes on the under-side of the landfill base liner. As shown on Figure 6-10, the highest pressure is estimated to be 5.5 feet of hydrostatic head, which is a pressure of 2.4 pounds per square inch (psi). This pressure is not of concern for the liner system itself; the liner will experience far greater pressure from the weight of overlying waste. The concern with hydrostatic pressure on the underside of the liner is related to the potential for the liner to be lifted (floated) from its installed position if there is not sufficient counteracting downward pressure from overlying leachate collection system materials and waste. An additional potential impact includes the potential for groundwater infiltration through liner defects.

6.3.4.3 Potential Impacts Due to Water Table Conditions

Uplift of Liner by Increased Hydrostatic Pressure

The Seep/W model predicts the hydrostatic pressure inside the cell from the 500-year flood, and assumes that either final cover has been installed or that other emergency protective measures such as sand bags have been installed, so that river water does not overtop the levee. The model assumes that the river stage has reached a steady-state condition. That is, the water table profile is not expected to rise in elevation beyond what the model predicts because the model assumes an infinite time period of sustained river level. A companion assumption is that the flood is not of sufficient duration to affect the regional water table.

The waste density ranges from approximately 0.7 to 1.0 tons per cubic yard (52 to 74 pounds per cubic foot), resulting in a downward pressure of 0.36 psi to 0.51 psi on top of the liner system. In a conservative case with waste density at 52 pounds per cubic foot, a waste depth of 6.7 feet or greater would be required in order to counteract the hydrostatic head pressure of 2.4 psi under the 500-year flood condition. As such, the liner system would be most susceptible to uplift pressure immediately after construction. After final closure (in the post-Project condition) the downward pressure of waste inside the cell far exceeds the uplift buoyant force of the elevated water table from the 500-year flood.

Infiltration of Groundwater through Geomembrane Defects

Rising river water levels increase the potential for seepage entering the lined disposal cells through liner defects. Any infiltrating groundwater would become leachate after entering the waste disposal cell – and hence would require removal through the leachate collection system. An estimate of the volume of water entering the cell through liner defects depends on the number and size of defects, the underlying material below the geomembrane, whether there is intimate contact between the geomembrane and soil, and the soil's permeability rate. Evaluation of the potential for leakage into,

or out of, geomembrane defects is included in the attached Attachment D-3, and indicates that the volume is negligible (less than .01 gallons per year through a 1-cm hole).

6.3.4.4 Potential for Disproportionate Impacts

The potential impacts to the liner and leachate collection system associated with a high water table (i.e. uplift pressure, groundwater infiltration) would have a very localized effect on the base of the landfill and disproportionate impacts would not be expected to occur within the identified Environmental Justice Area of Concern.

6.3.4.5 Mitigation of Impacts Due to Water Table Conditions

Mitigation of potential impacts from uplift pressure may entail visual inspections of the river water level relative to the waste level. Additional preventative measures could include the installation of piezometers through the levee to determine the effect of the river on groundwater at the liner. Detection of rising water pressures in the levee fill could warrant emergency actions that would counter-act the uplift pressure on the liner. Such actions could include placement of additional soil in the cell or increasing pumping at quarry dewatering wells.

6.3.5 Major Failure of Liner System at Complete Buildout

Major failure of the liner system refers to large segments of the liner system being damaged and causing displacement of waste or free discharge of leachate. Should a major failure occur after complete build-out, the only plausible cause would be slope failure. Slope failure is unlikely, as indicated in Section 6.3.2 and in the "Design Report" submitted with the permit modification application (Carlson McCain, 2019). A plausible mechanism is not believed to exist for creation of a large tear in the liner system at the time of complete build-out because the landfill is in a static condition at this time and there are no forces being applied to the liner that would result in such a tear.

6.3.5.1 Potential Impacts Due to Major Liner Failure

Impacts include those similar to the impacts described in Section 6.3.2 under the heading *Instability of the Flood Levee*. The result would be that waste materials from the exposed area could be deposited onto the surrounding soils or carried downstream with the river current; precipitation or flood waters would seep into the exposed waste and would generate new leachate; leachate could flow directly out from the exposed area, contacting the surrounding soils and impacting groundwater.

6.3.5.2 Mitigation of Impacts Due to Major Liner Failure

Engineering controls and operational best management practices are in place to reduce the potential for a major failure such as a liner tear or puncture resulting from placement of waste in the cell. These include placement of buffer soils over the liner, use of GPS-guided equipment during

construction, proper compaction of waste materials, and operator training programs, among others. Emergency response actions after a major liner failure are included in the *Closure, Post-Closure and Contingency Action Plan*, dated 4/12/2019, by Carlson McCain, submitted with the Application for Permit Modification (Carlson McCain, 2019), and includes containment of the free products of the waste and leachate from migrating further; excavating contaminated soils and disposing in the landfill; reconstruction of the subgrade or flood levee, landfill base liner, and final cover system at the location of the failure; and sampling groundwater monitoring wells. Treatment of groundwater may be required depending on the magnitude of contamination.

Mitigation strategies to limit the impacts of a major liner failure at complete buildout would include ensuring that leachate contained in the waste disposal area is continuously maintained at or below the 12-inch regulatory limit above the base liner floor, in order to minimize the volume of leachate that could escape the lined area.

6.4 Visual Impacts

This section includes the following items required by the Final Scoping Decision Document:

- Photo renderings showing complete buildout based on the 2005 EIS elevation, an elevation of 950 feet, and the elevation at complete Post-Project buildout. The renderings show multiple vantage points and varying leaf cover.
- Assessment of impacts from lights and other elevation related safety requirements (for example aviation safety requirements).

6.4.1 Photo Renderings

A series of photo renderings were prepared showing three different landfill buildout scenarios as viewed from key vantage points and varying leaf cover (i.e. some with leaf cover and some without) to illustrate the potential visual impacts of the Project. The buildout scenarios are as follows:

1. The currently-permitted complete buildout with a top elevation of 820 feet above MSL;
2. An interim buildout of the proposed Project with a top elevation of 950 feet above MSL; and
3. The proposed post-Project complete buildout, with a peak elevation of 1,082 feet above MSL.

The renderings are included in Attachment E-1, along with a map showing the vantage point locations from which the renderings were prepared.

6.4.2 Lighting Impacts

The Operations Plan included in the Solid Waste Permit Application (Carlson McCain, 2019) states that the landfill is normally open to accept waste from 7:00 a.m. to 4:30 p.m. Monday through Friday. Extended hours and/or Saturday operation may be allowed on a case-by-case basis. The hours of equipment operation are typically 6:00 a.m. to 6:00 p.m. Monday through Friday and 6:30 a.m. to 3:00 p.m. on Saturday. As such, the vast majority of landfill operations occur during daylight hours, and no supplemental lighting is needed. In the rare cases where night work is performed, landfill

operations and equipment have evolved to where the equipment itself provides sufficient illumination for the work. Portable lights similar to those sometimes seen on road construction projects are not used at the landfill. Modern safety policies at the landfill have generally eliminated people working on the ground in close proximity to heavy equipment during darkness, thereby eliminating the need for portable lights.

Permanent or long-term portable lighting is generally limited to conventional wall-mounted or pole-mounted omnidirectional or directional lights associated with on-site buildings including the shop/office, scale house, and gas plant, and also street intersections. This type of lighting is typical for the commercial/industrial setting in which the landfill is located. No modifications are proposed to the existing light sources, and no additional permanent lighting will be installed as part of the proposed Project; therefore, no directly-related impacts to facility lighting are expected as a result of the proposed Project.

The increased height of the proposed Project will indirectly affect lighting at the landfill as a result of the change in operating elevation for construction equipment that may be used during night work. Under the currently-permitted design, the top elevation of the landfill after closure would be approximately 100 to 120 feet above the surrounding land surface (corresponding to an elevation of 820 feet above MSL) and is characterized by a relatively broad, flat surface. The proposed Project will increase the maximum elevation to approximately 360 to 380 feet above the surrounding land surface (corresponding to an elevation of 1082 feet above MSL), with slopes coming to a peak instead of a flat top.

Equipment lighting is designed to illuminate the ground in the immediate vicinity of the equipment, and the resulting ground illumination will be different for flat versus sloped ground. To assess the differences in construction equipment lighting intensity between the proposed project and currently-permitted conditions, three photometric plans were created using photometric design software, and are attached as Attachment E-2. The plans show light effects from multiple positions in order to demonstrate possible locations of the operating equipment. The models were created using lighting information from a General Electric model 40579 spotlight. This type of light is typically used on airport runways and has a greater luminosity than any light that will be used on the operating equipment. This light was used to provide a worst-case scenario for the model.

The existing conditions model was performed assuming that the landfill had been built up to the ultimate permitted height of 820 feet above mean sea level. Two models were generated for the proposed Project: one model uses a truncated top elevation of 1,000 feet above MSL (i.e. 300 feet above the surrounding land surface), and the second model uses the full buildout top elevation of 1,082 feet above MSL. Light locations were placed onto the final cover on the side slopes and around the rim of the landfill top. The lights were angled in a manner to mimic equipment that is operating on sloped ground. Once the landfill grades and lighting information were entered into the program, the program modelled the ground intensity of the light beam for each location.
The results of the model show that light intensity of greater than one lumen will reach a maximum extent of 350 feet from the equipment location, and does not reach the property line at any location. For comparison, the brightness of a typical home use light bulb ranges from 450 to 1,600 lumens.

The landfill rises at a slope of three horizontal feet to one vertical foot. This means that for each foot of increased elevation, the landfill surface will be moving three feet closer to the center of the landfill. In terms of visual receptors, this means that construction equipment used on the landfill will be moving farther away from property boundaries and adjacent receptors as elevation increases. Since the increase of the ultimate vertical height of the landfill will not result in equipment lights moving closer to the property line when compared to the existing condition, the off-site effects of the proposed Project will not result in increased light intensity. Due to the increased height of the proposed Project, the top of the landfill will be visible from more locations than under the currently-permitted design, as shown in the photo renderings. Operating equipment and associated lighting could therefore also be seen from additional locations, however the modeled lighting intensity is not expected to cause a nuisance condition to receptors. Since no other changes in lighting will be made for the proposed Project, no additional impacts are expected.

6.4.2.1 Potential for Disproportionate Impacts

The increased height of the landfill will cause it to be visible from more locations than under the currently-permitted design. The photo renderings demonstrate that the taller landfill will be visible from areas both inside and outside the identified Environmental Justice Area of Concern, therefore visual impacts are not expected to be experienced disproportionately by residents of the identified Environmental Justice Area of Concern.

6.4.2.2 Mitigation of Visual Impacts

The visual impacts of the Project could be mitigated by measures such as landscaping (screening) as well as reducing the height of the proposed landfill expansion.

6.4.3 Aviation Safety

Aviation safety is addressed in the discussion of Federal Aviation Administration requirements in Section 6.6 – Sociological Impacts.

6.5 Air Quality

An air quality impacts analysis was conducted by Cornerstone Environmental Group, LLC, a Tetra Tech Company, which provides information required by the Final Scoping Decision Document, including the following specific information:

- Analysis of air quality impacts from the Project, using data available from the BSL and from monitoring studies at other landfills in the state.

- An evaluation of the impacts associated with landfill gas emissions (methane and volatile organic compounds) during BSL operations and post closure, using EPA's Landfill Air Emissions Estimation Model (developed under EPA contract EPA-600/8-90-85a). The emissions include those associated with the landfill gas, the electrical generating units (EGU's), and landfill gas

not captured by the BSL gas collection system. Results of the modeling are compared to Ambient Air Quality Standards or Health Benchmarks, and are used to evaluate the following six scenarios:

1. An estimate of the volume of landfill gas (LFG) currently being generated at the BSL.
2. An estimate of the volume of LFG that is currently being captured at the BSL.
3. An estimate of the percentage of the captured LFG that is flared, utilized in other ways, or discharged to the atmosphere at the BSL.
4. An estimate of the volume of the LFG that is expected to be generated by the Project at the BSL.
5. An estimate of the percentage of LFG that is expected to be captured by the LFG collection system (GCCS) for the Project.
6. An estimate of the percentage of the captured LFG that will be flared, utilized in some method, or allowed to escape to the atmosphere at the BSL for the Project.

- An evaluation of all direct, indirect, and cumulative ambient air impacts at the BSL consistent with the MPCA Air Quality Modeling Practices Manual (also known as, "MPCA Air Dispersion Modeling Practices") for the Project.

- Discussion of the ability of the BSL to meet applicable MPCA air quality regulations for the Project.
- An assessment of the applicability of federal New Source Performance Standards for new or modified MMSW landfills for the Project at complete buildout, including an analysis of implementation measures to meet the standards, if they apply.
- An evaluation of the mitigation options for controlling air emissions at the BSL for the Project.
- A qualitative summary of expected GHG production from the Project.
- A review of existing odor issues at the landfill and expected changes resulting from the Project.
- A review of current odor control protocols used at the BSL and a review odor control methods used at other MMSW landfills in the five-state area (Minnesota, North Dakota, South Dakota, Iowa, and Wisconsin).

The full report, titled "Burnsville Sanitary Landfill Annex Development Project Supplemental Environmental Impact Statement Air Quality Technical Report" (Air Quality Technical Report) (Cornerstone, 2021), is included in Attachment F. Much of the discussion and data presented in this section is taken directly from, or adapted from, the Air Quality Technical Report unless otherwise cited.

6.5.1 Emission Sources

BSL is an MMSW landfill, where air emissions are associated with the breakdown of waste by bacteria over the course of several years, which creates landfill gas. BSL operates a gas collection and control system (GCCS) to capture landfill gas and mitigate emissions. The proposed Project will increase the

maximum "peak" landfill gas generation at the BSL, as well as the number of years the facility will generate gas. The GCCS will be expanded as part of the Project to accommodate the additional gas generation.

Collected landfill gas at BSL is sent to an enclosed flare and/or a treatment system where it is compressed, dewatered, and filtered. Treated landfill gas is combusted in six EGUs.

Specific emission sources include the following:

- Uncaptured landfill gas, which is emitted as fugitive through the landfill surface
- Emissions related to combustion of captured landfill gas
- Fugitive dust generated by vehicle traffic and waste handling operations

6.5.2 Analysis Methods

Air quality impacts associated with the Project were evaluated using the following resources and methodologies:

- Emissions calculations were performed using site-specific information provided by BSL as well as accepted default values and emission factors from EPA.
- Landfill Gas Emissions Generation Model (LandGEM), Version 3.02 was used to estimate landfill gas generation.
- Dispersion modeling (AERMOD, Version 19191) was completed to compare predicted air quality impacts to NAAQS and MAAQS.
- Emission rates from emission sources near BSL were obtained from MPCA or calculated (and approved) based on data provided by MPCA and included in the cumulative impact analysis in the Air Quality Technical Report.
- Monitoring studies at other landfills were included in the odor impacts section of the Air Quality Technical Report.

Both "Pre-Project" and "Post-Project" scenarios were evaluated and compared. The descriptions of each scenario are provided below:

> **Pre-Project** – Based on potential to emit (defined in Section 3.3 of the Air Quality Technical Report) for the current facility – which includes the maximum landfill gas generation predicted without the expansion, and the landfill gas combustion devices conservatively assumed to be operating at capacity (as allowed by the current air permit).
>
> **Post-Project** – Potential to emit was calculated at the maximum landfill gas generation rate at full build-out of the Project. As in the "Pre-project" scenario, landfill gas combustion devices were assumed to operate at capacity. No additional landfill gas combustion devices are required.

It is possible that the EGUs may be shut down in the future for economic reasons. If this were to happen, landfill gas will be routed to the existing enclosed flare until such a time that the flare reaches its capacity of 3,000 scfm. If a second flare is to be installed in the future, an air permit modification will be required, with additional dispersion modeling and MPCA review performed prior to installation. The modeling must demonstrate compliance with ambient air standards to secure an air permit modification. The information provided in this SEIS is based on the six EGUs and enclosed flare continuing to operate.

6.5.3 Landfill Gas Generation

Table 6-8, below, is reproduced from Table 2-2 of the Air Quality Technical Report and presents estimates of landfill gas generated, captured and uncaptured in the Pre-Project and Post-Project scenarios, based on the LandGEM analysis. A description of LandGEM modeling parameters and protocols is included in the Air Quality Technical Report (Cornerstone, 2021)

Table 6-8
Landfill Gas Generated, Captured, and Uncaptured

Parameter	Pre-Project	Post-Project
Maximum Volume of Landfill Gas Generated (LandGEM estimated) (scfm)	2,924[(a)] (Year 2019)	5,863 (Year 2068)
Maximum Volume of Landfill Gas Captured (scfm)	2,553[(b)]	4,397[(C)]
Maximum Volume of Landfill Gas Uncaptured[(d)] (scfm)	371	1,466

(a) Based on waste acceptance rates through 2020.
(b) Average actual landfill gas burned in the EGUs and flare combined in 2019 (based on 8,760 hours of operation).
(c) Assuming EPA's average collection efficiency of 75%.
(d) Difference between LandfGEM predicted landfill gas generation and volume of landfill gas captured.

Comparing the actual amount of landfill gas captured (i.e. 2,553 scfm in 2019) to the LandGEM-estimated landfill gas generation rate for 2019 of 2,924 scfm results in a collection efficiency of 87 percent in the Pre-Project scenario. For the Post-Project scenario, the collection efficiency is conservatively assumed to be equal to the AP-42 average collection efficiency of 75%.

Comparing the amounts of uncaptured landfill gas in the Pre-Project and Post-Project scenarios shows that the Project will result in an increase in the maximum volume of uncaptured gas from approximately 371 scfm in year 2019 to 1,466 scfm in the year 2068. This estimate is based on the estimated gas generation rate and the conservative assumption of 75% collection efficiency.

6.5.3.1 Utilization of Collected Landfill Gas

A comparison of the percentage of captured landfill gas that will be flared or utilized in another method is provided in Table 6-9, which is reproduced from Table 2-3 of the Air Quality Technical Report. BSL indicated that the ratio of landfill gas sent to the EGUs and flare remains the same as

current values (52% of collected landfill gas to the EGUs and 48 percent to the flare), unless the EGUs are shut down, as described in Section 6.5.2. If that is the case, then 100% of the landfill gas collected will go to the enclosed flare.

Table 6-9
Landfill Gas Generated, Captured, and Uncaptured

Parameter	Pre-Project[(a)]	Post-Project[(b)]
Percentage of Captured Landfill Gas Flared	48%	48%
Percentage of Captured Landfill Gas to EGUs	52%	52%
Percentage of Captured Landfill Gas Escaping to Atmosphere[(c)]	0%	0%

(a) Based on waste acceptance rates through 2020.
(b) Average actual landfill gas burned in the EGUs and flare combined in 2019 (based on 8,760 hours of operation).
(c) Assuming EPA's average collection efficiency of 75%.

6.5.4 Air Emissions

6.5.4.1 Emissions Sources and Pollutants Emitted

As described in Section 6.5.1, emissions sources associated with the Project include uncaptured landfill gas, landfill gas combustion-related emissions, and fugitive dust from vehicle traffic and waste handling.

Pollutants emitted by these sources are classified into three different groups: criteria pollutants, GHGs and air toxics. More information for each group is provided below.

- Criteria pollutants include carbon monoxide (CO), nitrogen oxides (NO_x), particulate matter (PM), particulate matter with diameter less than 10 microns (PM_{10}), particulate matter with diameter less than 2.5 microns ($PM_{2.5}$), sulfur dioxide (SO_2), and volatile organic compounds (VOCs).
- Air toxics are a group of pollutants that cause or may cause cancer or other serious health effects or adverse environmental or ecological effects. EPA has identified a selected subset of air toxics known as hazardous air pollutants.
- GHGs are pollutants that absorb and emit radiant energy within the thermal infrared range, causing the "greenhouse effect" in the atmosphere. Carbon dioxide, methane (CH_4), and nitrous oxide (N_2O) are GHGs emitted by landfill sources.

The pollutants emitted by each emission source at BSL are presented in Table 3-2 of the Air Quality Technical Report, which is reproduced here as Table 6-10.

Table 6-10
Pollutants Emitted by Source

Source	Pollutants Emitted
Municipal Solid Waste Landfill (uncaptured landfill gas)	• VOCs • Air Toxics • GHGs
Dust from Vehicle Traffic	• PM • PM_{10} • $PM_{2.5}$
Dust from Material Handling & Bulldozing	• PM • PM_{10} • $PM_{2.5}$
EGUs	• CO • NOx • PM • PM_{10} • $PM_{2.5}$ • SO_2 • VOCs • GHGs • Air toxics
Enclosed Flare	• CO • NOx • PM • PM_{10} • $PM_{2.5}$ • SO_2 • VOCs • GHGs • Air toxics

6.5.4.2 Emission Rates

Air quality emission changes associated with the Project were evaluated using "potential to emit" (PTE) which is used by MPCA to evaluate air permit requirements. The PTE calculations involve analysis of each source of emissions, and incorporate physical or operational factors that would limit emissions including pollution control equipment, hours of operation, type/amount of material combusted, stored, or processed to determine the maximum potential emissions. Detailed potential emission calculations are included in the Air Quality Impacts Report and total facility potential emissions for criteria pollutants, HAPs, and GHGs are summarized in Table 6-11, which includes data from Tables 3-3, 3-4, and 3-5 in the Air Quality Impacts Report.

Table 6-11
Total Facility Potential to Emit

Pollutant	Pre-Project (tons/year)	Post-Project (tons/year)
Criteria Pollutants		
CO	223.4	223.4
NOx	155.1	155.1
$PM_{2.5}$	23.1	23.3
PM_{10}	31	32.9
PM	63.2	70.5
SO_2	53.9	53.9
VOC	55.6	65.8
Air Toxics		
Total HAPs	11.3	16.7
GHGs		
Total Carbon Dioxide Equivalent (CO_2e)	233,859	320,401

6.5.4.3 GHG Emissions Qualitative Summary

Captured and Combusted Landfill Gas

As solid waste is broken down by bacteria in the landfill, methane and carbon dioxide are produced. From a broad mass-balance perspective, carbon placed in a landfill is either sequestered or emitted as methane or carbon dioxide. BSL's primary focus is to minimize the emission of methane, which is a more potent GHG than carbon dioxide. This is primarily accomplished by operation of the GCCS sending the landfill gas to the EGUs and flare. The methane fraction of landfill gas that is collected and combusted in the EGUs and flare is emitted as carbon dioxide.

The carbon dioxide in the collected landfill gas is not combusted but is emitted to the atmosphere as "pass-through" emissions through the combustion device. This is similar to other waste processing techniques like composting or waste incineration where carbon in the waste is converted to carbon dioxide and emitted to the atmosphere.

Uncaptured Landfill Gas

The portion of the landfill gas that is not captured by the GCCS (an average of 25% of the landfill gas generated according to EPA) is conservatively assumed to be emitted to the atmosphere. However, the uncaptured landfill gas does not have a clear path to the air. The waste is covered with soil ("cover soil") as it is placed in the landfill. Aerobic bacteria in the upper layers of soil also consume the uncaptured landfill gas in a process called oxidation, further reducing emissions. Depending on conditions (e.g., methane generation, soil type, etc.), EPA's Mandatory GHG Reporting Rule (40 CFR 98, Subpart HH) estimates that between 10 and 35% of fugitive methane emissions are oxidized to carbon dioxide in the soil cover.

Carbon Sequestration in Landfills

Carbon sequestration is probably the least studied phenomenon relating to the overall greenhouse gas emissions from landfills, but carbon stored in landfills is removed from the carbon cycle. Carbon from materials that do not fully decompose under the anaerobic conditions in landfills is counted as an anthropogenic (man-made) "sink," by keeping this carbon buried in the landfill.

6.5.5 Ambient Air Impacts

Air quality impacts associated with the increase in emissions from the Project are direct and cumulative. Direct impacts were quantified using dispersion modeling to estimate offsite changes in concentrations associated with the Project. Cumulative impacts were evaluated by including nearby emission sources and monitored background concentrations. Table 4-2 of Attachment F provides the results of the modeled cumulative (I.e., results including nearby source) air impacts of BSL. Table 4-3 of Attachment F provides the names of the nearby sources used in the air modeling. There were no additional indirect air quality impacts identified for the Project. However, as the Post-Project scenario occurs at full-buildout (approximately 47 years into the future), the modeled impact can be considered an indirect effect per 40 CFR 1508.8, as these effects are caused by the action and are later in time but still reasonably foreseeable.

Dispersion modeling was performed using a computer program (AERMOD, Version 19191) that incorporates site-specific source information, changes to the landfill elevation, local meteorological data, nearby sources, monitored background concentrations and offsite terrain elevations to predict ambient air concentrations of pollutants emitted by a facility. Modeled impacts are compared to the NAAQS, MAAQS and health benchmarks.

The modeling protocol, methods, and results are presented in the Air Quality Technical Report (Attachment F). Major findings from the modeling results include the following:

- Pre-Project modeled impacts, assuming EGUs and enclosed flare are conservatively assumed to be operating at capacity, exceed the NAAQS/MAAQS for NO_2, $PM_{2.5}$, PM_{10}, and SO_2 at the current stack heights for the EGUs.
- When the EGUs' stack heights are increased by 10 feet and the Project is at full build-out, Post-Project modeled impacts meet the NAAQS/MAAQS with the EGUs and enclosed flare operating at capacity.
- Modeled impacts of hydrogen sulfide comply with the MAAQS for both the Pre-Project and Post-Project scenarios.
- Based on Pre- and Post-Project emissions, risks from BSL air toxics emissions are below suggested health guidance values.

6.5.6 Mitigation Options

6.5.6.1 Criteria Pollutants

The landfill will be designed and constructed according to Minnesota Rule 7035, Solid Waste. The landfill will have an engineered liner system, a leachate collection and control system, and a final cover system. In addition, BSL will expand the landfill gas collection system as part of the Project that will route landfill gas to the existing control devices (EGUs and flare) per NSPS regulations. No additional EGUs or flares are planned as part of the Project, as the estimated landfill gas collection will remain below current permit limits. However, as described in previous sections, if the EGUs are shut down it is likely that additional combustion devices or other beneficial re-use technologies will be needed some time in the future to manage the anticipated gas generation.

Landfill gas emissions will continue to be minimized by placing daily, intermediate, and final soil cover on the waste to help prevent the gases from migrating out of the landfill.

Fugitive dust emissions will continue to be mitigated by implementing the Fugitive Dust Emissions Plan.

6.5.6.2 Air Toxics

Air toxics will continue to be mitigated through a well-operated GCCS (per NSPS regulations) and the combustion of the captured landfill gas.

6.5.6.3 GHGs

GHGs will continue to be mitigated through a well-operated GCCS (per NSPS regulations) and the combustion of the captured landfill gas.

If the Project is approved, BSL will become subject to the provisions of NSPS XXX once it commences construction of the expansion. These provisions will apply to the entire facility, not just the expansion area. Applying the monitoring, recordkeeping and reporting requirements in NSPS XXX will further enhance the effectiveness of the GCCS in reducing GHG emissions from BSL.

GHG emissions are further reduced through BSL's operation of its 4.8-megawatt landfill gas-to-energy plant (i.e., the EGUs). Operation of the plant on renewable landfill gas results in emissions of CO_2, and each kilowatt generated offsets man-made CO_2 emissions from the combustion of fossil fuels. If the EGUs continue operating, the Project will extend the time period in which usable quantities of landfill gas are generated, thus extending the operating life of the gas-to-energy plant, or other potential new beneficial re-use technology that could augment or replace the plant.

6.5.7 Regulatory Requirements

6.5.7.1 Applicable Federal Standards

Currently-applicable standards include 40 CFR 60 Subpart WWW pertaining to NSPS, and 40 CFR 60 Subpart Cf pertaining to emissions guidelines, both of which are related to emissions of non-methane organic compounds (NMOCs).

Standards applicable in the future include 40 CFR 60 Subpart XXX pertaining to NSPS, and 40 CFR 63 Subpart AAAA pertaining to NESHAP. Subpart XXX includes updated NSPS for new or modified landfills, and the requirements will become effective when BSL commences construction on the Project and will remain in effect at full build-out of the Project. The updated NESHAP rule requires continued compliance with Subpart WWW, as well as certain provisions of the prior NESHAP, before September 28, 2021. The air emissions analysis demonstrates that the Project will comply with all applicable federal air quality regulations, and BSL will continue to comply with the regulations through the use of a GCCS.

6.5.7.2 Applicable MPCA Air Quality Regulations

MPCA regulations applicable to the Project include specific parts and subparts of Minnesota Rules Chapter 7007, *Permits and Offsets*, Chapter 7009, *Ambient Air Quality Standards*, and Chapter 7011, *Stationary Sources*, which are individually identified and described in the Air Quality Technical Report. BSL is also subject to the conditions of the current MPCA Air Emissions Permit No. 03700192-004. The air emissions analysis demonstrates that the Project will comply with all applicable MPCA air quality regulations, and BSL will continue to comply with the regulations through the use of GCCS.

6.5.8 Odors

All MMSW landfills, including BSL, have the potential to generate odors. Odors can be generated directly by the waste delivered to the landfill and by the decomposition of the waste at the landfill. Odors at landfills are primarily caused by hydrogen sulfide and ammonia, and landfills require preventive practices and controls to minimize the potential for fugitive emissions of these and other malodorous compounds.

6.5.8.1 Existing Odor Issues at BSL

An assessment of existing odor issues at BSL was conducted by inquiring with BSL management, the City of Burnsville, and Dakota County about documented odor complaints received in the past five years.

- BSL management stated that no odor complaints have been received in the past five years (M. Miller, personal communication, January 2021).

- The City of Burnsville reported no odor complaints in the past five years (Faulkner, 2021). The City provided one odor complaint record from September 2015, which was logged for informational purposes and did not result in follow-up actions.
- Dakota County reported no odor complaints in the past five years (Magnuson, 2021).

6.5.8.2 Current Odor Control Protocols Used at BSL

BSL operates under the provisions of its OCP, dated March 3, 2015 (Waste Management, 2015). The OCP is required by MPCA Solid Waste Management Facility Permit for operation of the BSL and is thus a publicly availably document and subject to regulatory compliance and enforcement. The OCP includes proactive and reactive processes to control odor emissions from the site.

Proactive measures include the following:

- Operating an active GCCS
- Burying particularly malodorous wastes in trenches and covering immediately
- Minimizing excavation of previously placed wastes and re-covering excavated wastes as soon as possible
- Placing daily cover (soil or tarps) over waste materials
- Installing and operating an active gas collection system
- Notifying public agencies and private neighbors in advance of activities that may produce odors
- Training staff in implementing odor control practices

Reactive measures are used to respond to odor complaints and the OCP includes detailed instructions for documenting and responding to odor complaints. Procedures include collection of pertinent information from the complainant; investigating potential odor sources; taking corrective actions; reporting complaints and responses to responsible regulatory agencies; and documenting the reactive measures process.

6.5.8.3 Expected Changes in Odor Issues Resulting from the Project

The Project is not expected to cause increased odors relative to current conditions. The Project is a continuation of existing operations at BSL and procedures for waste acceptance, handling, placement, and covering will be consistent with current practices. In particular, BSL will continue to employ the proactive measures listed in the OCP such as burying malodorous wastes immediately, minimizing excavations into the waste, and placing daily cover in order to minimize odors from the landfill working face. BSL's Odor Control Plan will remain in effect, subject to modification as may be needed based on MPCA review during the solid waste permitting process.

BSL will continue to operate the active gas collection system to prevent fugitive emissions of landfill gas. Gas will be collected and combusted using a flare and/or EGUs and malodorous compounds such as hydrogen sulfide, ammonia, and other NMOCs are destroyed during combustion.

6.5.8.4 Odor Control Methods Used at Other Landfills

A review of odor control methods at MMSW landfills in Minnesota, North Dakota, South Dakota, Iowa, and Wisconsin was conducted through email and telephone correspondence with solid waste regulators in these states and review of written odor control procedures described in landfill operations plans.

The odor control methods described in the landfill operations plans and implemented at MMSW landfills in the five-state area are all very similar, and are rather brief, typically a few sentences or paragraphs in length. Odor control methods identified in the plans include:

- Immediately burying and covering malodorous loads. (Tetra Tech, 2019) (SCS, 2018), (Wenck, 2012)
- Placement of daily cover (soil or tarps) over waste materials. (SCS, 2018) (Wenck, 2012)
- Minimizing disturbance of previously placed wastes. (Tetra Tech, 2019)
- In the case of larger facilities, operation of a gas control system. (Wenck, 2017) (SCS, 2018)
- Mention is made in a few plans of use of odor-masking agents if necessary. (Tetra Tech, 2019)

South Dakota solid waste regulators stated that the state does not regulate odors at landfills. Most landfills are located in rural areas where the neighbors are not close. Odor complaints that have been received have been related to composting operations located at or near landfill sites rather than to the landfills themselves (Kropp, 2019).

Iowa solid waste regulators stated that the state does not require landfills to provide odor control plans (Smith, 2019).

Wisconsin solid waste regulators stated that odor control measures are discussed in the plan of operation for each site (Joosten, 2019). In addition, landfills in Wisconsin are required to negotiate a local agreement between them and any municipalities located within 1,500 feet of the limit of waste if the municipality so chooses.

Minnesota and North Dakota regulators stated that odor control measures are discussed in landfill operating plans (D. Trussell, personal communication, December 2019).

6.5.9 Potential for Disproportionate Impacts

Dispersion of emissions from BSL are a function of meteorological conditions and distance from the source. The air quality impacts associated with the Project will be greatest along and near the BSL ambient air boundary, in close proximity to the emission sources at BSL. Dispersion modeling shows that the Project will meet ambient air quality standards and health benchmarks at and beyond the ambient air boundary. Air emissions associated with the Project are not expected to disproportionally impact the identified Environmental Justice Area of Concern. BSL will continue to mitigate emissions, as required by federal and state air quality regulations.

6.6 Sociological Impacts

6.6.1 Nearby Recreational Resources

Inventory of Recreational Resources:

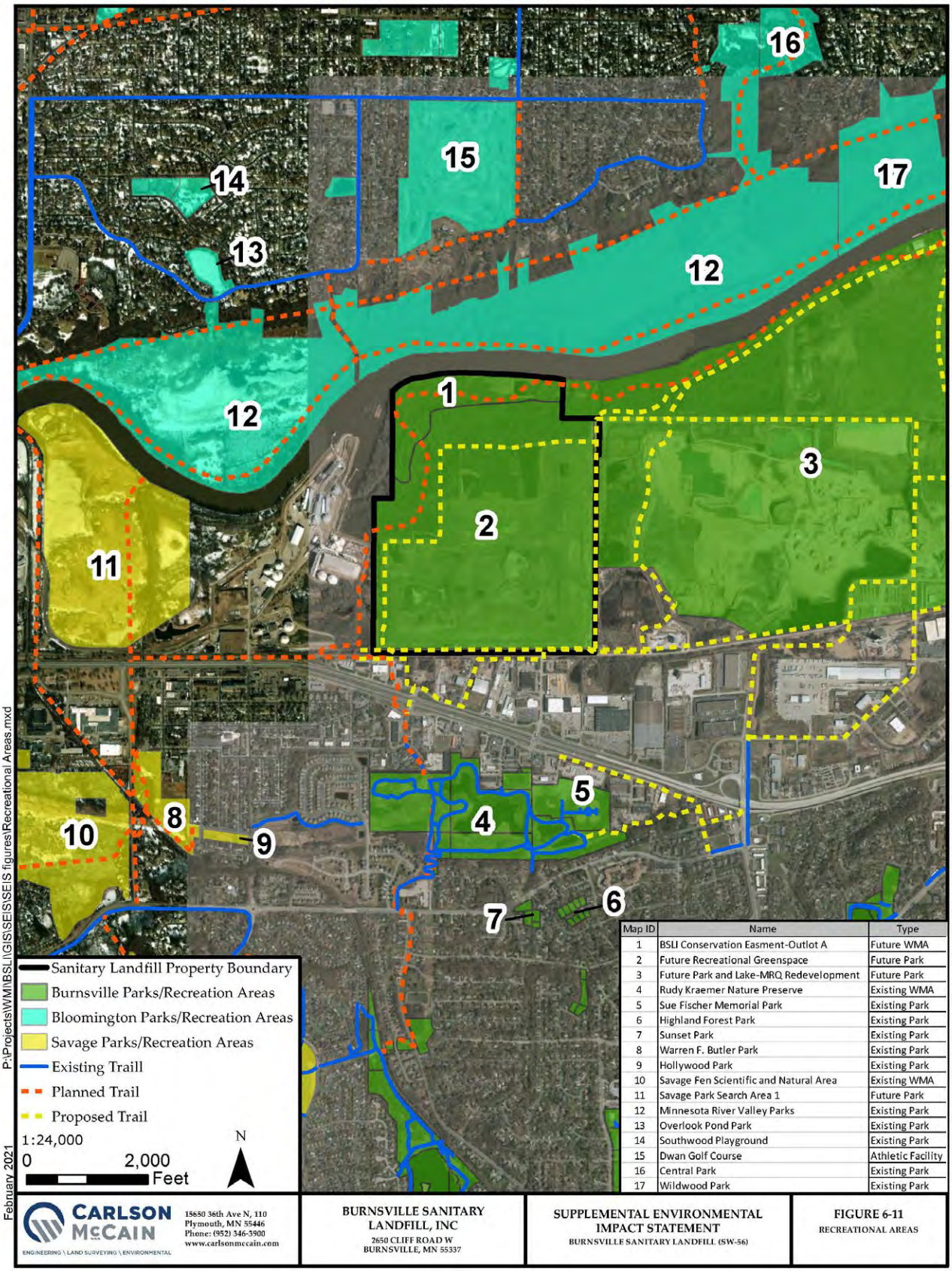
Existing and planned recreational resources near the BSL are illustrated on Figure 6-11. These include parks, trails, natural areas, playfields, golf courses, and other community recreational facilities. Primary information sources for the figure include web mapping and GIS data services, as well as published comprehensive development plans for the cities of Burnsville, Bloomington, and Savage.

The nearest existing recreational resources to the BSL include the following:

- Sue Fischer Memorial Park – baseball and softball fields, located less than one-half mile south of BSL in Burnsville.
- Rudy Kraemer Nature Preserve – nature and wildlife refuge and trails, located less than one-half mile south of BSL in Burnsville.
- Minnesota River Valley Park – nature and wildlife refuge and trails, located approximately one-quarter mile to the north of BSL in Bloomington.
- Dwan Golf Course – public golf course located approximately three-quarters of a mile north of BSL in Bloomington.

The most prominent planned recreational area near the BSL is associated with the Minnesota River Quadrant (MRQ) redevelopment area described in the Burnsville 2040 comprehensive plan (City of Burnsville, 2019b). The MRQ area includes the BSL, Kraemer quarry, the Freeway Landfill, and surrounding commercial and industrial land bounded by I-35W, Highway 13, and the western city limit of Burnsville. The planned MRQ redevelopment adjacent to the east of the BSL includes a recreational lake within the former quarry, along with a city park/beach, riverfront park, greenspace, and trails connecting to the existing trail within the Minnesota River Greenway, which currently terminates at I 35W.

The BSL is included in the proposed MRQ redevelopment. The current Planned Unit Development (PUD) Agreement with the City of Burnsville stipulates that the existing landfill is an interim use of the property, and the permanent end use will be open space, and/or recreational. As part of the long-term planning for the future closure of BSL, a 44-acre outlot containing land adjacent to the Minnesota River has been given to the City. Known as Outlot A, this parcel includes 31.9 acres which is intended to be within a conservation easement and will provide a continuation of the riverfront trail and greenway. The remainder of the BSL site is planned for use as public recreational area, with use types described later in this section.



Map ID	Name	Type
1	BSLI Conservation Easment-Outlot A	Future WMA
2	Future Recreational Greenspace	Future Park
3	Future Park and Lake-MRQ Redevelopment	Future Park
4	Rudy Kraemer Nature Preserve	Existing WMA
5	Sue Fischer Memorial Park	Existing Park
6	Highland Forest Park	Existing Park
7	Sunset Park	Existing Park
8	Warren F. Butler Park	Existing Park
9	Hollywood Park	Existing Park
10	Savage Fen Scientific and Natural Area	Existing WMA
11	Savage Park Search Area 1	Future Park
12	Minnesota River Valley Parks	Existing Park
13	Overlook Pond Park	Existing Park
14	Southwood Playground	Existing Park
15	Dwan Golf Course	Athletic Facility
16	Central Park	Existing Park
17	Wildwood Park	Existing Park

Approximately one-half mile west of BSL, the City of Savage has identified an area for a potential future riverfront park and river access known as Park Search Area 1 (PSA1), which currently comprises undeveloped floodplain area between the Minnesota River and Highway 13. The City of Savage anticipates developing a portion of the land within PSA1 for recreational use.

Potential Impacts to Recreational Resources:

The Project is not expected to cause adverse impacts that would affect the usability of existing nearby recreational resources or hinder the development of planned recreational areas. The facility operations, waste acceptance rates, equipment, etc. are expected to be consistent with current practices, which have not precluded the use of nearby recreational resources. The increased height of the proposed Project will be the primary difference from current conditions, and it is not anticipated that this would deter usage of existing or planned recreational resources. Common nuisance concerns such as noise, dust, odors, and windblown litter that could affect public enjoyment of nearby recreational resources are addressed through permitting requirements and operational best management practices, which have shown over the modern history of the BSL to be effective at controlling these potential concerns. An inquiry with the City of Burnsville resulted in one documented citizen complaint from 2015, which did not require follow-up action. There have been no reported permit violations related to nuisance conditions.

The proposed end use of the Project is recreational, which is consistent with the current zoning classification of "CRD – Commercial Recreation", and currently permitted end use type (City of Burnsville, 2015, 2019b). This end use would constitute a beneficial impact to planned recreational resources within the City of Burnsville because of the increased amount of recreational area available to citizens of Burnsville and the surrounding communities.

6.6.2 Proposed End Use

As described in the Concept-Stage PUD Application submitted to the City of Burnsville in 2018 (Carlson McCain, 2018), the end use plan for the currently-permitted final buildout of the BSL includes an 18-hole golf course; however, the golf course would be eliminated in the proposed Project due to the steeper slopes and a reduction in the amount of flat terrain available for golf course development. The end use for the BSL under the proposed Project complete buildout includes conversion of the majority of the BSL area to recreational use and greenspace, featuring walking and biking trails, observatories, and natural habitat areas, which will be open to the public. The system of trails would facilitate the City of Burnsville's connection to a future regional trail system within the Minnesota Valley National Wildlife Refuge.

The Findings of Fact and Decision (Findings of Fact) approved on March 5, 2019, by the City of Burnsville for the BSL Concept-Stage PUD Application notes that the interim use (Landfill) and end use (recreation, public access and open space) are appropriate land uses for the site, and lists public access, open space, trails, and other recreational uses as feasible end uses for the BSL (City of Burnsville, 2019a).

Additionally, the Findings of Fact lists the following specific examples of recreational end uses that shall be considered:

a. Mountain bike skills course
b. Dog park
c. Fully accessible playground
d. Large Picnic shelters and a community building
e. Athletic turf fields
f. Adult fitness park
g. Walking and biking trails
h. An observation area
i. Natural habitats

A number of factors will affect the viability of potential end uses, including but not limited to available land and suitability of terrain, protection of the final cover, and compatibility with stormwater and landfill gas control structures. In general, biking and walking trails, observation areas, and natural habitats are viable under the proposed Project complete buildout, as well as an interim buildout to elevation 950 and the currently permitted buildout to elevation 820. End uses requiring large amounts of relatively flat ground (e.g. athletic fields, large shelters/buildings, golf course) are not viable under the proposed Project complete buildout because there would be an insufficient amount of flat land available for these uses. An interim buildout to elevation 950 could potentially be designed with sufficient flat area to accommodate athletic fields and/or buildings. End uses with moderate space needs such as a dog park or playground would be viable under the currently-permitted buildout and the interim buildout to elevation 950; and could be viable under the proposed Project complete buildout if they were to be located on the northeastern portion of the existing landfill that will not be filled over. A mountain bike skills course could be viable under all three buildout scenarios, however special provisions for final cover protection would likely be required due to the potential for rutting of the final cover soils.

The specific end use(s) for the BSL will ultimately be determined during the Development-Stage PUD process in coordination with the City of Burnsville.

6.6.3 Federal Aviation Administration Requirements

Regulations directly pertaining to MMSW landfill proximity to airports include the following:

- The EPA regulates MMSW landfill location standards under the RCRA, which is located in Title 40, Section 258 (i.e. 40 CFR §258) of the CFR. Under the requirements of 40 CFR §258.10, owners or operators proposing to site new MMSW landfills and lateral expansions within a five-mile radius of any airport runway end used by turbojet or piston-type aircraft must notify the affected airport and the FAA.
- The FAA also regulates under Title 49 of the United States Code (U.S.C.) §44718(d) that the minimum separation distance for new landfills be six miles. However, §44718(d) does not apply to expansions or modifications of landfills which existed prior to the year 2000.

- Minn. R. §7035.2815 subpart 2C, states that MMSW landfills must not be located within 10,000 feet of an airport runway used by turbojet aircraft, or 5,000 feet of a runway used by piston type aircraft.

Other general regulations pertaining to certain proposed construction, or the alteration of existing structures include:

- Under 14 CFR §77.7 and §77.9, a person must file notice with the FAA by submitting Form 7460-1, Notice of Proposed Construction or Alteration if proposing any construction or alteration that is more than 200 feet above ground level (AGL) at its site.

BSL is located approximately 6.5 miles away from the nearest runway end at Minneapolis/St. Paul International Airport and therefore meets the specific State and Federal regulations for separation distance. The top elevation of the proposed Project will be approximately 360 to 380 feet AGL relative to the surrounding ground surface, therefore FAA notification was~~will be~~ provided by submittal of form 7460-1.

The FAA is currently aware of the Project and has issued a letter to the City of Burnsville in March of 2019, following its review of the Concept-stage Planned Unit Development Application submitted by BSL to the City during the preliminary stages of local permitting for the Project. The letter notes the potential adverse impacts of bird activity on airport safety and encourages the City to work with the U.S. Department of Agriculture Wildlife Services and the Metropolitan Airports Commission (MAC) to design and manage the landfill expansion in a way that can minimize hazardous wildlife activity. A copy of the letter is attached as Attachment G.

Notice of the Project was provided to the Federal Aviation Administration (FAA) using the FAA's online Obstruction Evaluation screening tool. FAA reviewed the Project and conducted an aeronautical study to determine whether the Project would be a hazard to air navigation. The study determined that the Project will not exceed obstruction standards and would not be a hazard to air navigation provided it is marked with a red obstruction light. The FAA hazard determination letter is attached to this SEIS as Attachment E-3. FAA staff stated that lighting shall consist of a single, steady burning red light of type L-810, which is a low-intensity light. The light shall be installed once the landfill elevation exceeds 1,000 feet above MSL, and shall be positioned such that it is visible from 360 degrees around the landfill (Souchet, 2021).

The obstruction lighting will not be a significant visual impact due to the presence of numerous existing obstruction lights (and other lighting) in the area surrounding the BSL. The BSL is located in an industrial corridor along Highway 13, and there are at least 14 other red obstruction lights at seven locations within two miles of the BSL site, including two tall antenna towers, each with four flashing lights, located less than a mile from the BSL site. These antenna towers are the predominant features in the night sky in this area and can be seen from several miles away. Additional white lighting is also used during both daytime and nighttime hours at the various industrial sites in the Project vicinity, including the Cargill East Elevator adjacent to the west of the BSL and the Kraemer Quarry adjacent to the east of the BSL. Attachment E-4 includes a map showing locations of other

red obstruction lights in the vicinity of the BSL, and photos of adjacent industrial activities from the top of the BSL.

6.6.4 Bird Interactions

This section presents information and discussion on the potential changes to bird interactions with airplanes resulting from the proposed increase in elevation of the landfill, due to the Project.

Background

Landfills provide a unique habitat for birds to thrive in, and it is well known that landfills attract birds. Landfills draw birds primarily because of the presence of food sources in the waste stream; available habitat for food, shelter, water, and nesting areas; and the physical layout of the facility which provides perching sites and thermal and orographic lift (DeFusco, 2007). The BSL does experience a noteworthy degree of bird activity, especially owing to its close proximity to the nearby Minnesota River and nature preserve areas. Birds often scavenge for food in the active waste placement area of the landfill, so facility operations plans include measures such as placement of daily cover to eliminate access for scavenging, and keeping operating area to a minimum practical size.

Changes to Habitat

The proposed Project would slightly change bird habitat around the landfill. The expansion would reduce the amount of total area available for waste disposal from what is currently permitted, because the majority NDA would not be developed. However, the proposed ADA, while occupying less of a footprint, would result in a greater amount of tree removal on the BSL property. The greater degree of tree removal would remove nesting and perching sites for birds on the property. Birds typically do not perch on closed portions of the landfill, instead they more often congregate close to the working area where they can scavenge for food. These scavengers include raptors such as bald eagles and hawks which are accustomed to landfilling activities at the site. Ultimately the proposed Project would eliminate some habitat for birds at the landfill, which could slightly reduce bird populations around the site, but it is unlikely this reduction would be significant.

Orographic Lift

When air passes over physical obstructions in a landscape, such as a landfill, it is deflected upwards resulting in atmospheric uplift; this is called orographic lift. Orographic lift occurs at relatively low altitudes and dissipates with height above ground level (Duerr, et. al, 2015 & Sage, et. al., 2019), as compared to thermal lift which can reach very high altitudes. Birds will frequently utilize orographic and thermal lift for soaring flight. Landfills create orographic lift due to their height above the surrounding land surface.

The Project will result in a top elevation of the landfill that is approximately 360 to 380 feet AGL relative to the surrounding ground surface. Expanding the landfill vertically will cause an increase in local orographic lift over the landfill. However, the spatial distribution of orographic lifting is also very important for day-to-day travel and habitation habits of birds. As noted by Sage, et. al. (2019), fragmented patches of high orographic lift do not facilitate bird movement like linear features such as tree-lines or ridge-lines. In addition, since orographic lift over the landfill does already exist, it is

not likely an increase in orographic lift will significantly change the habits or migratory patterns of birds around BSL. Ultimately, an increase in localized orographic lift above the landfill is not likely to encourage more birds to habituate or loaf near the landfill; rather, other factors, mainly including access to food sources and nesting areas, will determine if birds are attracted to the landfill.

Airports

Bird strikes to aircraft have the potential to cause harm to public health and safety as well as result in large financial damages. Regulations for landfills therefore mandate that they be located certain minimum distances from airports because landfills are known to attract birds. The closest airport to the BSL is Minneapolis/St. Paul International Airport, which is over six miles away. As described in the previous section, BSL meets the specific State and Federal requirements for separation distance from an airport.

Most bird strikes to aircraft occur at relatively low altitudes. According to the FAA, an estimated 87% of the collisions between wildlife and civilian aircraft occurred on or near airports when aircraft are below 2,000 feet AGL (USDOT, 2006), as birds that loaf and habituate near landfills generally only fly at these relatively low altitudes. Flight data available through the MAC online FlightTracker utility shows that for both inbound and outbound air traffic, the altitude of aircrafts flying over the BSL is greater than 2,000 feet AGL. As such, the risk of bird strikes to aircraft because of the landfill will be low. Moreover, the BSL is located in the Minnesota River valley such that there are bluffs north and south of the BSL site that are 100 to 200 feet higher in elevation, which results in a less pronounced vertical profile into the airway.

Potential Impacts Related to Bird-Airplane Interactions

Based on the information provided in the preceding sections, the Project is not expected to result in significant impacts resulting from bird interactions with airplanes when compared to the pre-expansion conditions.

Mitigation Measures

The BSL currently utilizes best management practices including placement of daily cover and minimizing the size of the working face, which reduce the availability of waste materials for scavenging by birds. Current bird management practices at the BSL have resulted in no reported adverse impacts due to bird-aircraft interactions or nuisance birds affecting neighboring properties; therefore no other practices are employed. There are a wide variety of non-lethal management practices that have been shown to reduce bird populations near landfills, including pyrotechnics, acoustic deterrents, vehicle hazing, anti-perching devices, etc. (DeFusco, 2007) that could be employed if necessary. Final design and permitting of the Project will be conducted in cooperation with the FAA in order to incorporate measures to minimize potential impacts to aircraft from bird activity at the BSL.

6.6.5 Wildlife and Natural Features

The 2005 BSL EIS, which is the document that the current BSL SEIS is supplementing, did include an evaluation of potential impacts to wildlife, habitat, or state-listed rare features. That evaluation

included a Natural Heritage Information System (NHIS) review letter within the scoping EAW for the 2005 EIS. Scoping EAWs include a requirement to include a NHIS review letter.

The BSL DSEIS did not include a discussion or evaluation of potential impacts to wildlife, habitat, state-listed rare features, or include a NHIS review letter because the BSL SEIS Scope does not require it and because no scoping EAW is required for a supplemental EIS.

Although it is not required to be included in the BSL FSEIS, the MPCA does believe that it is in the public's best interest to be aware of the NHIS letter submitted by the DNR and therefore it is included as Attachment K.

6.6.6 Cultural Resources

A Phase I archaeological survey was conducted at the BSL site by HDR Engineering in November 2002, based on a recommendations from the Minnesota Historical Society. The results of the study are contained in a report titled, "Cultural Resources Management – Proposed West and North Development Areas, BSL, Dakota and Hennepin Counties, Minnesota Phase I Investigation". The study identified no cultural horizons in the area of the Project and concluded that no properties listed on or eligible for listing on the National Register of Historic Places will be affected by this project". Although it is not required to be included in the BSL FSEIS, the MPCA does believe that it is in the public's best interest to be aware of the Phase I survey and therefore it is included as Attachment L.

7.0 ALTERNATIVES

This section presents an evaluation of a smaller landfill with lower height and capacity. The Scoping Decision states that the SEIS will examine the results of preprocessing waste to remove material banned from MMSW and to recover recyclable materials, and estimate the remaining waste to be landfilled and the resulting size and height of the landfill after 41 years of operation. For the purposes of this section, the removal of banned material (I.e., pre-processing) and recovery of recyclable materials are combined and termed the "recycling rate" as defined in Minn. S. 115A.551.

This section also describes economic impacts resulting from the No Build Alternative including the costs to users of the Burnsville Sanitary Landfill from waste going to other locations, the effects on regional and county solid waste system costs, effects on the City of Burnsville and Dakota County and other public and private entities, and effects on property values within a two-mile radius.

7.1.1 Increased Recycling and Preprocessing

The Minnesota Legislature directed the TCMA to greatly reduce land disposal through several measures. They implemented the Waste Management Act, the Metropolitan Landfill Abatement Act, the prohibition on land disposal of unprocessed waste, and by implementing a 75% recycling rate goal for the seven metro counties. Many of these laws have been in place for decades, while the 75%

goal is relatively recent (i.e., 2014). The 75% recycling rate goal will have the greatest impact on landfill diversion if achieved.

Two scenarios were evaluated for this analysis, one that meets the 75% recycling rate goal by 2030, and one that shows a 52% recycling rate that is phased in over 10 years to demonstrate the spectrum of potential outcomes. This section presents the results of analyzing these two scenarios.

Background

The 41-year landfill operational life was originally proposed by BSL in meetings with the MPCA. Any prediction of the life of the proposed landfill expansion must consider that State law and Metropolitan Area Solid Waste Policies will endeavor to implement all feasible and prudent alternatives to land disposal of waste and that there is a prohibition on the disposal of unprocessed MMSW in the Metro Area.

The 41-year landfill operational life represents the potential lifespan of the BSL expansion, given BSL's assumptions regarding waste acceptance rates and long-term waste density and compaction. Ultimately, the actual waste acceptance rate will be determined by a number of factors, including whether or not additional State laws and policies embodied by the waste management hierarchy are implemented, market conditions related to whether or not the BSL can obtain MMSW, and permit requirements, among others. As such, the actual acceptance rate may differ from the rate used for this analysis, in which case the expected lifespan would also change.

The following information/rationale/assumptions were used to make an assessment of the airspace expected to be consumed in the 41-year landfill operational period:

1. The 2019 BSL Annual Solid Waste Report to MPCA shows approximately 248,500 tons of waste (excluding alternative daily cover) was disposed in the MMSW cell at BSL during 2019. Additionally, during 2018 and 2019 BSL diverted some waste that would ordinarily be disposed at BSL to other landfills in order to preserve capacity and meet contractual obligations as BSL nears its permitted capacity. The amount of diversion during 2019 is estimated to be 81,759 tons of MMSW, which is the difference between the amount of MMSW received at BSL in 2017 (when diversion was not yet occurring) and the amount received in 2019, as reported in BSL's solid waste annual report. For the purposes of this assessment, the combined total of 330,263 tons of waste is used as the amount of MMSW generated in the BSL market area in 2019. The BSL market area consists of Dakota, Hennepin, Scott, and to a lesser extent Carver, and Ramsey, based on Solid Waste Annual Reports submitted to MPCA by the landfill.

2. The assessment assumes that some MMSW will continue to be diverted to other destinations through the year 2022, after which time new capacity will be available at BSL, and no additional MMSW will be diverted from BSL after 2022 (i.e. the currently-diverted waste is added back into the BSL MMSW disposal tonnage). The year 2022 is used as the starting point, or "year one" of the analysis. The final year of the 41-year analysis is 2062.

3. The assessment assumes that MMSW tonnage disposed at BSL will increase at the same rate as that predicted by the MPCA for the TCMA, which includes Anoka, Carver, Dakota, Hennepin, Ramsey, Scott, and Washington counties, for the period from 2020 through 2036. This works out to an annual increase of approximately 1.68% from the 2019 tonnage. Waste generation predictions are described in further detail in the Metropolitan Solid Waste Management Policy Plan 2016-2036 (Policy Plan) (MPCA, 2017).

4. The assessment assumes an airspace utilization factor (AUF) of 0.95 tons per cubic yard. The AUF value is analogous to waste density. As discussed in Section 5.1 of this SEIS, the actual waste density is most accurately described as a range of 0.7 to 1.0 tons per cubic yard based on time since initial placement and compaction in the landfill. The value of 0.95 tons per cubic yard used for this analysis is an estimated long-term average AUF which accounts for the compaction of the waste over the 41-year time period.

Two alternative landfill size scenarios are analyzed in the following sections. These are hypothetical alternative sizes and are presented for illustrative purposes. These scenarios involve significant assumptions related to:

- Compliance with the restriction on disposal of unprocessed MMSW,
- Recycling rates below and equivalent to State goals for Metropolitan Area Counties,
- MMSW waste composition, and
- The AUF actually achieved by compaction, cover, leachate recirculation, waste depth, and density.

If the actual levels of MMSW processing to recover materials and energy, recycling rates, waste composition and AUF do not match the assumptions, it could result in variability in the life of the landfill, the projected tons and volumes of waste disposed, and resulting landfill size over subsequent decades.

Alternative Size Based on Phased 52% Recycling Rate

This alternative landfill size assessment assumes a recycling rate of 52% phased in over 10 years, beginning in 2021 (See Table 7-1). The 52% recycling scenario assumes the waste volume disposed in 2020 already includes a recycling rate of 47% for TCMA. This assumption is based on the combined recycling and organics diversion rate for the TCMA of 47.06%, as reported for the 2019 Governor's Select Committee on Recycling and the Environment report. Table 7-1 shows the waste volume disposed at BSL each year and the cumulative waste volume based on this alternative size analysis. Starting in 2021, the recycling rate is increased until the assumed rate of 52% is achieved in 2030 and is maintained going forward. Using the policy plan escalator described in item 3 above, by the year 2062, the cumulative volume of waste landfilled at BSL is estimated to be approximately 21.2 million cubic yards. This compares to a projected volume of 23.6 million cubic yards for the proposed Project based on current landfilling rates. This alternative predicts a reduction of approximately 10% in landfill airspace consumed compared to the proposed Project.

BSL could achieve this alternative size by maintaining the same Project-proposed ADA waste footprint and lowering the top elevation from the currently proposed peak of 1,082 feet to an elevation of 973 feet. Profiles illustrating this height reduction are included in Figure 7-1. Another possibility would be to reduce the size of the ADA and place more of the waste on top of the existing landfill. This would result in a top elevation that is higher than 973 feet, but lower than the currently proposed peak of 1,082 feet.

Alternative Size Based on Immediate 75% Recycling Rate

The Legislature has established a goal of 75% recycling to be achieved in the TCMA by 2030. In order to achieve 75% recycling, all methods of collecting recyclables would need to be in place including the pre-processing at landfills and waste to energy facilities. This alternative landfill size assessment uses a 2020 baseline and assumes a linear increase in recycling rate to an ultimate rate of 75% beginning in 2030 and continuing thereafter (see Table 7-2). Using the policy plan escalator described in item 3. above, the cumulative total volume of waste disposed at BSL is estimated to be approximately 11.86 million cubic yards. This compares to a projected volume of approximately 23.6 million cubic yards for the proposed Project based on current landfilling rates. This alternative predicts a reduction of approximately 50% in landfill airspace consumed compared to the proposed Project.

BSL could achieve this alternative size by maintaining the same proposed ADA waste footprint and lowering the top elevation from the currently proposed peak of 1,082 feet to an elevation of 862 feet (See Figure 7-1).

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Table 7-1
BSL Capacity Used by 2062 Assuming
Phased 52% Recycling Rate

Year	MMSW Disposal at current recycling rate (47%) (Tons)	Modeled Recycling Rate (%)	MMSW Disposed after increased recycling rate (Tons)	Cumulative Total MMSW Disposed (Tons)	Airspace Used Current Year-MMSW (Cubic Yards)[X]	Airspace Used Current Year-Daily Cover* (Cubic Yards)	Cumulative Total Airspace Used (Cubic Yards)[X]
2020[Y]	252,673	47.0	252,673	252,673	265,972	39,896	305,868
2021[Z]	256,843	47.5	254,420	507,093	267,810	40,172	613,849
2022	261,012	48.0	256,087	763,180	269,565	40,435	923,849
2023[^]	352,427	48.5	342,453	1,105,633	360,477	54,071	1,338,397
2024	357,968	49.0	344,460	1,450,093	362,589	54,388	1,755,375
2025	363,509	49.5	346,362	1,796,455	364,592	54,689	2,174,656
2026	369,050	50.0	348,160	2,144,615	366,485	54,973	2,596,113
2027	374,591	50.5	349,854	2,494,469	368,267	55,240	3,019,621
2028	380,132	51.0	351,443	2,845,912	369,940	55,491	3,445,051
2029	385,673	51.5	352,927	3,198,839	371,502	55,725	3,872,279
2030	391,214	52.0	354,307	3,553,146	372,955	55,943	4,301,177
2031	396,755	52	359,325	3,912,471	378,237	56,736	4,736,149
2032	402,296	52	364,343	4,276,814	383,519	57,528	5,177,196
2033	407,837	52	369,362	4,646,176	388,802	58,320	5,624,318
2034	413,378	52	374,380	5,020,556	394,084	59,113	6,077,515
2035	418,919	52	379,398	5,399,954	399,366	59,905	6,536,787
2036	424,460	52	384,416	5,784,370	404,649	60,697	7,002,133
2037	430,001	52	389,435	6,173,805	409,931	61,490	7,473,553
2038	435,542	52	394,453	6,568,258	415,213	62,282	7,951,049
2039	441,083	52	399,471	6,967,729	420,496	63,074	8,434,619
2040	446,624	52	404,489	7,372,218	425,778	63,867	8,924,264
2041	452,165	52	409,508	7,781,726	431,061	64,659	9,419,984
2042	457,706	52	414,526	8,196,251	436,343	65,451	9,921,778
2043	463,246	52	419,544	8,615,795	441,625	66,244	10,429,647
2044	468,787	52	424,562	9,040,358	446,908	67,036	10,943,591
2045	474,328	52	429,580	9,469,938	452,190	67,828	11,463,609
2046	479,869	52	434,599	9,904,537	457,472	68,621	11,989,702
2047	485,410	52	439,617	10,344,154	462,755	69,413	12,521,870
2048	490,951	52	444,635	10,788,789	468,037	70,206	13,060,113
2049	496,492	52	449,653	11,238,442	473,319	70,998	13,604,430
2050	502,033	52	454,672	11,693,114	478,602	71,790	14,154,822
2051	507,574	52	459,690	12,152,804	483,884	72,583	14,711,289
2052	513,115	52	464,708	12,617,512	489,166	73,375	15,273,830
2053	518,656	52	469,726	13,087,238	494,449	74,167	15,842,446
2054	524,197	52	474,745	13,561,983	499,731	74,960	16,417,137
2055	529,738	52	479,763	14,041,746	505,013	75,752	16,997,903
2056	535,279	52	484,781	14,526,527	510,296	76,544	17,584,743
2057	540,820	52	489,799	15,016,326	515,578	77,337	18,177,658
2058	546,361	52	494,818	15,511,143	520,861	78,129	18,776,647
2059	551,902	52	499,836	16,010,979	526,143	78,921	19,381,712
2060	557,443	52	504,854	16,515,833	531,425	79,714	19,992,851
2061	562,984	52	509,872	17,025,705	536,708	80,506	20,610,064
2062	568,525	52	514,890	17,540,596	541,990	81,298	21,233,353

Notes:

* Daily cover estimated at 15% of annual waste volume

[X] Based on Airspace Utilization Factor (i.e. waste density) of 0.95 tons per cubic yard.

[Y] 2020 MMSW disposal rate is based on the 2019 BSL disposal of 248,504 tons multiplied by an escalation factor of 1.68% per MPCA projections.

[Z] Years 2021 through 2062 subject to annual increases based on MPCA projections.

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Table 7-2
BSL Capacity Used by 2062 Assuming
75% Recycling Rate Phased in by 2030

Year	MMSW Disposal at current recycling rate (47%) (Tons)	Modeled Recycling Rate (%)	MMSW Disposed after increased recycling rate (Tons)	Cumulative Total MMSW Disposed (Tons)	Airspace Used Current Year-MMSW (Cubic Yards)[X]	Airspace Used Current Year-Daily Cover* (Cubic Yards)	Cumulative Total Airspace Used (Cubic Yards)[X]
2020[Y]	252,673	51.4	231,697	231,697	243,891	36,584	280,475
2021[Z]	256,843	53.7	224,374	456,070	236,183	35,427	552,085
2022	261,012	56.1	216,197	672,267	227,575	34,136	813,797
2023[^]	352,427	58.5	275,957	948,224	290,481	43,572	1,147,850
2024	357,968	60.8	264,761	1,212,985	278,696	41,804	1,468,351
2025	363,509	63.2	252,399	1,465,384	265,683	39,852	1,773,886
2026	369,050	65.5	240,231	1,705,615	252,874	37,931	2,064,692
2027	374,591	67.9	226,875	1,932,490	238,816	35,822	2,339,330
2028	380,132	70.3	213,017	2,145,507	224,229	33,634	2,597,193
2029	385,673	72.6	199,386	2,344,893	209,880	31,482	2,838,554
2030	391,214	75	184,535	2,529,428	194,247	29,137	3,061,939
2031	396,755	75	187,149	2,716,576	196,998	29,550	3,288,487
2032	402,296	75	189,762	2,906,338	199,750	29,962	3,518,199
2033	407,837	75	192,376	3,098,714	202,501	30,375	3,751,075
2034	413,378	75	194,990	3,293,704	205,252	30,788	3,987,115
2035	418,919	75	197,603	3,491,307	208,003	31,201	4,226,319
2036	424,460	75	200,217	3,691,524	210,755	31,613	4,468,687
2037	430,001	75	202,831	3,894,354	213,506	32,026	4,714,218
2038	435,542	75	205,444	4,099,798	216,257	32,439	4,962,914
2039	441,083	75	208,058	4,307,856	219,008	32,851	5,214,773
2040	446,624	75	210,671	4,518,528	221,759	33,264	5,469,797
2041	452,165	75	213,285	4,731,813	224,511	33,677	5,727,984
2042	457,706	75	215,899	4,947,712	227,262	34,089	5,989,335
2043	463,246	75	218,512	5,166,224	230,013	34,502	6,253,850
2044	468,787	75	221,126	5,387,350	232,764	34,915	6,521,529
2045	474,328	75	223,740	5,611,090	235,516	35,327	6,792,372
2046	479,869	75	226,353	5,837,444	238,267	35,740	7,066,379
2047	485,410	75	228,967	6,066,411	241,018	36,153	7,343,550
2048	490,951	75	231,581	6,297,992	243,769	36,565	7,623,885
2049	496,492	75	234,194	6,532,186	246,521	36,978	7,907,383
2050	502,033	75	236,808	6,768,994	249,272	37,391	8,194,046
2051	507,574	75	239,422	7,008,416	252,023	37,803	8,483,872
2052	513,115	75	242,035	7,250,451	254,774	38,216	8,776,862
2053	518,656	75	244,649	7,495,101	257,525	38,629	9,073,017
2054	524,197	75	247,263	7,742,363	260,277	39,041	9,372,335
2055	529,738	75	249,876	7,992,240	263,028	39,454	9,674,817
2056	535,279	75	252,490	8,244,730	265,779	39,867	9,980,463
2057	540,820	75	255,104	8,499,834	268,530	40,280	10,289,272
2058	546,361	75	257,717	8,757,551	271,282	40,692	10,601,246
2059	551,902	75	260,331	9,017,882	274,033	41,105	10,916,384
2060	557,443	75	262,945	9,280,827	276,784	41,518	11,234,685
2061	562,984	75	265,558	9,546,386	279,535	41,930	11,556,151
2062	568,525	75	268,172	9,814,558	282,286	42,343	11,880,780

Notes:

* Daily cover estimated at 15% of annual waste volume.

[X] Based on Airspace Utilization Factor (i.e. waste density) of 0.95 tons per cubic yard.

[Y] 2020 MMSW disposal rate is based on the 2019 BSL disposal of 248,504 tons multiplied by an escalation factor of 1.68% per MPCA projections.

[Z] Years 2021 through 2062 subject to annual increase based on MPCA projections.

[^] Some MMSW diverted to other landfills in years 2020-2022. No diversion in years 2023-2062.

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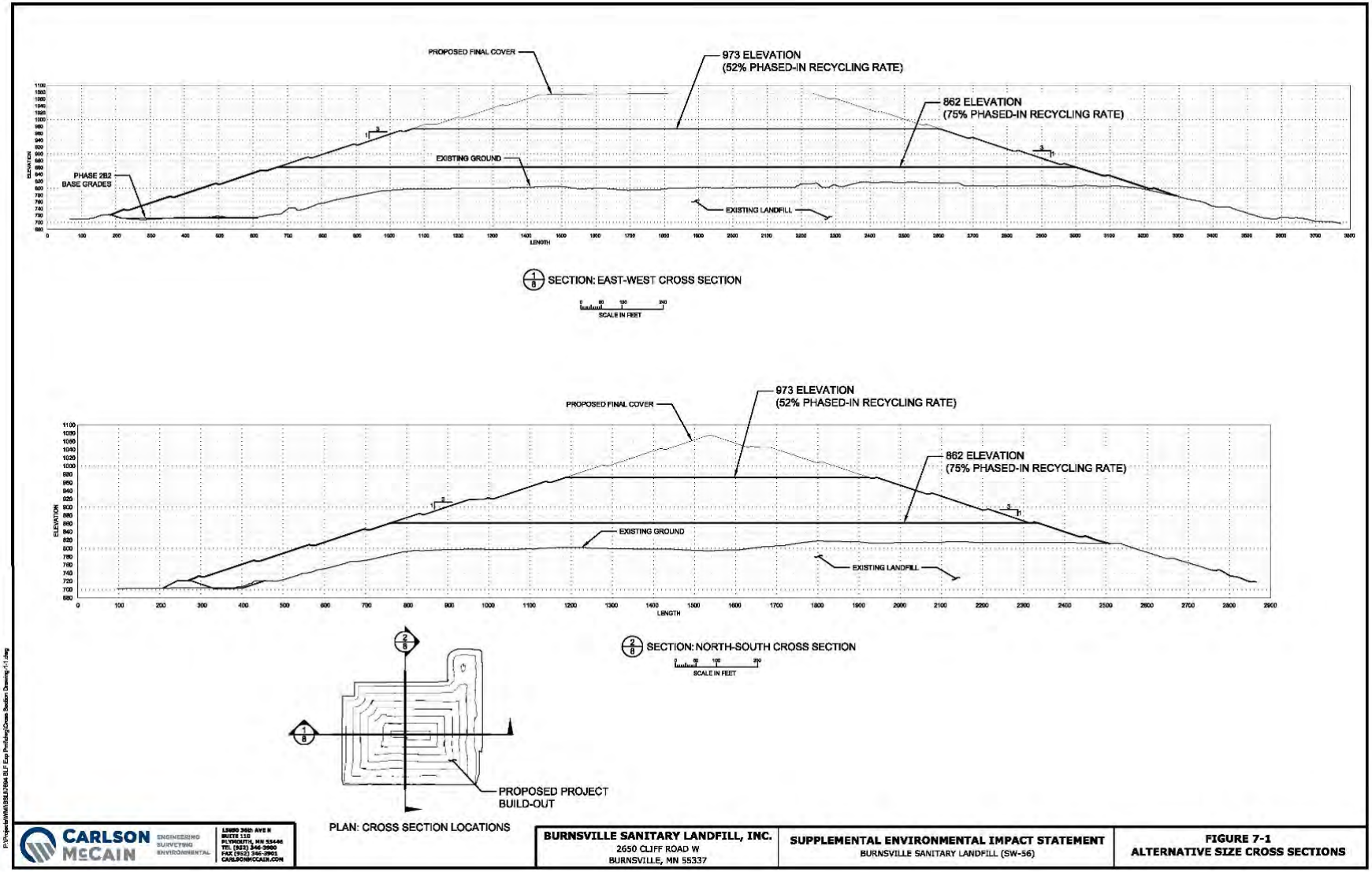

PROPOSED FINAL COVER
973 ELEVATION
(52% PHASED-IN RECYCLING RATE)
862 ELEVATION
(75% PHASED-IN RECYCLING RATE)
EXISTING GROUND
PHASE 2B2
BASE GRADES
EXISTING LANDFILL
ELEVATION
LENGTH
1/8 SECTION: EAST-WEST CROSS SECTION
SCALE IN FEET
PROPOSED FINAL COVER
973 ELEVATION
(52% PHASED-IN RECYCLING RATE)
862 ELEVATION
(75% PHASED-IN RECYCLING RATE)
EXISTING GROUND
EXISTING LANDFILL
ELEVATION
LENGTH
2/8 SECTION: NORTH-SOUTH CROSS SECTION
SCALE IN FEET
PROPOSED PROJECT
BUILD-OUT
PLAN: CROSS SECTION LOCATIONS
CARLSON McCAIN
ENGINEERING
SURVEYING
ENVIRONMENTAL
BURNSVILLE SANITARY LANDFILL, INC.
2650 CLIFF ROAD W
BURNSVILLE, MN 55337
SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT
BURNSVILLE SANITARY LANDFILL (SW-56)
FIGURE 7-1
ALTERNATIVE SIZE CROSS SECTIONS

The 848-foot elevation is only 41 feet higher than BSL's currently-permitted top elevation. In this scenario, it is likely that BSL would pursue an alternative design with a reduction in the proposed ADA waste footprint and placement of waste to a higher elevation over the existing waste. If the ADA was eliminated completely and the 12.6 million cubic yards were placed entirely over the existing waste, the resulting ultimate top elevation would be approximately 1,005 feet.

7.1.2 Alternative Size Achievability and Potential Impacts

Achievability

Reduction of the landfill size via a higher recycling rate would require implementation of additional recycling programs. The 75% recycling rate is a goal established in state law that assumes waste generators sort wastes, recyclables, and compost into the correct collection bins, and recyclable and compostable items can be recovered as commodities. This would also require the development of additional organics capacity. Based on the 2015 Recycling and Solid Waste Infrastructure Report, the large single-stream materials recovery facilities located in the TCMA have enough capacity to process material at a 75% recycling rate. However, commodity markets would need to be strong to meet this goal.

Potential Impacts

The potential environmental impacts of a smaller landfill are summarized below, relative to the impacts identified in Section 6 of this SEIS for the proposed Project at full buildout:

- Groundwater Impacts – Section 6.1 of this SEIS describes the potential groundwater impacts due to the proposed Project. A smaller landfill is not expected to result in additional direct, indirect, or cumulative potential significant adverse or beneficial effects on groundwater. There would be no change in the amount of unlined area, and the landfill design will have negligible effect on the current or future water table elevation or flow direction at the site.

- Surface water – Section 6.2 of this SEIS describes the potential surface water impacts due to the proposed Project. A smaller landfill is expected to result in less surface water runoff directly from the landfill. Direct beneficial impacts related to reduced runoff include reduced flow velocities and lower potential for erosion. No other direct, indirect, or cumulative potential significant adverse or beneficial effects on stormwater are anticipated due to a smaller landfill.

- Liner/Leachate collection – Section 6.3 of this SEIS describes the potential impacts to the liner/leachate collection system due to the proposed Project. If the size of the ADA area is reduced, the amount of new lined area would also be reduced, which would decrease the amount of area within which these potential liner impacts could occur. It would also result in less leachate generation and less leachate discharged to a MCES treatment plant. No other direct, indirect, or cumulative potential significant adverse or beneficial effects on the liner/leachate collection system are anticipated due to a smaller landfill. A smaller landfill is not expected to affect flood elevation in the Minnesota River; therefore, the potential for

overtopping the flood levee would be unchanged, as would the erosion potential and stability of the flood levee. The base liner design for a smaller landfill would be the same as the proposed Project, so there would be no change in potential for infiltration through geomembrane defects, and no change in potential for uplift due to hydrostatic pressure from the water table on a per unit area basis.

- Visual impacts – Section 6.4 of this SEIS describes the potential visual impacts due to the proposed Project, based on photo renderings of the full build-out. A potential direct beneficial effect of a smaller landfill would be the reduced amount of landfill and associated lighting visible from off-site locations compared to the higher height of the proposed Project. The exact amount of height difference would be based on the revised facility design. No other direct, indirect, or cumulative potential significant adverse or beneficial visual effects are anticipated due to a smaller landfill.

- Air quality – Section 6.5 of this SEIS describes potential air quality impacts due to the proposed Project. Air emissions resulting from the Project are associated with uncaptured landfill gas, landfill gas combustion equipment, and waste transport and handling equipment; and increased air emissions are primarily related to the larger waste volume resulting from the Project. A direct beneficial impact of a smaller landfill would be the reduction in air emissions resulting from the smaller waste mass and associated operational activities. An indirect adverse impact of a smaller landfill would be the reduction in energy production capacity resulting from lower gas generation rates. No other, direct, indirect, or cumulative potential significant adverse or beneficial air quality effects are anticipated due to a smaller landfill.

- Sociological – Section 6.6 of this SEIS describes potential sociological impacts due to the proposed Project. A smaller landfill is not expected to result in changes to the sociological impacts associated with the Project. No significant adverse impacts are predicted to surrounding recreational resources. End use options for a smaller landfill will be similar to the proposed Project and consist of recreational uses which will be a benefit to the community. A possible indirect benefit of a smaller landfill is that a wider variety of recreational end uses could be considered if the smaller landfill includes a flatter top area. No significant impacts are predicted under either scenario due to FAA requirements or bird interactions with aircraft. No other direct, indirect, or cumulative potential significant adverse or beneficial sociological effects are anticipated due to a smaller landfill.

7.1.3 Compaction Technology

The Scoping Decision states that the analysis of a smaller landfill will examine technology to achieve significantly greater level of compaction so that the same tonnage of waste might be landfilled to occupy less space. This section examines methods and technology to achieve better compaction levels at the BSL.

Compaction of MMSW occurs at several stages during the collection and disposal process. Most residential and commercial waste collection vehicles have on-board compactors to reduce volume

at the point of collection. Collection vehicles commonly offload at transfer stations, where the waste is loaded into large transfer trailers for delivery to a landfill or other disposal destination. The waste may be compacted prior to loading into the trailer, or loaded loosely into the trailer and compacted with an on-board compactor, similar to collection vehicles. At the landfill, there may be multiple types of compaction equipment, including stationary and/or movable equipment.

Overall, it is in BSL's best interests to maximize the compaction of waste in the landfill. Greater waste compaction creates a more stable waste mass, reduces settlement and associated problems with surface water drainage and landfill gas collection, and creates higher revenues by increasing the number of tons of waste that can fit in the landfill.

BSL currently utilizes bulldozer-size wheeled compactors that are specially designed to both spread and compact waste as it is placed in the landfill. This type of equipment is the industry standard for in-place compaction, and BSL employs multiple compactors to ensure adequate compaction of the waste mass.

One alternative compaction method that can be used at a landfill is balefill technology. This involves using a stationary compactor to press the waste into bales with typical dimensions of approximately 48 x 30 x 60 inches, which are then placed into the lined landfill cells. Baled wastes can achieve a density of up to 1,700 pounds (i.e. 0.85 tons) per cubic yard (WDEQ, 2018). This density is comparable to what the BSL is already achieving using the wheeled compactors, so it is not expected that the use of a baler would significantly reduce the volume of waste in the landfill.

Although baling of MMSW for land disposal does occur, the predominant use of baling has typically been in the preparation of recyclable materials for shipment (Tchobanoglous, et. al, 1993). One such example of this is the Bismarck MMSW Landfill in Bismarck, North Dakota. According to the facility's Engineering and Operations Plan (Houston, 2012) the Bismarck Landfill originally began operating a baler in the year 2000. It was previously used to bale MMSW prior to disposal in the landfill, but is now used only for baling recyclables, which are not disposed of in the landfill.

Shredding is another method of waste volume reduction. Depending on the degree of shredding performed, waste volume can be reduced by up to 75%, according to manufacturers' estimates. Shredding of MMSW for disposal is becoming more prevalent in places where there are significant physical limitations on available landfill capacity, including some European countries. In North America, shredding is not common to direct-dispose of shredded waste in a landfill on a large scale. Portable shredders may be used to process bulky wastes such as furniture and mattresses, either at the landfill or at the waste generator site. However, this is accomplished using low-speed, high-torque shredders that have a limited throughput capacity which is significantly less than the daily tonnage received at the landfill. To achieve a significant volume reduction through shredding would require a multi-stage shredding operation with different size shredders, screens, and separation equipment, air emissions controls, and dedicated loading/unloading areas, and the BSL does not have the space for such an operation in the current scale house area.

Other alternatives such as using smart technology to monitor equipment movement patterns and conducting more frequent waste surveys utilizing drone technology may aid in increasing the

efficiency of the current compaction methods at the landfill; however, these are not expected to result in achievement of significantly greater compaction levels.

7.2 "No-Build" Alternative

The SEIS also examines the alternative that the BSL is not expanded as proposed and is instead allowed to close after using all permitted capacity. The SEIS scoping decision calls this the "No Build" Alternative and states that the SEIS will compare the Project impacts to the environmental, economic, employment, and sociological impacts of the No Build alternative. The SEIS will specifically describe the following in any and all reasonable combinations to achieve a no-build analysis:

- Include all facilities that dispose of MMSW or Industrial Waste or C&D waste including Dem-Con landfills, Advanced Disposal landfills, Waste Management, Inc. landfills (including Spruce Ridge, Elk River, Dickinson County, and Central Disposal), BFI landfills, Nobles County, the East Central Solid Waste Commission landfill, the Morrison County landfill, the Rice County landfill, and the Ponderosa landfill.
- Include all facilities that are permitted to accept MMSW or industrial waste or C&D waste and process for resource recovery including Hennepin Energy Recovery Center (HERC), Recycling Energy Center (REC), the City of Red Wing, Atomic Recycling, SKB Environmental, Inc. and any other resource recovery facilities.

In addition, the Scoping Decision states that the SEIS will include an inventory of solid waste management facilities that are permitted to accept MMSW, industrial waste, and C&D waste, and assess how one or several of the following types of facilities could manage the waste materials forecast for disposal at the BSL:

- MMSW processing and/or landfills
- C&D and/or industrial waste processing and/or landfills
- Refuse-derived fuel facilities
- Mass burn facilities
- Transfer stations

Finally, the Scoping Decision states that following economic impacts resulting from the No Build Alternative will be evaluated:

- Cost on users of the BSL including the general public from waste going to other locations
- Effects on regional and county solid waste system costs
- Effects on the City of Burnsville and Dakota County and other public and private entities forecast to use the BSL
- Effects on property values within a two-mile radius

The following sections present information on the following topics for the No-Build analysis:

- An inventory of waste management facilities
- An assessment of how selected facilities could manage the waste material forecast for disposal at BSL
- An analysis of economic impacts
- An analysis of employment impacts
- An analysis of environmental impacts
- An analysis of sociological impacts

7.2.1 Facility Inventories

This SEIS contains the following three inventories of solid waste management facilities located in Minnesota, Wisconsin, and Iowa. The inventories were compiled from data provided by the MPCA (MPCA, 2020), Wisconsin Department of Natural Resources (WDNR, 2020), and Iowa Department of Natural Resources (IDNR, 2020).

1. Complete Facilities Inventory

The Complete Facilities Inventory is included in Attachment H-1 and consists of all of the solid waste management facilities that are permitted to accept MMSW, industrial waste, and/or C&D waste in the states of Minnesota, Wisconsin, and Iowa. Facilities are grouped according to management method (e.g., land disposal, transfer, and processing), and the inventory provides the state permit number, facility name, county in which the facility is located, and the type of waste managed.

2. MMSW Facilities Inventory

The MMSW Facilities Inventory is included in Attachment H-2 and is a sub-set of the Complete Facilities Inventory. It consists of those facilities that are permitted to accept MMSW in the states of Minnesota, Wisconsin, and Iowa. This inventory was created to narrow down the complete facilities inventory to exclude facilities which are not allowed to accept MMSW and therefore are not currently a viable alternative for the waste disposal under the No Build Scenario.

3. Identified Alternative Facilities Inventory

This inventory is a subset of the MMSW Facilities Inventory and identifies the facilities that will be further analyzed in this SEIS to determine how they could manage the MMSW forecast for disposal at BSL under the No Build alternative.

For a facility to be listed in the Identified Alternative Facilities Inventory, they must satisfy all of the following requirements:

1. Facilities in this inventory must be able to process or dispose of MMSW from the TCMA. Transfer stations serve only an intermediate function in moving MMSW from

points of generation to points of ultimate disposition. Therefore, transfer stations are not included in the Identified Facilities Inventory.

2. Landfills which are not allowed by their solid waste permit or an applicable written county policy from accepting MMSW from the TCMA were eliminated from the inventory.
3. Facilities in this inventory must be located within a reasonable hauling distance from the BSL market area. The reasonable hauling distance was determined to be 170 miles because it corresponds to the furthest specific facility required by the Scope to be included in the analysis.
4. Facilities must have sufficient remaining capacity and daily intake capacity to be able to receive additional MMSW from the BSL market area, and receipt of the additional MMSW should not place an undue burden on such facilities.

Three of the county landfills meet the first three criteria (Cottonwood County Landfill and Kandiyohi County Landfill in Minnesota, and La Crosse County Landfill in Wisconsin) but all have limited remaining disposal capacity and presently receive relatively small annual tonnages for disposal. Considering use of these facilities for disposal of MMSW from the BSL market area would stress their operating capacities and rapidly deplete their remaining capacities, placing undue burden on the Counties to maintain MMSW disposal capacity that is intended to serve their local disposal needs. Therefore, the three remaining county landfills were eliminated as they did not meet the fourth requirement.

Three of the four processing facilities (HERC, the REC, and the Red Wing Refuse-Derived Fuel (RDF) processing plant) meet the first three criteria and currently serve and receive MMSW from the TCMA, including the BSL market area. The Restriction on Disposal (ROD) statute (i.e. MN Statute 473.848) prohibits disposal of unprocessed MMSW generated in the TCMA at a waste disposal facility unless the waste has either been certified as unprocessible, or the waste has been transferred from a resource recovery facility and no resource recovery facility serving the metropolitan area is capable of processing the waste. The ROD statute applies to waste generated in the metro area and disposed in Minnesota landfills including the proposed Project. The prohibition does not extend to landfills in Wisconsin, Iowa, or other states.

In terms of comparing proposed Project impacts to those of the No Build alternative, the impacts are identical because waste must meet the ROD requirements before it can be landfilled in either scenario (i.e. resource recovery facilities must be operating at full capacity before TCMA MMSW can be landfilled). Therefore, processing facilities primarily serving the TCMA for material and/or energy recovery are not viable alternatives for the No Build scenario because they must be used as primary facilities under either scenario. As a result, the HERC, the REC, and the Red Wing RDF processing plant are eliminated from further consideration as potential Identified Alternative Facilities. The combined permitted capacity of these facilities is 851,000 tons of MMSW per year, which is not available for landfill due to ROD.

The Identified Alternative Facilities Inventory consists of the following facilities. BSL is included in the list because it has some remaining permitted capacity that will be used in the no-build analysis. The facilities are listed in order of increasing distance from BSL.

- BSL (Burnsville, MN)
- Pine Bend Landfill (Inver Grove Heights, MN)
- Elk River Landfill (Elk River, MN)
- Spruce Ridge Landfill (Biscay, MN)
- Central Disposal Landfill (Lake Mills, IA)
- Seven Mile Creek Landfill (Eau Claire, WI)
- Lake Area Landfill (Sarona, WI)
- Timberline Trail Landfill (Weyerhaeuser, WI)
- French Island RDF processing plant (La Crosse, WI)
- Dickinson Landfill (Spirit Lake, IA)
- Nobles County Landfill (Worthington, MN)

Figure 7-2 shows the locations of MMSW facilities within 170 miles of BSL. Locations identified with green or yellow dots are Identified Alternative Facilities. Locations identified with red or orange dots were eliminated from consideration as potential Identified Alternative Facilities based on the criteria presented above.

Table 7-3 provides the following information for each of the Identified Alternative Facilities:

- Calculation of residuals from processing that require land disposal
- Distance to/from the proposed Project site
- Distance to/from the proposed Project site from the waste origin if a transfer station is currently used
- Permitted and unused MMSW, industrial waste, and C&D processing and/or disposal capacity (i.e. remaining permitted ultimate design capacity)
- Inventory of material and energy recovery resulting from waste processing in 2019
- Overall landfill abatement resulting from processing
- The potential for the facility to accept additional waste
- Expansion plans for each facility within the next 10 years (if available)
- 2019 processing and/or landfill rates
- Name of current owner
- Tipping fees

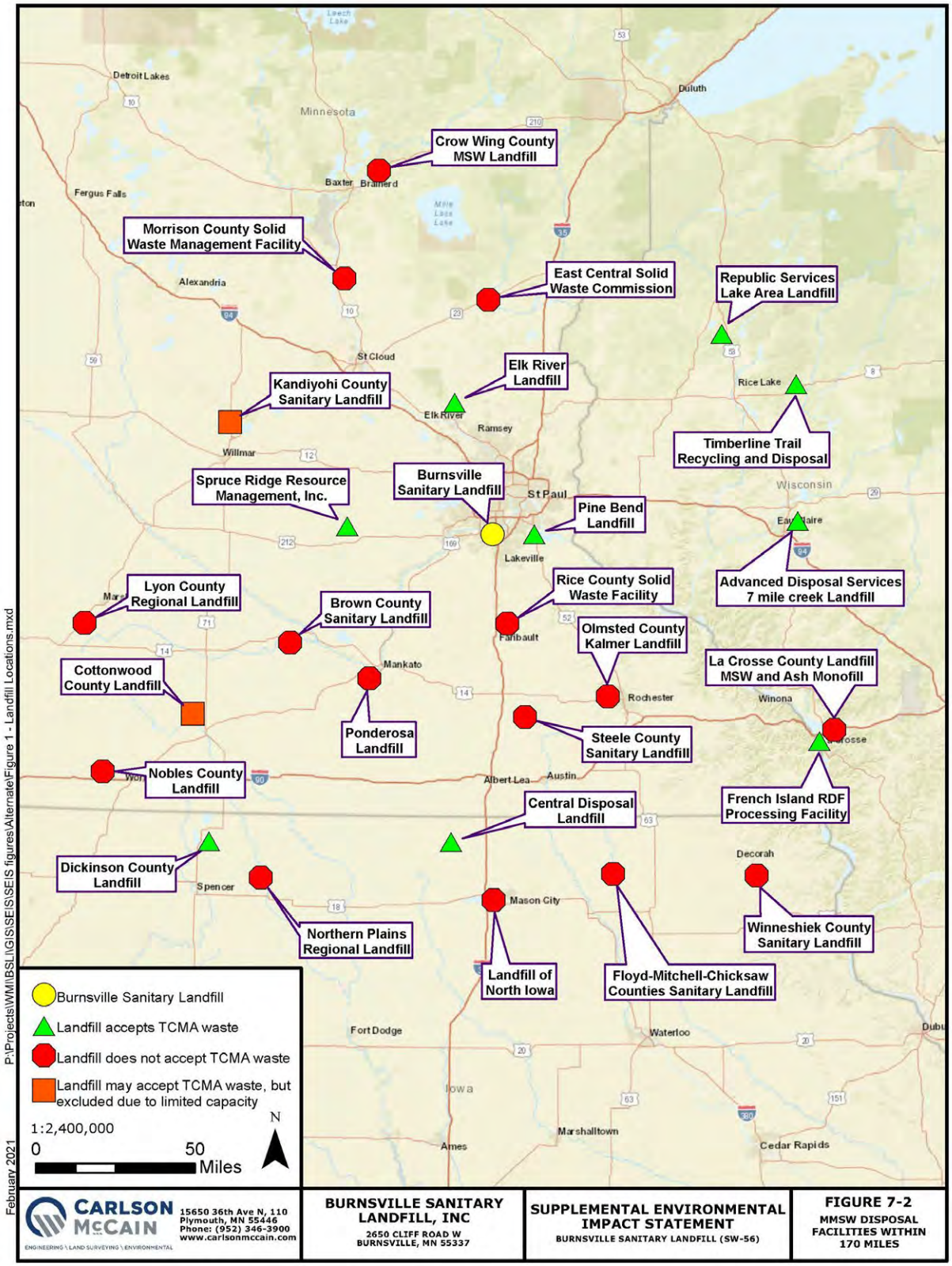
Burnsville Sanitary Landfill
Supplemental Env. Impact Statement

Table 7-3
Identified Alternative Facilities

Permit No.	SW-56	SW-45	SW-74	SW-6	95-SDP-01-72	3097	3474	3455		30-SDP-01-75	SW-11
Facility Name	**Burnsville Sanitary Landfill**	**Pine Bend Landfill**	**Elk River Landfill**	**Spruce Ridge Resource Management, Inc.**	**Central Disposal Landfill**	**Seven Mile Creek Landfill**	**Lake Area Sarona Landfill**	**Timberline Trail Recycling and Disposal Facility**	**French Island RDF Processing Facility**	**Dickinson County Landfill Inc.**	**Nobles County Landfill**
Name of Current Owner	Waste Management, Inc.	Republic Services, Inc.	Waste Management, Inc.	Waste Management, Inc.	Waste Management, Inc.	Advanced Disposal Services, Inc.	Republic Services, Inc.	Waste Management, Inc.	Xcel Energy	Waste Management, Inc.	Waste Connections, Inc.
State / County	MN / Dakota	MN / Dakota	MN / Sherburne	MN / McLeod	IA / Winnebago	WI / Eau Claire	WI / Washburn	WI / Rusk	WI / La Crosse	IA / Dickinson	MN / Nobles
Residuals from Processing that require Land Disposal (tons)	NA	NA	NA	NA	NA	NA	NA	NA	15,495	NA	NA
Distance from BSL (miles)	0	15	52	52	108	110	126	135	148	165	170
Distance from Newport Recycling & Energy Center (miles)	21	12	52	68	122	87	103	112	143	185	190
Distance from Recycle Minnesota, LLC Transfer Station (miles)	15	19	64	64	98	115	131	140	138	167	174
Distance from DemCon Transfer Station (miles)	15	28	53	38	122	121	136	145	161	152	157
Distance from Henn. Energy Recovery Center (miles)	19	26	38	61	122	98	110	119	157	179	184
Remaining Permitted MMSW Design Capacity 1/1/2020 (CY)[i]	1,205,001	5,440,936	4,813,312	1,854,180	30,791,049	1,322,048	5,707,624	4,142,318	NA	4,743,573	3,247,927
Remaining Permitted Industrial Design Capacity 1/1/2020 (CY)[i]	7,222,460	0	0	0	0	0	0	0	0	0	0
Remaining Permitted C&D Design Capacity 1/1/2020 (CY)[i]	99,294	0	8,600,379	14,735,948	0	0	0	0	0	0	59,964
Material or Energy Recovery from Waste Processing in 2019	NA	NA	NA	NA	NA	NA	NA	NA	77,985 MWHrs electricity	NA	NA
Overall Landfill Abatement resulting from Processing (tons)	NA	NA	NA	NA	NA	NA	NA	NA	44,949	NA	NA
Potential for Facility to accept Additional Waste	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Known Future Expansion Plans (CY)	0	0	0	0	0	4,130,000	0	0	0	0	0
Tipping Fee or Processing Rate ($/ton)	$64.46[ii]	$58.57[ii]	$60.41[ii]	$50.00[iii]	$35.4[ii]	$107.44[ii]	93.99[ii]	60.99[ii]	$62.00[iii]	$39.25[ii]	$31.51[ii]
2019 MMSW Disposal (tons)[iv]	248,504	410,124	434,988	198,898	166,280	321,161	193,996	99,845	57,448	30,491	61,220

[i] From 2019 annual operating report. For Iowa landfills, reported remaining tonnage divided by Airspace Utilization Factor of 0.95 tons per cubic yard to obtain capacity in cubic yards.
[ii] Provided by MPCA
[iii] Provided by BSL
[iv] Includes all wastes disposed in MMSW cell except: 1) alternative daily cover, and 2) liquids added to bioreactor cells.

P:\Projects\W\WI\05...\7642 B_E Exp Pm\Env Review\EIS\Alternatives\Table 7-3 Identified Facilities


Crow Wing County MSW Landfill
Morrison County Solid Waste Management Facility
East Central Solid Waste Commission
Republic Services Lake Area Landfill
Elk River Landfill
Kandiyohi County Sanitary Landfill
Timberline Trail Recycling and Disposal
Spruce Ridge Resource Management, Inc.
Burnsville Sanitary Landfill
Pine Bend Landfill
Advanced Disposal Services 7 mile creek Landfill
Lyon County Regional Landfill
Brown County Sanitary Landfill
Rice County Solid Waste Facility
Olmsted County Kalmer Landfill
La Crosse County Landfill MSW and Ash Monofill
Cottonwood County Landfill
Ponderosa Landfill
Steele County Sanitary Landfill
Nobles County Landfill
French Island RDF Processing Facility
Central Disposal Landfill
Dickinson County Landfill
Northern Plains Regional Landfill
Landfill of North Iowa
Floyd-Mitchell-Chicksaw Counties Sanitary Landfill
Winneshiek County Sanitary Landfill
Burnsville Sanitary Landfill
Landfill accepts TCMA waste
Landfill does not accept TCMA waste
Landfill may accept TCMA waste, but excluded due to limited capacity
1:2,400,000
0 50 Miles
N
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February 2021
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SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT
BURNSVILLE SANITARY LANDFILL (SW-56)
FIGURE 7-2
MMSW DISPOSAL FACILITIES WITHIN 170 MILES

7.2.2 Assessment of How Identified Alternative Facilities Could Manage MMSW from BSL Market Area

This section presents an assessment of how one or several of the Identified Alternative Facilities could manage the MMSW forecast for disposal at BSL under the No Build scenario. This assessment utilizes a model to observe how the Identified Facilities could manage the MMSW forecast for disposal at BSL. The model tracks the quantity of MMSW generated within each Identified Facility's market area, the remaining disposal capacity of, and hauling distance to, each Identified Facility, and the affiliation status of each Identified Facility relative to the other market areas. Remaining disposal capacities are based on the ultimate design capacity listed in the facility permits. In each year of the model, an annual disposal volume is forecast for each facility and is subtracted from the remaining ultimate disposal capacity from the prior year.

The manner in which MMSW from the BSL market area may flow to the Identified Facilities is modeled for both the No-Build and Project scenarios in order to produce a comparison of the potential effects of the No-Build Scenario. The following information/rationale/assumptions were used in creating the model used in this assessment.

Background Information

1. The 2019 BSL Annual Solid Waste Report to MPCA shows approximately 248,500 tons of waste (excluding alternative daily cover) was disposed in the MMSW cell at BSL during 2019. Additionally, during 2018 and 2019 BSL diverted some waste that would ordinarily be disposed at BSL to other landfills in order to preserve capacity and meet contractual obligations as BSL nears its permitted capacity. The amount of diversion during 2019 was approximately 81,759 tons of MMSW. For the purposes of this assessment, the combined total of 330,259 tons of MMSW is used as the amount of MMSW generated in the BSL market area in 2019. Using an AUF of 0.95 tons per cubic yard and adding 15% (by volume) to account for daily cover material results in a total of 399,792 cubic yards of MMSW landfill capacity consumed by BSL market area disposal.
2. In 2019, approximately 1.176 million tons of MMSW was disposed in the four landfills that primarily serve disposal needs for MMSW generated in the TCMA. These include BSL, Pine Bend Landfill, Elk River Landfill, and Spruce Ridge Landfill. Of the 1.176 million tons accepted at those facilities, 904,000 tons originated in the seven metro counties. These landfills are collectively referred to hereinafter as the "TCMA landfills." According to the Policy Plan, approximately 90% of unprocessed MMSW generated in the TCMA in 2015 was disposed at those four landfills. The remaining 10% was disposed at out-of-state landfills. This change in behavior in 2019 is due to the closure of Great River Energy, which resulted in increased landfilling out of state.
3. This assessment assumes that MMSW generation for each Identified Facility will increase at the rate stipulated by the Metro Policy Plan (1.68% increase annually from the 2019 tonnage).
4. As of January 2020, BSL reported a remaining permitted design capacity of 1,205,001 cubic yards. BSL assumes that it will consume its remaining MMSW disposal capacity in 2023.

5. This assessment assumes the MMSW disposed at each Identified Alternative Facility is generated from each facility's "market area." The BSL market area consists of Dakota, Hennepin, Scott, and to a lesser extent Carver, and Ramsey, based on Solid Waste Annual Reports submitted to the MPCA by the landfill. The term, "market area" is a convenient way to track waste materials managed by each disposal facility.
6. BSL, Elk River Landfill, Spruce Ridge Landfill, Central Disposal Landfill, Timberline Trail Landfill, and Dickinson Landfill are subsidiary companies of Waste Management, Inc. (Waste Management). Waste Management also owns and operates waste collection and hauling companies in the TCMA and beyond.
7. Pine Bend Landfill and Lake Area Landfill are subsidiary companies of Republic Services, Inc. (Republic Services). Republic Services also owns and operates waste collection and hauling companies in the TCMA and beyond.
8. Seven Mile Creek Landfill is a subsidiary company of GFL Environmental, Inc.
9. The cost to dispose waste at a facility is called a "tipping fee." Table 7-3 lists the tipping fees associated with each Identified Alternative Facility. These tipping fees represent the cost per ton charged to the general public (i.e. non-contract customers); however, they are not necessarily the rates charged for disposal to all parties. Landfills typically establish disposal contract pricing with both affiliated and non-affiliated collection/hauling companies that may be different from the tipping fee charged to the general public. The contract disposal prices are a private matter between the landfills and the collection/hauling companies. According to BSL management, the vast majority of MMSW received at BSL is subject to contract pricing rather than the published tipping fee (Mike Miller, personal communication, July 2020).
10. This assessment makes certain assumptions regarding the collection/hauling/disposal arrangements that influence the manner in which the model predicts MMSW will be redistributed among the Identified Alternative Facilities as they consume their permitted MMSW capacity:
    a. It is assumed that the Identified Alternative Facilities will continue to accept MMSW upon reaching their currently permitted MMSW capacity, after which point they are shown with a deficit capacity.
    b. For the affiliated hauling companies, it is assumed that MMSW collected and hauled by the Waste Management, Advanced Disposal and Republic Services companies will be preferentially disposed of at their affiliated landfills (i.e., rather than simply at the landfill closest to the collection point or the landfill with the lowest tipping fee, as might be assumed under a pure free-commerce system).
    c. For the non-affiliated collection/hauling companies, it is assumed that the MMSW will be disposed at the lowest cost facility based on the combination of hauling distance and tipping fee.
11. This assessment utilizes the following information regarding the current and future BSL waste acceptance, which is based on correspondence with management personnel from Waste Management (Mike Miller, personal communication, April 2020) :
    a. BSL accepts MMSW from both Waste Management haulers (i.e. affiliated haulers) and third-party haulers (i.e. non-affiliated haulers).

b. BSL-affiliated collection/hauling accounts for approximately 45% of MMSW generated in the BSL market area. When BSL runs out of permitted capacity, WMI has stated it will divert 45% of the BSL market area MMSW to Central Disposal, and the remaining 55% would be diverted on a free-commerce basis. Diverting waste to Central Disposal in Iowa is a business decision by Waste Management in order to preserve capacity at Spruce Ridge and Elk River, which are much closer to the TCMA.

12. La Crosse County Solid Waste Department personnel stated that the French Island RDF processing plant has capacity to accept up to 20,000 tons/year of MMSW from the TCMA (Jackie Davis, personal communication, March 2020)
13. This assessment assumes that the other Identified Alternative Facilities will accept MMSW from outside of their market areas following the use of all permitted capacity at BSL.

MMSW Management under No-Build Scenario

The management of the BSL market area MMSW was modeled for the No-Build scenario. Model data and detailed results are provided in Attachment H-3. The model tracks, on an annual basis, the following data:

- The quantity of MMSW disposal required for each Identified Facility's market area based upon the quantity actually disposed in 2019 and increasing that quantity by 1.68% from the 2019 tonnage each year thereafter.
- The quantity of MMSW disposed in each Identified Facility, both MMSW generated within each facility's market area and MMSW diverted to that facility from another market area.
- The remaining permitted MMSW capacity of each Identified Facility.
- The quantity of MMSW diverted from BSL after closure and the associated ton-miles (tons of MMSW diverted multiplied by the round-trip mileage between the BSL and the receiving facility) of transportation required for the diversion, for use in evaluating economic impacts.
- The cost of diverting MMSW (transfer station and trucking), for use in evaluating economic impacts.
- Labor hours for transfer operations and diversion trucking, for use in evaluating employment impacts.

The model tracks MMSW flows and the other data listed above from year 2020 through year 2030. A chronological summary of results is provided below:

Years 2020 - 2023

In the No-Build scenario, BSL continues to operate during 2020 through 2022, and reaches full MMSW capacity and stops accepting MMSW for disposal during the year 2023. It is estimated that over the four years, 438,179 tons of MMSW from the BSL market area is diverted to Central Disposal, Spruce Ridge Landfill, Elk River Landfill, and Pine Bend Landfill. Each of these Identified Facilities has capacity for disposal of MMSW generated from its market area. It is assumed that BSL would develop the approximately 3 million tons of currently-permitted industrial solid waste disposal capacity and continue to accept industrial waste following cessation of MMSW acceptance.

Year 2024

In 2024, the BSL market area generates 411,662 tons of MMSW. Since BSL has closed to MMSW disposal, it diverts 100% of its market area MMSW. All Identified Facilities have sufficient remaining capacity to accept the BSL market area MMSW. Using the assumptions listed above, 45% of the market area MMSW (the share collected by BSL's affiliated collection/hauling companies) is diverted to Central Disposal, one of BSL's affiliated landfills. The remaining 55% is diverted to the next lowest-cost Identified Facility, which in this case is Pine Bend Landfill.

- BSL market area: diverted 411,662 tons

Years 2025 - 2027

In years 2025 through 2027, diversion of MMSW from the BSL market area to Central Disposal Landfill and Pine Bend Landfill continue in this manner, and BSL is the only Identified Facility that has consumed its permitted capacity through 2026.

- BSL market area 2025: diverted 418,034 tons
- BSL market area 2026: diverted 424,406 tons
- BSL market area 2027: diverted 430,778 tons

Year 2028 - 2030

In 2028, Pine Bend Landfill and Elk River Landfill both reach full capacity and show a deficit capacity at year end. As noted in item 12a, above, the model assumes that Identified Facilities will continue to accept MMSW after reaching their currently-permitted capacity. As such, diversion of MMSW from the BSL market area continues to Central Disposal and Pine Bend in the manner previously described.

- BSL market area 2028: diverted 437,150 tons
- BSL market area 2029: diverted 443,522 tons
- BSL market area 2030: diverted 449,894 tons

At the end of 2030, Central Disposal shows a remaining permitted capacity of 25,885,143 tons and Pine Bend shows a deficit capacity of 2,301,486 tons.

MMSW Management under Project Scenario

The flow of waste destined for disposal at BSL was also modeled for the proposed Project scenario to establish a baseline against which to compare the impacts of the No-Build alternative. In the Project scenario, approximately 21.6 million tons of MMSW expansion capacity is added to BSL capacity in year 2023. The model tracks MMSW flows and the other data described above through the year 2030, the same time period as the No-Build scenario, and performs the same functions and operates under the same rationale/assumptions as the No-Build model.

Under the Project scenario, it remains apparent that other solutions for managing the TCMA MMSW will need to be developed and model projections beyond 2030 are not likely to be meaningful. Model data and detailed results for the Project scenario are provided in Attachment H-4. A chronological summary of results is provided below.

Years 2020 - 2023

In the Project scenario, BSL continues to operate during 2020 through 2022, making the same diversions to Central Disposal Landfill, Spruce Ridge Landfill and Elk River Landfill as described for the No-Build scenario. The volume of 21.6 million tons of MMSW disposal capacity is added for year 2023, and BSL continues to receive MMSW from its market area for disposal.

Years 2024 – 2030

In years 2024 through 2030, all Identified Facilities are assumed to be receiving waste for disposal from their respective market areas. All Minnesota landfills presently providing waste disposal services for the TCMA, with the exception of BSL, have exceeded their design capacities and are showing deficit capacities by the end of 2030. At the end of 2030, BSL has remaining capacity of 18.4 million tons and Pine Bend has a deficit capacity of 0.60 million tons.

Summary of No-Build Alternative and Project Scenario Modeling

A summary of modeling data for the No-Build and Project scenarios for years 2020 through 2030 is provided in Tables 7-4, and 7-5.

Table 7-4
Summary of MMSW Diversions, Years 2020 - 2030

Scenario		No-Build	Project
Tons MMSW Disposed at BSL		1.1 million	4.3 million
Tons MMSW Diverted from BSL		3.4 million	0.25 million
BSL MMSW Tons Disposed by State	MN	3.0 million	4.5 million
	WI	0	0
	IA	1.6 million	0.1 million

Table 7-5
Year that Design Capacity is Reached

Facility	Year in which current design capacity is reached for Identified Facilities	
	No-Build	**Project**
BSL	2023	> 2030
Pine Bend Landfill	2028	2030
Elk River Landfill	2028	2028
Spruce Ridge Landfill	2027	2027
Central Disposal Landfill	> 2030	> 2030
Seven Mile Creek Landfill	>2030	>2030
Lake Area Landfill	> 2030	> 2030
Timberline Trail Landfill	> 2030	> 2030
French Island RDF	NA	NA
Dickinson Landfill	> 2030	> 2030
Nobles County Landfill	> 2030	> 2030

Analysis of Transfer Station Capacity for MMSW Diversion

Transfer stations are used to receive MMSW from collection vehicles and re-load the waste materials into larger, more efficient trucks for longer hauling distances. In both the No-Build and Project scenarios, a substantial quantity of MMSW is projected to be diverted from local areas of generation to distant disposal or processing facilities. The presence of sufficient transfer station capacity is needed to accommodate the projected diversions. A list of transfer stations located within or near the BSL market area is provided in Table 7-6, and includes each facility's available (i.e. excess) capacity based upon the facilities' 2019 solid waste reports to the MPCA. Examination of transfer stations located within or near the BSL market area reveals that in 2018, there was 1.4 million tons of excess transfer station capacity. According to the No-Build alternative diversion model in Attachment H-3, the average annual diversion in the five-year period following closure of the BSL is approximately 424,000 tons, so there is more than enough available permitted capacity to accommodate diversions from BSL under the No-Build Alternative.

7.3 Economic Impacts

This section of the SEIS contains an analysis of the economic impacts of the No-Build alternative and a comparison of the economic impacts of the No-Build alternative to the Project' impacts (see Table 7-7). The information in this section is intended to fulfill the requirements of the Scoping Decision, which states the following:

- The SEIS will assess impacts on cost to the users of the BSL including general public from waste going to other locations.
- The SEIS will also assess effects on regional and county solid waste system costs.
- The SEIS will assess economic effects to the city of Burnsville and Dakota County and other public and private entities forecast to use the BSL resulting from the "No-Build" Alternative and compare it with construction of the Project
- The SEIS will review existing studies, reports and other information of MMSW landfills within the five-state area as it relates to their impact on property values within a 2-mile radius of the landfill. The review will also include information on the change in property values resulting from an expansion of an existing MMSW landfill.

The following sub-sections present a description of the types of economic impacts that result from the No-Build Alternative and quantify the impacts compared to the proposed Project. Additionally, a discussion of potential employment impacts is presented in terms of jobs creation or elimination. Finally, this section includes a discussion on MMSW landfills impacts on property value based on a review of existing information.

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Table 7-6
Transfer Stations within the BSL Market Area

Permit No.	Facility Name	County	State	Waste Type Accepted	Permitted MMSW Transfer Capacity (tons/yr)	2019 MMSW Transferred (tons)	Additional Available Capacity (tons)
SW-344	Brooklyn Park Recycling Center and Transfer Station	Hennepin	MN	MSW	273,000	152,398	120,602
SW-555	Dem-Con Recovery & Recycling, LLC	Scott	MN	MSW, C&D	327,600	39,138	288,462
SW-597	Eden Prairie Transfer Station	Hennepin	MN	MSW	156,000	106,397	49,603
SW-354	Freeway Transfer, Inc.	Dakota	MN	MSW, C&D	296,400	41,035	255,365
SW-445	Lloyd's Construction Services, Inc. Transfer	Scott	MN	MSW, C&D	62,000	2,540	59,460
SW-525	Malcolm Avenue Recycling & Transfer	Hennepin	MN	MSW, Industrial, C&D	373,000	60,185	312,815
SW-41	Minneapolis Southside Transfer Station	Hennepin	MN	MSW, C&D	127,750	1,866	125,884
SW-678	Recycle Minnesota LLC	Dakota	MN	MSW, C&D	99,000	0	99,000
SW-601	SET Empire Processing	Dakota	MN	MSW	78,000	727	77,273
SW-594	Waste Management - Maple Grove Transfer	Hennepin	MN	MSW, Industrial, C&D	103,440	53,471	49,969
						Total Additional Available Capacity	**1,438,433**

7.3.1 Economic Impacts of No-Build Alternative Compared to Proposed Project

The No-build Alternative would result in the following types of economic impacts:

- Increased MMSW transportation cost compared to the proposed Project, due to the cost of diverting MMSW from disposal at BSL to disposal/processing at the Identified Facilities, which are further away from the point of waste generation.
- The City of Burnsville, Dakota County, and the State of Minnesota would experience a reduction of tax and fee revenue compared to the proposed Project.
- The City of Inver Grove Heights, the City of Lake Mills, Winnebago County, IA, and the State of Iowa will experience an increase of tax and fee revenue.
- Given that the Identified Facilities operate in a quasi-free-commerce system ("quasi" due to the relationship between affiliated collection/hauling companies and landfill companies), the tipping fees charged at Identified Facilities would be expected to change in response to the redistribution of waste associated with the closure of the BSL. An analysis of this market reaction is beyond the scope of this SEIS. Therefore, the assessment utilizes existing information on tipping fees in order to assess how the current fee structure would impact disposal costs. Tipping fees for each Identified Facility have been assigned based on publicly available contract rates provided by MPCA and/or posted gate rates. Many of the Identified Facilities listed in Table 7-3 show lower tipping fees than BSL, therefore under the current pricing structure the cost of disposal at the landfill may be reduced compared to the proposed Project.

Cost to BSL Users of Waste Going to Other Locations

The cost of diverting MMSW from BSL to other Identified Alternative Facilities includes the tipping fees, cost of operating transfer stations to receive MMSW from local collection vehicles and load transport trailers, the cost of transporting MMSW, and state and local fees (if any) levied on the disposal of MMSW.

Table 7-7 presents a comparison of the cost of MMSW diversion for the proposed Project and the No-Build Alternative. The number of tons diverted and the tipping fee differences are taken from the MMSW diversion models presented in Attachment H-3 and H-4. The transfer load cost was calculated using a cost of $8 per ton of MMSW for operating transfer stations multiplied by the number of tons diverted. The transportation cost was calculated using a cost of $0.131 per ton-mile for transporting MMSW multiplied by the number of ton-miles diverted shown in the MMSW diversion models. The transfer load cost and transportation cost are based upon Waste Management's recent experience using third-party transfer stations and transport companies in the tristate area (Mike Miller, personal communication, April 2020).

Table 7-7
MMSW Diversion Cost[1] Comparison of No-Build Alternative vs. Proposed Project BSL
Market Area MMSW Only; Years 2020 Through 2030

Item	No-Build Alternative	Proposed Project
Tons Diverted	3.45 million	0.25 million
Transfer Load Cost	$27.6 million	$2.0 million
Transportation Cost	$53.1 million	$5.4 million
Tipping Fee Difference	-$57.3 million	-$5.1 million
Total Cost of Diversion	**$23.4 million**	**$2.3 million**

[1] Costs are in 2020 dollars

Cost increases resulting from the diversion of MMSW from BSL to other Identified Alternative Facilities is likely to be borne by the users of BSL, including the general public, because that is a direct cost for managing MMSW from the BSL market area. Any cost savings would not likely be seen by the general public. Based upon the information presented above, the average transfer/transportation cost difference between the No-Build alternative and the proposed Project during the 2020 through 2030 time period is $6.70 per ton.

Economic Effects on City, County, and Regional Solid Waste System

The No-Build Alternative results in changes to the collection of taxes and fees by the City of Burnsville, Dakota County, and the State of Minnesota, which are the host communities for the BSL. Table 7-8 summarizes the cumulative taxes/fees collected by these governmental entities during years 2020 through 2030 for the No-Build Alternative and the proposed Project, related only to the BSL market area MMSW. The cumulative total fees are calculated by multiplying the total tons disposed by the following per-ton fees charged by each entity in 2020, as promulgated in applicable host fee agreements, County ordinances, and State rules:

- The City of Burnsville collects $4.33 per ton of MMSW disposed at BSL.
- Dakota County collects a host fee of $10.51 per ton MMSW for in-County waste and $11.03 per ton for out-of-County MMSW. For simplicity, these two values are averaged and a value of $10.77 per ton is used in this analysis for the Dakota County host fee. This fee applies to MMSW disposed in both BSL and Pine Bend Landfill.
- The State of Minnesota collects $6.66 per ton MMSW disposed in Minnesota landfills.

Table 7-8 also lists cumulative taxes/fees collected by the communities in which Pine Bend and Central Disposal (i.e. the Identified Facilities that receive the diverted MMSW) are located. These are based on the following per ton fees, as promulgated in applicable host fee agreements, County ordinances, and State rules:

- The City of Inver Grove Heights collects a host fee of $7.20 per ton of MMSW disposed at Pine Bend.
- The City of Lake Mills, Iowa collects a host fee of $0.15 per ton of MMSW disposed at Central Disposal.
- Winnebago County, Iowa collects a host fee of $0.60 per ton of MMSW disposed at Central Disposal.
- The State of Iowa mandates that a fee of $3.65 per ton be collected for MMSW disposed at Central Disposal. This includes $2.10 per ton that is remitted to the State of Iowa and $1.55 per ton that is retained for planning and environmental protection activities at the local level.

Table 7-8
Cumulative Taxes and Fees Collected by Governmental Entities
BSL Market Area MMSW Only; Years 2020 Through 2030

Government Entity	No-Build Alternative		Proposed Project		Difference[1] (total taxes/fees collected)
	Total Tons Disposed	Taxes/Fees Collected	Total Tons Disposed	Taxes/Fees Collected	
City of Burnsville, MN	1.1 million	$5.0 million	4.6 million	$18.8 million	-$13.8 million
City of Inver Grove Heights, MN	1.8 million	$13.0 million	0	$0	$13.0 million
Dakota County, MN	2.9 million	$31.3 million	4.6 million	$46.8 million	-$15.5 million
State of Minnesota	3.0 million	$20.1 million	4.6 million	$29.7 million	-$9.6 million
City of Lake Mills, IA	1.6 million	$0.2 million	0.1 million	$0.02 million	$0.18 million
Winnebago County, IA	1.6 million	$1.0 million	0.1 million	$0.06 million	$0.94 million
State of Iowa	1.6 million	$5.8 million	0.1 million	$0.4 million	$5.4 million
Total		$76.4 million		$95.8 million	-$19.4 million

[1] Difference in total taxes/fees under the No-Build Alternative compared to the Proposed Project.

The total tons disposed shown in Table 7-8 are compiled from the data presented in the MMSW diversion models in Attachment H-3 and H-4. For the City of Burnsville totals, this includes only the MMSW generated in the BSL market area that is ultimately disposed at BSL, and none of the diverted MMSW, which is all disposed outside of Burnsville. The Dakota County totals include the MMSW disposed at BSL as well as MMSW diverted from BSL to Pine Bend Landfill, as both facilities are located within Dakota County. The same total tonnages are used for the State of Minnesota as for Dakota County because BSL and Pine Bend are the only two Minnesota landfills that receive waste from the BSL market area in the MMSW diversion models.

The last row of the table indicates the sum of all taxes/fees collected from landfills in the No-Build and Proposed Project scenarios. The Total Difference cell indicates the difference between the total taxes/fees collected under the Proposed Project and the total taxes/fees collected under the No-Build scenario. The -$19.4 million is a system-wide loss of tax revenue in the No-Build scenario, but as the table shows, each local jurisdiction either sees an increase or decrease of revenue under each scenario. The cost of lost tax and fee revenue by city, county, and state governments is likely to be borne by the general public. It is generally believed that taxes and fees collected by governmental entities are used to provide programs and services that benefit the general public. Although some of the tax revenue collected from landfill disposal is designated for solid waste management-specific programs and is not part of general revenue, a reasonable conclusion is that either a portion of the lost revenue is made up by increased taxes and fees elsewhere, or programs and services are reduced, a portion of which bear on the general public.

7.3.2 Employment Impacts of the No Build Alternative

Employment impacts related to the No Build alternative are primarily related to changes in the location of MMSW landfill jobs and transfer/transportation needs for diverting the MMSW to other landfills. This section examines the employment impacts of the No Build alternative for these two categories.

Landfill Employment

The overall amount of MMSW landfilled does not change between the Project and No Build alternative, so the number of landfill jobs is expected to remain relatively stable. BSL employs approximately 17 people: 11 full-time employees, 4 full-time support staff that also manage other sites, and 2 part-time laborers. Under the No Build alternative, the BSL would still be permitted to accept industrial and C&D waste, so it would remain open. However, the annual quantities of those wastes are expected to be significantly less than the MMSW that would be received under the Project scenario, and therefore fewer staff would be needed to maintain landfill operations. Waste Management estimates that staff would be reduced by 50%, or approximately 8 people (7 full-time, 1 part-time), under the No Build alternative due to smaller amounts of waste expected.

Conversely, the Identified Facility (or facilities) would be expected to add employees in order to accommodate the additional MMSW tonnage that would be diverted from BSL. In the No Build alternative model presented above, the vast majority of the diverted tonnage is divided between Pine Bend and Central Disposal in a nearly even split. It is therefore estimated that up to 4 jobs would be created at each of these two alternative facilities.

MMSW Transfer and Transportation Employment

MMSW Transfer Stations

The 2005 EIS included the assumption that a transfer station would employ up to four people. The 2019 transfer tonnage listed in Table 7-6 for transfer stations within the BSL market area is less than 25% of the combined permitted capacities of the transfer stations, and even with an additional

326,000 tons diverted from BSL the transfer tonnage would be less than half of the combined permitted capacities. It is therefore assumed that the number of current transfer station jobs is an average of two per facility (for MMSW transfer only, independent of other potential facility operations), and that an additional one job would be created at each of the nine listed facilities to accommodate the increased transfer tonnage.

MMSW Transport/Hauling

The 2005 EIS included the following assumptions which factor into the amount of additional trucking that would be needed to transport the waste diverted from BSL.

- Transfer trailers can haul an average of 19 tons per transfer load.
- The average speed of the transfer vehicle is dependent on the distance of the alternative facility from BSL. An average speed of 45 miles per hour (mph) was used for facilities located less than 25 miles away. An average speed of 55 mph was used for facilities greater than 25 but less than 100 miles away. An average speed of 60 mph was used for facilities greater than 100 miles away.
- The number of trips each driver could make in a year is based on the trip time and an allowance of 2,000 hours per year for each driver.

An average speed of 52 miles per hour has been selected to simplify the analysis. This average speed is appropriate being that 49% of the MMSW diverted from BSL goes to facilities greater than 100 miles away (i.e. 60 mph speed) and 51% goes to facilities less than 25 miles away (i.e. 45 mph speed).

Using the above assumptions, the number of diversion transport hours required to haul the 3.4 million tons of MMSW diverted from BSL over the 10-year period from 2020 through 2030 is 387,774 hours. This equates to an average of additional 19 drivers per year needed during the period from 2020 through 2030.

7.3.3 Summary of Potential Economic and Employment Effects of the No Build Alternative

Table 7-9 provides a summary of the potential beneficial and adverse effects of the No Build alternative based on the factors considered in this alternatives section.

Table 7-9
Summary of No-Build Economic and Employment Effects

	Beneficial	Adverse
Diversion cost to public	N/A	Increased cost to general public for disposal.
Government Fees	Increase in tax/fee revenue for the cities of Inver Grove Heights, MN and Lake Mills, IA, Winnebago County, IA and the State of Iowa, the hosts of Identified Alternative Facilities	Loss of tax/fee revenue for the City of Burnsville, Dakota County, State of Minnesota
Employment	Added employment at transfer stations, hauling, and Identified Alternative Facilities	Reduction in jobs at BSL

Economic Impacts of a Smaller Landfill

Section 7.1.1 of this SEIS examined alternative size scenarios for the BSL that could result from an immediate 75% recycling rate. This section outlines the potential economic impacts resulting from the 75% recycling rate relative to the economic impacts identified for the No-Build Alternative.

- Employment – The landfill will continue to operate under the 75% recycling rate, but is predicted to experience a significant reduction in annual disposal volumes. Based on information in Table 7-2, annual disposal volumes at BSL under the 75% recycling rate would be approximately 51% of projected disposal volumes under the current recycling rate. It is assumed that other MMSW landfills would also experience a decrease in annual disposal volumes. This would result in a decrease in employment associated with land disposal. Employment in the recycling sector would be expected to increase.

- Transfer cost – Because of the decreased need for land disposal under the 75% recycling rate, the cost for MMSW diversion and transfer to other landfills would be expected to decrease relative to the proposed Project and the No-Build Alternative. There would be costs associated with transporting the MMSW to recycling facilities, however the nature and logistics (i.e. recyclable material end markets, processing locations, collection methods, etc.) of the recycling program that would result in the 75% rate are unknown, so at this time it is not possible to compare these costs to the MMSW diversion costs.

- Airspace/Capacity consumption – System-wide MMSW landfill airspace would be expected to be consumed at a slower rate under the 75% recycling rate relative to the proposed Project and the No-Build Alternative. Utilization of existing recycling capacity would be expected to increase.

- Tax/fee revenue – Table 7-2 reports a cumulative total of approximately 2.53 million tons of MMSW disposed at BSL under the 75% recycling rate during the modeled time period from 2020 to 2030. Applying the tax and fee rates listed in Section 7.3.1, above, this results in a total of approximately $55.1 million in tax and fee revenue over the modeled time period.

This is lower than the total of $56.4 million reported for the No-Build Alternative and lower than the $95.3 million reported for the proposed Project.

Mitigation of Adverse Economic and Employment Effects

The adverse economic and employment impacts identified in Table 7-9 would affect BSL employees, BSL users, the general public, and local, county and state government. Possible solutions for the adverse impacts identified in Table 7-9 would be to allow the proposed Project to proceed, enact policy change to mitigate potential impacts, or move waste further up the waste hierarchy which would create additional jobs and stimulate the reuse/recycling economy.

7.3.4 Impact on Property Values

This section addresses the following scope items for the SEIS:

1) The SEIS will review existing studies, reports, and other information of MMSW landfills within the five-state area as it relates to their impact on property values within a 2-mile radius of the landfill.
2) The review will also include information on the change in property values resulting from the expansion of an existing MMSW landfill.

A literature search for published studies, reports, and other information of MMSW landfills within the five-state area (Minnesota, North Dakota, South Dakota, Iowa, Wisconsin) produced five sources of information relating to property values in proximity to MMSW landfills. No studies of impacts to property values due to expansion of a Minnesota MMSW landfill were obtained. One study was obtained of a Pennsylvania MMSW landfill vertical expansion, a project which has many similarities to the proposed Project. A summary of results and conclusions from those sources is presented in this section.

Background

Property values are based upon market forces, and typically reflect the preferences of buyers and sellers for locational characteristics as well as the features of the property itself. Locational characteristics include both amenities and disamenities. Amenities and disamenities are subjective; one buyer may find proximity to major roadways or shopping areas to be an amenity because of ease of access to those features, whereas another buyer may consider such proximity to be a disamenity because of traffic noise and congestion. Over time, property values adjust up or down to reflect what buyers are willing to pay for a property given its particular locational characteristics.

The effect of landfills on residential property values is the subject of debate. Some literature indicates negative effects while other literature indicates neutral or positive effects. Landfill issues that may negatively affect the market value include ambient effects such as noise, traffic, and dust, and perceived impacts such as the potential for environmental effects relating to groundwater contamination or gas migration. In the case of environmental effects, negative perceptions may be based more upon legacy issues connected with old unlined dump sites rather than on current landfill

design and operating practices, in which potential environmental effects are mitigated by liners, leachate collection, and gas control systems.

Landfill issues that may have a positive or neutral effect on market value include the presence of green buffer spaces surrounding the landfill. Once the landfill is completed the land will be put to a different use. If the planned end use is an attractive park, open space, or recreational area, buyers may be willing to overlook the perceived disamenities during the landfill's operating life in view of the longer-term benefits.

Anoka Regional Landfill

Two studies of the Anoka Regional Landfill (a.k.a. Anoka Sanitary Landfill) are summarized below. Anoka Regional Landfill is a now-closed MMSW landfill located in Ramsey, Minnesota. The two studies are: Metropolitan Council of the Twin Cities Area, Anoka Sanitary Landfill, Draft Environmental Impact Statement (MCES, 1988); and Price Effects of Landfills on Houses (Nelson et al., 1992).

Metropolitan Council, Draft Environmental Impact Statement

Metropolitan Council of the Twin Cities Area (MCES, 1988) published a Draft Environmental Impact Statement (DEIS) for the Anoka Sanitary Landfill Expansion. The DEIS includes a section on valuation implications from proximity to the landfill. The DEIS examined the valuation issue from several perspectives without detecting any objective indications of impact, either positive or negative, related to proximity to the landfill.

The DEIS states that development activity appears to slow temporarily in response to initial news about the landfill expansion proposal or pollution problems at the site. Subsequent spurts of construction, however, result in an overall rate of development comparable to that of other areas with a similar mix of land use patterns. Sales price information available to the assessors' offices (Ramsey City Assessor and Anoka County Assessor) had never varied enough from assessor appraisals to indicate an adverse impact of prices of properties near the landfill. The Ramsey City Assessor had made no assessment adjustment for proximity of residential properties to the landfill and only one adjustment for commercial properties (made at the direction of the City Council in response to a threat from that business to relocate outside of the City). Annual sales ratio studies prepared by the Anoka County Assessor's Office indicated the relationship of sale price to assessor evaluation was too close to the county-wide pattern to ascribe any impact from proximity to the landfill.

The DEIS analyzed sales statistics maintained by the Greater Minneapolis Area Board of Realtors. Sales data for properties located within one mile of the landfill were compared with remaining properties within the City of Ramsey. After screening the data and removing unusual transactions that skewed the results, it was found that homes near the landfill sold for slightly more relative to assessed values than home further away. In addition, the data showed that the listing period and reductions from listed prices for homes within one mile of the landfill were "surprisingly low" in comparison with the rest of Ramsey and other communities.

Nelson et al., Price Effects of Landfills on House Values

Nelson et al. (1992) published a study entitled Price Effects of Landfills on House Values, with its primary subject being the now-closed Anoka Regional Landfill located in Ramsey, Minnesota. The study develops and applies an empirical model to estimate the price effects of the Anoka Regional Landfill on the value of more than 700 single-family homes, located within 2 miles of the landfill, sold from 1979 to 1989. The study authors state that this landfill was selected for a number of reasons, including: its location amidst a suburbanizing landscape near a major urban area (i.e. Minneapolis-St. Paul); the relatively flat and lightly wooded terrain; the landfill is operating under substantial regulatory constraints principally aimed at minimizing adverse effects; the landfill has been operating since 1967 and will continue into the 1990s, thus covering the study period; and the landfill is surrounded by a reasonably homogeneous housing market which eliminates some valuation variables and helps isolate the effect of distance from the landfill on valuation.

The first phase of the analysis concluded that the price effect of landfill proximity became statistically insignificant at a distance between 2.0 and 2.5 miles from the landfill. The second phase of analysis used a price modeling method that isolates the effect of proximity to the landfill from other price-influencing characteristics such as age, number of bedrooms, lot size, etc. Modeling results indicate that the landfill adversely affects single-family house values in the Ramsey, Minnesota area to a distance of about 2 miles from the center of the landfill; beyond 2 miles there is little if any price effect. The results further indicate that house values rise by about 6.2% per mile of distance from the center of the landfill, with a value reduction of perhaps more than 12% at the landfill boundary and about 6% at a distance of one mile from the landfill boundary. It is further stated that "A $100,000 home built within one mile of the proposed landfill the day before the landfill operations commence would lose $6,000 the day after."

The study authors caution that the analysis does not specifically address the price effects of the latest landfills built and operated to modern standards (the Anoka Regional Landfill is an unlined landfill that preceded the design, monitoring, operational, and closure standards of RCRA under 40 CFR Part 258, Subpart D), however they find it reasonable to assume that unless new landfills achieve a state of operations such that the housing markets view them as benign, it is expected that landfills will continue to have negative price effects.

Flying Cloud Landfill

Two studies of the Flying Cloud Landfill are summarized below. Flying Cloud Landfill is a now-closed MMSW landfill located in Eden Prairie, Minnesota. The two studies are: Metropolitan Council of the Twin Cities Area Final Environmental Impact Statement, Flying Cloud Sanitary Landfill Expansion (MCES, 1984); and Price Effects of Landfills on Different House Value Strata (Nelson et al., 1997).

Metropolitan Council, Final Environmental Impact Statement

Metropolitan Council of the Twin Cities Area (MCES, 1984) published a Final Environmental Impact Statement (FEIS) for the Flying Cloud Landfill Expansion. The potential impacts to property values resulting from expansion of the landfill, as reported in the FEIS, are summarized below.

The FEIS indicates that there are many other positive and negative outside factors, aside from the presence and potential expansion of the landfill, that affect the market for, and value of, property in

the local area. Positive factors include proximity to employment, shopping, and services, good highway access, and closeness to the Minnesota River Valley. Negative factors include proximity to Flying Cloud Airport. The FEIS identifies mitigating measures proposed by the landfill to eliminate or minimize potential negative impacts associated with the landfill, with the effect of such measures being to minimize the impact on the surrounding area and protect the attractiveness of the area and the value of property.

The FEIS concluded that property value impacts in the Hillsborough subdivision would likely be minimal due to buffer space, perimeter berms, and proposed control measures to eliminate or minimize nuisance impacts. The FEIS concluded that the value of vacant lots and houses in the Bluffs West – Second Addition Properties could be affected because the expansion would reduce the buffer space from the range of 800 to 1,200 feet from the existing landfill to 200 to 500 feet from the expanded landfill, and because potential impacts from noise, odors, litter, dust, gas emissions, and visual impacts could increase due to the extended life and increased proximity of the expansion. The potential effect on property values was not quantified.

Nelson et al., Price Effects of Landfills on Different House Value Strata

Nelson et al. (1997) published a study entitled "Price Effects of Landfills on Different House Value Strata," with its primary subject being the now-closed Flying Cloud Landfill located in Eden Prairie, Minnesota. The study develops and applies an empirical model similar to the model described in the Anoka Regional Landfill study but which further isolates the price effects of the Flying Cloud Landfill on houses in three different price categories: less than $100,000, between $100,000 and $150,000, and greater than $150,000. The model is applied to data previously collected on 644 house sales that occurred between 1977 and 1988 and located within 3 miles of the landfill. The study authors state that this landfill was selected for a number of reasons, including: its setting in a rural residential and suburbanizing landscape near a major urban area; the relatively flat and lightly wooded terrain; the landfill is not subject to significant regulatory constraint; it was operating during the entire study period; and the area possesses a wide range of house values.

Study authors state that the results indicate that landfill price effects clearly fall differently on different house price strata. Modeling results indicate that price effects are proportionally more than three times higher on homes selling for more than $150,000 than on homes selling for less than $100,000, and are nearly twice as high as for homes selling between $100,000 and $150,000. The study reports a price gradient relative to distance from the landfill of 2.64% per mile for properties in the $50,000 to $100,000 price range, 4.32% per mile for properties in the $100,000 to $150,000 price range, and 8.43% per mile for properties over $150,000. Prices were all adjusted to 1980 constant dollars for purposes of comparison.

Burnsville Sanitary Landfill

Metropolitan Council (MCES, 1992) published a FEIS for the BSL Expansion, the same facility that is the subject of this SEIS. The FEIS did not examine property value effects of the landfill expansion, but did examine the compatibility of the proposed expansion with proposed long-range surrounding land uses.

The FEIS states that the expansion of the landfill is not expected to create any major changes to the land use in the I-35W and Highway 13 corridors and interchange. The FEIS notes that three areas of potential impact to the corridors involve traffic impacts, nuisance impacts, and visual impacts. The FEIS states that the surrounding land uses in the area were developed with two landfills operating in the area; that with the presence of the existing BSL, the closed Freeway Landfill, and the quarry operation it is unlikely that planned land use in the area would be changed to more sensitive uses; that any different land use will have to be compatible with the existing landfills, quarry, and other industrial and commercial developments already in the area; and that expansion of the BSL will do little to affect that situation.

Change in Property Value Resulting from Expansion of an MMSW Landfill

In 2014, Keystone Sanitary Landfill (KSL) located in Dunmore, Pennsylvania proposed a major expansion which included a vertical expansion. As part of the expansion permitting process through the Pennsylvania Department of Environmental Protection KSL commissioned a study to investigate the potential effects of the expansion on property values in the vicinity of the landfill. The study, titled Market Impact on Real Estate Values due to a Landfill Expansion (Swift, 2015) was prepared by Swift Real Estate Solutions and dated June 2015. The scope of the study was to analyze property value impacts relative to proximity to the landfill resulting from an expansion of an existing landfill (as opposed to siting a new landfill). The study evaluates the performance of real estate markets in the vicinity of KSL from 1998 to 2015. KSL has been in existence since the 1960s and was granted a major permit modification in 1997 to increase MMSW disposal capacity. The study period analyzes price effects observed during the period following the 1997 expansion permit to the date of the report (i.e. 2015).

The 1997 KSL expansion increased the permitted capacity from 25.4 million cubic yards to 36.6 million cubic yards and increased the peak elevation from 1,310 to 1,595 feet above MSL. Measurements of the KSL site taken from Google Earth indicate the landfill currently occupies a footprint of approximately 500 acres. Residential and commercial/industrial developments located adjacent to the west and north of the landfill are situated at elevations of approximately 1050 to 1150 feet above MSL, which is 450 to 550 feet below the peak elevation permitted in 1997.

By comparison, the proposed Project reduces the BSL footprint slightly from 216 to 204 acres, increases the disposal capacity from 25.4 million cubic yards to approximately 45 million cubic yards, and increases the ultimate height to 380 feet above adjacent land areas. BSL commenced waste disposal operations in the mid 1960s, and was previously granted permits for expansion in 1992 and 2006. Nearby residential, commercial, and industrial development has occurred with BSL already present as a preexisting land use.

The study considered market resources within Lackawanna County and those surrounding KSL during periods of change in capacity levels (i.e. when expansions were permitted) to determine price change and impact based upon proximity. The analysis included evaluating housing market pricing and activity within a 1-, 3-, and 5-mile radius of KSL, as well as a neighborhood just south of the KSL commonly known as the Swinnick Community of Dunmore, and also Lackawanna County as a whole.

The study reports the following results regarding change in average home sale price within the different study areas:

Table 7-10
Average Home Sale Price

	Swinnick Community	1 Mile from Landfill	3 Miles from Landfill	5 Miles from Landfill	County
1998	$86,955	$84,042	$66,617	$64,749	$89,876
2015	$141,803	$126,930	$102,857	$111,639	$140,329

The report notes that during the study period, the value concludes that there is no market evidence to support any negative impact on real estate value as a result of the planned expansion of the KSL.

7.4 Summary of Potential Environmental and Sociological Impacts of the No Build Alternative

The potential environmental impacts of the No Build alternative are summarized below, relative to the impacts identified in Section 6 of this SEIS for the proposed Project full buildout:

- Groundwater Impacts – Section 6.1 of this SEIS describes the potential groundwater impacts due to the proposed Project. The No-Build Alternative is not expected to result in additional direct, indirect, or cumulative potential significant adverse or beneficial effects on groundwater. There would be no change in the amount of unlined area, and the landfill design will have negligible effect on the current or future water table elevation or flow direction at the site.
- Surface water – Section 6.2 of this SEIS describes the potential surface water impacts due to the proposed Project, including detailed comparisons of surface water runoff volumes, peak runoff rates, and sedimentation pond performance for the proposed Project and the Pre-Expansion (i.e. No-Build Alternative) scenarios. In general, for the 2-year and 10-year storm events, the No-Build Alternative results in similar total runoff volumes, higher peak runoff rates, and more sediment discharged from the site compared to the proposed Project. Therefore, in typical storm events, the No-Build Alternative would result in direct adverse effects due to higher peak runoff rates and lower sediment removal efficiency. For the 500-year storm event, the No-Build Alternative results in a lower total runoff volume and lower peak discharge rate than the proposed Project. The No-Build Alternative is not designed for extreme storms, so there would be adverse effects. However, the adverse effects of the No-Build Alternative would be less than those of the proposed Project. No other direct, indirect, or cumulative potential significant adverse or beneficial effects on stormwater are anticipated due to the No-Build Alternative.
- Liner/Leachate Collection System – Section 6.3 of this SEIS describes the potential impacts to the liner/leachate collection system due to the proposed Project. Under the No-Build alternative, it is assumed that the NDA would be developed as-permitted for industrial waste disposal. Developing the NDA would include constructing the surrounding flood levee approximately 700 feet closer to the Minnesota River than the levee needed for the proposed Project. The No Build alternative is not expected to affect flood elevation in the Minnesota

River, therefore the potential for overtopping the flood levee would be unchanged, as would the erosion potential and stability of the flood levee. The base liner design for the NDA is the same as the proposed Project, so there would be no change in potential for infiltration through geomembrane defects, and no change in potential for uplift due to hydrostatic pressure from the water table, on a per unit area basis. The permitted area of the NDA is larger than the proposed ADA, so the amount of new lined area would increase under the No-Build Alternative. This would be an indirect adverse effect, because there would be a larger area within which these potential liner impacts could occur. No other direct, indirect, or cumulative potential significant adverse or beneficial effects on the liner/leachate collection system are anticipated due to the No-Build Alternative.

- Visual Impacts – Section 6.4 of this SEIS describes the potential visual impacts due to the proposed Project, based on photo renderings of the full build-out. A direct beneficial effect of the No-Build Alternative would be the reduced amount of landfill and associated lighting visible from off-site locations compared to the higher height of the proposed Project. No other direct, indirect, or cumulative potential significant adverse or beneficial visual effects are anticipated due to the No-Build Alternative.

- Air quality – Section 6.5 of this SEIS describes the potential air quality impacts due to the proposed Project. Air emissions resulting from the Project are associated with uncaptured landfill gas, landfill gas combustion equipment, and waste transport and handling equipment; and increased air emissions are primarily related to the larger waste volume resulting from the Project. A direct beneficial impact of the No-Build Alternative would be the reduction in air emissions resulting from the smaller waste mass and associated operational activities. An indirect adverse impact of the No-Build Alternative would be the reduction in energy production capacity resulting from lower gas generation rates. No other, direct, indirect, or cumulative potential significant adverse or beneficial air quality effects are anticipated due to the No-Build Alternative.

- Sociological – Section 6.6 of this SEIS describes potential sociological impacts due to the proposed Project. The No-Build Alternative is not expected to result in changes to the sociological impacts associated with the Project. No significant adverse impacts are predicted to surrounding recreational resources. End use options for a smaller landfill will be similar to the proposed Project and consist of recreational uses which will be a benefit to the community. An indirect benefit of the No-Build Alternative is that a wider variety of recreational end uses could be considered due to the large, flat top for the landfill. No significant impacts are predicted under either scenario due to FAA requirements or bird interactions with aircraft. No other direct, indirect, or cumulative potential significant adverse or beneficial sociological effects are anticipated due to the No-Build Alternative.

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Attachment A

Waste Characterization Study

Report

Waste Characterization Study

Project I.D.: 19B050.00

Prepared For
Burnsville Sanitary Landfill

December 2019

Foth

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December 30, 2019

Mike Miller
Sr. District Manager – Waste Management
2650 West Cliff Road
Burnsville, MN 55372

Dear Mike:

RE: Waste Characterization Study Report

Thank you for the opportunity to provide this Waste Characterization Study Report for the Burnsville Sanitary Landfill. This report describes the methodology used for sampling to obtain representative data, sampling procedures, and results.

Please contact Nathan Klett at (651) 288-8519 or Nathan.Klett@Foth.com with any questions.

Sincerely,

Foth Infrastructure & Environment, LLC

Jennefer Klennert
Senior Client Manager

Nathan Klett, PE
Lead Environmental Engineer

cc: Bruce Rehwaldt, PE Foth

Waste Characterization Study

Distribution

No. of Copies	Sent To
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Waste Characterization Study

Project ID: 19B050.00

Prepared for
Burnsville Sanitary Landfill

2650 Cliff Road
Burnsville, MN 55372

Prepared by
Foth Infrastructure & Environment, LLC

December 2019

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Waste Characterization Study

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Appendices

Appendix A: Study Design Supporting Documentation
Appendix B: Composition Data Sheet

List of Abbreviations, Acronyms, and Symbols

ASTM	American Society for Testing and Materials
BSL	Burnsville Sanitary Landfill
C&D	Construction and demolition
Foth	Foth Infrastructure & Environment, LLC
HHW	Household Hazardous Waste
ISW	Industrial Solid Waste
M-F	Monday through Friday
MMSW	Mixed Municipal Solid Waste
MPCA	Minnesota Pollution Control Agency

1 INTRODUCTION

Waste Management is seeking approval for an expansion at the Burnsville Sanitary Landfill (BSL). As a part of the process for landfill expansion, the Minnesota Pollution Control Agency (MPCA) required Waste Management to conduct a waste characterization study. Waste Management retained Foth Infrastructure & Environment, LLC (Foth) to conduct a waste characterization study of the mixed municipal solid waste (MMSW) being delivered to Waste Management's BSL. This report describes the method used for determining the material categories, number of samples for obtaining representative data, method used for load selection, sampling procedures, and results.

2 BACKGROUND

The MPCA required Waste Management to conduct a waste characterization study as a part of the expansion request process for the BSL. Foth developed a sampling and data analysis plan based on the requirements defined by the MPCA. During email correspondence with MPCA including Sig Scheurle and Kevin Kain the following recommendations for the waste characterization were provided:

- Based on Waste Management's commitment that little or no construction and demolition (C&D) waste and industrial solid waste (ISW) will be disposed at the BSL, MPCA recommends that composition analysis of MMSW is all that is required.
- MPCA recommends that the MMSW composition study use the ASTM methods. However, the composition study should use the longer and more detailed materials types from the MPCA's commissioned 2013 statewide study, which divides the MMSW into fifty (50) material categories (Attachment A).
- MPCA recommends that the sampling be done over a 5 to 6 consecutive day study, Monday through Friday or Saturday if waste delivery occurs on Saturday, with approximately 11 samples per day (M-F).
- No less than 52 samples are necessary and more samples would be preferable and may be necessary if Saturday delivery occurs.

Waste Management indicated that the BSL would only receive material Monday through Friday. Therefore, Foth proposed to sort a total of 52 samples over the course of one week (Monday-Friday). Foth's sorting methodology generally followed ASTM D5231-92 (reapproved 2016) Standard Test Method for Determination of the Composition of Unprocessed Municipal Waste with the exception of using the fifty (50) material categories found in the 2013 Statewide Waste Characterization completed for the MPCA by Burns and McDonnell.

3 STUDY DESIGN

3.1 Methodology

Prior to conducting the Waste Characterization Study, Foth staff met with staff from BSL to discuss logistics of sample collection and space available for safely sorting the samples. Sampling and sorting took place at the BSL in Waste Management's maintenance garage space which provided an area protected from the elements and cordoned off from vehicle traffic. In order to obtain consistent and representative data, Foth requested historical information on the number and type of loads delivered to the BSL over the course of a week's time. Foth used this information and the MPCA requested number of samples (52) to determine the number of samples to collect each day. Based on the historical data and number of desired samples, Foth planned to sort approximately 11 samples per day (Monday through Thursday) and 8 samples on Friday. This Waste Characterization Study was conducted December 9 through December 13, 2019.

In order to obtain consistent and representative data, Foth used a random number generator to randomly select a minimum of eleven (11) loads per day for sample collection. Pursuant to ASTM D5231-92, samples between 200 and 300 pounds were obtained by BSL staff using a loader. Foth sorting staff observed the collection of samples at the working face of the landfill to insure a representative sample was collected. When a randomly selected load was delivered to the landfill, BSL staff recorded the truck identification number, waste hauler, origin (city and county), and type of waste (residential or commercial). The load was dumped near the working face and the load was divided into quarters, mixed and approximately 50-60 pound grab samples were collected from each quarter as shown in Figure 1. Some grabs were taken from the perimeter, some from the middle (after pushing aside the edge), some at ground level, and some slightly above ground level. This procedure was conducted to provide a representative sample from the entire load. Samples were transferred from the loader bucket into four (4) pre-weighed 95-gallon carts to insure adequate sample weights were obtained as shown in Figure 2.

Figure 1: Grab Sample Collection

Figure 2: Transferring Samples into Carts

The 95-gallon carts were loaded into a BSL pickup and were transferred from the landfill working face to the maintenance garage space for sorting. Prior to sorting, the individual 95-gallon carts were weighed to confirm adequate sample weight. If any sample was below 200 pounds, the sample was rejected and a new sample was obtained. The primary sort supervisor also photographed each sample, with a sample placard and identification number visible in the picture (see attached Photographic Log for sample photographs). Grab samples contained in the 95-gallon containers were deposited (one by one) onto the sort table for sorting by one of two sorting crews. A total of six (6) sorting staff were onsite daily at BSL in order to sort two (2) 200-300 pound samples simultaneously on the two (2) sorting tables that were positioned inside the BSL maintenance garage. Figure 3 shows a sorting table with containers surrounding the table for sorted materials based on the respective sorting categories.

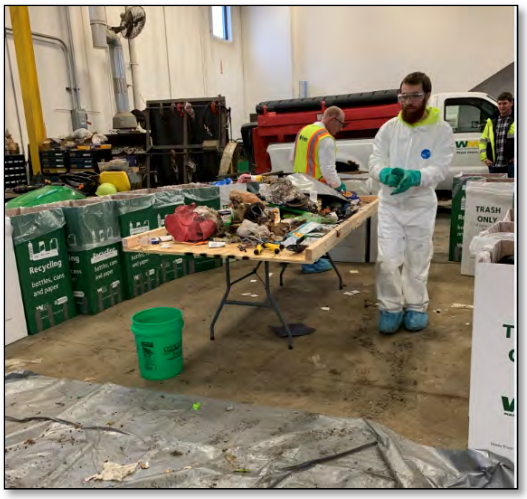

Figure 3: Sorting Operations in BSL Maintenance Garage Space

Samples delivered to the maintenance garage in 95-gallon carts were weighed on the digital scale to confirm adequate sample weight and were briefly stored until the sorting crew was finished sorting the previous sample. Figure 4 shows a sample in 95-gallon carts waiting to be sorted.

Figure 4: Samples Waiting to be Sorted in BSL Maintenance Garage Space

Samples were either emptied onto a tarp in the maintenance garage or directly onto a sorting table when the sorting crew was prepared to begin sorting. Samples emptied onto the tarp were then transferred to the sorting table with a shovel. Figure 5 shows one of the samples in a 95-gallon cart being emptied onto a tarp for sorting.

Foth sorting staff used the Waste Composition Data Sheet found in the 2013 Statewide Waste Characterization completed for the MPCA by Burns and McDonnell as requested by MPCA for the sorting categories. This Composition Data Sheet is included as Attachment B. The material from each sample was manually sorted, based on the prescribed component categories, into cardboard containers with liners to contain the separated components. An example of a sorting table and sorting containers is shown in Figure 3.

Generally, once the entire sample (all 95-gallon carts) was sorted, each component category container was carried over to the digital scale for weighing and tabulating the results on the field form (one form per sample). Once all component categories were weighed and recorded, contents of each category container were placed in either a waste or recycling roll-off. The tabulated field form results were emailed to a Foth data analyst for exporting into a Microsoft Excel spreadsheet for analysis.

Foth's data analyst compiled the results from each sample into a single spreadsheet with all results combined into the respective component categories. Additionally, information pertaining to waste type (residential, commercial, or commercial/residential) was recorded and included in the spreadsheet (Foth included a commercial/residential waste type in the material if the load was a mix of light commercial, multi-family and/or residential waste). A separate Foth data analyst conducted a quality control review of the data to insure data validation.

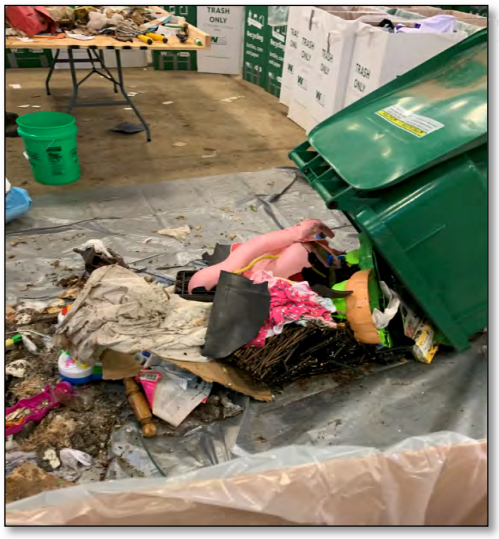

Figure 5: Sample Being Emptied onto a Tarp for Sorting in BSL Maintenance Garage Space

4 STUDY RESULTS

4.1 Modifications to the Original Study Methodology

The intent of the original waste characterization study was to sort 11 samples each day on Monday through Thursday and 8 samples on Friday. On Monday December 9, 2019 there was a snow event in the morning which affected initial deliveries of waste to BSL and therefore resulted in the sorting crew only being able to sort 8 samples. On Tuesday and Wednesday 11 samples were sorted each day, on Thursday the sorting crew sorted 14 samples, and on Friday 8 samples were sorted for a weekly total of 52 samples.

The snow event that occurred on Monday December 9, 2019 was followed by below zero temperatures for several days. The weather conditions affected the sorting staff's ability to accurately sort the compostable paper products from the MMSW being sorted. The compostable paper was wet and deteriorating initially and then transitioned to being frozen to liquid and solid organics. These conditions made it nearly impossible to separate the compostable paper from the other materials. Therefore, the compostable paper was included in the "other organic fraction" category. This procedure was continued for the duration of the waste characterization event to maintain consistency throughout.

4.2 MMSW Composition at BSL

The waste composition study results for material received at BSL includes MMSW only since BSL does not anticipate accepting C&D or ISW materials. The C&D materials included in the results represent those that were commingled within the loads of MMSW that were sorted during the waste characterization study for BSL. A total of nearly 6 tons of MMSW were sorted over the week of December 9 to 13. This included residential, commercial and commercial/residential material. Table 4-1 provides a breakdown of the type of materials sorted during the week. The results in Table 4-1 are generally in agreement with the waste types historically received at the BSL based on discussion with BSL staff.

Table 4-1
Breakdown of Waste Type

Waste Type	Percent of Total
Commercial	56.2%
Commercial / Residential	8.1%
Residential	35.7%

Table 4-2 provides the composition results by primary material category for all materials sorted at the BSL. Materials in the "Other Wastes" category in Tables 4-2 through Table 4-5 includes but is not limited to the following items: brick, drywall, building material, construction, cement, rocks/dirt, and landscaping concrete/stone.

Table 4-2
Composition by Primary Material Category

Primary Material Category	Percent in All Waste Sorted
Electronics	1.60%
Glass	1.91%
HHW	0.18%
Metal	3.59%
Organics	49.13%
Other Wastes	15.64%
Paper	13.03%
Plastic	14.92%
Grand Total	**100.00%**

Table 4-3 provides the composition results by primary material category for materials sorted at the BSL that were identified as commercial.

Table 4-3
Composition by Primary Material Category – Commercial

Primary Material Category	Percent in Commercial Waste Sorted
Electronics	1.06%
Glass	2.13%
HHW	0.14%
Metal	3.28%
Organics	48.87%
Other Wastes	14.62%
Paper	13.58%
Plastic	16.33%
Grand Total	**100.00%**

Table 4-4 provides the composition results by primary material category for materials sorted at the BSL that were identified as commercial/residential.

Table 4-4
Composition by Primary Material Category – Commercial/Residential

Primary Material Category	Percent in Commercial/Residential Waste Sorted
Electronics	0.82%
Glass	1.16%
HHW	0.53%
Metal	5.43%
Organics	58.22%
Other Wastes	16.28%
Paper	3.67%
Plastic	13.89%
Grand Total	**100.00%**

Table 4-5 provides the composition results by primary material category for materials sorted at the BSL that were identified as residential.

Table 4-5
Composition by Primary Material Category – Residential

Primary Material Category	Percent in Residential Waste Sorted
Electronics	2.65%
Glass	1.76%
HHW	0.16%
Metal	3.62%
Organics	47.23%
Other Wastes	17.04%
Paper	14.54%
Plastic	12.99%
Grand Total	**100.00%**

For all individual waste types and the aggregate of all waste sorted, organics represented the largest percentage of the waste sorted at the BSL. The percent organics in the residential (47.23%) waste type was very similar to the percent organics in the commercial (48.87%) waste type.

Table 4-6 provides the composition percentages for all material categories found in the waste sorted at BSL. Compostable paper greater than two inches in size was placed in the "non-recyclable paper" category and compostable paper (i.e. napkins, tissues, etc.) smaller than 2 inches in size was places in the "other organic material" category. PLA and compostable plastics were placed in the "other plastics (non-packaging)" category.

Table 4-6
Composition for All Material Categories

(Percent of Total by Weight)

Material Category	Percent of Total	Material Category	Percent of Total
Paper	**13.03%**	**Metal**	**3.59%**
Boxboard	1.45%	Aluminum Beverage Containers	0.58%
Compostable Paper	0.00%	Other Aluminum	0.52%
Corrugated Cardboard & Kraft Bags	3.59%	Other Metal	0.40%
Gable Top/Aseptic Containers/Cartons	2.04%	Steel/Tin (Ferrous) Containers	2.09%
High Grade Office Paper	0.89%		
Magazines/Catalogs	1.76%	**Glass**	**1.91%**
Mixed Recyclable Paper	1.59%	Beverage Container Glass	0.95%
Newsprint	0.51%	Glass Containers	0.96%
Non-Recyclable Paper	1.20%	Other (Non-Container) Glass	0.00%
Phone Books	0.00%		
		Electronics	**1.60%**
Plastic	**14.92%**	All Other Electronic Items	1.60%
Bags and Film Plastic	6.29%	Computer Monitors	0.00%
HDPE Bottles/Jars #2	0.41%	Laptops/Cell Phones	0.00%
LDPE (Rigids; no bags/wrap) #4	0.25%	Printers	0.00%
Other #7 Plastics	0.50%	Televisions	0.00%
Other HDPE #2	1.52%		
Other PET (e.g. jars and clamshells) #1	0.38%	**Organics**	**49.13%**
Other Plastic (nonpackaging)	2.47%	Food Waste	22.58%
PET Beverage Containers #1	0.79%	Other Organic Material	21.71%
PLA & Compostable Plastics	0.00%	Wood	3.65%
Polypropylene #5	1.55%	Yard Waste	1.20%
Polystyrene #6	0.75%		
PVC #3	0.01%	**Other Wastes**	**15.64%**
		Appliances &Furniture	1.10%
HHW	**0.18%**	Carpet	0.19%
Batteries	0.12%	Liquids	1.15%
Mercury Containing Lamps	0.00%	Mattresses/Box Springs	0.00%
Oil Containers & Filters	0.03%	Other Not Elsewhere Classified (Misc. Fines)	4.14%
Other HHW	0.04%	Sharps & Infectious Waste	0.00%
Paint Containers	0.00%	Textiles & Leather	4.40%
Smoke Detectors	0.00%	Added	4.66%

4.3 Comparison of Composition Results to the 2013 Statewide Study

A comparison of the primary material categories from the 2013 Statewide Composition Study and the BSL Waste Characterization Study is provided in Table 4-7.

Table 4-7
Comparison of Composition between BSL and 2013 Characterization Studies

(Percent of Total by Weight)

Primary Material Category	Percent in All Waste Sorted	2013 Statewide Characterization Study
Electronics	1.60%	1.20%
Glass	1.91%	2.20%
HHW	0.18%	0.40%
Metal	3.59%	4.50%
Organics	49.13%	31.00%
Other Wastes	15.64%	18.30%
Paper	13.03%	24.50%
Plastic	14.92%	17.90%
Grand Total	**100.00%**	**100.00%**

The data presented in Table 4-7 was not compared for any statistically significant difference between the BSL study and the 2013 Statewide Characterization Study. It is rather shown for general observations and discussion purposes. There is a large increase in the percent of organic in the BSL Study as compared to the 2013 Statewide Characterization Study. This may suggest that residents served by the BSL may lack access to organics management options. There is also a noticeable decrease in the percent of paper and plastic between the 2013 Study and the Study at the BSL. This may indicate an increased recycling rate by the residents served by the BSL or may be indicative of general light-weighting of materials.

4.4 Observations

Organic waste including fine organic matter and small pieces (less than 2 inches in size) of compostable paper was observed in many of the loads. This smaller material was included with "other organic material" under the primary material category of "Organics". Due to temperatures below freezing, liquids that were frozen solid (e.g. milk, water, etc.) were physically removed from the container (when applicable) and were included in the "food waste" category.

Items categorized as "textiles and leather" accounted for 4.40% of the material. Many of these items were in usable condition and could have been donated rather than disposed of as MMSW.

During the BSL characterization study, there were no sharps, infectious waste or CRT's observed in the MMSW that was sorted. This may indicate that residents are aware of and are using recycling options and proper sharps disposal practices.

Very little hazardous waste was found in the MMSW. Batteries were the most prevalent waste in this category.

The BSL waste characterization study was conducted during the winter, but yard waste was still found in the trash and accounted for 1.20% of the material sorted.

The traditional recyclable categories plastic, paper, metal, and glass accounted for 23.49% of the material when removing the non-recyclable paper, bags and film plastic, and other plastic (non-packaging). Recyclable materials sorted from the trash were highly contaminated with liquid and food residue, which may make them more difficult to recycle after being sorted from the MMSW.

5 Resources Used

ASTM International. (1992) ASTM D5231-92 (reapproved 2016): Standard Test Method for Determination of the Composition of Unprocessed Municipal Waste. Downloaded with permission on July 2, 2019. www.astm.org.

Burns & McDonnell. 2013 Statewide Waste Characterization completed for the MPCA. 2013 Downloaded on July 2, 2019. www.mpca.org.

APPENDIX A

STUDY DESIGN SUPPORTING DOCUMENTATION

(2013 Statewide Characterization)

Table 4-5: Minnesota Statewide Aggregate Composition (by Weight)

Material	Mean	Conf Int. (90%) Lower	Conf Int. (90%) Upper	Material	Mean	Conf Int. (90%) Lower	Conf Int. (90%) Upper
PAPER				**METAL**			
Newsprint (ONP)	1.4%	1.1%	1.7%	Aluminum Beverage Containers	0.4%	0.4%	0.5%
High Grade Office Paper	1.1%	0.7%	1.6%	Other Aluminum	0.7%	0.3%	1.0%
Magazines/Catalogs	0.7%	0.5%	1.0%	Steel/Tin (Ferrous) Containers	0.7%	0.4%	1.0%
Phone Books	0.1%	0.0%	0.3%	Other Metal	2.7%	1.8%	3.5%
Gable Top/Aseptic Containers/Cartons	0.3%	0.2%	0.4%	***Subtotal Metal***	***4.5%***	**3.5%**	**5.4%**
OCC and Kraft Bags	3.7%	3.1%	4.2%				
Boxboard	1.6%	1.4%	1.8%	**GLASS**			
Compostable Paper	9.8%	8.7%	10.8%	Beverage Container Glass	1.3%	0.9%	1.8%
Mixed Recyclable Paper	3.4%	2.8%	4.1%	Glass Containers	0.5%	0.2%	0.8%
Non-Recyclable Paper	2.3%	1.4%	3.2%	Other (Non-Container) Glass	0.4%	0.2%	0.6%
Subtotal Paper	***24.5%***	**22.4%**	**26.5%**	***Subtotal Glass***	***2.2%***	**1.6%**	**2.9%**
PLASTIC				**ELECTRONICS**			
#1 PET Beverage Containers	0.8%	0.7%	0.9%	Laptops	0.0%	0.0%	0.0%
Other PET (e.g. jars and clamshells)	0.5%	0.5%	0.6%	Computer Monitors		*not found*	
HDPE Bottles/Jars	0.5%	0.4%	0.6%	Televisions	0.0%	0.0%	0.1%
Other HDPE	0.6%	0.3%	0.8%	Printers	0.1%	0.0%	0.2%
PVC - #3	0.0%	0.0%	0.1%	All Other Electronic Items	1.1%	0.7%	1.4%
Polystyrene - #6	1.0%	0.8%	1.2%	***Subtotal Electronics***	***1.2%***	**0.8%**	**1.6%**
LDPE (Rigids) - #4	0.1%	0.0%	0.1%				
Polypropylene - #5	0.6%	0.5%	0.7%	**ORGANIC**			
Other #7 Plastics	0.1%	0.0%	0.2%	Yard Waste	2.8%	1.6%	3.9%
PLA & Compostable Plastics	0.0%	0.0%	0.1%	Food Waste	17.8%	15.2%	20.3%
Bag and Film Film Plastic	6.6%	5.9%	7.3%	Wood	5.7%	4.3%	7.2%
Other Plastic (nonpackaging)	7.1%	5.6%	8.6%	Other Organic Material	4.7%	3.8%	5.6%
Subtotal Plastic	***17.9%***	**16.3%**	**19.5%**	***Subtotal Organic***	***31.0%***	**28.4%**	**33.6%**
HHW				**OTHER WASTES**			
Batteries	0.1%	0.0%	0.1%	Mattresses/Box Springs	0.4%	0.0%	0.8%
Mercury Containing Lamps	0.0%	0.0%	0.0%	Appliances & Furniture	3.0%	1.6%	4.3%
Paint Containers	0.2%	0.0%	0.5%	Textiles & Leather	4.7%	3.8%	5.5%
Oil Containers & Filters	0.0%	0.0%	0.0%	Carpet	2.3%	1.5%	3.1%
Smoke Detectors	0.0%	0.0%	0.0%	Sharps and Infectious Waste	0.0%	0.0%	0.0%
Other HHW	0.2%	0.0%	0.4%	Other Not Elsewhere Classified	8.0%	6.1%	9.8%
Subtotal HHW	***0.4%***	**0.0%**	**0.8%**	***Subtotal Other Wastes***	***18.3%***	**15.3%**	**21.2%**

Note: Subtotals for the mean percentages may not equal the sum of the mean percentages due to rounding. Confidence intervals for primary categories and subcategories are calculated independently.

Appendix B
Burnsville Waste Sort Data Sheet

Burnsville 2019 Waste Sort Data Sheet

Sample ID:	**Team:**
Date:	**Time:**

Material	**Tare Weight**	**Sample Weight**	**Material**	**Tare Weight**	**Sample Weight**
Paper			Metal		
Newsprint			Aluminum Beverage Containers		
High Grade Office Paper			Other Aluminum		
Magazines/Catalogs			Steel/Tin (Ferrous) Containers		
Phone Books			Other Metal		
Gable Top/Aseptic Containers/Cartons			**Metal Subtotal**		
Corrugated Cardboard & Kraft Bags					
Boxboard			Glass		
Compostable Paper			Beverage Container Glass		
Mixed Recyclable Paper			Glass Containers		
Non-Recyclable Paper			Other (Non-Container) Glass		
Paper Subtotal			**Glass Subtotal**		
Plastic			Electronics		
PET Beverage Containers - #1			Laptops/Cell Phones		
Other PET (e.g. jars and clamshells) - #1			Computer Monitors		
HDPE Bottles/Jars - #2			Televisions		
Other HDPE - #2			Printers		
PVC - #3			All Other Electronic Items		
LDPE (Rigids; no bags/wrap) - #4			**Electronics Subtotal**		
Polypropylene - #5					
Polystyrene - #6			Organic		
Other #7 Plastics			Yard Waste		
PLA & Compostable Plastics			Food Waste		
Bags and Film Plastic			Wood		
Other Plastic (nonpackaging)			Other Organic Material		
Plastic Subtotal			**Organic Subtotal**		
HHW			Other Wastes		
Batteries			Mattresses/Box Springs		
Mercury Containing Lamps			Appliances & Furniture		
Paint Containers			Textiles & Leather		
Oil Containers & Filters			Carpet		
Smoke Detectors			Sharps & Infectious Waste		
Other HHW			Other Not Elsewhere Classified (Misc. Fines)		
HHW Subtotal			Liquids		
			Other Wastes Subtotal		

Comments:

Appendix C
Photolog: BLF Sample Pictures

Foth

Photographic Log

Client's Name:	Site Location:	Project No.
Burnsville Sanitary Landfill	2650 Cliff Rd W, Burnsville, MN	19B050

Photo No.	Date:
1	12/09/19

Photo Taken By: BDR

Description:
Sample 1
Truck Type: Rear Load
Origin of Sample: Bloomington / Minneapolis Commercial
Type: Bars, Apartments

Photo No.	Date:
2	12/09/19

Photo Taken By: BDR

Description:
Sample 1
Truck Type: Rear Load
Origin of Sample: Bloomington / Minneapolis Commercial
Type: Bars, Apartments

Foth

Photographic Log

Client's Name:	Site Location:	Project No.
Burnsville Sanitary Landfill	2650 Cliff Rd W, Burnsville, MN	19B050

Photo No.	Date:
3	12/09/19

Photo Taken By:
NTS

Description:
Sample 2
Truck Type: Front Load
Origin of Sample: Eden Prairie Commercial
Type: Bars, Apartments, Restaurants

Photo No.	Date:
4	12/09/19

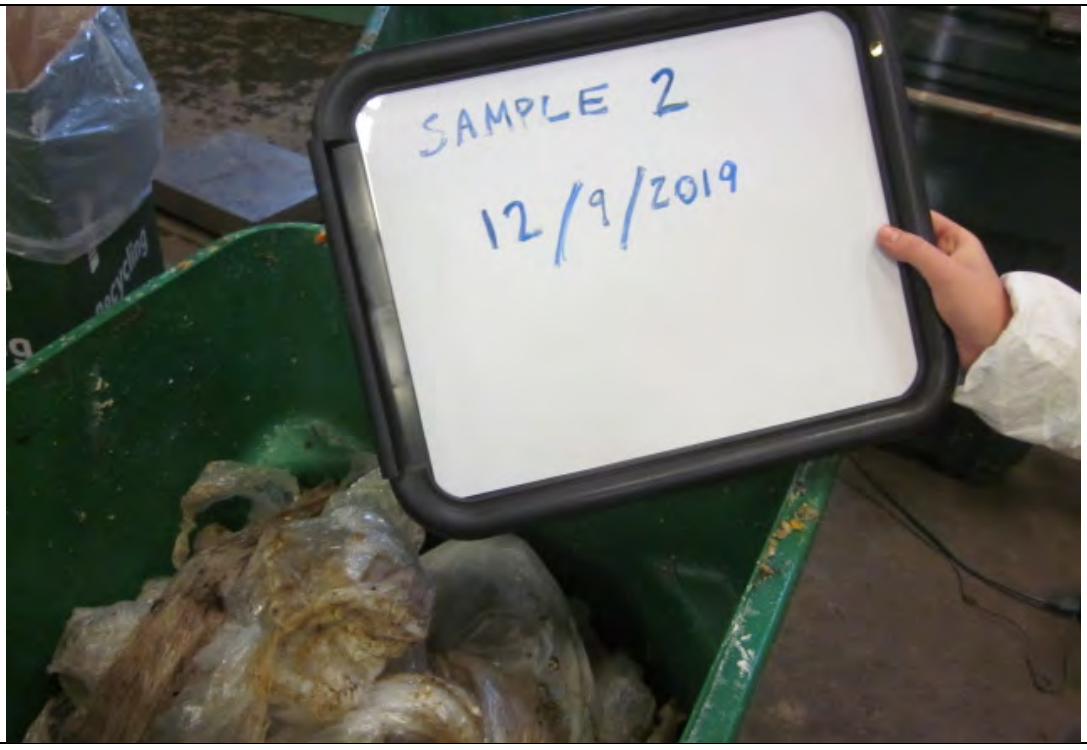

Photo Taken By:
NTS

Description:
Sample 2
Truck Type: Front Load
Origin of Sample: Eden Prairie Commercial
Type: Bars, Apartments, Restaurants

Foth

Photographic Log

Client's Name:	Site Location:	Project No.
Burnsville Sanitary Landfill	2650 Cliff Rd W, Burnsville, MN	19B050

Photo No.	Date:
5	12/09/19

Photo Taken By:
NTS

Description:
Sample 3
Truck Type: Front Load
Origin of Sample: Hopkins Commercial
Type: Apartments, Restaurants, Hospital

Photo No.	Date:
6	12/09/19

Photo Taken By:
NTS

Description:
Sample 3
Truck Type: Front Load
Origin of Sample: Hopkins Commercial
Type: Apartments, Restaurants, Hospital

Foth

Photographic Log

Client's Name:	Site Location:	Project No.
Burnsville Sanitary Landfill	2650 Cliff Rd W, Burnsville, MN	19B050

Photo No.	Date:
7	12/09/19

Photo Taken By:
NTS

Description:
Sample 4
Truck Type: Roll Off
Origin of Sample: Chanhassen Residential
Type: Single family

Photo No.	Date:
8	12/09/19

Photo Taken By:
NTS

Description:
Sample 4
Truck Type: Roll Off
Origin of Sample: Chanhassen Residential
Type: Single family

Foth

Photographic Log

Client's Name:	Site Location:	Project No.
Burnsville Sanitary Landfill	2650 Cliff Rd W, Burnsville, MN	19B050

Photo No.	Date:
9	12/09/19

Photo Taken By:
NTS

Description:
Sample 5
Truck Type: Compactor Self-Contained
Origin of Sample: Savage Commercial
Type: Prior Lake High School

Photo No.	Date:
10	12/09/19

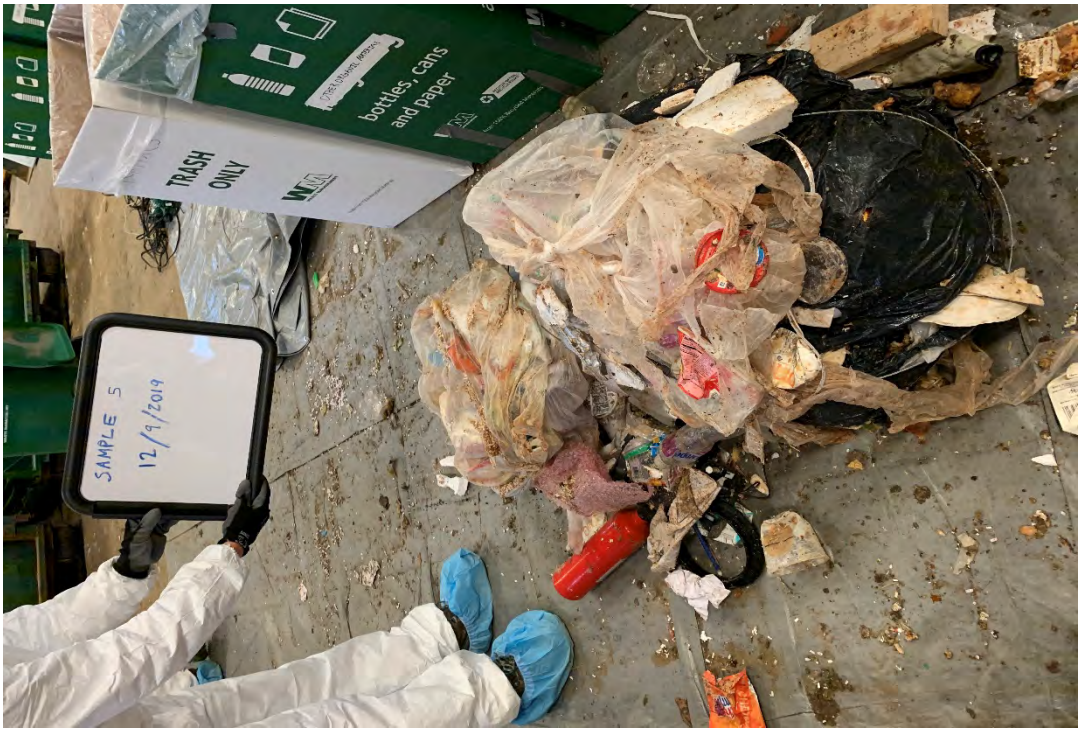

Photo Taken By:
NTS

Description:
Sample 5
Truck Type: Compactor Self-Contained
Origin of Sample: Savage Commercial
Type: Prior Lake High School

Foth

Photographic Log

Client's Name:	Site Location:	Project No.
Burnsville Sanitary Landfill	2650 Cliff Rd W, Burnsville, MN	19B050

Photo No.	Date:
11	12/09/19

Photo Taken By:
NTS

Description:
Sample 6
Truck Type:
Front Load
Origin of Sample:
Inver Grove Heights
Commercial
Type: School, Restaurant, Mall

Photo No.	Date:
12	12/09/19

Photo Taken By:
NTS

Description:
Sample 6
Truck Type:
Front Load
Origin of Sample:
Inver Grove Heights
Commercial
Type: School, Restaurant, Mall

Foth

Photographic Log

Client's Name:	Site Location:	Project No.
Burnsville Sanitary Landfill	2650 Cliff Rd W, Burnsville, MN	19B050

Photo No.	Date:	
13	12/09/19	Picture not available
Photo Taken By: NTS		
Description: Sample 7 Truck Type: Side Load Origin of Sample: Lakeville / Apple Valley Residential Type: Single and Multi-family		

Photo No.	Date:	
14	12/09/19	Picture not available
Photo Taken By: NTS		
Description: Sample 7 Truck Type: Side Load Origin of Sample: Lakeville / Apple Valley Residential Type: Single and Multi-family		

Foth

Photographic Log

Client's Name:	Site Location:	Project No.
Burnsville Sanitary Landfill	2650 Cliff Rd W, Burnsville, MN	19B050

Photo No.	Date:
15	12/09/19

Photo Taken By:
NTS

Description:
Sample 8
Truck Type:
Side Load
Origin of Sample:
Eagan
Residential
Type: Single and Multi-family

Photo No.	Date:
16	12/09/19

Photo Taken By:
NTS

Description:
Sample 8
Truck Type:
Side Load
Origin of Sample:
Eagan
Residential
Type: Single and Multi-family

Foth

Photographic Log

Client's Name:	Site Location:	Project No.
Burnsville Sanitary Landfill	2650 Cliff Rd W, Burnsville, MN	19B050

Photo No.	Date:
17	12/10/19

Photo Taken By:
NTS

Description:
Sample 9
Truck Type:
Side Load
Origin of Sample:
Rosemount
Residential
Type: Single family

Photo No.	Date:
18	12/10/19

Photo Taken By:
NTS

Description:
Sample 9
Truck Type:
Side Load
Origin of Sample:
Rosemount
Residential
Type: Single family

Foth

Photographic Log

Client's Name:	Site Location:	Project No.
Burnsville Sanitary Landfill	2650 Cliff Rd W, Burnsville, MN	19B050

Photo No.	Date:
19	12/10/19

Photo Taken By:
NTS

Description:
Sample 10
Truck Type:
Roll Off
Origin of Sample:
Apple Valley
Residential
Type: Single family

Photo No.	Date:
20	12/10/19

Photo Taken By:
NTS

Description:
Sample 10
Truck Type:
Roll Off
Origin of Sample:
Apple Valley
Residential
Type: Single family

Foth

Photographic Log

Client's Name:	Site Location:	Project No.
Burnsville Sanitary Landfill	2650 Cliff Rd W, Burnsville, MN	19B050

Photo No.	Date:
21	12/10/19

Photo Taken By:
NTS

Description:
Sample 11
Truck Type:
Front Load
Origin of Sample:
Bloomington
Commercial
Type: Malls, School, Church

Photo No.	Date:
22	12/10/19

Photo Taken By:
NTS

Description:
Sample 11
Truck Type:
Front Load
Origin of Sample:
Bloomington
Commercial
Type: Malls, School, Church

Foth

Photographic Log

Client's Name:	Site Location:	Project No.
Burnsville Sanitary Landfill	2650 Cliff Rd W, Burnsville, MN	19B050

Photo No.	Date:
23	12/10/19

Photo Taken By:
NTS

Description:
Sample 12
Truck Type:
Side Load
Origin of Sample:
Lakeville
Residential
Type: Single and Multi-family

Photo No.	Date:
24	12/10/19

Photo Taken By:
NTS

Description:
Sample 12
Truck Type:
Side Load
Origin of Sample:
Lakeville
Residential
Type: Single and Multi-family

Foth

Photographic Log

Client's Name:	Site Location:	Project No.
Burnsville Sanitary Landfill	2650 Cliff Rd W, Burnsville, MN	19B050

Photo No.	Date:
25	12/10/19

Photo Taken By:
NTS

Description:
Sample 13
Truck Type:
Rear Load
Origin of Sample:
Minneapolis
Commercial
Type: Multi-family apartments

Photo No.	Date:
26	12/10/19

Photo Taken By:
NTS

Description:
Sample 13
Truck Type:
Rear Load
Origin of Sample:
Minneapolis
Commercial
Type: Multi-family apartments

Foth

Photographic Log

Client's Name:	Site Location:	Project No.
Burnsville Sanitary Landfill	2650 Cliff Rd W, Burnsville, MN	19B050

Photo No.	Date:
27	12/10/19

Photo Taken By:
NTS

Description:
Sample 14
Truck Type:
Front Load
Origin of Sample:
Shakopee
Commercial
Type: Multi-family

Photo No.	Date:
28	12/10/19

Photo Taken By:
NTS

Description:
Sample 14
Truck Type:
Front Load
Origin of Sample:
Shakopee
Commercial
Type: Multi-family

Foth

Photographic Log

Client's Name:	Site Location:	Project No.
Burnsville Sanitary Landfill	2650 Cliff Rd W, Burnsville, MN	19B050

Photo No.	Date:
29	12/10/19

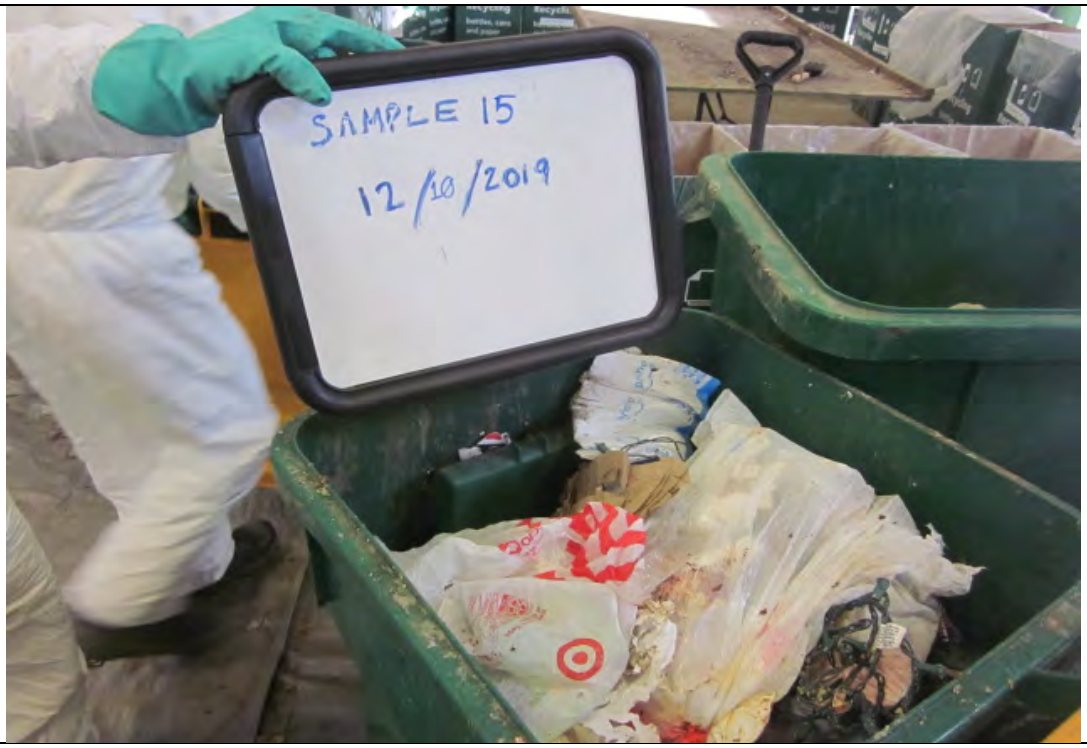

Photo Taken By:
NTS

Description:
Sample 15
Truck Type:
Side Load
Origin of Sample:
Prior Lake
Residential
Type: Single and Multi-family apartments

Photo No.	Date:
30	12/10/19

Photo Taken By:
NTS

Description:
Sample 15
Truck Type:
Side Load
Origin of Sample:
Prior Lake
Residential
Type: Single and Multi-family

Foth

Photographic Log

Client's Name:	Site Location:	Project No.
Burnsville Sanitary Landfill	2650 Cliff Rd W, Burnsville, MN	19B050

Photo No.	Date:
31	12/10/19

Photo Taken By:
NTS

Description:
Sample 16
Truck Type:
Front Load
Origin of Sample:
Apple Valley
Commercial
Type: Menard's, Mall

Photo No.	Date:
32	12/10/19

Photo Taken By:
NTS

Description:
Sample 16
Truck Type:
Front Load
Origin of Sample:
Apple Valley
Commercial
Type: Menard's, Mall

Foth

Photographic Log

Client's Name:	Site Location:	Project No.
Burnsville Sanitary Landfill	2650 Cliff Rd W, Burnsville, MN	19B050

Photo No.	Date:
33	12/10/19

Photo Taken By:
NTS

Description:
Sample 17
Truck Type:
Side Load
Origin of Sample:
Chanhassen
Residential
Type: Single family

Photo No.	Date:
34	12/10/19

Photo Taken By:
NTS

Description:
Sample 17
Truck Type:
Side Load
Origin of Sample:
Chanhassen
Residential
Type: Single family

Foth

Photographic Log

Client's Name:	Site Location:	Project No.
Burnsville Sanitary Landfill	2650 Cliff Rd W, Burnsville, MN	19B050

Photo No.	Date:
35	12/10/19

Photo Taken By:
NTS

Description:
Sample 18
Truck Type:
Compactor
Origin of Sample:
Chaska
Commercial
Type: Bakery

Photo No.	Date:
36	12/10/19

Photo Taken By:
NTS

Description:
Sample 18
Truck Type:
Compactor
Origin of Sample:
Chaska
Commercial
Type: Bakery

Foth

Photographic Log

Client's Name:	Site Location:	Project No.
Burnsville Sanitary Landfill	2650 Cliff Rd W, Burnsville, MN	19B050

Photo No.	Date:
37	12/11/19

Photo Taken By:
NTS

Description:
Sample 19
Truck Type:
Compactor / Self Contained
Origin of Sample:
Eden Prairie
Commercial
Type: Costco

Photo No.	Date:
38	12/11/19

Photo Taken By:
NTS

Description:
Sample 19
Truck Type:
Compactor / Self Contained
Origin of Sample:
Eden Prairie
Commercial
Type: Costco

Foth

Photographic Log

Client's Name:	Site Location:	Project No.
Burnsville Sanitary Landfill	2650 Cliff Rd W, Burnsville, MN	19B050

Photo No.	Date:
39	12/11/19

Photo Taken By:
NTS

Description:
Sample 20
Truck Type:
Compactor / Break Away
Origin of Sample:
Lakeville Commercial
Type: Post Consumer Brand

Photo No.	Date:
40	12/11/19

Photo Taken By:
NTS

Description:
Sample 20
Truck Type:
Compactor / Break Away
Origin of Sample:
Lakeville Commercial
Type: Post Consumer Brand

Foth

Photographic Log

Client's Name:	Site Location:	Project No.
Burnsville Sanitary Landfill	2650 Cliff Rd W, Burnsville, MN	19B050

Photo No.	Date:
41	12/11/19

Photo Taken By:
NTS

Description:
Sample 21
Truck Type:
Roll Off
Origin of Sample:
Prior Lake
Residential
Type: Multi family, Twin homes

Photo No.	Date:
42	12/11/19

Photo Taken By:
NTS

Description:
Sample 21
Truck Type:
Roll Off
Origin of Sample:
Prior Lake
Residential
Type: Multi family, Twin homes

Foth

Photographic Log

Client's Name:	Site Location:	Project No.
Burnsville Sanitary Landfill	2650 Cliff Rd W, Burnsville, MN	19B050

Photo No.	Date:
43	12/11/19

Photo Taken By:
NTS

Description:
Sample 22
Truck Type:
Front Load
Origin of Sample:
Rosemount
Commercial
Type: Senior Center, Mall

Photo No.	Date:
44	12/11/19

Photo Taken By:
NTS

Description:
Sample 22
Truck Type:
Front Load
Origin of Sample:
Rosemount
Commercial
Type: Senior Center, Mall

Foth

Photographic Log

Client's Name:	Site Location:	Project No.
Burnsville Sanitary Landfill	2650 Cliff Rd W, Burnsville, MN	19B050

Photo No.	Date:
45	12/11/19

Photo Taken By:
NTS

Description:
Sample 23
Truck Type:
Front Load
Origin of Sample:
Edina
Commercial
Type: Restaurant, Malls, Hotel

Photo No.	Date:
46	12/11/19

Photo Taken By:
NTS

Description:
Sample 23
Truck Type:
Front Load
Origin of Sample:
Edina
Commercial
Type: Restaurant, Malls, Hotel

Foth

Photographic Log

Client's Name:	Site Location:	Project No.
Burnsville Sanitary Landfill	2650 Cliff Rd W, Burnsville, MN	19B050

Photo No.	Date:
47	12/11/19

Photo Taken By:
NTS

Description:
Sample 24
Truck Type:
Side Load
Origin of Sample:
Prior Lake
Residential
Type: Single and
Multi Family

Photo No.	Date:
48	12/11/19

Photo Taken By:
NTS

Description:
Sample 24
Truck Type:
Side Load
Origin of Sample:
Prior Lake
Residential
Type: Single and
Multi Family

Foth

Photographic Log

Client's Name:	Site Location:	Project No.
Burnsville Sanitary Landfill	2650 Cliff Rd W, Burnsville, MN	19B050

Photo No.	Date:
49	12/11/19

Photo Taken By:
NTS

Description:
Sample 25
Truck Type:
Roll Off
Origin of Sample:
Eden Prairie
Commercial
Type: Apartment
Complex

Photo No.	Date:
50	12/11/19

Photo Taken By:
NTS

Description:
Sample 25
Truck Type:
Roll Off
Origin of Sample:
Eden Prairie
Commercial
Type: Apartment
Complex

Foth

Photographic Log

Client's Name:	Site Location:	Project No.
Burnsville Sanitary Landfill	2650 Cliff Rd W, Burnsville, MN	19B050

Photo No.	Date:
51	12/11/19

Photo Taken By:
NTS

Description:
Sample 26
Truck Type:
Compactor / Self Contained
Origin of Sample:
Chanhassen
Commercial
Type: Bakery

Photo No.	Date:
52	12/11/19

Photo Taken By:
NTS

Description:
Sample 26
Truck Type:
Compactor / Self Contained
Origin of Sample:
Chanhassen
Commercial
Type: Bakery

Foth

Photographic Log

Client's Name:	Site Location:	Project No.
Burnsville Sanitary Landfill	2650 Cliff Rd W, Burnsville, MN	19B050

Photo No.	Date:
53	12/11/19

Photo Taken By:
NTS

Description:
Sample 27
Truck Type:
Front Load
Origin of Sample:
Bloomington
Commercial /
Residential
Type: Mall, Senior
Center, Multi-Family

Photo No.	Date:
54	12/11/19

Photo Taken By:
NTS

Description:
Sample 27
Truck Type:
Front Load
Origin of Sample:
Bloomington
Commercial /
Residential
Type: Mall, Senior
Center, Multi-Family

Foth

Photographic Log

Client's Name:	Site Location:	Project No.
Burnsville Sanitary Landfill	2650 Cliff Rd W, Burnsville, MN	19B050

Photo No.	Date:
55	12/11/19

Photo Taken By:
NTS

Description:
Sample 28
Truck Type:
Front Load
Origin of Sample:
Shakopee
Commercial
Type: Multi-Family, Warehouse, Restaurants

Photo No.	Date:
56	12/11/19

Photo Taken By:
NTS

Description:
Sample 28
Truck Type:
Front Load
Origin of Sample:
Shakopee
Commercial
Type: Multi-Family, Warehouse, Restaurants

Foth

Photographic Log

Client's Name:	Site Location:	Project No.
Burnsville Sanitary Landfill	2650 Cliff Rd W, Burnsville, MN	19B050

Photo No.	Date:
57	12/11/19

Photo Taken By:
NTS

Description:
Sample 29
Truck Type:
Front Load
Origin of Sample:
Bell Plaine
Commercial /
Residential
Type: Apartments,
Restaurants, Schools

Photo No.	Date:
58	12/11/19

Photo Taken By:
NTS

Description:
Sample 29
Truck Type:
Front Load
Origin of Sample:
Bell Plaine
Commercial /
Residential
Type: Apartments,
Restaurants, Schools

Foth

Photographic Log

Client's Name:	Site Location:	Project No.
Burnsville Sanitary Landfill	2650 Cliff Rd W, Burnsville, MN	19B050

Photo No.	Date:
59	12/11/19

Photo Taken By:
NTS

Description:
Sample 30
Truck Type:
Rear Load
Origin of Sample:
Eden Prairie
Residential
Type: Single and
Multi-Family

Photo No.	Date:
60	12/11/19

Photo Taken By:
NTS

Description:
Sample 30
Truck Type:
Rear Load
Origin of Sample:
Eden Prairie
Residential
Type: Single and
Multi-Family

Foth

Photographic Log

Client's Name:	Site Location:	Project No.
Burnsville Sanitary Landfill	2650 Cliff Rd W, Burnsville, MN	19B050

Photo No.	Date:
61	12/11/19

Photo Taken By:
NTS

Description:
Sample 31
Truck Type: Compactor
Origin of Sample: Savage Commercial
Type: Rolex Vans

Photo No.	Date:
62	12/11/19

Photo Taken By:
NTS

Description:
Sample 31
Truck Type: Compactor
Origin of Sample: Savage Commercial
Type: Rolex Vans

Foth

Photographic Log

Client's Name:	Site Location:	Project No.
Burnsville Sanitary Landfill	2650 Cliff Rd W, Burnsville, MN	19B050

Photo No.	Date:
63	12/11/19

Photo Taken By:
NTS

Description:
Sample 32
Truck Type:
Side Load
Origin of Sample:
Apple Valley
Residential
Type: Single and
Multi-Family

Photo No.	Date:
64	12/11/19

Photo Taken By:
NTS

Description:
Sample 32
Truck Type:
Side Load
Origin of Sample:
Apple Valley
Residential
Type: Single and
Multi-Family

Foth

Photographic Log

Client's Name:	Site Location:	Project No.
Burnsville Sanitary Landfill	2650 Cliff Rd W, Burnsville, MN	19B050

Photo No.	Date:
65	12/11/19

Photo Taken By:
NTS

Description:
Sample 33
Truck Type: Compactor
Origin of Sample: Bloomington
Commercial Type: Hotel

Photo No.	Date:
66	12/11/19

Photo Taken By:
NTS

Description:
Sample 34
Truck Type: Compactor
Origin of Sample: Bloomington
Commercial Type: Hotel

Foth

Photographic Log

Client's Name:	Site Location:	Project No.
Burnsville Sanitary Landfill	2650 Cliff Rd W, Burnsville, MN	19B050

Photo No.	Date:
67	12/12/19

Photo Taken By:
NTS

Description:
Sample 34
Truck Type:
Side Load
Origin of Sample:
Savage / Prior Lake
Residential
Type: Single and
Multi-Family

Photo No.	Date:
68	12/12/19

Photo Taken By:
NTS

Description:
Sample 34
Truck Type:
Side Load
Origin of Sample:
Savage / Prior Lake
Residential
Type: Single and
Multi-Family

Foth

Photographic Log

Client's Name:	Site Location:	Project No.
Burnsville Sanitary Landfill	2650 Cliff Rd W, Burnsville, MN	19B050

Photo No.	Date:
69	12/12/19

Photo Taken By:
NTS

Description:
Sample 35
Truck Type:
Roll Off
Origin of Sample:
Golden Valley
Commercial /
Residential
Type: Estate
Business, House
Cleaning

Photo No.	Date:
70	12/12/19

Photo Taken By:
NTS

Description:
Sample 35
Truck Type:
Roll Off
Origin of Sample:
Golden Valley
Commercial /
Residential
Type: Estate
Business, House
Cleaning

Foth

Photographic Log

Client's Name:	Site Location:	Project No.
Burnsville Sanitary Landfill	2650 Cliff Rd W, Burnsville, MN	19B050

Photo No.	Date:
71	12/12/19

Photo Taken By:
NTS

Description:
Sample 36
Truck Type:
Front Load
Origin of Sample:
Eagan
Commercial
Type: Warehouse,
Restaurant

Photo No.	Date:
72	12/12/19

Photo Taken By:
NTS

Description:
Sample 36
Truck Type:
Front Load
Origin of Sample:
Eagan
Commercial
Type: Warehouse,
Restaurant

Foth

Photographic Log

Client's Name:	Site Location:	Project No.
Burnsville Sanitary Landfill	2650 Cliff Rd W, Burnsville, MN	19B050

Photo No.	Date:
73	12/12/19

Photo Taken By:
NTS

Description:
Sample 37
Truck Type:
Rear Load
Origin of Sample:
Richfield
Residential
Type: Single Family

Photo No.	Date:
74	12/12/19

Photo Taken By:
NTS

Description:
Sample 37
Truck Type:
Rear Load
Origin of Sample:
Richfield
Residential
Type: Single Family

Foth

Photographic Log

Client's Name:	Site Location:	Project No.
Burnsville Sanitary Landfill	2650 Cliff Rd W, Burnsville, MN	19B050

Photo No.	Date:
75	12/12/19

Photo Taken By:
NTS

Description:
Sample 38
Truck Type:
Front Load
Origin of Sample:
Richfield/ Bloomington / Minneapolis
Commercial
Type: Warehouse, Restaurants, Apartment Buildings

Photo No.	Date:
76	12/12/19

Photo Taken By:
NTS

Description:
Sample 38
Truck Type:
Front Load
Origin of Sample:
Richfield/ Bloomington / Minneapolis
Commercial
Type: Warehouse, Restaurants, Apartment Buildings

Foth

Photographic Log

Client's Name:	Site Location:	Project No.
Burnsville Sanitary Landfill	2650 Cliff Rd W, Burnsville, MN	19B050

Photo No.	Date:
77	12/12/19

Photo Taken By:
NTS

Description:
Sample 39
Truck Type:
Side Load
Origin of Sample:
Burnsville
Residential
Type: Single Family

Photo No.	Date:
78	12/12/19

Photo Taken By:
NTS

Description:
Sample 39
Truck Type:
Side Load
Origin of Sample:
Burnsville
Residential
Type: Single Family

Foth

Photographic Log

Client's Name:	Site Location:	Project No.
Burnsville Sanitary Landfill	2650 Cliff Rd W, Burnsville, MN	19B050

Photo No.	Date:
79	12/12/19

Photo Taken By:
NTS

Description:
Sample 40
Truck Type:
Front Load
Origin of Sample:
Savage
Commercial
Type: Warehouse,

Photo No.	Date:
80	12/12/19

Photo Taken By:
NTS

Description:
Sample 40
Truck Type:
Front Load
Origin of Sample:
Savage
Commercial
Type: Warehouse,

Foth

Photographic Log

Client's Name:	Site Location:	Project No.
Burnsville Sanitary Landfill	2650 Cliff Rd W, Burnsville, MN	19B050

Photo No.	Date:
81	12/12/19

Photo Taken By:
NTS

Description:
Sample 41
Truck Type:
Front Load
Origin of Sample:
Savage
Commercial
Type: Industrial
Warehouse

Photo No.	Date:
82	12/12/19

Photo Taken By:
NTS

Description:
Sample 41
Truck Type:
Front Load
Origin of Sample:
Savage
Commercial
Type: Industrial
Warehouse

Foth

Photographic Log

Client's Name:	Site Location:	Project No.
Burnsville Sanitary Landfill	2650 Cliff Rd W, Burnsville, MN	19B050

Photo No.	Date:
83	12/12/19

Photo Taken By:
NTS

Description:
Sample 42
Truck Type:
Front Load
Origin of Sample:
Bloomington
Commercial /
Residential
Type: Loffler, Multi-
Family

Photo No.	Date:
84	12/12/19

Photo Taken By:
NTS

Description:
Sample 42
Truck Type:
Front Load
Origin of Sample:
Bloomington
Commercial /
Residential
Type: Loffler, Multi-
Family

Foth

Photographic Log

Client's Name:	Site Location:	Project No.
Burnsville Sanitary Landfill	2650 Cliff Rd W, Burnsville, MN	19B050

Photo No.	Date:
85	12/12/19

Photo Taken By:
NTS

Description:
Sample 43
Truck Type:
Front Load
Origin of Sample:
Elko / New Market /
Lakeville
Residential
Type: Single Family

Photo No.	Date:
86	12/12/19

Photo Taken By:
NTS

Description:
Sample 43
Truck Type:
Front Load
Origin of Sample:
Elko / New Market /
Lakeville
Residential
Type: Single Family

Foth

Photographic Log

Client's Name:	Site Location:	Project No.
Burnsville Sanitary Landfill	2650 Cliff Rd W, Burnsville, MN	19B050

Photo No.	Date:
87	12/12/19

Photo Taken By:
NTS

Description:
Sample 44
Truck Type:
Side Load
Origin of Sample:
Lakeville
Residential
Type: Single Family

Photo No.	Date:
88	12/12/19

Photo Taken By:
NTS

Description:
Sample 44
Truck Type:
Side Load
Origin of Sample:
Lakeville
Residential
Type: Single Family

Foth

Photographic Log

Client's Name:	Site Location:	Project No.
Burnsville Sanitary Landfill	2650 Cliff Rd W, Burnsville, MN	19B050

Photo No.	Date:
89	12/13/19

Photo Taken By:
NTS

Description:
Sample 45
Truck Type:
Roll Off
Origin of Sample:
Lakeville
Residential
Type: Single Family

Photo No.	Date:
90	12/13/19

Photo Taken By:
NTS

Description:
Sample 45
Truck Type:
Roll Off
Origin of Sample:
Lakeville
Residential
Type: Single Family

Foth

Photographic Log

Client's Name:	Site Location:	Project No.
Burnsville Sanitary Landfill	2650 Cliff Rd W, Burnsville, MN	19B050

Photo No.	Date:
91	12/13/19

Photo Taken By:
NTS

Description:
Sample 46
Truck Type:
Side Load
Origin of Sample:
Burnsville
Residential
Type: Single Family

Photo No.	Date:
92	12/13/19

Photo Taken By:
NTS

Description:
Sample 46
Truck Type:
Side Load
Origin of Sample:
Burnsville
Residential
Type: Single Family

Foth

Photographic Log

Client's Name:	Site Location:	Project No.
Burnsville Sanitary Landfill	2650 Cliff Rd W, Burnsville, MN	19B050

Photo No.	Date:
93	12/13/19

Photo Taken By:
NTS

Description:
Sample 47
Truck Type:
Front Load
Origin of Sample:
Bloomington
Commercial
Type: Strip Malls

Photo No.	Date:
94	12/13/19

Photo Taken By:
NTS

Description:
Sample 47
Truck Type:
Front Load
Origin of Sample:
Bloomington
Commercial
Type: Strip Malls

Foth

Photographic Log

Client's Name:	Site Location:	Project No.
Burnsville Sanitary Landfill	2650 Cliff Rd W, Burnsville, MN	19B050

Photo No.	Date:
95	12/13/19

Photo Taken By:
NTS

Description:
Sample 48
Truck Type:
Front Load
Origin of Sample:
Bloomington
Commercial
Type: Restaurants,
Warehouses

Photo No.	Date:
96	12/13/19

Photo Taken By:
NTS

Description:
Sample 48
Truck Type:
Front Load
Origin of Sample:
Bloomington
Commercial
Type: Restaurants,
Warehouses

Foth

Photographic Log

Client's Name:	Site Location:	Project No.
Burnsville Sanitary Landfill	2650 Cliff Rd W, Burnsville, MN	19B050

Photo No.	Date:
97	12/13/19

Photo Taken By:
NTS

Description:
Sample 49
Truck Type:
Front Load
Origin of Sample:
Burnsville
Commercial
Type: Restaurants,
Hotels

Photo No.	Date:
98	12/13/19

Photo Taken By:
NTS

Description:
Sample 49
Truck Type:
Front Load
Origin of Sample:
Burnsville
Commercial
Type: Restaurants,
Hotels

Foth

Photographic Log

Client's Name:	Site Location:	Project No.
Burnsville Sanitary Landfill	2650 Cliff Rd W, Burnsville, MN	19B050

Photo No.	Date:
99	12/13/19

Photo Taken By:
NTS

Description:
Sample 50
Truck Type:
Front Load
Origin of Sample:
Apple Valley
Commercial
Type: Restaurants, Senior Living, Mini Malls

Photo No.	Date:
100	12/13/19

Photo Taken By:
NTS

Description:
Sample 50
Truck Type:
Front Load
Origin of Sample:
Apple Valley
Commercial
Type: Restaurants, Senior Living, Mini Malls

Foth

Photographic Log

Client's Name:	Site Location:	Project No.
Burnsville Sanitary Landfill	2650 Cliff Rd W, Burnsville, MN	19B050

Photo No.	Date:
101	12/13/19

Photo Taken By:
NTS

Description:
Sample 51
Truck Type:
Rear Load
Origin of Sample:
New Prague
Commercial
Type: Grocery,
Restaurants, Stores,
Hardware

Photo No.	Date:
102	12/13/19

Photo Taken By:
NTS

Description:
Sample 51
Truck Type:
Rear Load
Origin of Sample:
New Prague
Commercial
Type: Grocery,
Restaurants, Stores,
Hardware

Foth

Photographic Log

Client's Name:	Site Location:	Project No.
Burnsville Sanitary Landfill	2650 Cliff Rd W, Burnsville, MN	19B050

Photo No.	Date:
103	12/13/19

Photo Taken By:
NTS

Description:
Sample 52
Truck Type:
Front End
Origin of Sample:
Burnsville
Commercial
Type: Apartments

Photo No.	Date:
104	12/13/19

Photo Taken By:
NTS

Description:
Sample 52
Truck Type:
Front End
Origin of Sample:
Burnsville
Commercial
Type: Apartments

Appendix D
Photolog: Materials Sorted BLF Materials 12 2019

Photographic Log

Client's Name:	Site Location:	Project No.
Burnsville Sanitary Landfill	2650 Cliff Rd W Burnsville, MN	19B050

Photo No.	Date:
1	12/9/19

Photo Taken By: JLK2

Description:

Newsprint

Photo No.	Date:
2	12/9/19

Photo Taken By: JLK2

Description:

High Grade Office Paper

Photographic Log

Client's Name:	Site Location:	Project No.
Burnsville Sanitary Landfill	2650 Cliff Rd W Burnsville, MN	19B050

Photo No.	Date:
3	12/9/19

Photo Taken By:
JLK2

Description:

Magazines / Catalogs

Photo No.	Date:
4	12/9/19

Photo Taken By:
JLK2

Description:

Gable Top / Aseptic Containers / Cartons

Photographic Log

Client's Name:	Site Location:	Project No.
Burnsville Sanitary Landfill	2650 Cliff Rd W Burnsville, MN	19B050

Photo No.	Date:
5	12/9/19

Photo Taken By: JLK2

Description:

Corrugated Cardboard & Kraft Bags

Photo No.	Date:
6	12/9/19

Photo Taken By: JLK2

Description:

Boxboard

Photographic Log

Client's Name:	Site Location:	Project No.
Burnsville Sanitary Landfill	2650 Cliff Rd W Burnsville, MN	19B050

Photo No.	Date:
7	12/9/19

Photo Taken By: JLK2

Description:

Mixed Recycling Paper

Photo No.	Date:
8	12/9/19

Photo Taken By: JLK2

Description:

Non-Recyclable Paper

Foth

Photographic Log

Client's Name:	Site Location:	Project No.
Burnsville Sanitary Landfill	2650 Cliff Rd W Burnsville, MN	19B050

Photo No.	Date:
9	12/9/19

Photo Taken By: JLK2

Description:

PET Beverage Containers #1

Photo No.	Date:
10	12/9/19

Photo Taken By: JLK2

Description:

Other PET (e.g. jars & clamshells) #1

Photographic Log

Client's Name:	Site Location:	Project No.
Burnsville Sanitary Landfill	2650 Cliff Rd W Burnsville, MN	19B050

Photo No.	Date:
11	12/9/19

Photo Taken By: JLK2

Description:

HDPE Bottles/Jars #2

Photo No.	Date:
12	12/9/19

Photo Taken By: JLK2

Description:

Other HDPE #2

Photographic Log

Client's Name:	Site Location:	Project No.
Burnsville Sanitary Landfill	2650 Cliff Rd W Burnsville, MN	19B050

Photo No.	Date:
13	12/9/19

Photo Taken By: JLK2

Description:

LLDPE #4

Photo No.	Date:
14	12/9/19

Photo Taken By: JLK2

Description:

Polypropylene #5

Photographic Log

Client's Name:	Site Location:	Project No.
Burnsville Sanitary Landfill	2650 Cliff Rd W Burnsville, MN	19B050

Photo No.	Date:
15	12/9/19

Photo Taken By: JLK2

Description:

Polystyrene #6

Photo No.	Date:
16	12/9/19

Photo Taken By: JLK2

Description:

Other #7 Plastics

Photographic Log

Client's Name:	Site Location:	Project No.
Burnsville Sanitary Landfill	2650 Cliff Rd W Burnsville, MN	19B050

Photo No.	Date:
17	12/9/19

Photo Taken By: JLK2

Description:

Bags & Film Plastics

Photo No.	Date:
18	12/10/19

Photo Taken By: JLK2

Description:

Other Plastics

Photographic Log

Client's Name:	Site Location:	Project No.
Burnsville Sanitary Landfill	2650 Cliff Rd W Burnsville, MN	19B050

Photo No.	Date:
19	12/9/19

Photo Taken By: JLK2

Description:

Other Plastic (non-packaging)

Photo No.	Date:
20	12/9/19

Photo Taken By: JLK2

Description:

Batteries

Photographic Log

Client's Name:	Site Location:	Project No.
Burnsville Sanitary Landfill	2650 Cliff Rd W Burnsville, MN	19B050

Photo No.	Date:
21	12/9/19

Photo Taken By: JLK2

Description:

Mercury Containing Lamps

Photo No.	Date:
22	12/10/19

Photo Taken By: JLK2

Description:

Paint Containers

Photographic Log

Client's Name:	Site Location:	Project No.
Burnsville Sanitary Landfill	2650 Cliff Rd W Burnsville, MN	19B050

Photo No.	Date:
23	12/11/19

Photo Taken By: NST

Description:

Oil Containers & Filters

Photo No.	Date:
24	12/9/19

Photo Taken By: JLK2

Description:

Aluminum Beverage Containers

Photographic Log

Client's Name:	Site Location:	Project No.
Burnsville Sanitary Landfill	2650 Cliff Rd W Burnsville, MN	19B050

Photo No.	Date:
25	12/9/19

Photo Taken By: JLK2

Description:

Other Aluminum

Photo No.	Date:
26	12/9/19

Photo Taken By: JLK2

Description:

Steel / Tin (Ferrous) Objects/Containers

Photographic Log

Client's Name:	Site Location:	Project No.
Burnsville Sanitary Landfill	2650 Cliff Rd W Burnsville, MN	19B050

Photo No.	Date:
27	12/9/19

Photo Taken By: JLK2

Description:

Other Metal

Photo No.	Date:
28	12/9/19

Photo Taken By: JLK2

Description:

Beverage Container Glass

Photographic Log

Client's Name:	Site Location:	Project No.
Burnsville Sanitary Landfill	2650 Cliff Rd W Burnsville, MN	19B050

Photo No.	Date:
29	12/9/19

Photo Taken By: JLK2

Description:

Glass Containers

Photo No.	Date:
30	12/10/19

Photo Taken By: JLK2

Description:

All Other Electronic Items

Photographic Log

Client's Name:	Site Location:	Project No.
Burnsville Sanitary Landfill	2650 Cliff Rd W Burnsville, MN	19B050

Photo No.	Date:
31	12/10/19

Photo Taken By: JLK2

Description:

Yard Waste

Photo No.	Date:
32	12/10/19

Photo Taken By: JLK2

Description:

Food Waste

Photographic Log

Client's Name:	Site Location:	Project No.
Burnsville Sanitary Landfill	2650 Cliff Rd W Burnsville, MN	19B050

Photo No.	Date:
33	12/10/19

Photo Taken By: JLK2

Description:

Wood

Photo No.	Date:
34	12/10/19

Photo Taken By: JLK2

Description:

Other Organic Material

Picture not available

Photographic Log

Client's Name:	Site Location:	Project No.
Burnsville Sanitary Landfill	2650 Cliff Rd W Burnsville, MN	19B050

Photo No.	Date:
35	12/10/19

Photo Taken By: JLK2

Description:

Other Household Goods

Photo No.	Date:
36	12/9/19

Photo Taken By: JLK2

Description:

Textiles & Leather

Photographic Log

Client's Name:	Site Location:	Project No.
Burnsville Sanitary Landfill	2650 Cliff Rd W Burnsville, MN	19B050

Photo No.	Date:
37	12/9/19

Photo Taken By: JLK2

Description:

Other Not Elsewhere Classified (Misc. Fines) - Concrete

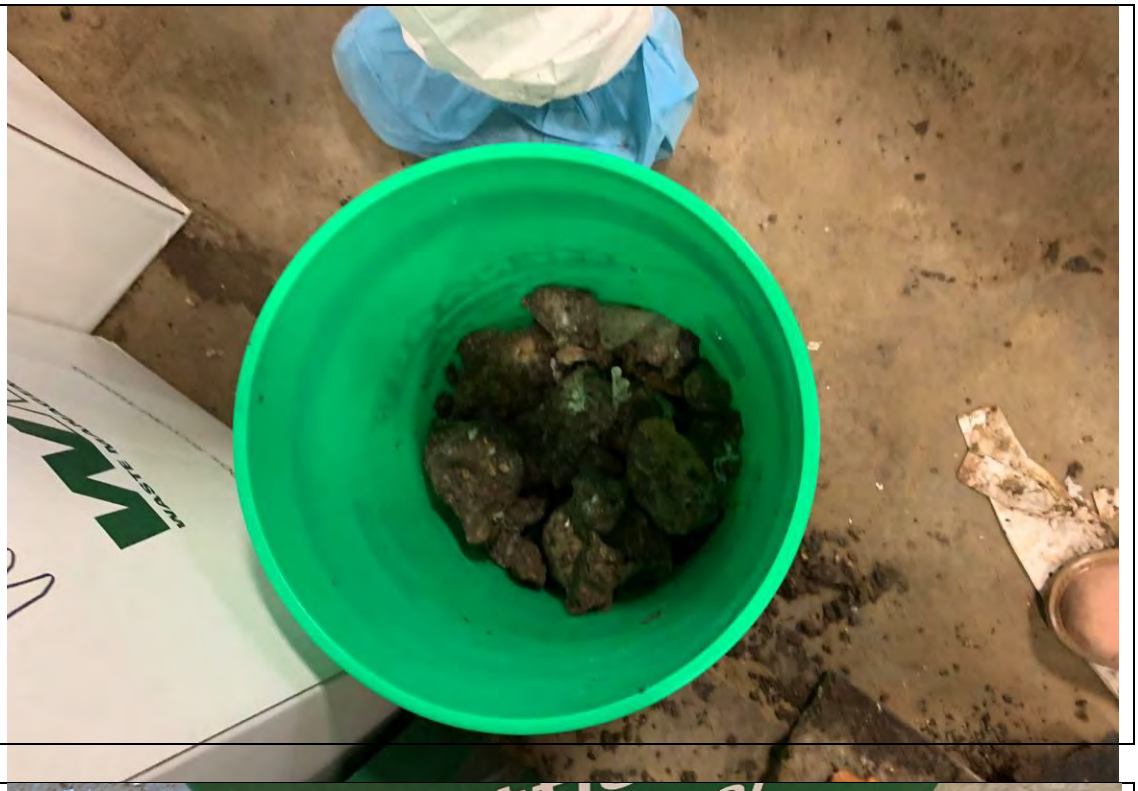

Photo No.	Date:
38	12/9/19

Photo Taken By: JLK2

Description:

Liquids

Photographic Log

Client's Name:	Site Location:	Project No.
Burnsville Sanitary Landfill	2650 Cliff Rd W Burnsville, MN	19B050

Photo No.	Date:
39	12/10/19

Photo Taken By:
JLK2

Description:

Building Materials (Drywall, and Insulation)

Attachment B

Groundwater Impacts Analysis

GROUNDWATER IMPACTS ANALYSIS

DRAFT SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT
BURNSVILLE SANITARY LANDFILL
ANNEX DEVELOPMENT PROJECT

Burnsville Sanitary Landfill, Inc.
MPCA Solid Waste Permit SW-56
Burnsville, Minnesota

Prepared By:

Carlson McCain, Inc.
March 11, 2021

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1.0 INTRODUCTION

1.1 Project Background

This Groundwater Impact Analysis has been prepared as one component of a Supplemental Environmental Impact Statement (SEIS) and is designed to address the items in the Final Scoping Decision Document, dated September 30, 2019, for the Burnsville Sanitary Landfill Annex Development Project 2019 (Project) pertaining to potential groundwater impacts. The Minnesota Pollution Control Agency (MPCA) is the Responsible Government Unit (RGU) for environmental review of the proposed Project and has determined that the Project will require an SEIS and is a phased action pursuant to Minn. R. 4410.3000 subp. 3(C) "*whenever an EIS has been prepared for one or more phases of a phased action or one or more components of a connected action and a later phase or another component is proposed for approval or implementation that was not evaluated in the initial EIS"* and will prepare a SEIS.

1.2 Site Description

The Burnsville Sanitary Landfill (BSL), Solid Waste Permit No. SW-56, is a mixed municipal solid waste (MMSW) landfill that is also permitted to accept construction and demolition debris in addition to asbestos-containing materials and certain industrial wastes. The 362-acre property is located in Section 32, Township 27 North, Range 24 West in Burnsville, Minnesota as shown on Figure 1 - Site Location Map. The site address is 2650 West Cliff Rd., Burnsville, Minnesota, 55337.

Adjacent land use is predominantly industrial, with Kraemer Mining and Materials (KMM) to the east, Cargill to the west, and railroad right-of-way to the south. A commercial district is located south of the BSL, and the railroad right-of-way, along the Highway 13 corridor. Cargill's operations include Port Cargill and Cargill Salt as well as research and grain storage facilities. KMM operates a dolomitic limestone quarry that requires year-round dewatering to access the formation. The quarry also supplies water to the City of Burnsville for treatment and distribution of potable water.

The site began receiving mixed municipal waste at the request of the City of Burnsville in approximately 1962 (Barr, 1993) and was first permitted as the Burnsville Sanitary Landfill on October 14, 1971 with MPCA Permit No. SW-56. The facility was opened by Ed Kraemer & Sons, Inc. in the vicinity of the Kraemer's quarry and operated as an open dump between 1962 and 1971. In 1971 development plans were prepared for the site and between 1971 and approximately 1992 BSL accepted MMSW in unlined waste cells over an area of approximately 98.4 acres. From this point forward, landfilling operations have involved engineered covers, liners, and leachate and gas management systems. The facility underwent environmental review and re-permitting in 1992 to expand into the southeast corner of the property and in 1995 an additional 48.6 acres of permitted landfill area was added to the BSL.

Waste Management, Inc. acquired the landfill in 1997 and has operated the facility as Burnsville Sanitary Landfill, Inc. since that time. An expansion of the landfill area to the north, designated the North Development Area (NDA), was proposed and a hydrogeologic evaluation was conducted in

2002. In 2005, the permit was modified to allow vertical expansion and to acknowledge the design and proposed construction of the NDA. Per a request from BSL in 2005, the permit was further modified in 2006 to allow for a West Development Area (WDA) in the western portion of the site. The WDA has subsequently been developed, and the final phase of the WDA buildout was constructed in 2019. The NDA is still permitted but is currently undeveloped. Figure 2 illustrates the existing permitted waste limit and the location of the undeveloped NDA.

In 2019, BSL applied for a permit modification for approximately 23.6 million cubic yards of additional disposal capacity. This would include a vertical expansion of approximately 260 feet above the currently-permitted top elevation, as well as a smaller, reconfigured base liner footprint that would eliminate the majority of NDA and instead include an area immediately north of the WDA known as the Annex Development Area. It is this current expansion that requires a SEIS described in 1.1 above. The waste limit resulting from the proposed Project is also illustrated on the attached Figure 2 along with the proposed Annex Development Area.

1.3 Previous Environmental Review

The 2005 request for a permit modification and expansion triggered mandatory environmental review. The MPCA, as the RGU, prepared the EIS for the BSL pursuant to Minn. R. 4400 subp. C *"for expansion by 25 percent or more of previous capacity of a mixed municipal solid waste disposal facility for 100,000 cubic yards or more of waste fill per year."* The EIS covered the overall facility design capacity of 18,692,245 cubic yards of MSW, demolition and industrial waste and a final determination of adequacy was made in August 2005. This is the EIS that is being supplemented by the current SEIS.

The BSL has also been the subject of two EISs prepared by The Metropolitan Council for the BSL in 1981 and 1991. The final 1991 EIS was published in January 1992 and a final determination of adequacy was made in February 1992. A complete copy of the 1981 EIS is not available.

1.4 Existing Hydrogeologic Information

The following documents have been obtained and reviewed as part of preparing this groundwater impact analysis:

- **KMM Burnsville Quarry PUD Amendment – City of Burnsville Planning Commission Agenda Report with Attachments, August 10, 2020 (Burnsville, 2020a)**
  This document, dated August 10, 2020, was prepared for a public hearing to consider a proposal by KMM for Development Stage Planned Unit Development (PUD) to expand the interim mining of limestone / dolomite to include an additional 72 acres.
- **KMM Burnsville Quarry PUD Amendment Environmental Assessment Worksheet City of Burnsville, MN, January 27, 2020 (Burnsville, 2020b)**
  This Environmental Assessment Worksheet (EAW) was prepared to for a 72-acre expansion of its existing quarry located adjacent to the BSL. The EAW includes a Technical Memorandum titled "Simulations of Proposed Future Kraemer Burnsville Quarry Mine Expansion January 2020." The Technical Memorandum provides analysis of the impacts of

additional dewatering required for the expansion and mitigative measures to protect nearby water resources.

- **Annual Monitoring Reports (Wenck, January 2015, January 2016, January 2017, January 2018, January 2019 and January 2020)**
  These reports are submitted annually to summarize that year's sampling and monitoring data and identify exceedances of permit limits, if any. The reports also provide a comparison with the results from previous years.
- **Burnsville Sanitary Landfill, (SW-56), Sampling and Analysis Plan, 2018 Update (Wenck, 2018)**
  This document is approved by the MPCA and provides the latest information concerning the details of compliance monitoring at the landfill. The document specifies the monitoring points, required analyses, standard operating procedures and identifies the companies responsible for sampling, analysis and reporting.
- **Simulated Future Water Table, Pit Lake at Elevation 690, Burnsville Landfill (Barr, 2016)**
  This document consists of a single figure prepared by Barr Engineering depicting a simulated future water table at BSL with contours based on quarry lake water elevation of 690 feet above mean sea level. The figure was prepared for the City of Burnsville and was printed on October 31, 2016.
- **Technical Memorandum, Simulations of Future Kraemer Quarry Pit-Lake Stage and Rise of Water Table at the Freeway Landfill, Prepared for the City of Burnsville by Barr Engineering (Barr, 2015)**
  This Technical Memorandum, dated May 22, 2015, presents the results of a groundwater flow model used to estimate the pit-lake stage at varying rates of groundwater withdrawal. The results were then used to estimate the water table elevation at the Freeway Landfill.
- **Burnsville Sanitary Landfill SW-56 West Development Area Supplemental Hydrogeologic Evaluation Report (Wenck, 2014)**
  This report supplements the hydrogeologic information for the landfill in the West Development Area and Annex Development Area. The work included soil borings and geotechnical work on the west side of the landfill property that were used to develop cross-sections, a water table contour map, depth to bedrock map and proposed monitoring well locations.
- **Initial Assessment of Manganese in Minnesota Groundwater (MDH, 2012)**
  Technical Memorandum prepared by the Minnesota Department of Health (MDH) concerning manganese in drinking water.
- **Report of Geotechnical Exploration and Review, Proposed MSW Landfill Expansion, North Development Area (AET, 2012)**
  This document provides the results of soil borings and geotechnical review for the North Development Area expansion.
- **Kraemer Quarry Groundwater Level Evaluation, Office Memorandum (DNR, 2010)**
  This memo, prepared by Evan Drivas of the Department of Natural Resources (DNR), presents an evaluation of pre-development and post-quarrying water levels at the Kraemer Quarry.

- **Burnsville Sanitary Landfill (SW-56) Re-permitting Technical Review Comments – Environmental Monitoring, Correspondence Dated December 16, 2010, prepared by Liesch Associates, Inc. (Liesch, 2010)**
  This letter provides detail concerning the landfill monitoring network and schedule along with a map of the monitoring well network and compliance boundary that was referenced in the facility dated July 31, 2015.
- **2005-2008 Perfluorochemical Evaluation at Solid Waste Facilities in Minnesota – Technical Evaluation and Regulatory Management Approach (MPCA, 2010)**
  This summarizes the results of per- and polyfluoroalkyl substances (PFAS) samples collected from solid waste facilities and provides recommendations based on those sampling results.
- **Final Environmental Impact Statement, Burnsville Sanitary Landfill, July 2005 (MPCA, 2005)**
  This is the final Environmental Impact Statement (EIS) that is being supplemented by this SEIS. This EIS addressed a horizontal expansion into the West Development Area and a vertical expansion over the existing landfill and the proposed West Development Area.
- **Geotechnical Evaluation and Design, Phase 26-Areas A & D, Burnsville Sanitary Landfill (Spaulding, 2005)**
  The work included soil borings and an assessment of the berm between the NDA and the retired (unlined) landfill.
- **Supplemental Hydrogeologic Investigation – West Development Area (WDA), Burnsville Sanitary Landfill, Inc., Burnsville, MN (McCain, 2004)**
  This supplemental investigation provided an update to a groundwater flow model, initially developed in 1993, to assess whether changes in groundwater withdrawal significantly affect the previous conclusions.
- **Hydrogeological Evaluation and Water Monitoring System Report for West Development Area (McCain, 2003)**
  This report provides a detailed assessment of hydrogeologic conditions at the West Development Area (WDA) and recommended revisions to the monitoring network to include the WDA.
- **Environmental Survey Report for Northern Development Area, Burnsville Sanitary Landfill, Inc., MPCA Permit Number SW-56, Burnsville, Minnesota (Polaris, 2002)**
  This report provides a detailed assessment of hydrogeologic conditions at the North Development Area (NDA) and recommended revisions to the monitoring network and compliance boundary.
- **Environmental Survey Work Plan, North Development Area, MPCA Permit Number SW-56 (Polaris, 2001)**
  This is the work plan for the 2002 NDA Environmental Survey Report that reviewed previous work at the site including a discussion of the design basis water table.
- **Application for Permit Modification – Burnsville Sanitary Landfill: Appendix A – Design Basis Ground Water Table (Polaris, 1999)**
  This application for permit modification incorporates the design basis water table and provides the background and documentation in Appendix A.
- **Phase III Hydrogeologic Investigation, Water Monitoring System Workplan Burnsville Sanitary Landfill Solid Waste Permit Number SW-056 (Barr, 1996a)**

Early Hydrogeologic Investigation and Work Plan prepared by Barr Engineering for Ed Kraemer and Sons.

- **Phase III Water Monitoring System Report, Phase IV Work Plan (Barr, 1996b)**
  Water monitoring system installation and testing report prepared by Barr Engineering for Ed Kraemer and Sons.
- **Phase II Hydrogeologic Evaluation, Burnsville Sanitary Landfill Expansion (Barr, 1993)**
  Early Hydrogeologic Evaluation prepared by Barr Engineering for Ed Kraemer and Sons.
- **Supplemental Remedial Investigation Report, Burnsville Sanitary Landfill (Barr, 1991)**
  This investigation and report were prepared at the request of the MPCA to define groundwater impacts and the hydrogeology at the landfill with emphasis on the effects of quarry dewatering and drinking water supplies. The report also included a baseline risk assessment for the Minnesota River.
- **Burnsville Sanitary Landfill Expansion, Final Environmental Impact Statement, January 1991 (Metropolitan Council, 1991)**
  This document is the Final Environmental Impact Statement (EIS) for the first major expansion of the facility. As a result of the EIS the landfill was expanded to the south and subsequent phases of development included engineered liner and leachate collection systems.
- **Environmental Impact Statement, Burnsville Sanitary Landfill (Barr, 1980)**
  This is the first EIS for the BSL; however, a complete copy of this document is not available.
- **Plan Sheets Prepared by William K. McKie and Assoc., Inc. and Midwest Planning and Research, Inc. (McKie, 1971 and 1973)**
  These plan sheets, representing the earliest known design documents for BSL, were prepared for E. Kraemer & Sons, Inc. They provide a general development plan for both the Burnsville Quarry and the BSL as well as cross-sections that include observations of the original ground surface, water table, base grades and bedrock surface.

2.0 GROUNDWATER REGULATIONS

2.1 Review of Current Regulations

2.1.1 Solid Waste Facility Rules

Minnesota Rules governing solid waste facilities are codified in Chapter 7035. The primary sections pertaining to groundwater are Part 7035.2815 (*Specific Technical Requirements at Mixed Municipal Solid Waste Land Disposal Facilities*), which includes "*Ground water performance standards"* in Subpart 4. The specific technical requirements state that "The owner or operator must design, construct, operate, and maintain the facility to achieve compliance with [ground water performance standards]." These standards are site specific and are developed by the MPCA during the solid waste permitting process based on the hydrogeologic setting at the facility. Development of compliance boundaries and the attendant intervention limits (ILs) are key components of this section.

Compliance Boundary
The owner or operator must propose the location of the compliance boundary to the commissioner together with the rationale for the selected locations, supporting information, and any additional information the commissioner may require describing the locations of the boundaries in the facility permit. For the BSL it has been established that potential pollutants entering the groundwater would ultimately discharge to the Minnesota River. Therefore, a surface water compliance boundary has been established under Minn. R. 7035.2815, subp. 4 item E. The compliance boundary illustrated on Figure 2 is defined in a Response to Technical Review Comments letter dated December 16, 2010, prepared by Liesch Associates, Inc. (Liesch, 2010) and was incorporated into the 2015 solid waste permit by reference.

Groundwater Performance Standards
Groundwater performance standards are implemented through the solid waste permit which includes a "limits table" of required monitoring parameters and associated ILs, if applicable. A copy of the permit limits table from the most current BSL solid waste permit is attached to this report as Table 1. Since the BSL has an established surface water compliance boundary, the groundwater performance standards are based on the water quality standards for Class 2B surface waters. The limits table from the permit replaces the standards listed in Minn. R. 7035.2815, subp. 4, item F. The ILs on the limits table are generally set at 25% of the actual corresponding surface water standard or other water quality criteria including United States Environmental Protection Agency's (US EPA) Maximum Contaminant Levels (MCLs). Not all monitored parameters have ILs; however, if the presence of a contaminant is confirmed through groundwater sampling for which an IL has not been established, the MPCA may request that a surface water standard be developed as provided for in Minn. R. 7035.2815, subp. 4, item E.

Exceedance of Intervention Limit
If an IL is exceeded for a specific analyte, the permitee must take specific actions listed in Minn. R. 7035.2815, subp. 4, item G, including immediate written notification to the MPCA, evaluation of the

need to resample, evaluation of the source and significance of the exceedance, evaluate the need for immediate corrective action to prevent the analyte from approaching or exceeding the standard at the compliance boundary. The permitee must submit a written report within 30 days describing the evaluations, conclusions and any corrective actions taken. If the exceedance is determined to be a result of natural conditions, this is noted in the report and routine groundwater monitoring in accordance with the permit continues. The permitee must also take other actions described in the facility's permit-required contingency action plan.

Even if an IL has not been exceeded, the MPCA commissioner has the authority to require corrective action under the following circumstances: 1) in the event of a substantial release of leachate that the commissioner may reasonably expect to result in a violation of water quality standards, or 2) based on the additive carcinogenicity or toxicity of a combination of pollutants in the ground water, in lieu of the limits for individual substances.

2.1.2 Drinking Water Regulations

Minnesota Department of Health

The Minnesota Department of Health (MDH) has established human health-based guidance values including Health Risk Limits (HRLs) and Health Based Values (HBVs) under the Groundwater Protection Act of 1989. HRLs and HBVs are intended for use as guidance values for use by the public, risk managers, and others in assessing health risks associated with specific contaminants in groundwater and drinking water. According to MDH, HRLs and HBVs are based on the concentration of a contaminant that can be present in water with little or no risk to the health of a person drinking that water. HRLs have been promulgated under Minnesota rules and HBVs, while based on the same algorithm, have not been through the rule making process and have not been peer reviewed. HBVs are re-evaluated when the HRL rules are updated and may or may not be adopted as an HRL, based on the data available at the time. The rule making process also provides for at least one public comment period for stake holders to provide feedback on the proposed guidance values. HRLs and HBVs are based solely on health effects and do not consider the costs required for prevention, monitoring and/or treatment.

Minnesota solid waste rules (Minn. R. 7035.2815, subp. 4, item F) require MMSW facilities to meet ILs at the compliance boundary that are based, in part, on the HRLs.

Safe Drinking Water Act Maximum Contaminant Levels

MCLs are established by the US EPA for public water supplies based on a scientific process to evaluate health impacts in addition to the costs required for prevention, monitoring and/or treatment. In Minnesota, MCLs are enforced by the state and states are allowed to enforce more strict standards but may not enforce less strict standards.

Minnesota solid waste rules (Minn. R. 7035.2815, subp. 4, item H (3)) provide for the use of MCLs in place of ILs if the quality of a public water supply is potentially affected by migration of leachate from a facility if the MCL is lower than the corresponding IL.

Groundwater Protection Areas

Groundwater protection areas are developed under the MDH Wellhead Protection (WHP) program for public water supplies Minn. R. in parts 4720.5100 to 4720.5590. These rules require development of Drinking Water Supply Management Areas (DWSMAs) based on an estimate of the capture zone created by operating the well, or wellfield. The BSL does not fall within a DWSMA established under Minnesota rules.

The City of Burnsville has developed a Drinking Water Protection Overlay District (DWPOD) to provide enhanced protection for a portion of its water supply that is obtained from intakes located at the Kraemer Quarry. This water source represents approximately one third of Burnsville's water supply and is considered to be a surface water source. The DWPOD is illustrated on Figure 3 and includes the eastern half of the BSL property. Figure 3 also shows the locations of the closest DWSMAs which do not include the area of the landfill.

The quarry water source was not included in the City's WHP plan because it is considered to be a surface water source. It is likely that most of the water originating at the quarry is groundwater from Prairie du Chien-Jordan Aquifer; however, the water requires surface water treatment since it is exposed at the quarry and receives at least some recharge from runoff and direct precipitation. The DWPOD strategy includes water quality monitoring and management activities consisting of inspections, education, verification of environmental permits and requirements for dedicated wash pads, lined stormwater basins and other items.

2.2 Proposed Regulations

Currently, there are no known changes proposed for the existing regulations or proposed new regulations for the groundwater performance standards and the underlying surface water quality standards for Class 2B waters. Updates to the applicable standards will be incorporated into the limits table when the BSL facility permit is reissued.

3.0 SITE GEOLOGY AND HYDROGEOLOGY

The BSL is located within the Minnesota River valley, on the south side of the river, as illustrated on Figure 1. The Minnesota River is located within a relatively large valley that was initially formed by the Glacial River Warren which served as the outlet for Glacial Lake Agassiz in northwest Minnesota and northeast North Dakota during the last glacial advance. As the glacial ice retreated to the north at the end of Wisconsin Glaciation, the former glacial lake began to drain to the north by the Red River of the North. The modern Minnesota River occupies the valley formed by the much larger Glacial River Warren and drains portions of Minnesota, South Dakota and Iowa as it flows from Big Stone Lake on the border with South Dakota to the Mississippi River near Fort Snelling. Figure 4 presents a stratigraphic column that provides some basic information for the major geologic formations in the vicinity of the BSL. The geologic and hydrogeologic descriptions presented in this section are generally consistent with information in the previous EIS completed in 2005, although some of the bedrock formations have been renamed since the completion of the 2005 EIS. Detailed descriptions of site hydrogeologic conditions are presented in a series of reports prepared by Barr Engineering from 1987 through 1996 for Edward Kraemer and Sons, Inc., in the Environmental Survey Report for the North Area Development (Polaris, 2002) and the Hydrogeologic Evaluation and Water Monitoring System Report for the West Development Area (McCain, 2003).

3.1 Surficial Geology

Near the BSL, Glacial River Warren eroded the younger sediments to expose and erode the more resistant bedrock formations. More recently, unconsolidated surficial materials have been deposited above the bedrock surface consisting primarily of alluvial silty clay, sand and peat extending from the surface to depths in excess of 60 feet on the northern portion of the site near the river. Further from the river to the south, bedrock is generally less than five feet deep and the surficial materials include sandy river terrace and wetland deposits.

According to the United States Department of Agriculture Natural Resources Conservation Service (USDA NRCS) soils closest to the river at the BSL consist primarily of Minneiska loam - occasionally flooded, that form in alluvial materials deposited in flood plains. Oshawa silty clay loam also occurs at the site which is a hydric soil that forms in alluvial material and is very poorly drained. The soils on the site where most landfilling has occurred were most likely Faxon Silty Clay Loam prior to landfilling. Faxon soils generally form in shallow alluvium over bedrock at depths of three to five feet. Prior to use as an MMSW landfill, portions of the site may have been used for agricultural purposes, dredge and quarry spoil stockpiles or for disposal of dredge and quarry spoils.

3.2 Bedrock Geology

The uppermost bedrock at the BSL is the Prairie du Chien Group. The softer, overlying St. Peter Sandstone has been eroded away, probably during Wisconsin Glaciation by the River Warren, resulting in an erosional surface such that the full thickness of the Prairie du Chien Group may not be present. The Prairie du Chien Group consists of two dolostone formations, the Shakopee and the

Oneota. The upper Shakopee Formation tends to be sandier while the lower Oneota Formation tends to be more massively bedded and less sandy.

The Jordan Sandstone, which underlies the Prairie du Chien Group, is a medium to coarse, quartzose sandstone in the upper portion and primarily fine grained in the lower portion. The Prairie du Chien Group and the Jordan Sandstone are hydraulically connected and are commonly referred to as the Prairie du Chien-Jordan Aquifer. The Jordan Sandstone is, in turn, underlain by the St. Lawrence Formation and Tunnel City Group which consists of dolomitic shale, siltstone and silty sandstone that serves as a confining layer hydraulically separating the Prairie du Chien-Jordan Aquifer from deeper formations. The Prairie du Chien-Jordan Aquifer represents a major source of groundwater for the metropolitan area.

3.3 Site Hydrogeology

The BSL is located on the south side of the Minnesota River which serves as a regional groundwater discharge area. Groundwater moves horizontally from the upland areas south of BSL, north towards the river. The Prairie du Chien Group is the first bedrock at the landfill and can occur at depths of less than five feet, particularly on the southern and eastern portions of the site. Closer to the river, depths to bedrock may exceed 60 feet corresponding with greater thicknesses of fine to coarse alluvium, silty organic clays and peat. The water table in the area has historically been close to the land surface partly in response to the poorly drained unconsolidated deposits and due to the upwelling of groundwater from the Prairie du Chien-Jordan Aquifer. The area between the base of the bluffs south of the landfill and the river is known for the occurrence of springs, flowing wells, and a particular type of wetland known as a calcareous fen. These wetlands are associated with surface discharge of cool, calcium-rich groundwater.

Under pre-development conditions, groundwater from the Prairie du Chien-Jordan Aquifer discharged to the surface within the Minnesota River valley and directly to the Minnesota River. Near the landfill the water table occurred within the shallow alluvium or, where bedrock was very close to the surface, within the upper portion of the bedrock formation. Vertical gradients within the bedrock were upwards towards the river.

Prior to landfilling, quarrying operations began on the adjacent parcel that is the current Kraemer Quarry. The quarry currently extracts and processes the limestone and dolomite of the Prairie du Chien Group, which is also a robust aquifer, for use as building and landscape material. Over the years as the quarry developed, it became necessary to manage increasing groundwater inflows by conducting year-round dewatering operations permitted through the Minnesota Department of Natural Resources. Based on the water appropriation permit data summarized on Table 2, over the last five years, the quarry has pumped an average of 3,247 million gallons per year (mgy) on a year-round basis, or an average of 8.9 million gallons per day (mgd), to manage groundwater and for processing at the site.

This dewatering operation has a pronounced effect on hydraulic gradients within the Prairie du Chien-Jordan Aquifer and depresses the water table and aquifer water levels across a broad area,

including the BSL property. A reservoir or sump-like structure is used to facilitate the withdrawal of water from the quarry, and this pumping creates drawdown sufficient to capture shallow groundwater from beneath the landfill and reverse groundwater gradients between the quarry and the river. A second reservoir and sump-like structure, located on the southeastern portion of the quarry, has been configured to safely supply water to Burnsville's surface water treatment plant, which provides treatment that produces water suitable for domestic consumption. Water used for public supply reduces the amount of water that needs to be pumped to support quarry operations and also reduces the need for Burnsville to develop and maintain additional groundwater supplies. The City of Savage also receives a portion of its supply from the Burnsville treatment plant. The nature of the withdrawal and the effects on groundwater flow at the landfill are discussed in more detail in the following sections.

Previous studies have identified the Prairie du Chien-Jordan Aquifer as the "hydrogeologic unit of concern" (Barr, 1991) based on the shallow depth at the landfill and the occurrence of an upward gradient between the Jordan Sandstone and the Prairie du Chien Group. This situation results in a "no flow" boundary within the lower Prairie du Chien Group that has been described in detail initially by Barr Engineering (Barr, 1996) and later by McCain and Associates (McCain, 2003). Since the no flow boundary occurs within the Prairie du Chien Group, any potential groundwater impacts would be limited to this unit. The deeper Jordan Sandstone is hydraulically upgradient. The Minnesota River valley is a groundwater discharge point for the Prairie du Chien and Jordan Formations (Barr, 1996). The area of interest for this groundwater assessment consists of the shallow unconsolidated deposits and the Prairie du Chien and Jordan Formations within approximately two miles of the BSL and south of the Minnesota River. The current area of interest is constrained by pumping for quarry dewatering which captures the majority of water moving under the BSL.

4.0 GROUNDWATER ASSESSMENT

4.1 Groundwater Quality and Areas of Impact in the Vicinity of the Project

Groundwater quality in the vicinity of the Project is assessed using the BSL water monitoring system and the permit-required, groundwater monitoring parameters that are provided on the attached Table 1, the limits table from the BSL permit. For purposes of this groundwater assessment, groundwater impacts are considered to be exceedances of the standards provided on the limits table, except where the exceedance is the result of background concentrations or naturally occurring groundwater constituents.

4.1.1 Existing Groundwater Monitoring System

Groundwater quality is monitored at the BSL site using a series of monitoring wells that are located around the perimeter of the landfill, between the permitted landfill footprint and the Compliance Boundary. Figure 5 shows the locations of the facility monitoring wells that are designated as compliance wells (i.e., used for groundwater quality sampling), and the wells that are designated for water level measurement only.

Each monitoring point is named according to the following system:

- "100" series wells monitor the alluvial or terrace deposits
- "200" series wells monitor the upper Prairie du Chien Group
- "300" series wells monitor the middle Prairie du Chien Group
- "400" series wells monitor the lower Prairie du Chien Group
- "500" series wells monitor the Jordan Sandstone
- "S" designates a surface water sampling location

Sampling is conducted in accordance with a *Sampling and Analysis Plan* (SAP) (most recent version dated July 30, 2018, prepared by Wenck Associates, Inc.). The SAP includes details concerning the monitoring required by the MPCA permit for the facility and addresses the Metropolitan Council Environmental Services (MCES) requirements for leachate disposal and the requirements of the Dakota County Solid Waste License primarily related to leachate management.

Existing groundwater flow conditions under non-flooding conditions are represented on Figure 6. This figure has been created using water levels measured during the October 16, 2018 sampling event together with a Minnesota River stage elevation of approximately 699 feet above mean sea level. All elevations referred to in this report are given in feet above mean sea level unless otherwise noted. The water levels used to create the contours were measured at the water table wells which are the W-100 series or W-200 series wells depending on whether the water table is in the unconsolidated alluvium or in the shallow bedrock formation. The river stage data was obtained for the day of sampling from the National Weather Service web page for the Army Corps of Engineers' (ACOE) gauge at Port Cargill (SAV5M). Under these flow conditions, monitoring well W-235

represents upgradient groundwater quality and the wells along the eastern border of the property (W125R, W-139, W-231 and W-247) represent downgradient water quality. Monitoring wells W-242 and W-244 are downgradient of the West Development Area; and W-140, W-141R and W-222 are situated upgradient or sidegradient of the older, unlined landfill area. The location of W-231 is used for water quality monitoring, along with three other wells that are used for water level monitoring. The surface water location S-5 monitors the quarry dewatering discharge, after it goes through a series of sedimentation ponds, along with drainage from the ditch along the east side of the landfill.

4.1.2 Annual Groundwater Monitoring Results

The MPCA permit, dated July 31, 2015, requires three sampling events per year with volatile organic compounds (VOCs) and field parameters collected during each event (spring, summer and fall). For the summer sampling event the parameter list is expanded to include select metals and other inorganic parameters as noted on Table 1. Water levels are measured at each well during each sampling event including the "water level only" wells indicated on Table 1.

Annual water quality reports for the last six years (2014, 2015, 2016, 2017, 2018 and 2019) have been reviewed as part of the SEIS, and analytical results have been assessed for compliance with applicable ILs. Table 3 provides a summary of IL exceedances which have been limited to manganese (for reasons explained in the next section Inorganic Parameters). Note that the IL for manganese was established 2015 so the values from 2014 were not exceedances at the time, but are over the current IL for manganese. Table 4 lists VOC detections for the six-year review period.

Inorganic Parameters
Manganese has been detected above the current intervention limit of 75 ug/l at least once at each upgradient, downgradient or sidegradient groundwater monitoring point, except W-242, including the surface water station S-5. Manganese does not have a federal MCL but does have a federal health advisory level of 300 ug/l and an MDH HRL of 100 ug/l. The reported manganese results at the BSL ranged from <20 to 3,910 ug/l with most values less than 1,000 ug/l. Manganese concentrations and distribution are discussed in detail in the BSL 2019 Annual Monitoring Report (Wenck, 2020), which includes a map with average manganese concentrations calculated over the last 12 years. The highest average concentrations are observed at well W-140 and the lowest average levels are observed W-242 where there no detections above the IL. The annual report also attempted to correlate trends between manganese and other parameters without identifying a clear pattern. The report concludes that the observed "concentrations do not correlate with other landfill indicator parameters and are likely due to mobilization of naturally occurring manganese due to changes in redox conditions associated with precipitation, pumping, flooding."

Manganese was previously considered to be a nuisance or aesthetic concern and the US EPA established a secondary maximum contaminant level (SMCL) of 50 ug/l based on color, taste and the propensity for manganese to cause black or grey stains at low concentrations. More recently, since potential health effects have been identified, several studies have been conducted to assess the occurrence of manganese in water supplies. The MDH conducted an initial assessment of manganese in groundwater (MDH, 2012) that included data from 4,339 wells located around the state of

Minnesota. Overall, 61.5 percent of all wells sampled exceeded the SMCL (50 ug/l) and 48.9 percent exceeded the HRL (100 ug/l). The percentages were higher for wells completed in glacial drift with 68.5 percent exceeding the SMCL and 60.0 percent exceeding the HRL.

No other inorganic parameters have exhibited IL exceedances over the past six years.

Organic Parameters
During the last six years, three organic compounds (i.e., ethyl ether, benzene, and chloroethane) have been detected intermittently in groundwater at the landfill. Ethyl ether at W-125R was detected in a total of three sampling events in 2014 and 2015, and at W-222 during a total of four events at in 2014, 2015 and 2016. Benzene was detected at the upgradient well W-235 during one event in 2015, and chloroethane was detected at W-125R during one event in 2014 and one event in 2018. None of these detections exceeded an IL or an established water quality standard (US EPA MCL or MDH RAA, HRL or HBV). These compounds are mostly anthropogenic and may serve as indicators of landfill impacts if detected at higher concentrations. The intermittent VOC detections observed are consistent with historical data for the site in that there are few low-level detections, none of which have exceeded a water quality standard. Table 4 provides a summary of VOC detections for the last six years, along with corresponding ILs. Reported VOC concentrations are one to three orders of magnitude less than applicable ILs.

4.1.3 MPCA PFAS Sampling

As part of a wider PFAS evaluation conducted by the MPCA at solid waste facilities in the late 2000s, groundwater samples were collected from four monitoring wells at BSL in 2007 and 2008. PFAS were detected in all four of the monitoring wells sampled, which included three wells down-gradient and one well up-gradient from the landfill. The PFAS concentrations were below the ILs used at the time the data were collected, but PFAS standards have become more stringent and the concentrations would be above current drinking water standards. Further sampling and analysis would be needed to assess current site conditions against current standards. Potential future PFAS sampling requirements are discussed in Section 4.6.2.

4.2 Groundwater Flow Conditions

4.2.1 Existing Conditions

Water levels collected during the October 16, 2018 quarterly sampling event at BSL were used to create the water table contour map provided as Figure 6. This map represents the interpreted existing conditions with respect to measured water levels at the monitoring wells; however, the Minnesota River was higher than the long-term average with a reported elevation of approximately 699 feet. The Minnesota River stage was determined at the ACOE Savage gauging station (SAVM5) located at Port Cargill approximately 500 feet west of the BSL property. An average river elevation at this location is approximately 695 and the flood stage begins at 702 feet.

Figure 6 illustrates the horizontal groundwater flow in the vicinity of the BSL and the quarry with groundwater moving from beneath the footprint of the BSL towards the quarry sump where it is then pumped and directed to the river. The figure also illustrates flow directly towards the Minnesota River just to the west of the BSL with the transition occurring near Port Cargill at the time these water level measurements were made in October 2018. This water table surface and flow regime is generally consistent with interpretations presented in previous investigations and annual reports.

The BSL monitoring network includes a four-well monitoring well nest, (i.e., wells W-231, W-331, W-431, W-531), located between the unlined area and the quarry sump. Under the existing conditions, the water levels at these monitoring points are influenced by quarry pumping. A hydrograph, presented as Figure 7, has been prepared using the water level data measured at these wells during the period from April 2014 to November 2019. The hydrograph shows the lowest water level elevations occur in wells W-331 and W-431 which are open to the intermediate and lower Prairie de Chien Group, respectively. These wells are completed in the same portion of the formation where pumping for quarry dewatering is occurring and demonstrate the most direct response. The deepest well, W-531, is completed in the Jordan Sandstone, which typically has a higher elevation indicating an upward gradient between the Jordan Sandstone and the Prairie du Chien Group. The shallowest well, W-231, is also completed within the Prairie du Chien Group but has been constructed to intersect the water table. This situation results in downward flow within the upper Prairie du Chien, and upward flow within the lower Prairie du Chien and Jordan Sandstone, creating a no-flow (i.e., no vertical flow) boundary as described in reports by Barr (Barr, 1996a, 1996b) and McCain (McCain, 2003). The work performed by Barr in 1996 provided the basis for development of the groundwater monitoring network that is in use today. The Barr reports present a conceptual hydrogeologic model and identify groundwater flow associated with the facility including capture of groundwater by the quarry sump. The reports recommended monitoring system improvements including two piezometers to assess flow conditions in the northeast portion of the landfill. The McCain 2003 work built on the Barr conceptual hydrogeologic model to assess conditions to the west for design, permitting and monitoring of the West Development Area.

4.2.2 Future Conditions

Future groundwater flow conditions at BSL will eventually include a time when Kraemer quarrying operations and the attendant dewatering cease. It is anticipated that the area of the former quarry will be part of the City of Burnsville's planned Minnesota River Recreational Area. Under this scenario, the former quarry will be allowed to fill with groundwater and become a recreational amenity such as a quarry lake or Minnesota River harbor. The details for such an end use are not available at this time; however, it is assumed that there will be some degree of hydraulic separation between the quarry lake and the Minnesota River. Previous studies (Polaris, 1999) have suggested an elevation of 698 feet for the quarry lake based on a three-foot increase in elevation above the Minnesota River average elevation of 695 feet. More recent information documented in the City of Burnsville KMM Burnsville Quarry PUD Amendment and KMM Burnsville Quarry PUD Amendment Environmental Assessment Worksheet (Burnsville, 2020a, 2020b) suggests a future quarry lake elevation of 690 feet with a managed outlet. If the dewatering system is simply turned off, it is

expected that the water level in the lake would rise to an elevation that corresponds with the hydraulic head in the Prairie du Chien-Jordan Aquifer, of 700 feet, or more.

The elevation of the water table beneath the BSL is expected to change from currently observed conditions after cessation of quarry dewatering. The elevation of the predicted future water table has been estimated during previous hydrogeologic investigations and modeling work at the BSL and the quarry. The following are brief descriptions of three water table scenarios developed as part of previous work:

Scenario 1: No Quarry Dewatering, Quarry Lake Not Modeled, SLAEM Model

A groundwater flow model was developed by Barr Engineering in 1993 as part of the Phase II Hydrogeologic Evaluation for the Burnsville Sanitary Landfill Expansion (Barr, 1993). The model is described in a Technical Memorandum included in the report as Appendix F in the 1993 report. The Single Layer Analytic Element Model (SLAEM) was primarily used to predict the capture zones for City of Burnsville water supply wells, and whether groundwater from beneath the BSL would be captured by the wells. The model includes a scenario where the quarry pumping is 'shut off' to investigate whether city wells would capture groundwater from beneath the landfill. In this scenario, the resulting quarry lake is not explicitly included in the model. This provides a more conservative result because the increased recharge due to the lake would reduce the modeled capture zone of the city wells. In this conservative case, the city wells were not predicted to capture water from beneath the BSL. The modeled water table elevation is approximately 720 feet at the south edge of the landfill and 700 feet at the north edge of the landfill, with contours roughly parallel with the Minnesota River and a resulting groundwater flow direction generally straight north toward the river. The model was updated in 2004 as part of supplemental hydrogeologic investigation work by Waste Management and McCain and Associates, Inc. in response to questions from the MPCA during WDA permitting. This revised model included updated pumping data for the quarry and City wells. While the 2004 model was primarily focused on pumping conditions, the modeling report notes that the predicted effect of shutting off the quarry remains unchanged from the original model. The estimated water table contours developed under Scenario 1 are illustrated on Figure 8.

Scenario 2: No Quarry Dewatering, Quarry Lake not Modeled, Water Table Projection

A second water table scenario designated as the "design-basis water table" was developed during solid waste facility permitting and initially described in the 1999 Application for Permit Modification by Polaris Group, Inc. (Polaris, 1999). The design-basis water table has been used during multiple permitting design phases to provide an estimate of the water table in the absence of both quarry dewatering and the quarry lake, in order to maintain separation between the design elevation for the landfill base liner and the predicted future water table. It was developed by projecting the regional water table gradient (reported to be 0.0056) northward across the landfill area, using the highest known water table elevation at the southwestern corner of the landfill area as a starting elevation. Similar to the SLAEM model discussed above, the design basis water table also results in a drop of approximately 25 feet across the site and groundwater flow direction is to the north-northeast. The design basis water table contours are illustrated on Figure 9.

Scenario 3: Quarry Dewatering/Discharge to Maintain Quarry Lake at Elevation 690, Metro Model

A more recent groundwater flow model was prepared as part of work for the City of Burnsville by Barr Engineering (Barr, 2016) to assess future water table conditions in the vicinity of the quarry with the post-quarrying quarry lake at an assumed elevation of 690 feet. A simulated, average pumping rate of approximately 6.5 mgd would be required to maintain this elevation (Barr, 2015). This modeling was conducted using a refined, local-scale version of the Twin Cities Metropolitan Area Regional Groundwater Flow Model (Metro Model), a finite-element model developed by the Metropolitan Council that is widely used by municipalities, state agencies and water resources consultants. Similar to the SLAEM model and the design basis water table, post-mining groundwater flow beneath the BSL shifts more to the north, towards the Minnesota River, and the modeled water table elevation drops 20 to 25 feet from south to north across the landfill. However, this model does consider the post-mining quarry lake and its effect on the water table, which indicates groundwater flow from the southeast portion of the landfill towards the quarry lake. The water table contours developed under the third scenario are illustrated on Figure 10.

The three scenarios described above are hypothetical and are based on assumptions about existing groundwater elevations, aquifer characteristics, groundwater recharge and withdrawals, among other factors; and changes to these assumptions will result in changes to the predicted water table contours. The first two water table scenarios use slightly different assumptions, but generally exhibit similar characteristics: namely, the water table would rise and the groundwater flow direction would revert to the north, toward the river in the absence of quarry dewatering. The third scenario does include post-mining quarry dewatering, at approximately 6.5 mgd, to maintain a quarry-lake elevation of 690 feet. Under these conditions, groundwater from the southeast portion of the landfill flows towards a future quarry lake. A higher river elevation would flatten the water table gradient across the BSL site. This would generally result in higher groundwater elevations, particularly on the north half of the site, and could possibly result in short term flow reversals (i.e., north to south) during periods of high flow and/or flooding. A higher quarry lake elevation, and thus reduced quarry pumping, would reduce the eastward component of groundwater flow, resulting in more flow going north to the river. Pumping of city water supply wells is not expected to result in significant effects on the water table beneath the BSL (Barr, 1993). Effects due to localized variations in groundwater recharge are not expected to be significant relative to the effects of the river and quarry.

Area High Capacity Pumping

High capacity groundwater pumping within two miles of the BSL is summarized on Table 2 and the permitted high capacity wells within this area are illustrated on Figure 11. Individual municipal wells used for potable supply are not shown on the map; however, the Drinking Water Supply Management Areas (DWSMAs) are included to illustrate the areas that have been established under the MDH Wellhead Protection program to manage potential impacts to the groundwater supplies. Three DWSMAs are located with a two-mile radius of the BSL but do not include the landfill area. The DWSMA for the City of Bloomington water supply lies on the opposite side of the Minnesota

River and the DWSMAs for Savage and Burnsville lie in upgradient and sidegradient positions with respect to groundwater flow near the BSL.

The City of Burnsville also obtains water from a portion of the Kraemer Quarry which is considered a surface water source and is treated as such prior to use for potable water supply. This water source is separate and distinct from quarry dewatering operations although the withdrawal for City use reduces the volume of water that needs to be pumped for dewatering. The City of Burnsville has established a Drinking Water Protection Overlay District (DWPOD) to manage potential impacts to this water supply from potential contaminant throughout the DWPOD. The DWPOD illustrated on Figure 11 includes approximately one half of the BSL property. Under existing conditions, this water source is designed to obtain water directly from the Prairie du Chien-Jordan Aquifer with minimal exposure to conditions at the surface.

The BSL is located within the capture zone created by dewatering for the quarry located adjacent to the BSL to the east. Information from the Department of Natural Resources (DNR) water appropriation permit program has been obtained and summarized on Table 2. Based on this information, the quarry has pumped an average of 3,247 million gallons per year (MGY), for the five-year period from 2014 to 2018, for quarry dewatering (3,126 mgy) and aggregate processing (121 mgy). The bulk of this water is pumped from the quarry sump and discharged to the Minnesota River. The water for aggregate processing is pumped from an on-site well and is collected and re-used. Some of this water may also be collected by the quarry sump and discharged to the Minnesota River along with a portion of the stormwater generated at the quarry. In the absence of quarry dewatering, the horizontal groundwater flow direction would revert to a northerly flow direction across the BSL site, discharging directly to the Minnesota River. The configuration and location of the withdrawal point for quarry dewatering has moved over the years but generally consists of a deeper extension of the quarry floor that extends below the water table in the bedrock and is often referred to as a “sump”. It collects shallow groundwater directly from the Prairie du Chien Group and indirectly from the underlying Jordan Sandstone, in addition to seepage from shallower formations, direct precipitation and runoff that collects within the quarry.

The City’s quarry water source has been in use since 2009 and has operated at an average rate of 1,095 mgy (3.0 mgd) over the period from 2014 through 2018. A portion of the water pumped by the City is offset by a reduction in the amount of pumping needed for quarry dewatering. Combined pumping rates for the quarry and City are approximately 4,342 mgy (11.9 mgd). Based on the DNR water use data, for the 10 years preceding the City’s withdrawal, quarry dewatering averaged 3,820 mgy (10.5 mgd) compared to an average of 3,126 mgy (8.6 mgd) for the last five years.

Future groundwater scenarios assume that quarrying operations have ceased and associated quarry dewatering is no longer necessary. Under these conditions, if the City of Burnsville maintains a maximum permitted withdrawal of up to 3.4 mgd as part of the municipal water supply, the predicted quarry lake elevation is approximately 707.9 (Barr, 2015). Maintenance of a quarry lake elevation of 690 feet would require pumping at approximately 6.5 mgd (Barr, 2015). Therefore, whether or not the City continues to use the quarry for water supply at current levels, additional

withdrawals or discharge from the quarry will be required to maintain the quarry lake at elevation 690.

4.3 Base Grade Elevation of the Unlined Area

4.3.1 Determine the Base Grade Elevation of the Unlined Area

The unlined areas of the landfill are illustrated on Figure 12. These were the earliest areas to be filled, before Subtitle D and MPCA permitting was in effect, so the base grade can only be estimated from the available information. Requests were made to the City of Burnsville, Dakota County, and Kraemer Mining and Materials for any development plans or engineering documents relating to the initial phases of landfilling. The most relevant documents that were discovered from these requests were development plans from the early 1970s that were provided by Dakota County. The earliest of the plans were prepared by William McKie and Associates, Inc. dated January 15, 1971 and are included as Appendix A. These plans appear to have been prepared for both landfilling and quarrying operations when Ed Kraemer & Sons owned land in what would eventually become the BSL and the Kraemer Quarry. The plans prepared in 1971 show an area labelled as the "retired landfill area" which is located in the northern most extension of the landfilled area in the northeast portion of the site. The 1971 plans do not indicate that quarrying took place in the future BSL property or that MMSW landfilling took place on the future quarry property. A second set of plans prepared by William McKie dated September 21, 1973 are also included in Appendix A. This plan set includes a contour map, operational plan, cross-sections and a final grading plan. These plans provide for an expanded landfill area and the cross-sections include notes on the land surface, water table and bedrock surface profile in the area that would be designated as the unlined area. There is no indication that MMSW was placed in low lying or excavated areas and the cross-sections indicate a planned landfill base at an elevation of approximately 700 feet and demonstrate the intent to bring the ground surface up to 700 feet prior to landfilling.

There are multiple landfill gas wells within the unlined area, but these do not extend to the base of the waste and the lowest reported elevation for a well bottom is 709 feet. The closest soil borings to the unlined area include three borings conducted as part of geotechnical work on the NDA in 2005 (Spaulding, 2005). The soil borings were drilled on the flood protection berm adjacent to the unlined area, at an elevation of approximately 722 feet, and were intended to provide geotechnical data on berm fill and native soils for use in stability modeling for the NDA. The borings generally encountered fill material down to elevations ranging from 690 to 696 feet. The fill consisted of a mixture soils, cobbles and quarry spoils with trace pieces of plastic observed at one boring, and pieces of wood, concrete and debris at another, which is consistent with uncontrolled fill. The lowest reported elevation of the man-made debris was 694 feet. Black, organic clay swamp deposits were encountered below the fill in two of the borings, indicating that the fill was placed at or near the pre-development ground surface.

Historic aerial photos, topographic maps and atlases were also obtained for the site in an attempt to verify initial landfilling activities. Select topographic maps and air photos from the late 1960s are included in the attached Appendix B. The topographic maps indicate a pre-development ground

surface elevation of approximately 700 feet. Additionally, the aerial photographs show no evidence of mining or quarrying in the landfill area, indicating that the waste was initially placed at the existing ground surface. The Supplemental Remedial Investigation report (Barr, 1991) also provides an estimate of 700 feet for the landfill base grade. It is likely that the predevelopment ground surface exhibited a few feet of variability, with localized lower or higher areas, but was generally a uniform elevation based on the location in the flood plain. Therefore, a base grade elevation of 700 feet has been assigned to the unlined area.

4.3.2 Compare Base Grade Elevations to Existing and Future Groundwater Flow Conditions

The water table contour maps included as Figures 6 and 8, 9 and 10 depicting existing and future water table scenarios have been compared to the unlined area base grade by creating cross-sections with east-west and north-south orientations as shown on Figure 12. Cross-sections have been prepared for each future water table scenario and are included as Figures 13, 14 and 15. Each cross-section shows the existing condition water table as a bold blue line along with the future water table condition and the unlined area base grade. The difference between the two water table surfaces is greatest in the areas that are furthest from the river, to the south, and in the southeast corner of the site where water levels are projected to recover more than 20 feet when quarry dewatering stops. Water levels near the middle of the site are projected to recover five to eight feet. In each case the simulated future water table elevation is above a portion of the unlined area base grade, particularly in the central and southern portion of the unlined area.

4.3.3 Potential Impacts and Mitigation Options

Potential impacts related to future water table conditions and interaction with the base of the unlined area would most likely be associated with changes to groundwater quality as it passes through the unlined area, due to the possibility of contact between groundwater and waste. The proposed Project does not change the depth or span of the unlined area relative to currently permitted conditions, so the Project would not result in increased potential for impacts resulting from interaction between the future water table and the unlined waste area.

Whether the future water table conditions would result in exceedances of permit limits or water quality standards is unknown. The most analogous observable situation is flooding on the Minnesota River, which periodically inundates the ground surrounding the unlined area. The issue of flooding impacts on water quality has been examined by BSL representatives for the period from 1995 to 2016. Flood stage on the Minnesota River near BSL is elevation 702 feet as measured at the Army Corps of Engineers gauge located at Port Cargill. This level has been exceeded 13 times during the study period including three major flood events with the river stage above elevation 712. Historical water level monitoring data has been previously used to demonstrate that the water table has been higher than elevation 700 feet (i.e., the base of the unlined area) in the vicinity of the unlined area following flood events.

This interpretation has primarily been based on measurements from upgradient wells W-244, W-246, and W-235 because downgradient wells are either inaccessible due to flood water (often fully submerged) or are within the influence of the quarry dewatering, which generally keeps the water table below elevation 700 on the east side of the landfill nearest the quarry. In order to obtain representative groundwater elevations closer to the unlined area, additional measurements were collected from wells W-242 and W-222 during a flood event in April 2020. Well W-242 is approximately 150 feet from the west edge of the unlined area, which is closer than wells W-244, W-246 and W-235. Well W-222 is immediately adjacent to the edge of the unlined area at the northernmost edge of the north arm of the landfill. From March 31 through April 3, a total of seven water level measurements were collected from W-242 and six measurements were collected from W-222. During flood conditions observed on April 3, 2020, well W-242 exhibited a measured groundwater elevation of 700.53 feet, and had increased approximately two feet over a period of four days during flood water advance. Similarly, on April 2, well W-222 exhibited a groundwater elevation of 695.61, and had increased approximately 1.2 feet over a three-day period (the well was inaccessible on April 3 due to frozen outer casing cap). This well is closer to the quarry, and therefore exhibits a lower groundwater elevation due to the effects of the quarry dewatering. For comparison, well W-222 exhibited an elevation of 698.65 feet during the routine monitoring event in May 2019, which was approximately two months after the river crest elevation of 712.60 feet observed on March 30, 2019.

River stage and groundwater elevation data collected during this time period are presented in tabular and graphical format in Appendix C. The groundwater elevations show a strong correlation with the Minnesota River elevation. This indicates a hydraulic connection between the river and the upper Prairie du Chien water table aquifer. The crest of the river associated with the April 2020 flood event was projected to occur on April 7, at an elevation of 706.2 feet (NWS, 2020). It is likely that the groundwater elevations continued to rise along with the flood water, so the ultimate water table elevation associated with this flood event was likely higher than the elevation documented on April 3. This information supports the previous interpretation that the water table periodically exceeds elevation 700 feet in the unlined area during flood events.

Based on BSL groundwater monitoring data, there have not been notable impacts to groundwater quality observed following flood events.

If impacts to groundwater quality as a result of the landfill are observed under future water table conditions, one mitigation strategy would be to lower the water table by pumping near the unlined area. Based on the lack of impacts observed under current conditions with the quarry dewatering, it would be expected that reverting to a lower water table beneath the unlined area would eliminate the observed impacts. Additional studies and permitting would be required prior to implementing a pumping system.

4.4 Area Water Supplies

4.4.1 Existing and Potential Future Drinking Water Supplies

Existing area groundwater supplies located within two miles of the BSL are shown on Figure 16. The locations for individual public water supply wells are not presented on the figures so as not to reveal specific well locations consistent with the Cities' vulnerability assessments and risk mitigation plans; however, the associated Drinking Water Supply Management Areas (DWSMAs) are presented to illustrate the area that has been designated for management of potential contaminant sources through the MDH Wellhead Protection (WHP) program. The DWSMA encompasses the area where land use activities have the potential to impact water quality at the public supply well(s) based on computer modeling of the 10-year capture zone.

In addition, the City of Burnsville has established a Drinking Water Protection Overlay District (DWPOD) for the quarry water source. The DWPOD is intended to help protect a surface water source so it is based on different criteria than the DWSMAs, including surface runoff. The limits of the DWPOD are shown on Figure 16.

The Minnesota Well Index (MWI) was queried to obtain locations and construction information for all wells located within two miles of BSL. Many of the wells in the data base are shallow monitoring wells which have not been plotted. These wells tend to be completed at the water table at relatively shallow depths for the purpose of monitoring groundwater contamination or potential contamination and are not used for potable water supply. The data base also includes "unlocated wells" which have not been plotted due to poor, uncertain or missing location data. Several high capacity wells have been identified within two miles including non-crop irrigation wells and wells for commercial and industrial use. While not necessarily used for potable supply, these wells have been included to assess potential effects on groundwater flow patterns at BSL.

Individual domestic supply wells occur primarily in the neighborhoods located at higher elevations beyond the bluffs to the north across the Minnesota River in Bloomington and to the south within the City of Burnsville. A limited number of domestic supply wells are located south of Highway 13 and west of I-35W within the Cities of Savage and Burnsville. In general, public water supply connections are available for domestic, commercial and industrial uses within two miles of the BSL.

Most domestic wells are completed within the Prairie du Chien Group or shallower glacial drift, alluvial or terrace deposits. High capacity wells for potable supply or other purposes are typically completed within the Prairie du Chien Group and/or Jordan Sandstone. Deeper aquifer formations, including the Tunnel City Group and Wonewoc Sandstone are not robust aquifers and not generally used for high capacity supply except in combination with other aquifers in multi-aquifer wells which are no longer permitted. The Mt. Simon Sandstone is the deepest major aquifer in the Twin Cities Metropolitan Area and a moratorium has been placed on further development of this resource except in special circumstances by variance. The existence of calcareous fens, and potential impacts from groundwater withdrawal, has been well documented in the area which could limit use of the Prairie du Chien-Jordan Aquifer in specific areas east of I-35W and west towards the Credit River and Eagle Creek. These fens are specific wetland types that rely on springs and the upwelling of calcareous groundwater from the Prairie du Chien Group to create suitable hydrogeologic conditions.

4.4.2 Potential Impacts to Drinking Water Supplies and Mitigation Options

Potential impacts to water supplies are limited to the immediate vicinity of the BSL property. The Minnesota River serves as a regional discharge point to the north and interaction of groundwater at the BSL with potential water supply aquifers is limited to the Prairie du Chien Group and shallower formations. Under the existing conditions, groundwater at the BSL is collected by the quarry dewatering sump and there is little opportunity for groundwater to migrate elsewhere. Under a future scenario, without active dewatering in support of quarrying operations, groundwater flow at the landfill will at least partially revert to the north. Depending on future plans for the post-mining quarry lake, groundwater originating from beneath the landfill may flow north towards the Minnesota River and towards a future quarry lake. If the quarry lake is managed to maintain an elevation of 690 feet, shallow groundwater from underneath the BSL would be captured similar to the current situation. A lower quarry lake elevation will result in greater capture of groundwater from the area surrounding the former quarry, including the BSL, whereas a higher quarry lake elevation will result in less capture of surrounding groundwater.

Current water quality data from the BSL monitoring network do not indicate landfill-related impacts at the quarry dewatering discharge point (S-5) or downgradient monitoring wells between the BSL and the quarry (W-125R, W-139, W-247 and W-231), and no landfill-related impacts have been reported by the City of Burnsville at the existing quarry water supply. The proposed Project is not expected to impact groundwater flow conditions at the BSL, and therefore is not expected to impact the quarry water supply system as it is currently configured based on current groundwater monitoring parameters. The Project is primarily a vertical expansion of the BSL that results in an overall smaller landfill footprint than is currently permitted.

Details concerning the City's sources of water supply, including location and configuration, are not available to the public consistent with their vulnerability and risk management plans. In addition, the configuration of a potential future (i.e., post-dewatering) quarry water supply has not yet been determined, as the end date for quarry dewatering is anticipated to be at least 15 to 20 years in the future (Burnsville, 2020a). Therefore, potential impacts from the BSL to a future quarry water supply resulting from discharge of groundwater from beneath the BSL to the quarry are unknown. If future impacts are identified, they would most likely be observed first at the monitoring wells along the east side of the BSL. BSL has indicated that they have a 150-foot easement on the west side of the KMM quarry property that restricts further development in this area (T. Johnson, personal communication, September 2020). This buffer is between the permitted waste limit and the compliance boundary and is sufficient for implementation of remedial measures such as groundwater pumping, barrier systems, or infiltration trenches, or other measures necessary to mitigate potential impacts. During the solid waste permitting process, the MPCA will require additional information from BSL pertaining to groundwater monitoring, including contaminants of concern and contingency actions to be taken in response to potential environmental impacts, as described in Section 4.6.2, below. This information will assist in evaluating the potential for the Project to impact human health and the environment, including current and future water supplies in the area.

The existing and predicted future groundwater flow patterns do not result in capture of groundwater from beneath the BSL by any currently-existing drinking water wells, therefore no impacts to drinking water wells are anticipated. For a future water supply well to be in-line with potentially impacted groundwater it would need to be located on or adjacent to the landfill property. High capacity pumping, capable of reversing groundwater gradients would also need to be relatively close to the landfill.

4.5 Potential Groundwater Impacts from Weight of Vertical Expansion

Adding weight to the landfill will cause some degree of consolidation and compaction of the underlying waste mass. This may reduce the void space in the waste, leaving less available space for liquid to occupy. If the waste has a high in-situ moisture content, this void reduction could result in increased drainage of liquid (i.e., leachate) from the waste. In lined areas, this additional leachate would be collected in the leachate collection sumps and pumped out as part of normal landfill operations. In unlined areas, the additional leachate would not be captured by the liner system and could potentially migrate into groundwater.

Neither the settlement nor the leachate generation in the unlined area is expected to be significant as a result of the proposed Project. The waste in the unlined area has already undergone over 30 years of settlement. Unlined areas beneath the vertical expansion portion of the proposed Project currently have over 100 feet of waste in place and will have undergone a significant amount of consolidation and compaction. As described in Section 5 of the SEIS, the majority of the consolidation occurs immediately following waste placement and subsequent loading, so the additional amount of volume reduction in this area is expected to be small. Furthermore, waste in the unlined area is under final cover consisting of a clay or synthetic membrane barrier which prevents infiltration of surface water into the waste, and moisture is actually removed from the waste through the existing active gas collection system. Therefore, the in-situ moisture content of the unlined area is expected to be relatively low, compared to active fill areas (all of which are lined) that do not yet have a low-permeability cover or active gas collection system. Because of the limited potential for additional leachate generation from the unlined area under current groundwater conditions, the additional weight of the expanded landfill is not expected to significantly impact groundwater quality at the BSL.

4.6 Groundwater Monitoring

4.6.1 Existing Groundwater Monitoring Plan

The existing groundwater monitoring plan for the facility is described in the 2018 Sampling and Analysis Plan (Wenck 2018). The plan details the monitoring locations, procedures and parameters that are in place at the facility and is updated and approved by MPCA when significant changes are needed.

The current plan requires BSL to monitor groundwater quality and to assess compliance with applicable groundwater quality standards. The gradients created by operation of the quarry

dewatering system result in relatively constant and predictable groundwater flow patterns to the east across the majority of the landfill footprint. The highest groundwater levels are observed in the southwest corner of the landfill with flow towards the northeast corner and east side of the facility. On the west side of the landfill, near the dredged channel for Port Cargill, there is a groundwater flow boundary where groundwater flow shifts from discharging to the Minnesota River (generally west of Port Cargill) to a point where the Minnesota River recharges the shallow groundwater being discharged at the quarry dewatering system.

The existing groundwater monitoring system is illustrated on Figures 5 and 6. Water quality is monitored at four points along the eastern boundary of the landfill which are the primary downgradient monitoring points (W-125, W-139, W-231 and W-247). Upgradient water quality is monitored on the south side at one point (W-235) and at three points on the north side (W-140, W-141, and W-222). Monitoring points W-242 and W-244 on the west side are cross-gradient from most of the landfill area but are downgradient of the west development area and the west side of the landfill.

4.6.2 Conceptual Groundwater Monitoring Plan

This section describes a conceptual groundwater monitoring plan for the purposes of this SEIS. The full groundwater monitoring plan will be developed during the MPCA solid waste permitting process. The MPCA has provided a document titled "Future Permitting Needs for BSL Expansion Project," which is attached to the SEIS as Appendix D, and lists several items related to water quality that will be addressed during permitting. Among other requirements, the MPCA will require that BSL update its groundwater Sampling and Analysis Plan to include current standard parameters and monitoring limits based on MDH HRLs or similar health standards, as appropriate, and evaluate additional contaminants of concern for potential inclusion into BSL's permit. The specific contaminants of concern that will be evaluated during the permitting process may include PFAS and 1,4-dioxane. Additional requirements include identifying contingency actions to be taken if groundwater impacts are detected, as well as establishment of financial assurance that will provide funding for contingency actions and/or mitigation activities.

A conceptual groundwater monitoring plan that takes into account the changes in the landfill footprint resulting from the proposed Project is illustrated on Figure 17. A total of four monitoring well locations (five wells) are affected by changes in the landfill footprint with the proposed Project. Monitoring wells W-242, W-244 and P-344 will eventually need to be sealed due to their location in the annex construction area. A new well designated W-244R could be constructed as a replacement to the west of the existing well, at the toe of the slope, less than 200 feet from the fill limit and inside the property boundary. A replacement for W-242 (W-242R) could be constructed to the north of the existing location at the toe of the slope and less than 200 feet from the fill limit. Wells W-140 and W-141R were initially installed to monitor conditions at the north fill boundary; however, the changes in the landfill footprint leave these locations too far from the waste limits. A single monitoring well, designated W-238R, should be constructed as a replacement on the north side of the fill area at the toe of the slope within 200 feet of the waste limits. These replacement well locations are situated

to monitor cross-gradient to upgradient locations during quarry dewatering but will become downgradient monitoring wells when dewatering stops.

The existing wells used for water quality monitoring should be retained and water levels measured at the same time as the monitoring wells are sampled during the spring, summer and fall monitoring events. Monitoring locations, parameters and frequencies will be confirmed during re-permitting.

Analysis of water levels and groundwater flow conditions over time would benefit from surface water measurements on the Minnesota River. The Army Corps of Engineers maintains a gauge at Port Cargill, illustrated on Figure 5, that could be used to monitor river levels during sampling events. Monitoring of future quarry lake stages should also be conducted once active quarrying and dewatering have ceased.

4.7 Summary of Groundwater Impacts

The following is a summary of Groundwater Impacts:

1) Groundwater Monitoring, during the period from 2014 through 2019, has not identified impacts to groundwater for the monitored parameters resulting from the BSL. Manganese detections above the IL have been detected at both upgradient and downgradient monitoring wells and appear to be related to naturally occurring manganese and/or background concentrations. There were no other IL exceedances reported during the monitoring period. Sporadic detections of VOCs have been observed at concentrations lower than applicable ILs.

2) Predictive modeling indicates the potential for the water table to be in contact with the base of the unlined area if quarry dewatering ceases in the future. Potential groundwater quality impacts associated with this condition are unknown at least in part due to plans for the future quarry lake being unknown. However, water level monitoring at BSL has shown the water table periodically exceeds the base elevation of the unlined area during periods of flooding on the Minnesota River, and no significant changes in groundwater quality are evident for the monitored parameters following flood events. The proposed Project does not change the depth or span of the unlined area relative to currently permitted conditions, so the Project would not result in increased potential for impacts related to future water table conditions.

3) Potential impacts to water supplies are as follows:
    a. Quarry Water Supply - There are currently no identified landfill-related impacts to the existing quarry water supply, nor are there impacts observed at the quarry dewatering outfall (or downgradient monitoring wells) based on permit-required monitoring. Impacts to the existing quarry water supply are not expected as a result of the Project. Under a future scenario with the post-mining quarry lake at elevation 690, some groundwater from underneath the BSL is predicted to discharge to the quarry lake. Potential impacts from the BSL to a future quarry lake are not known but will be further investigated through the permitting process.

b. Water Supply Wells – Existing and future groundwater flow scenarios do not result in groundwater flow from the landfill towards any other known potable water supply wells.

4) The additional weight of the expanded landfill is not expected to significantly impact groundwater quality at the BSL. The waste in the unlined area has already undergone over 30 years of settlement.

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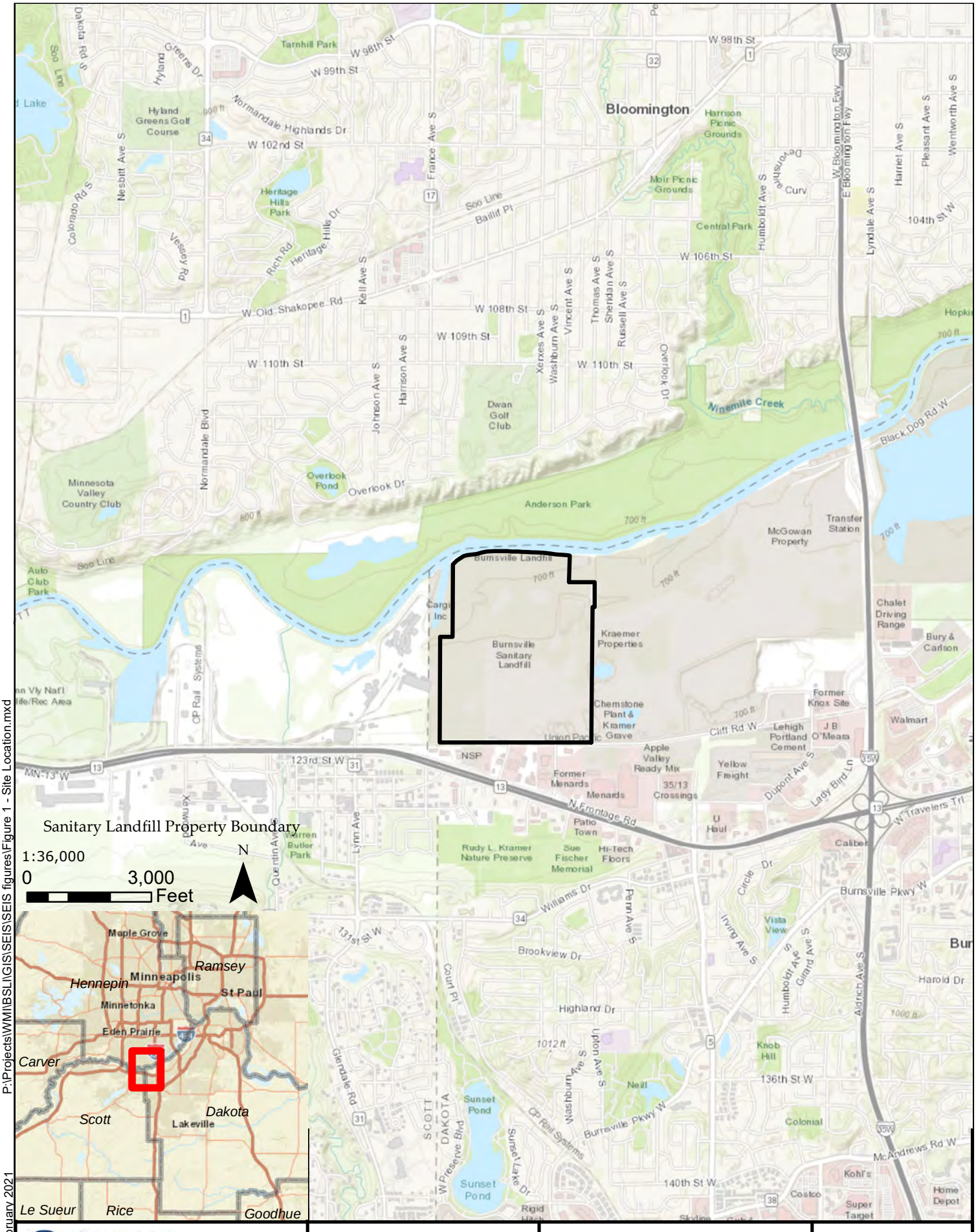
Figures



P:\Projects\WMIBSLI\GIS\SEIS\SEIS figures\Figure 1 - Site Location.mxd

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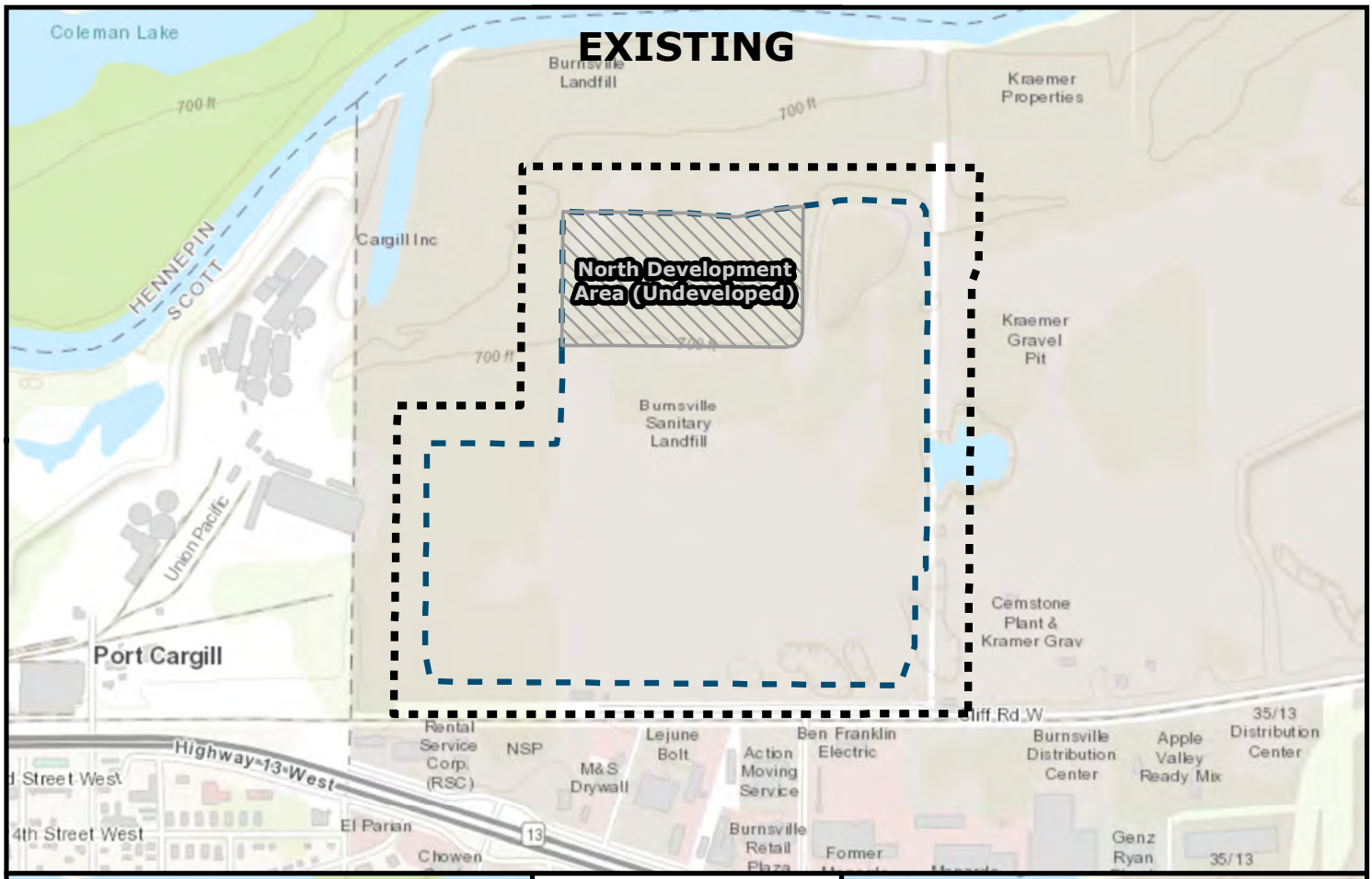
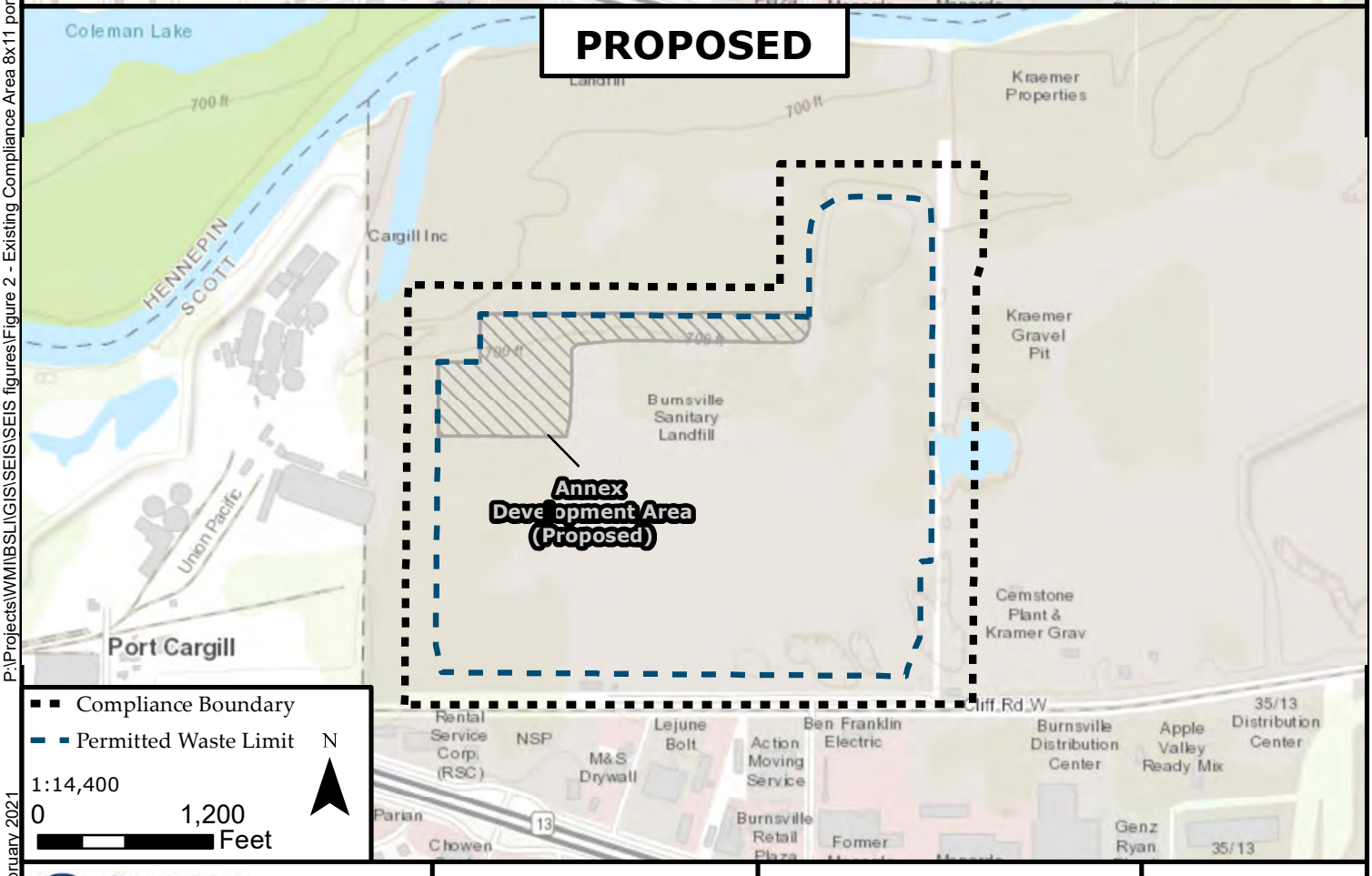
BURNSVILLE SANITARY LANDFILL (SW-56)

FIGURE 1
SITE LOCATION





Compliance Boundary
Permitted Waste Limit
N
1:14,400
0 1,200 Feet

P:\Projects\WMIBSLI\GIS\SEIS\SEIS figures\Figure 2 - Existing Compliance Area 8x11 porttrait.mxd

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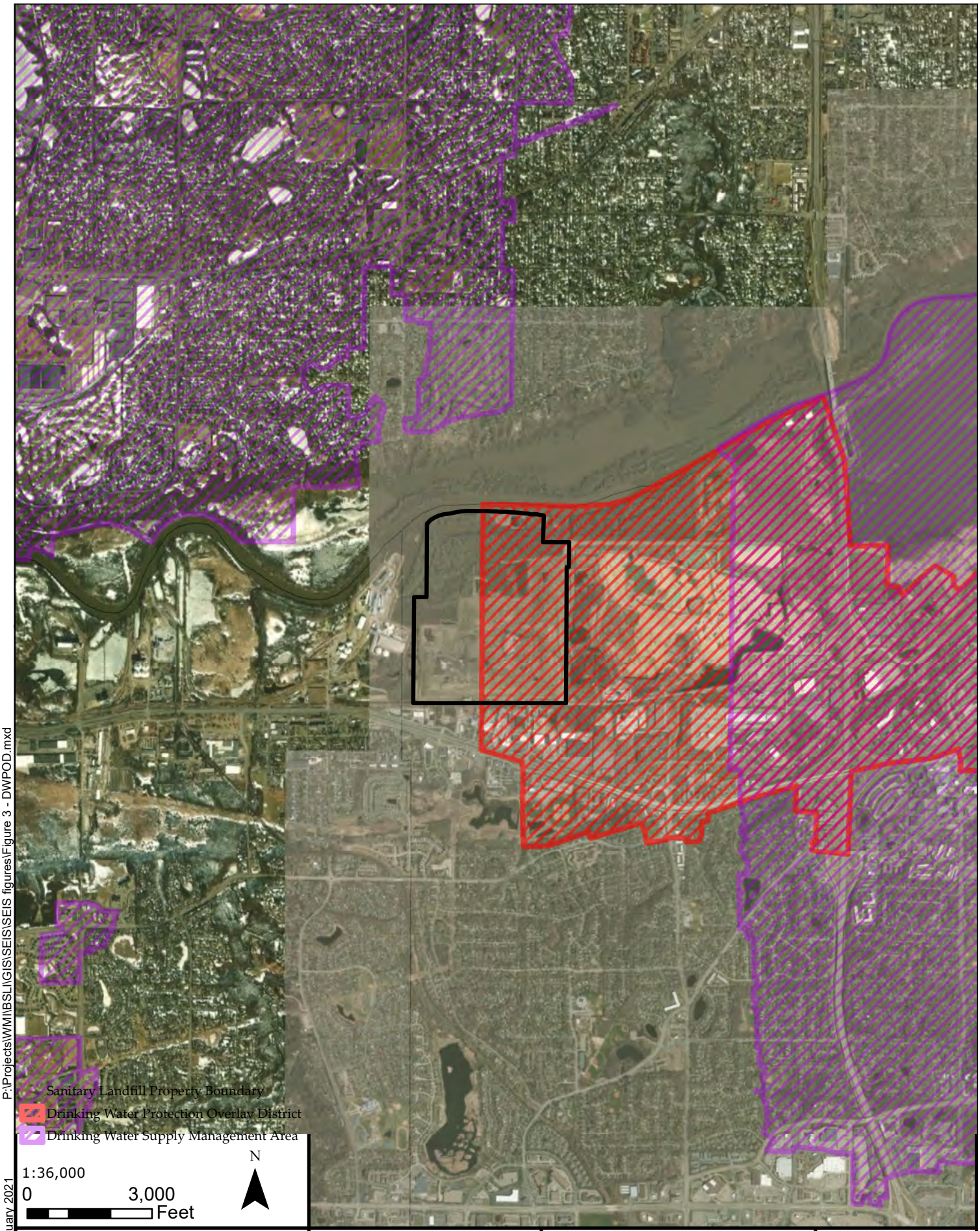
FIGURE 2
EXISTING AND PROPOSED PERMITTED AREAS



P:\Projects\WM\BSL\GIS\SEIS\SEIS figures\Figure 3 - DWPOD.mxd

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FIGURE 3
DRINKING WATER PROTECTION AREAS

System/Series	Formation or Group Name	Thickness Near BSL (Feet)	Depth to Bottom of Formation or Group (feet)	Hydrogeologic Characteristics
Quaternary	Floodplain Alluvium, Organic and Terrace Deposits	0 to 75	5	Alluvium and Terrace Deposits Have Limited Use for Domestic supplies.
Lower Ordivician	Prairie du Chien Group	150	155	Aquifer
Cambrian	Jordan Sandstone	100	255	Aquifer
	St. Lawrence Formation	180	435	Confining Layer
	Tunnel City Group* (Formerly Franconia Formation)			
	Wonewoc Sandstone* (Formerly Ironton and Galesville Sandstones)	70	505	Aquifer
	Eau Claire Formation	75	580	Confining Layer
	Mt. Simon Sandstone	150	730+	Aquifer

* The Minnesota Geological Survey adopted these changes in stratigraphic nomenclature for use with the County Well Index on August 1, 2014. Geology adapted from County Atlas Series C-6 (Dakota County) and C-17 (Scott Cointy) and area well logs.

P:\Projects\WMIBSLI\GIS\SEIS\SEIS figures\Figure 5 - Existing GW Monitoring Network.mxd

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FIGURE 5
EXISTING GROUNDWATER MONITORING NETWORK

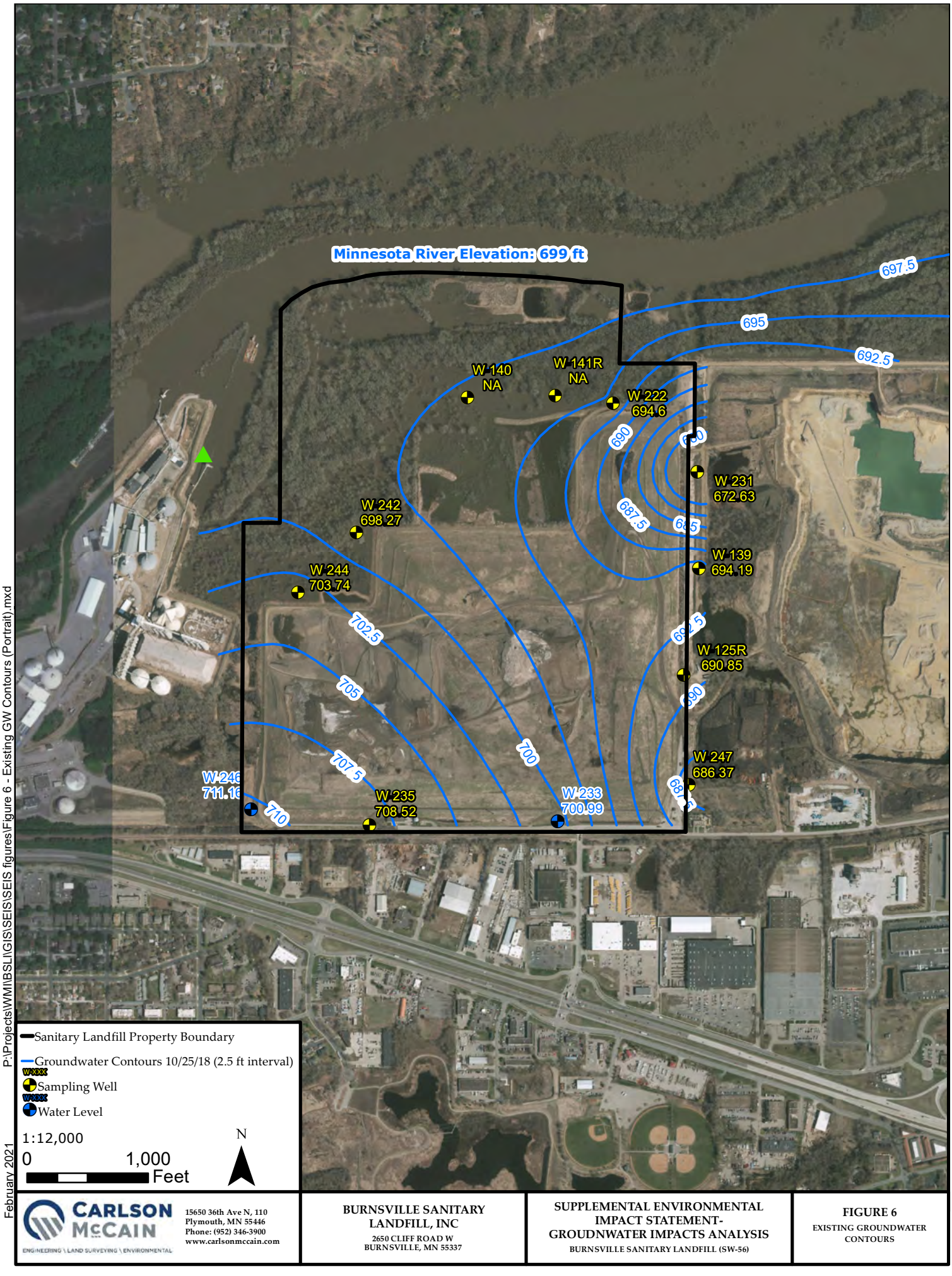

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FIGURE 6
EXISTING GROUNDWATER CONTOURS

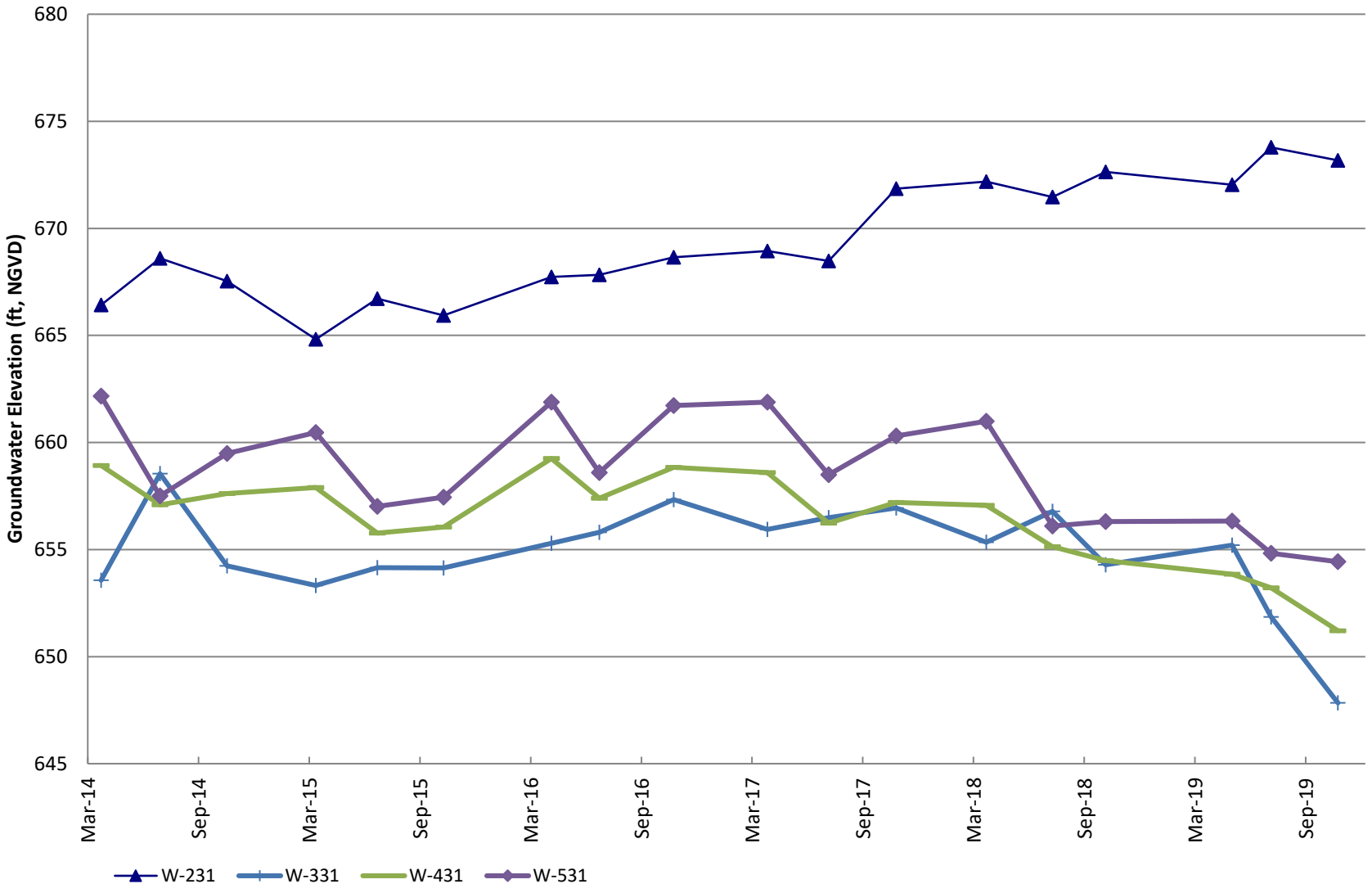

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FIGURE 7
HYDROGRAPH

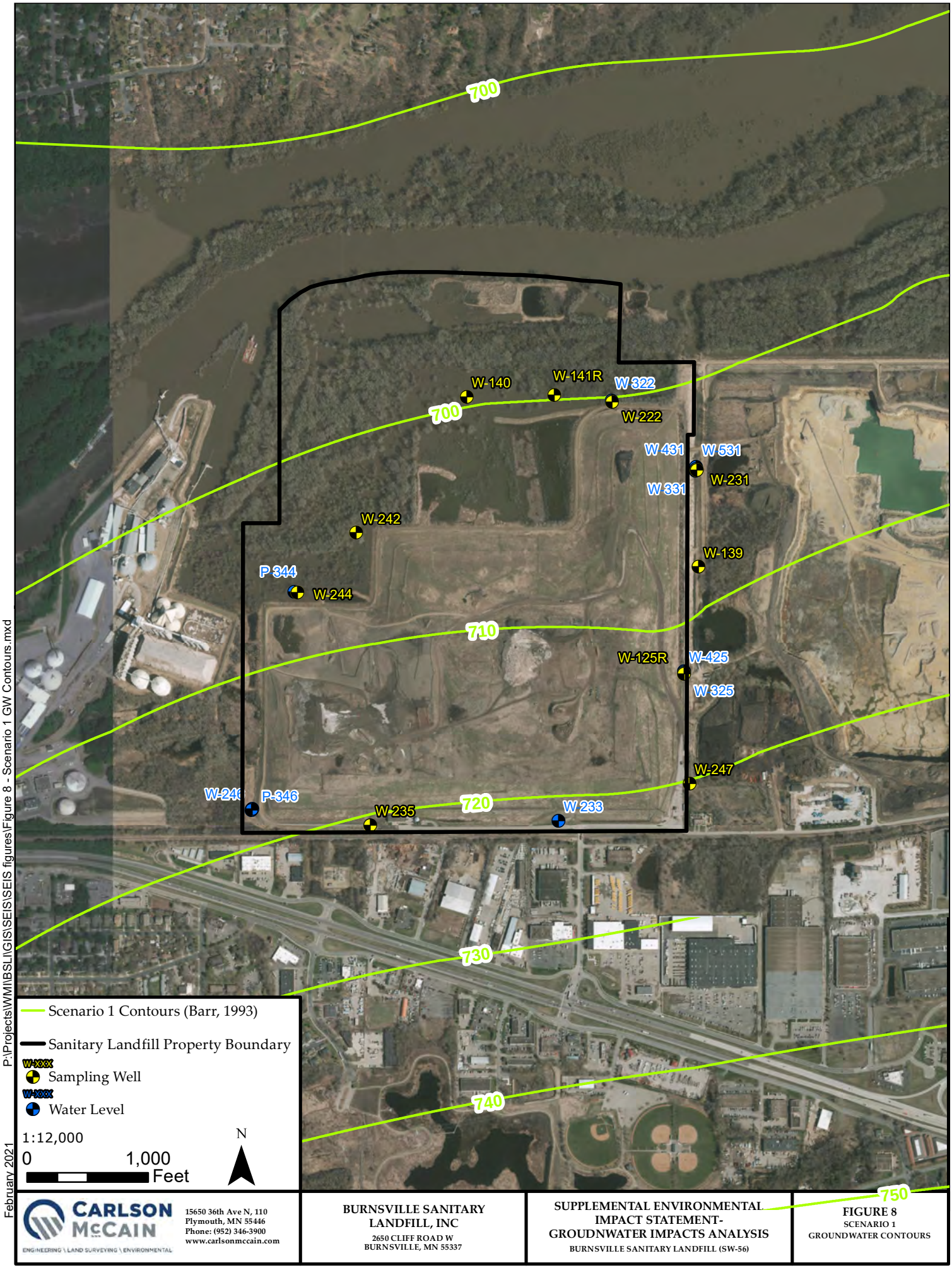

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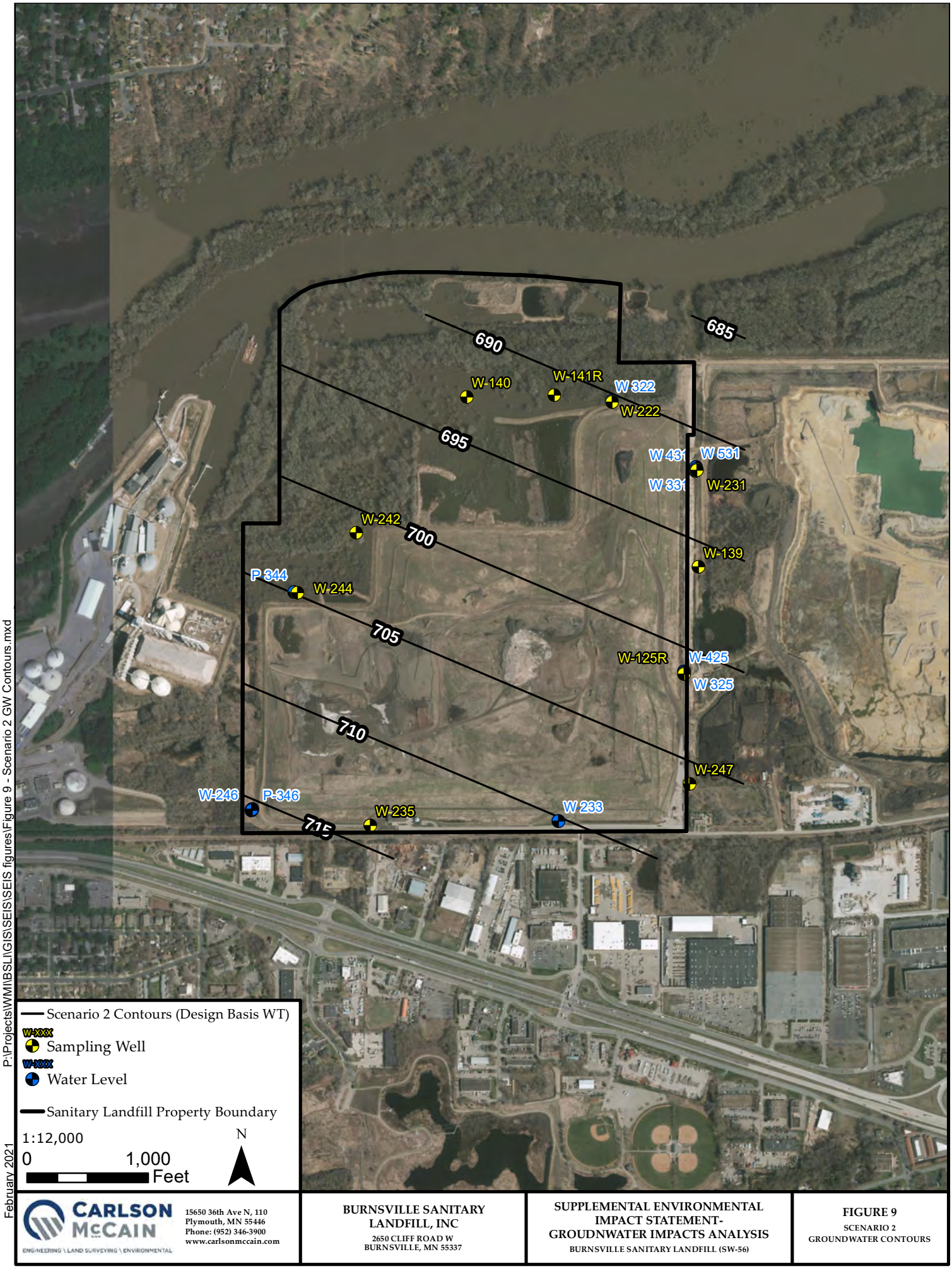
FIGURE 8
SCENARIO 1
GROUNDWATER CONTOURS



P:\Projects\WM\BSL\GIS\SEIS\SEIS figures\Figure 9 - Scenario 2 GW Contours.mxd

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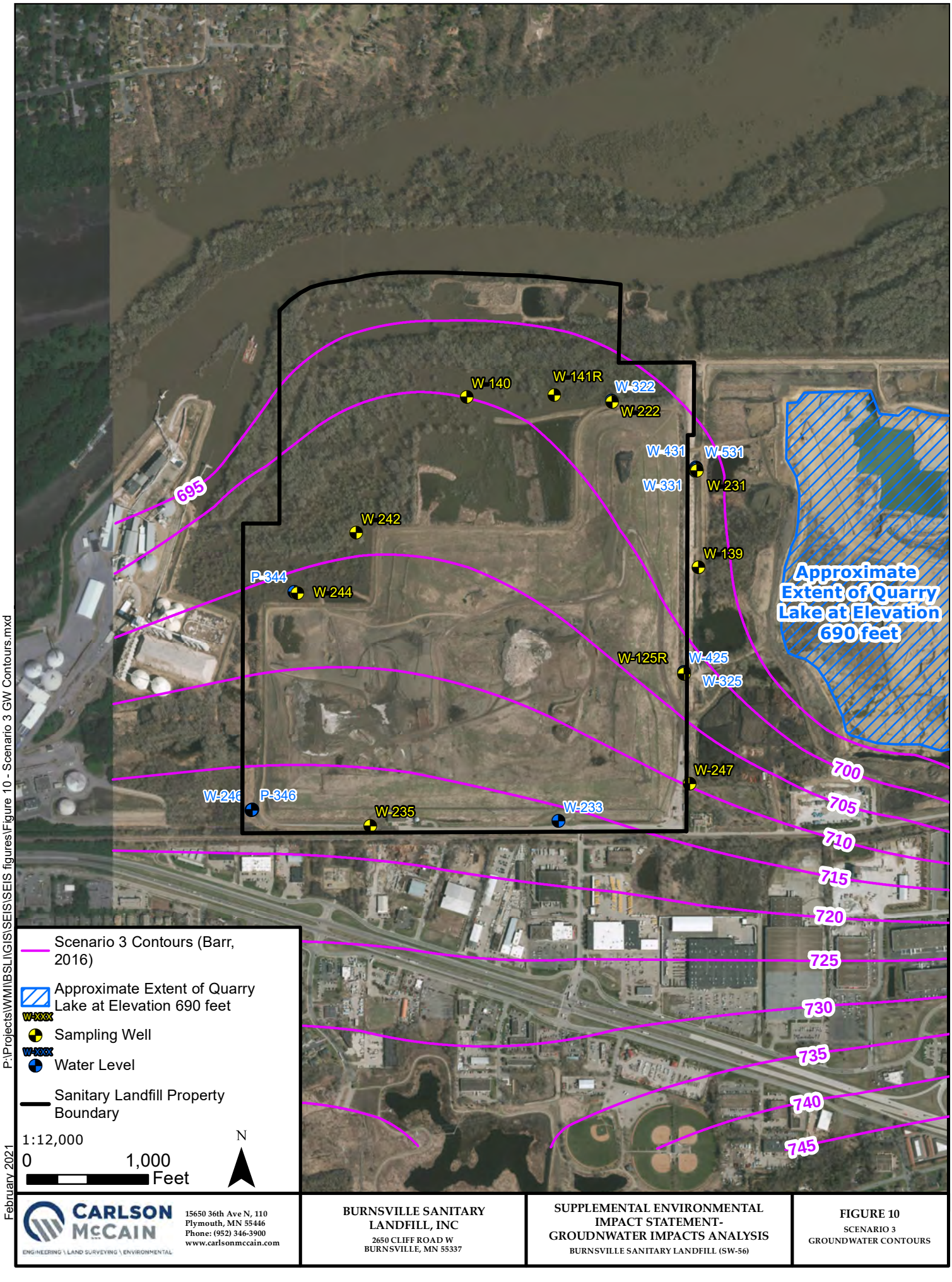
FIGURE 9
SCENARIO 2
GROUNDWATER CONTOURS



P:\Projects\WM\BSLI\GIS\SEIS\SEIS figures\Figure 10 - Scenario 3 GW Contours.mxd

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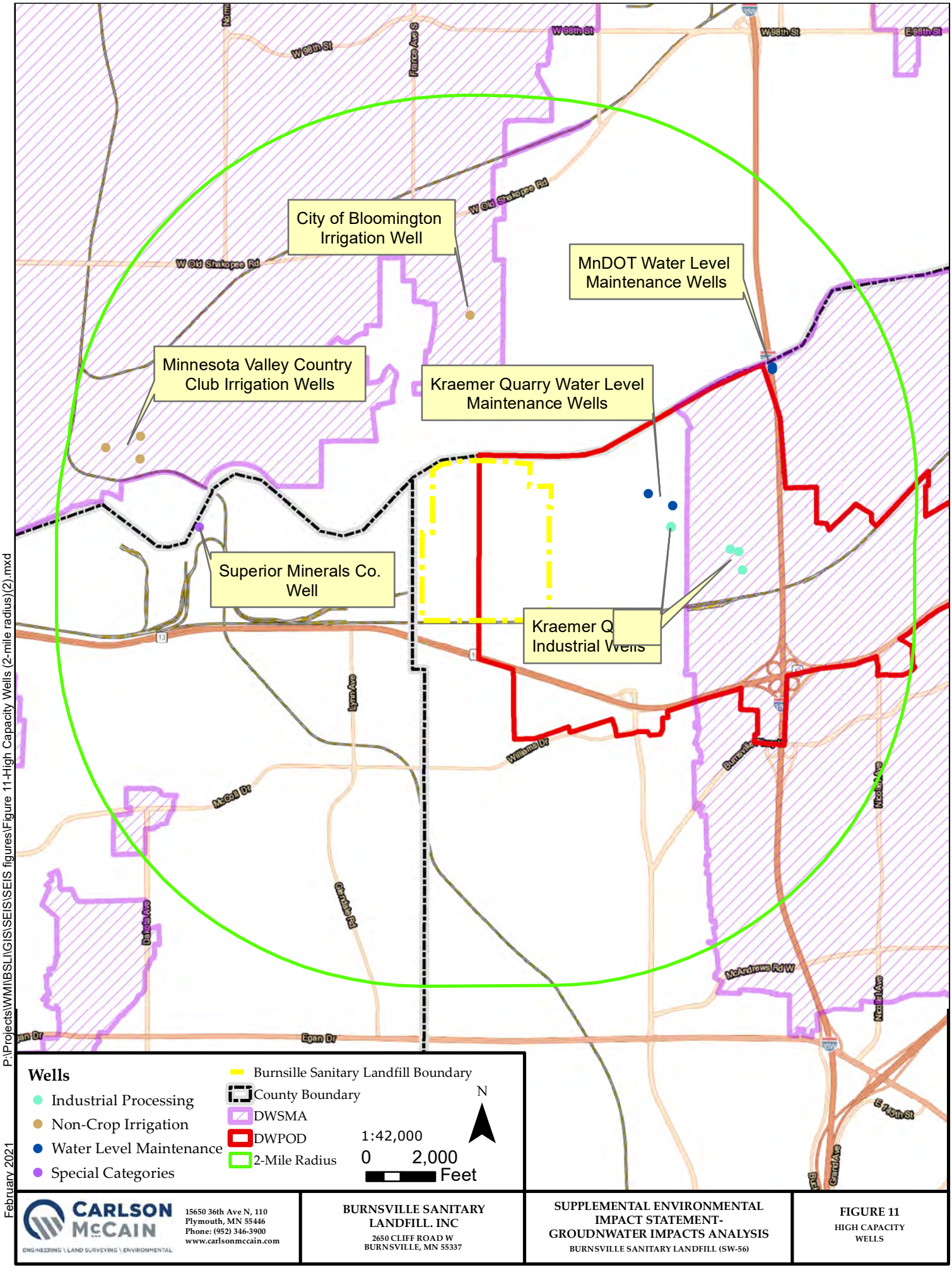
FIGURE 10
SCENARIO 3
GROUNDWATER CONTOURS



P:\Projects\WM\BSL\GIS\SEIS\SEIS figures\Figure 11-High Capacity Wells (2-mile radius)(2).mxd

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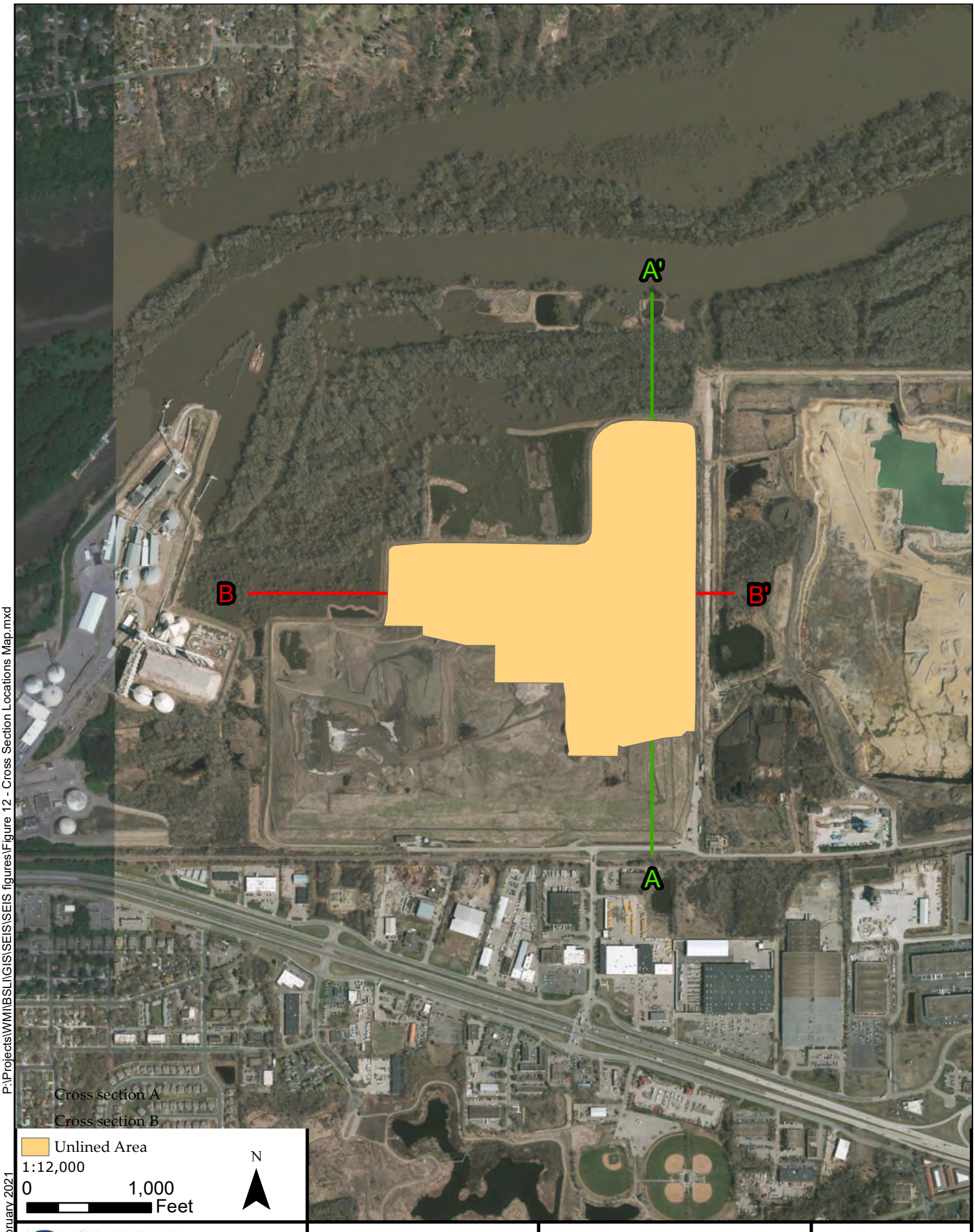
FIGURE 11
HIGH CAPACITY WELLS



P:\Projects\WM\BSL\GIS\SEIS\SEIS figures\Figure 12 - Cross Section Locations Map.mxd

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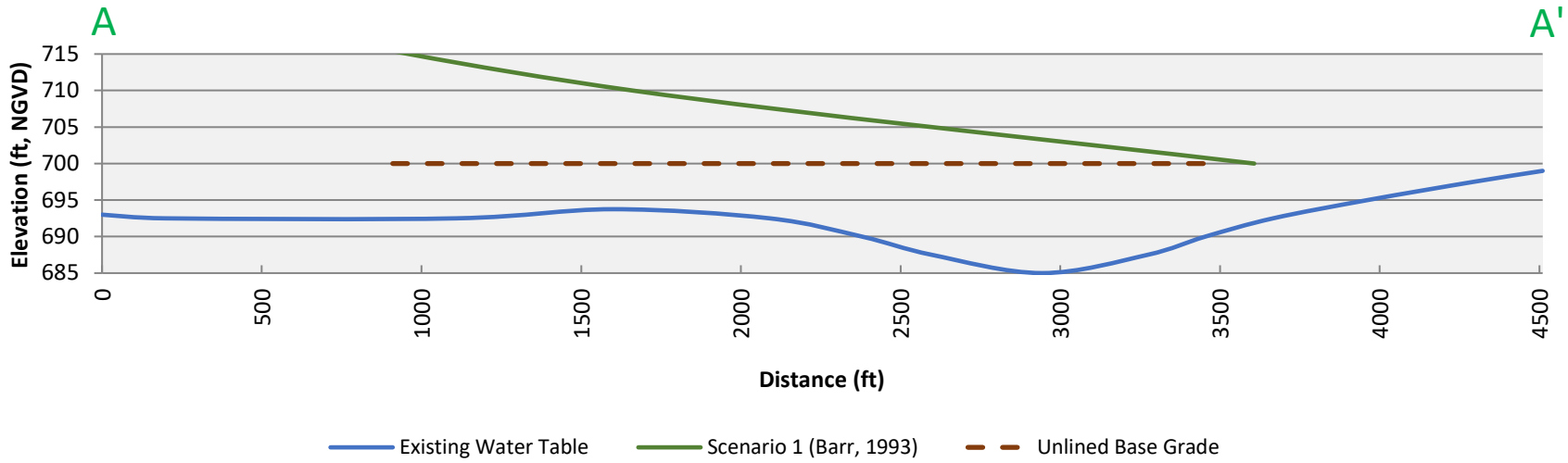
FIGURE 12
CROSS SECTION LOCATIONS



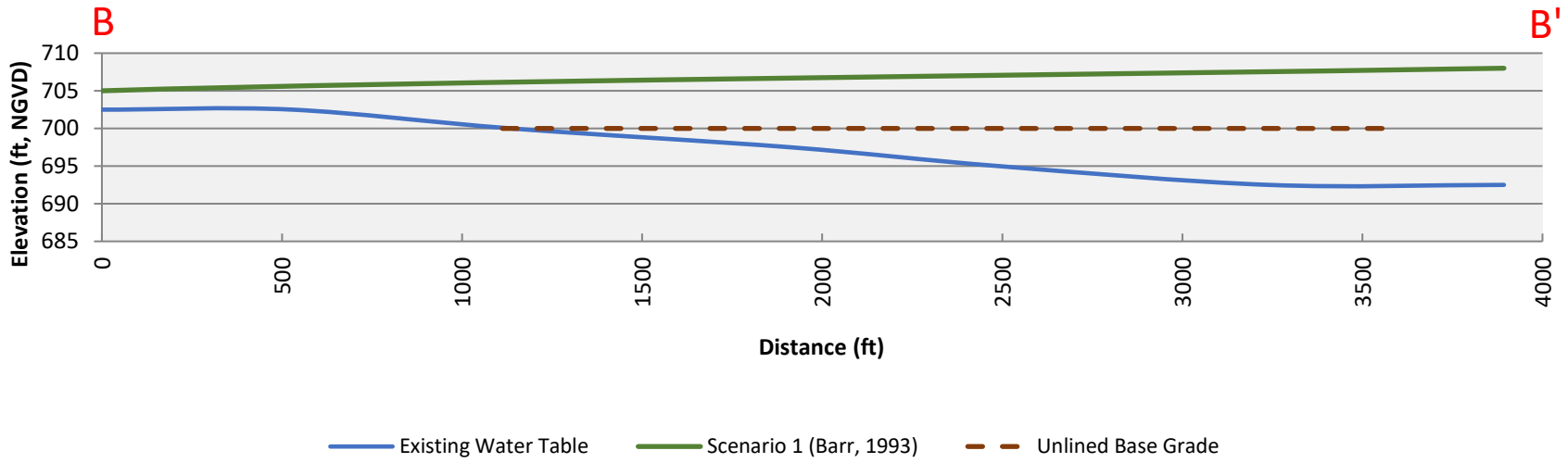


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FIGURE 13
SCENARIO 1 CROSS SECTIONS

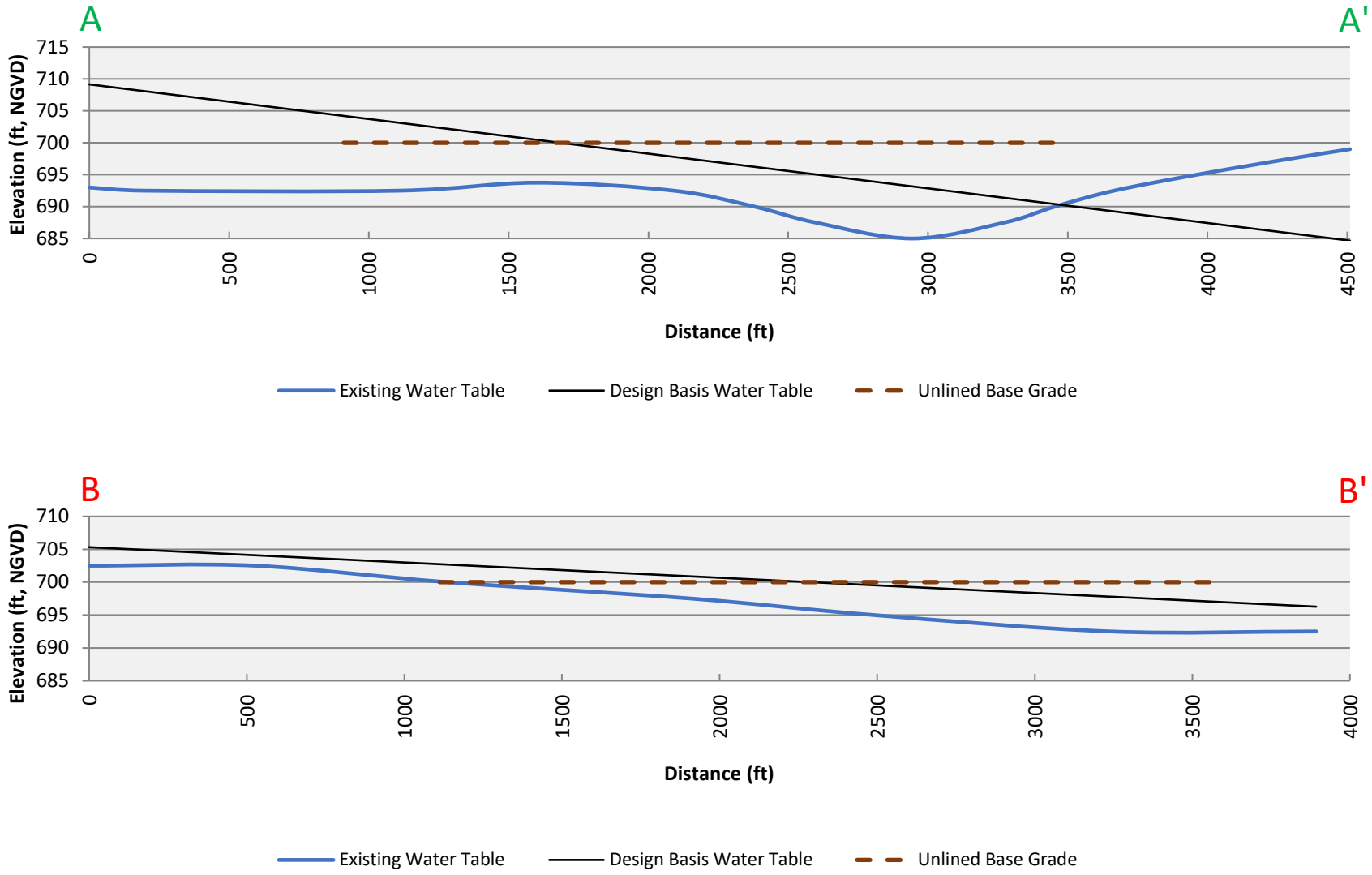

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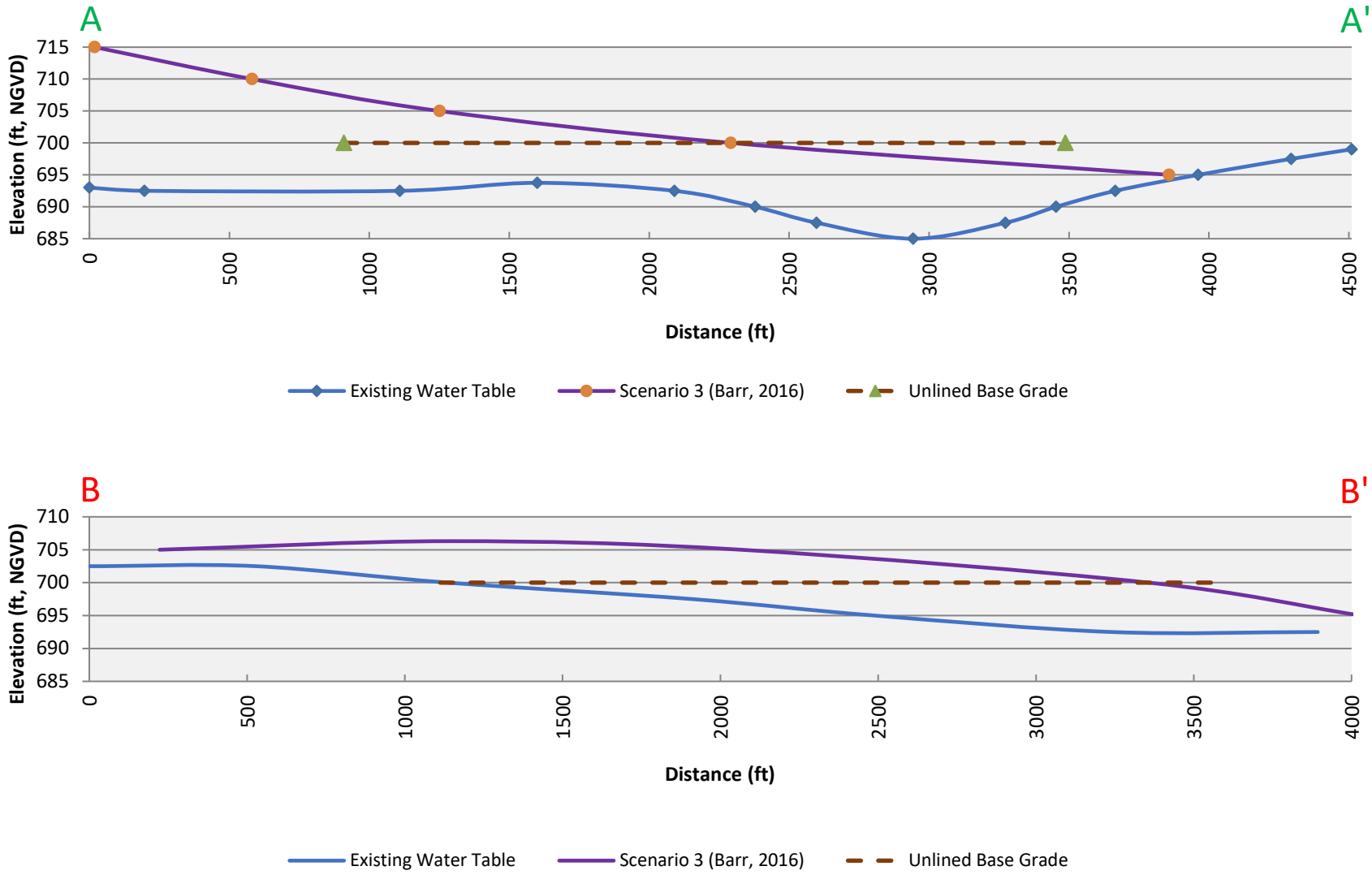
FIGURE 14
SCENARIO 2 CROSS SECTIONS



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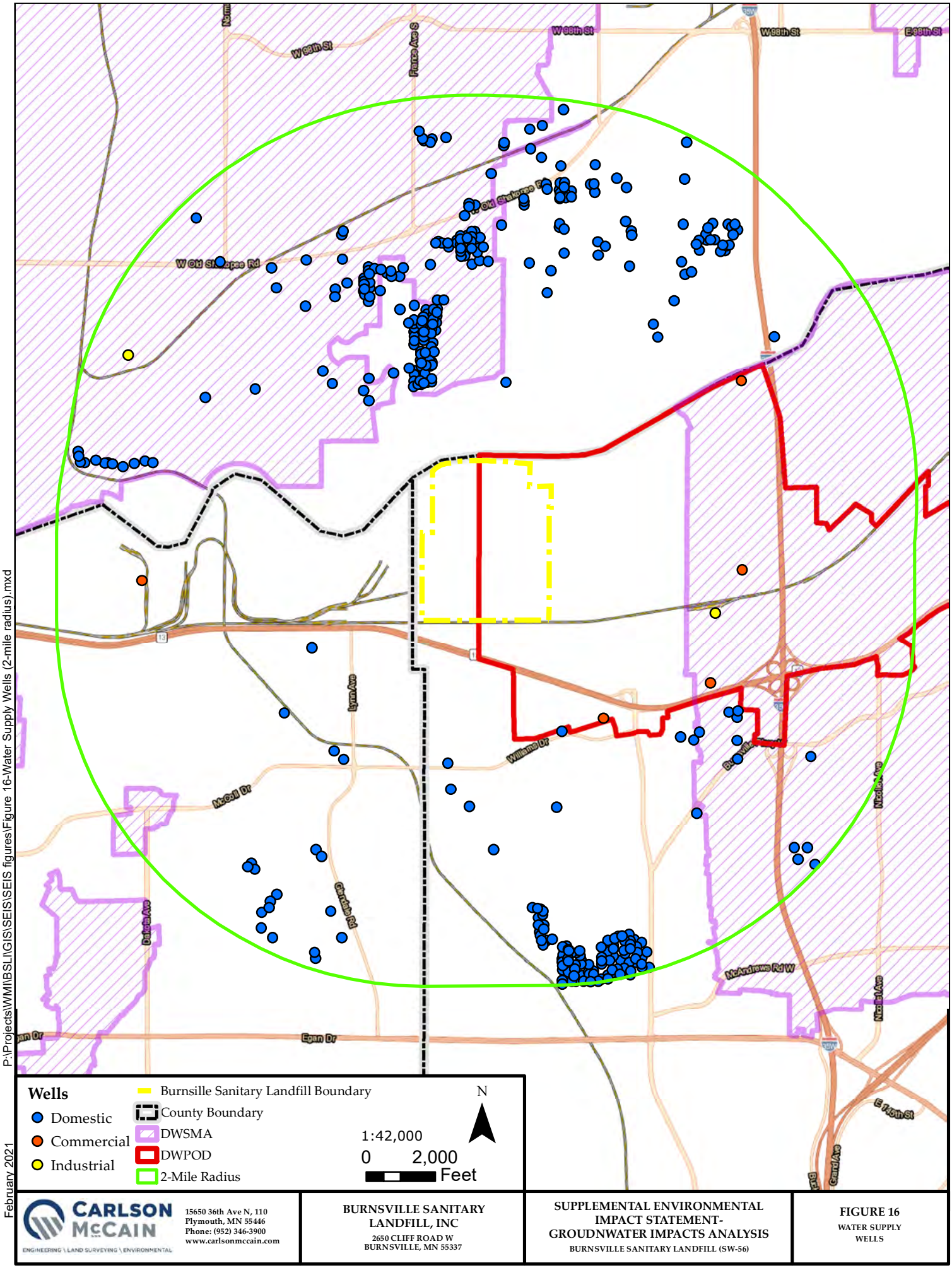
BURNSVILLE SANITARY LANDFILL (SW-56)

FIGURE 15
SCENARIO 3 CROSS SECTIONS



P:\Projects\WMIBSLI\GIS\SEIS\SEIS figures\Figure 16-Water Supply Wells (2-mile radius).mxd

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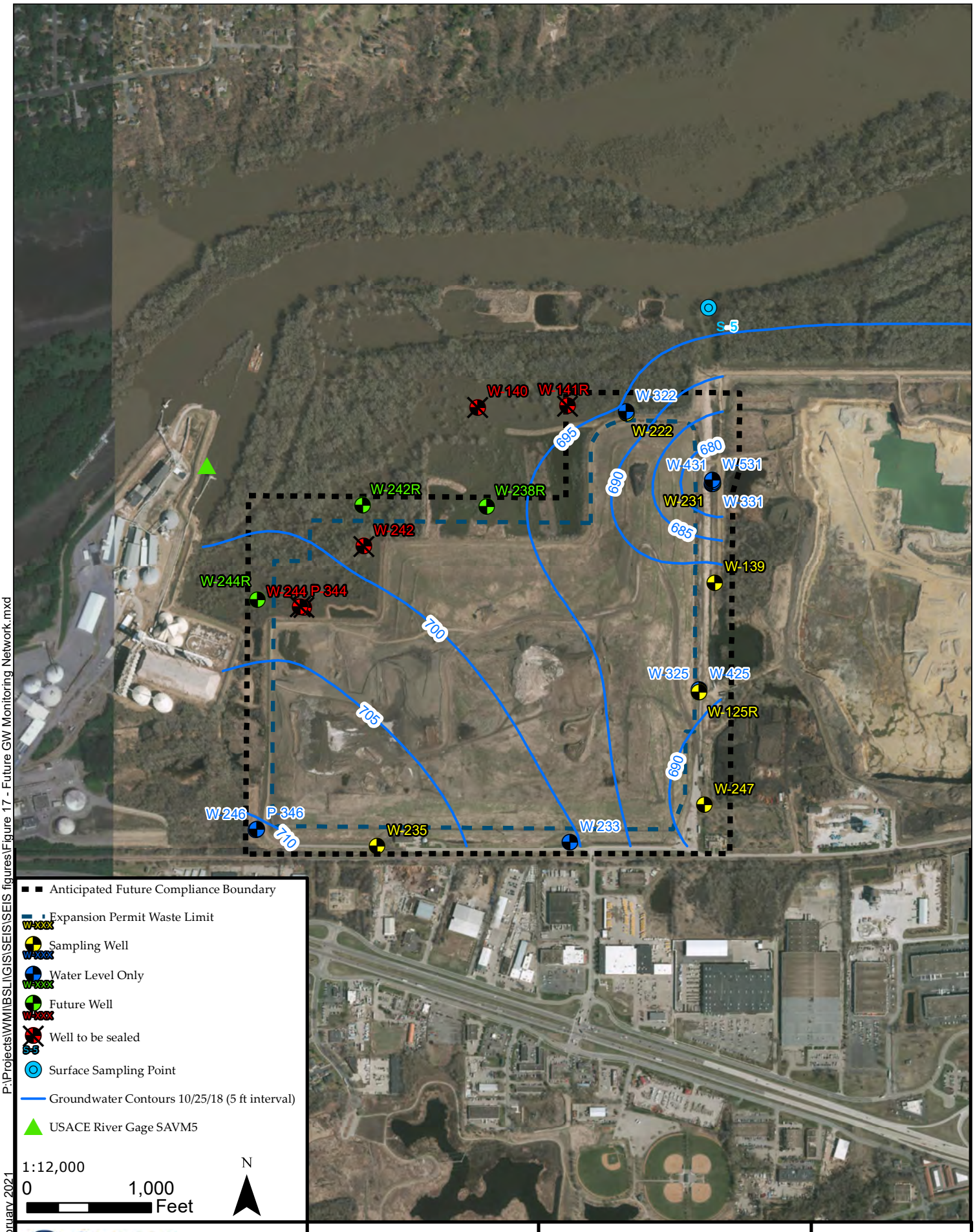
FIGURE 16
WATER SUPPLY WELLS



P:\Projects\WM\IBSL\GIS\SEIS\SEIS figures\Figure 17 - Future GW Monitoring Network.mxd

February 2021

CARLSON McCAIN
ENGINEERING \ LAND SURVEYING \ ENVIRONMENTAL

15650 36th Ave N, 110
Plymouth, MN 55446
Phone: (952) 346-3900
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BURNSVILLE SANITARY LANDFILL, INC
2650 CLIFF ROAD W
BURNSVILLE, MN 55337

SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT-GROUDNWATER IMPACTS ANALYSIS
BURNSVILLE SANITARY LANDFILL (SW-56)

FIGURE 17
POTENTIAL FUTURE GROUNDWATER MONITORING NETWORK

Tables

Table 1 - Permit Limits Table
Burnsville Landfill Groundwater Impacts Analysis

LIMITS TABLE

Comments:

Facility: Burnsville Sanitary Landfill
Permit SW-56

Standard Landfill Monitoring Periods:
Spring: Mar-14 **to** Apr-21
Summer: Jun-21 **to** Jul-31
Fall: Oct-21 **to** Nov-21

This Limits Table applies to the following stations:
P-344 , P-346 , W-233 , W246 , W-322 , W-325 , W-331 , W-425 , W-431 , W-531

Analyte	CAS/EMMI#	Intervention Limit	Units	Frequency	Comments
Static Water Level (Elevation, MSL)	PCA-00-1	-	ft	Spring, Summer and Fall	

LIMITS TABLE

Comments:

Facility: Bumsville Sanitary Landfill
Permit SW-56

Standard Landfill Monitoring Periods:
Spring: Mar-14 to Apr-21
Summer: Jun-21 to Jul-31
Fall: Oct-21 to Nov-21

This Limits Table applies to the following stations:
S-5 , W-125R , W139 , W-140 , W141R , W-222 , W-231 , W-235 , W242 , W244 , W-247

Analyte	CAS/EMMI#	Intervention Limit	Units	Frequency	Comments
1,1,1,2-Tetrachloroethane	630-20-6	-	ug/L	Spring, Summer and Fall	
1,1,1-Trichloroethane	715-56	739.25	ug/L	Spring, Summer and Fall	
1,1,2,2-Tetrachloroethane	793-45	281.75	ug/L	Spring, Summer and Fall	
1,1,2-Trichloroethane	790-05	-	ug/L	Spring, Summer and Fall	
1,1,2-Trichlorotrifluoroethane	761-31	-	ug/L	Spring, Summer and Fall	
1,1-Dichloroethane	753-43	25.0	ug/L	Spring, Summer and Fall	
1,1-Dichloroethylene;(Vinylidene chloride)	753-54	50.0	ug/L	Spring, Summer and Fall	
1,1-Dichloropropene	563-58-6	-	ug/L	Spring, Summer and Fall	
1,2-(trans-) Dichloroethylene	156-60-5	-	ug/L	Spring, Summer and Fall	
1,2,3-Trichlorobenzene	876-16	-	ug/L	Spring, Summer and Fall	
1,2,3-Trichloropropane	961-84	-	ug/L	Spring, Summer and Fall	
1,2,4-Trichlorobenzene	120-82-1	-	ug/L	Spring, Summer and Fall	
1,2,4-Trimethylbenzene	956-36	25.0	ug/L	Spring, Summer and Fall	
1,2-Dibromoethane;(Ethylene dibromide); EDB	106-93-4	-	ug/L	Spring, Summer and Fall	
1,2-Dichlorobenzene (orth-)	955-01	-	ug/L	Spring, Summer and Fall	
1,2-Dichloroethylene (cis-)	156-59-2	1,322.0	ug/L	Spring, Summer and Fall	
1,2-Dichloropropane	788-75	-	ug/L	Spring, Summer and Fall	
1,3,5-Trimethylbenzene	108-67-8	25.0	ug/L	Spring, Summer and Fall	
1,3-Dichlorobenzene (meta-)	541-73-1	-	ug/L	Spring, Summer and Fall	
1,3-Dichloropropane	142-28-9	-	ug/L	Spring, Summer and Fall	
1,4-Dichlorobenzene (para-)	106-46-7	-	ug/L	Spring, Summer and Fall	
2,2-Dichloropropane	594-20-7	-	ug/L	Spring, Summer and Fall	
2-Chlorotoluene (ortho-)	954-98	-	ug/L	Spring, Summer and Fall	
4-Chlorotoluene (para-)	106-43-4	-	ug/L	Spring, Summer and Fall	
Acetone	676-41	-	ug/L	Spring, Summer and Fall	
Alkalinity, Total as CaCO3	T-0-05	-	mg/L	Summer	
Allyl chloride; (3 chloropropene)	107-05-1	-	ug/L	Spring, Summer and Fall	
Appearance	1	-	N/A	Spring, Summer and Fall	
Benzene	714-32	1,121.75	ug/L	Spring, Summer and Fall	
Bromobenzene	108-86-1	-	ug/L	Spring, Summer and Fall	
Bromochloromethane (Chlorobromomethane)	749-75	-	ug/L	Spring, Summer and Fall	

LIMITS TABLE

Comments:

Facility: Burnsville Sanitary Landfill
Permit SW-56

Standard Landfill Monitoring Periods:
Spring: Mar-14 **to** Apr-21
Summer: Jun-21 **to** Jul-31
Fall: Oct-21 **to** Nov-21

This Limits Table applies to the following stations:
S-5 , W-125R , W139 , W-140 , W141R , W-222 , W-231 , W-235 , W242 , W244 , W-247

Analyte	CAS/EMMI#	Intervention Limit	Units	Frequency	Comments
Bromodichloromethane (Dichlorobromomethane)	752-74	-	ug/L	Spring, Summer and Fall	
Bromoform	752-52	725.0	ug/L	Spring, Summer and Fall	
Bromomethane (Methyl bromide)	748-39	-	ug/L	Spring, Summer and Fall	
Calcium	744-07-02	-	mg/L	Summer	
Carbon tetrachloride	562-35	147.5	ug/L	Spring, Summer and Fall	
Cation-Anion Balance	F84-1 -	-	%	Summer	
Chlorobenzene; (monochlorobenzene)	108-90-7	105.75	ug/L	Spring, Summer and Fall	
Chlorodibromomethane;(Dibromochloromethane)	124-48-1	-	ug/L	Spring, Summer and Fall	
Chloroethane	750-03	-	ug/L	Spring, Summer and Fall	
Chloroform	676-63	348.0	ug/L	Spring, Summer and Fall	
Chloromethane; (Methyl chloride)	748-73	-	ug/L	Spring, Summer and Fall	
cis-1,3-Dichloropropene	100-61-015	-	ug/L	Spring, Summer and Fall	
Cumene; (Isopropylbenzene)	988-28	-	ug/L	Spring, Summer and Fall	
Dibromochloropropane; (DBCP)	961-28	-	ug/L	Spring, Summer and Fall	
Dibromomethane; (Methylene bromide)	749-53	-	ug/L	Spring, Summer and Fall	
Dichlorodifluoromethane	757-18	175.0	ug/L	Spring, Summer and Fall	
Dichlorofluoromethane	754-34	-	ug/L	Spring, Summer and Fall	
Dichloromethane; (Methylene chloride)	750-92	3,468.75	ug/L	Spring, Summer and Fall	
Dissolved Oxygen, Field	T-1-05	-	mg/L	Spring, Summer and Fall	Field and lab
Dissolved Solids, Total	C-0-10	-	mg/L	Summer	
Eh (Oxidation potential)	4	-	mV	Spring, Summer and Fall	Field and lab
Ethyl benzene	100-41-4	12.5	ug/L	Spring, Summer and Fall	
Ethyl ether	602-97	50.0	ug/L	Spring, Summer and Fall	
Hexachlorobutadiene	876-83	-	ug/L	Spring, Summer and Fall	
Iron	743-98-96	-	ug/L	Summer	
Magnesium	743-99-54	-	ug/L	Summer	
Manganese	743-99-65	75.0	ug/L	Spring, Summer and Fall	
Methyl ethyl ketone (MEK)	789-33	-	ug/L	Spring, Summer and Fall	
Methyl isobutyl ketone; (4-Methyl-2-pentanone)	108-10-1	-	ug/L	Spring, Summer and Fall	
Methyl tertiary-Butyl Ether (MTBE)	163-40-44	-	ug/L	Spring, Summer and Fall	
Naphthalene	912-03	102.25	ug/L	Spring, Summer and Fall	

LIMITS TABLE

Comments:

Facility: Bumsville Sanitary Landfill
Permit SW-56

Standard Landfill Monitoring Periods:
Spring: Mar-14 to Apr-21
Summer: Jun-21 to Jul-31
Fall: Oct-21 to Nov-21

This Limits Table applies to the following stations:
S-5 , W-125R , W139 , W-140 , W141R , W-222 , W-231 , W-235 , W242 , W244 , W-247

Analyte	CAS/EMMI#	Intervention Limit	Units	Frequency	Comments
n-Butyl Benzene	104-51-8	-	ug/L	Spring, Summer and Fall	
Nitrate (as Nitrogen)	147-97-558	-	ug/L	Summer	
Nitrite (as Nitrogen)	147-97-650	-	ug/L	Summer	
n-Propyl benzene	103-65-1	-	ug/L	Spring, Summer and Fall	
pH	C-0-06	-	SU	Spring, Summer and Fall	Field and lab
p-Isopropyltoluene	998-76	-	ug/L	Spring, Summer and Fall	
Potassium	744-00-97	-	ug/L	Summer	
sec-Butyl Benzene	135-98-8	-	ug/L	Spring, Summer and Fall	
Sodium	744-02-35	-	ug/L	Summer	
Specific Conductance	C-0-11	-	umho/cm	Spring, Summer and Fall	Field and lab
Styrene	100-42-5	55.875	ug/L	Spring, Summer and Fall	
Sulfate	148-08-798	-	mg/L	Summer	
Suspended Solids, Total	C-0-09	-	mg/L	Summer	
Temperature	T-1-21	-	Deg C	Spring, Summer and Fall	Field and lab
tert-Butyl Benzene	980-66	-	ug/L	Spring, Summer and Fall	
Tetrachloroethylene; (Perchloroethylene)	127-18-4	107.0	ug/L	Spring, Summer and Fall	
Tetrahydrofuran	109-99-9	-	ug/L	Spring, Summer and Fall	
Toluene	108-88-3	50.0	ug/L	Spring, Summer and Fall	
Trichloroethylene; (TCE)	790-16	1,747.0	ug/L	Spring, Summer and Fall	
Trichlorofluoromethane	756-94	-	ug/L	Spring, Summer and Fall	
Turbidity, Field	G-0-19	-	NTU	Spring, Summer and Fall	
Vinyl chloride; (chloroethene)	750-14	230.0	ug/L	Spring, Summer and Fall	
Zinc	744-06-66	86.5	ug/L	Summer	

Table 2
High Capacity Water Use - Two Mile Radius
2014-2018
Burnsville Sanitary Landfill

Permit	Owner	Annual Volume (mgy)	Rate (gpm)	Resource Name	Use	Annual Reported Pumping (mgy)					Five Year	Five Year
						2018	2017	2016	2015	2014	Ave. mgy	Ave. mgd
1959-0286	Kraemer Mining & Minerals, Inc.	250.0	3,000.0	Burnsville Quarry	Sand & Gravel Washing	174.3	181.4	78.8	81.1	87.7	120.7	0.3
1968-1117	Savage Public Works	1,250.0	10,240.0	CMTS	Municipal/Public Water Supply							
1969-0053	Bloomington Public Works	68.0	450.0	OPCJ	Golf Course Irrigation	35.6	34.9	33.1	38.5	34.3	35.3	0.1
1974-5014	Burnsville Public Works	3,400.0		CJDN	Municipal/Public Water Supply	732.6	799.8	942.0	1,142.5	841.7	891.7	2.4
1974-5014	Burnsville Public Works	3,400.0		OPCJ	Municipal/Public Water Supply							
1974-5014	Burnsville Public Works	3,400.0		CMTS	Municipal/Public Water Supply							
1974-5014	Burnsville Public Works	3,400.0		CFRN-CMTS	Municipal/Public Water Supply							
1976-6200	Bloomington Public Works	13.3	225.0	OPDC-CFRN	Landscaping/Athletic Field Irrig	6.3	4.9	6.2	3.6	5.2	5.2	0.0
1988-6329	Kraemer Mining & Minerals, Inc.	4,000.0	20,000.0	Burnsville Quarry	Quarry Dewatering	3,481.5	3,321.0	3,026.9	2,679.9	3,122.2	3,126.3	8.6
1992-6212	Minnesota Valley Country Club	60.0	450.0	CJDN	Golf Course Irrigation	24.6	22.6	22.4	14.7	28.4	22.6	0.1
1992-6212	Minnesota Valley Country Club	60.0	450.0	Pit/Pond	Golf Course Irrigation							
1997-6148	Bloomington Public Works	22.0	550.0	QBAA	Golf Course Irrigation	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1997-6148	Bloomington Public Works	22.0	550.0	CJDN	Golf Course Irrigation	9.7	8.1	8.5	10.4	9.2	9.2	0.0
2007-0101	Burnsville Public Works	1,500.0	3,820.0	Kraemer Quarry	Municipal/Public Water Supply	1,133.6	1,094.9	1,063.9	1,050.6	1,134.7	1,095.5	3.0
2009-0352	Superior Minerals Company	6.6	220.0	Minnesota River	Other Special Categories							
2018-0377	CenterPoint Energy	26.0	150.0	Pit/Pond	Other Water Level Maintenance							
2018-3335	General Permit				Temporary Construction and Dewatering	5.0	0.0	0.0	0.0	0.0	1.0	0.0
gpm = Gallons per Minute					Total Annual Pumping within 2 miles from OPDC, CJDN and Kraemer Quarry	5,603.2	5,467.6	5,181.8	5,021.3	5,263.5	5,307.5	14.5
mgy = Million Gallons per Year												
mgd = Million Gallons per day					Total Annual Pumping Within 2 Miles, South of the River	5,562.5	5,431.9	5,144.8	4,992.6	5,220.6	5,269.5	14.4
	North of River											
	Water Source Not Relevant				Kraemer Quarry Pumping 1959-0286 & 1988-6392	3,655.8	3,502.4	3,105.7	2,761.0	3,209.9	3,247.0	8.9
					City of Burnsville Pumping from OPDC, CJDN and Kraemer Quarry	1,866.1	1,894.7	2,005.9	2,193.1	1,976.4	1,987.2	5.4
					Kraemer and City Pumping from OPDC, CJDN and Kraemer Quarry	5,521.9	5,397.0	5,111.7	4,954.1	5,186.3	5,234.2	14.3
					Kraemer and City Pumping from Kraemer Quarry	4,789.3	4,597.3	4,169.7	3,811.6	4,344.6	4,342.5	11.9

TABLE 3
INTERVENTION LIMIT EXCEEDENCES
2014-2019

Burnsville Sanitary Landfill

Well	Date	Concentration
Manganese		**IL = 0.075 mg/L**
W-125R	7/24/2014 & 9/12/2014	0.135
W-125R	7/15/2015	0.217
W-125R	5/16/2016	0.28
W-125R	7/14/2016	0.235
W-125R	4/17/2017	0.3
W-125R	7/26/2017 & 8/16/2017	0.201
W-125R	11/15/2017	0.18
W-125R	4/12/2018	0.48
W-125R	7/30/2018	0.118
W-125R	10/23/2018 & 10/24/2018	0.16
W-125R	5/21/2019 & 5/22/2019	0.19
W-125R	7/24/2019 & 7/25/2019	0.134
W-125R	11/11/2019 & 11/12/2019	0.14
W-139	7/24/2014 & 9/12/2014	2.18
W-139	7/15/2015	3.91
W-139	5/16/2016	1.2
W-139	7/14/2016	1.29
W-139	4/17/2017	0.79
W-139	7/26/2017 & 8/16/2017	0.583
W-139	11/15/2017	0.64
W-139	4/12/2018	0.22
W-139	7/30/2018	0.58
W-139	10/23/2018 & 10/24/2018	0.74
W-139	5/21/2019 & 5/22/2019	0.77
W-139	7/24/2019 & 7/25/2019	0.79
W-139	11/11/2019 & 11/12/2019	1.1
W-140	7/24/2014 & 9/12/2014	2.62
W-140	5/16/2016	2.8
W-140	7/26/2017 & 8/16/2017	2.74
W-140	11/15/2017	2.6
W-141R	7/24/2014 & 9/12/2014	0.546
W-141R	7/15/2015	0.331
W-141R	5/16/2016	0.32
W-141R	7/14/2016	0.233
W-141R	4/17/2017	0.76
W-141R	7/26/2017 & 8/16/2017	1.39
W-141R	11/15/2017	0.63
W-141R	4/12/2018	0.3
W-222	7/24/2014 & 9/12/2014	0.4
W-222	7/15/2015	0.338
W-222	5/16/2016	0.34
W-222	7/14/2016	0.315
W-222	4/17/2017	0.54
W-222	7/26/2017 & 8/16/2017	0.489
W-222	11/15/2017	0.52
W-222	4/12/2018	0.63
W-222	7/30/2018	0.496
W-222	10/23/2018 & 10/24/2018	0.72
W-222	5/21/2019 & 5/22/2019	0.59

TABLE 3
INTERVENTION LIMIT EXCEEDENCES
2014-2019

Burnsville Sanitary Landfill

Well	Date	Concentration
Manganese		**IL = 0.075 mg/L**
W-222	7/24/2019 & 7/25/2019	0.383
W-222	11/11/2019 & 11/12/2019	0.4
W-231	7/24/2014 & 9/12/2014	0.889
W-231	7/15/2015	0.086
W-231	5/16/2016	0.825
W-231	4/17/2017	0.48
W-231	7/26/2017 & 8/16/2017	0.712
W-231	11/15/2017	0.69
W-231	4/12/2018	0.28
W-231	7/30/2018	0.528
W-231	10/23/2018 & 10/24/2018	0.67
W-231	5/21/2019 & 5/22/2019	0.8
W-231	7/24/2019 & 7/25/2019	0.7
W-235	7/24/2014 & 9/12/2014	0.385
W-235	7/15/2015	0.293
W-235	5/16/2016	0.49
W-235	7/14/2016	0.492
W-235	7/26/2017 & 8/16/2017	0.37
W-235	11/15/2017	0.43
W-235	4/12/2018	0.4
W-235	7/30/2018	0.557
W-235	10/23/2018 & 10/24/2018	0.56
W-235	5/21/2019 & 5/22/2019	0.44
W-235	7/24/2019 & 7/25/2019	0.46
W-235	11/11/2019 & 11/12/2019	0.44
W-244	5/16/2016	0.7
W-244	4/17/2017	0.35
W-244	7/26/2017 & 8/16/2017	0.478
W-244	11/15/2017	0.087
W-244	4/12/2018	0.15
W-244	7/30/2018	0.105
W-244	7/24/2019 & 7/25/2019	0.0905
W-247	7/24/2014 & 9/12/2014	1.25
W-247	7/15/2015	0.817
W-247	5/16/2016	0.96
W-247	7/14/2016	1.15
W-247	4/17/2017	1
W-247	7/26/2017 & 8/16/2017	1.24
W-247	11/15/2017	1.9
W-247	4/12/2018	3.2
W-247	7/30/2018	0.728
W-247	10/23/2018 & 10/24/2018	0.54
W-247	5/21/2019 & 5/22/2019	0.48
W-247	7/24/2019 & 7/25/2019	0.844
W-247	11/11/2019 & 11/12/2019	0.82
S-5	11/15/2017	0.097
S-5	7/24/2019 & 7/25/2019	0.198
S-5	11/11/2019 & 11/12/2019	0.077

IL = Intervention Limit

Table 4
VOC DETECTIONS
2014-2019
Burnsville Sanitary Landfill

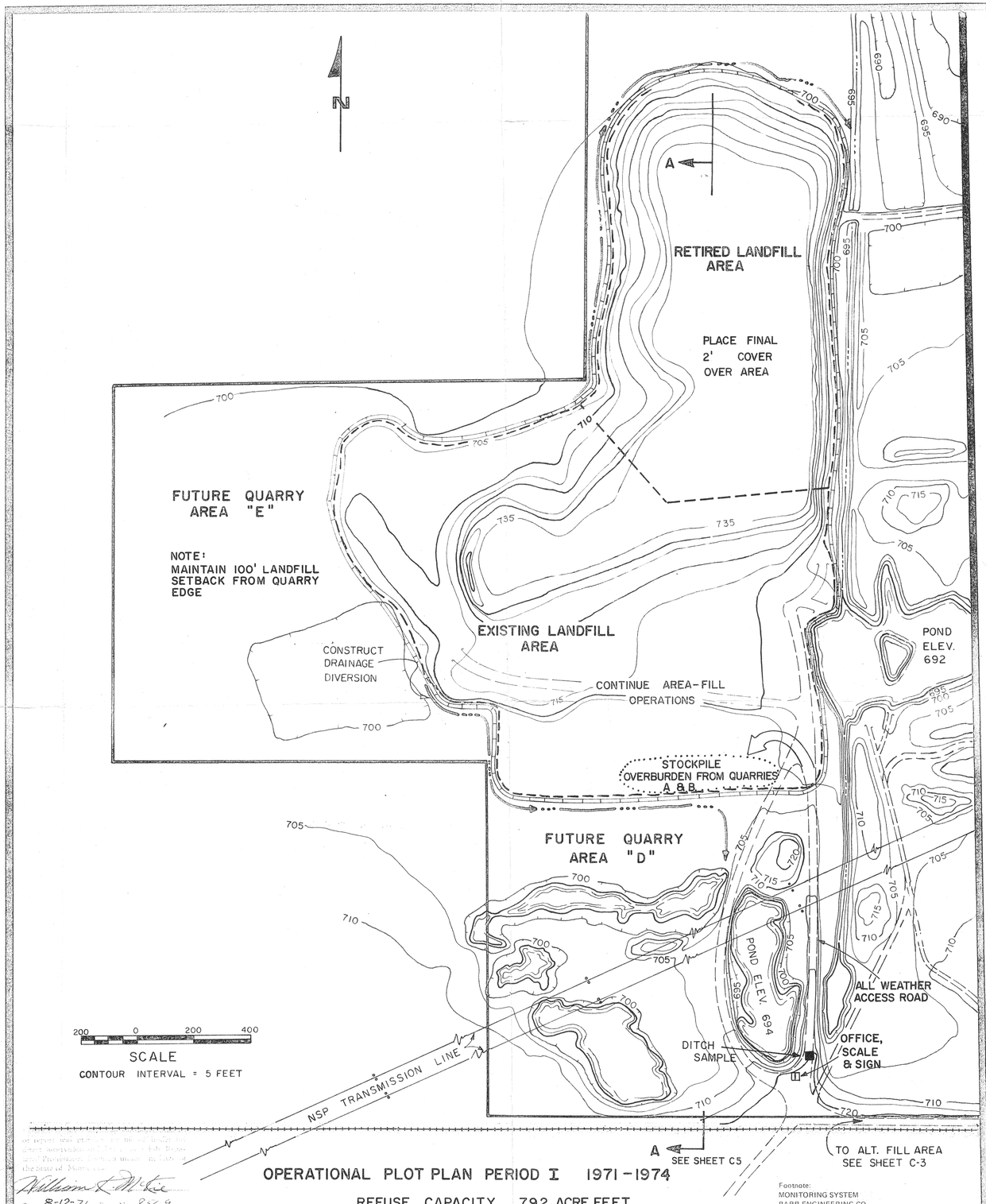
Well	Parameter	Date	Unit	IL	Concentration
W-125R	Ethyl ether	4/18/2014	ug/L	50	5.3
		7/15/2015	ug/L	50	1.1
		11/2-3/2015	ug/L	50	1.9
	Chloroethane	4/18/2014	ug/L	-	1.20
		4/12/2018	ug/L	-	3.50
W-222	Ethyl ether	11/11/2014	ug/L	50	1.30
		7/15/2015	ug/L	50	1.20
		11/2-3/2015	ug/L	50	1.80
		7/14/2016	ug/L	50	1.20
W-235	Benzene	11/2-3/2015	ug/L	1121.75	1.5

IL = Intervention Limit

- = IL not established

Appendix A

1971 and 1973 Landfill Development Plans

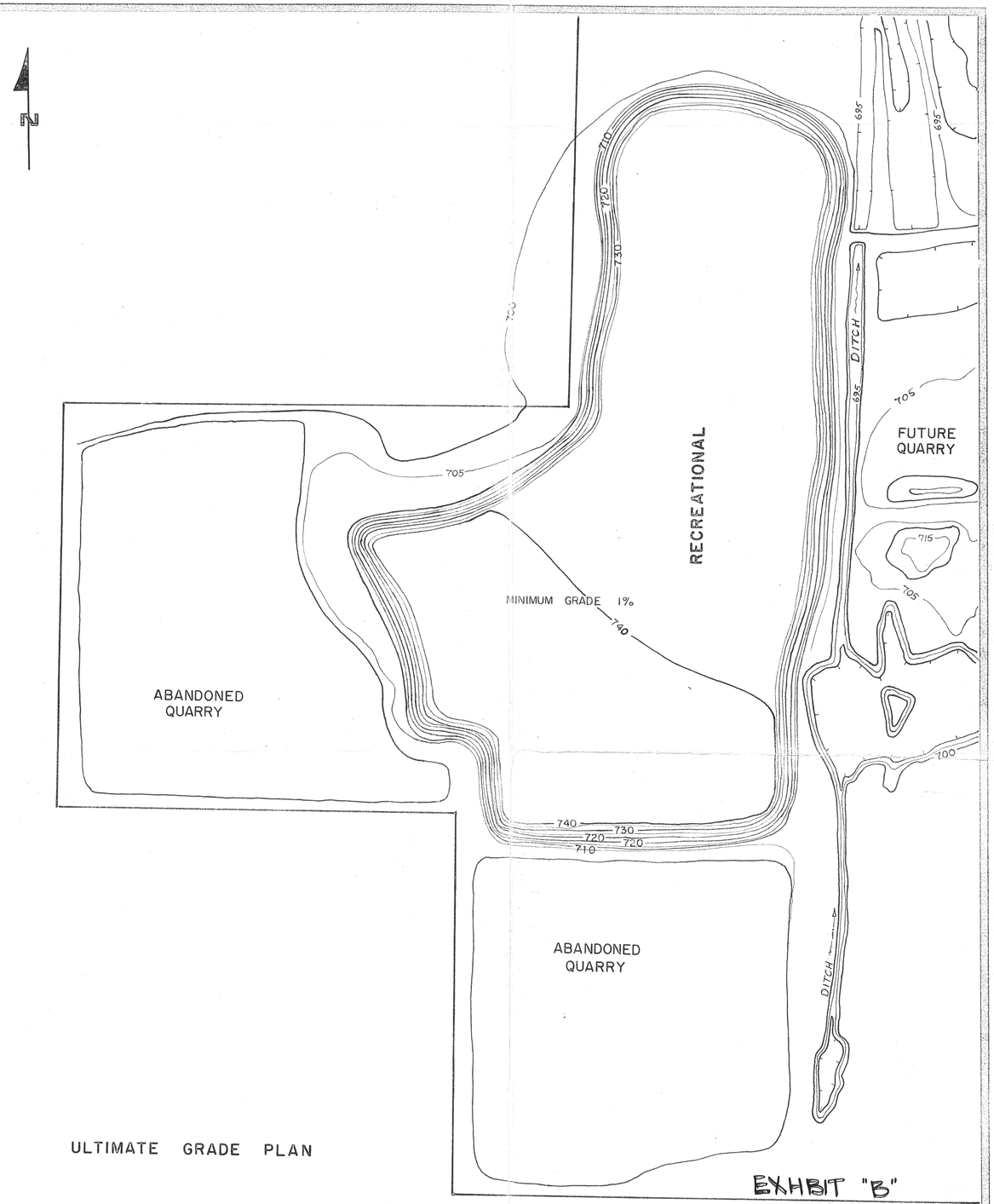


OPERATIONAL PLOT PLAN PERIOD I 1971-1974

REFUSE CAPACITY 792 ACRE FEET

Footnote:
MONITORING SYSTEM
BARR ENGINEERING CO.

William K. McKie
Date 8-12-71 Reg. No. 8569



ULTIMATE GRADE PLAN

EXHIBIT "B"
Drawings C-2 thru C-6

William K. McKie and Assoc., Inc.
4620 West 77th Street • Minneapolis, Minnesota 55435

MIDWEST PLANNING & RESEARCH, INC.
Land Planning & Urban Research Consultants
Minneapolis, Minnesota —— Madison, Wisconsin

JOB NAME	KRAEMER	DATE	1/15/71	DRAWN	J. ROOS
LOCATION	BURNSVILLE	REVISION	8/12/71	DRAWING No.	C-2

C

D

CONSTRUCT DRAINAGE DIVERSION

CLEAN FILL TO ELEV. 700

CLEAN FILL TO ELEV. 704.5

QUARRY AREA "A"

LANDFILL AREA "3"

100'

FUTURE QUARRY AREA "C"

CONSTRUCT DRAINAGE DIVERSION

STOCKPILE

OFFICE & SCALE

PROPERTY LINES

NSP EXCEPTION

CASPERSON EXCEPTION

NOTE: MAINTAIN 100' LANDFILL SETBACK FROM QUARRY EDGE

CLEAN FILL TO ELEV. 705

LANDFILL AREA "2"

STOCKPILE

NSP TRANSMISSION LINES

LANDFILL AREA I

SEE SHEET C3

CONSTRUCT DRAINAGE DIVERSION

CONSTRUCT ALL WEATHER ACCESS ROAD

OFFICE & SCALE

FUTURE PLANT AREA

DITCH SAMPLE

CONTROL WELL

Footnote: MONITORING SYSTEM BARR ENGINEERING CO.

C

SEE SHEET C5

D

SEE SHEET C5

200 0 200 400

SCALE

CONTOUR INTERVAL = 5'

I hereby certify that these plans, specifications or report was prepared by me or under my direct supervision and that I am a duly Registered Professional Engineer under the laws of the State of Minnesota.

William K. McKie

Date 8-12-71 Reg. No. 8569

OPERATIONAL PLOT PLAN PERIOD III 1982-1984

REFUSE CAPACITY 1607 ACRE FEET

N

MINIMUM GRADE 1%

ABANDONED QUARRY

DITCH

PROPERTY LINES

CASPERSON EXCEPTION

NSP EXCEPTION

INDUSTRIAL

NSP TRANSMISSION LINES

ABANDONED QUARRY

ULTIMATE GRADE PLAN

200 0 200 400

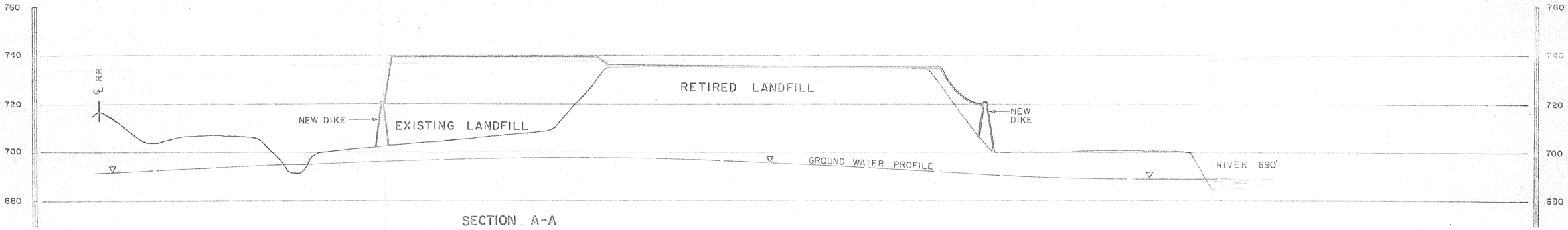
SCALE

CONTOUR INTERVAL = 10'

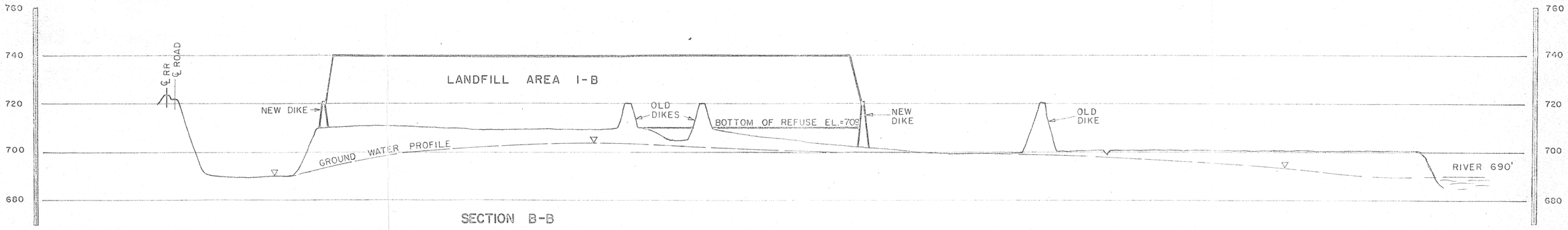
William K. McKie and Assoc., Inc.
4620 West 77th Street • Minneapolis, Minnesota 55435

MIDWEST PLANNING & RESEARCH, INC.
Land Planning & Urban Research Consultants
Minneapolis, Minnesota ——— Madison, Wisconsin

JOB NAME	KRAEMER	DATE	1/15/71	DRAWN	J. ROOS
LOCATION	BURNSVILLE	REVISION	8/12/71	DRAWING No.	C-4



SECTION A-A



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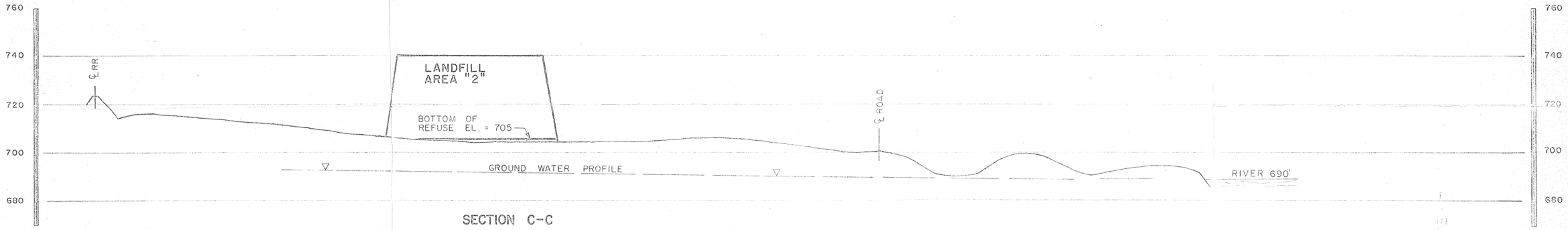

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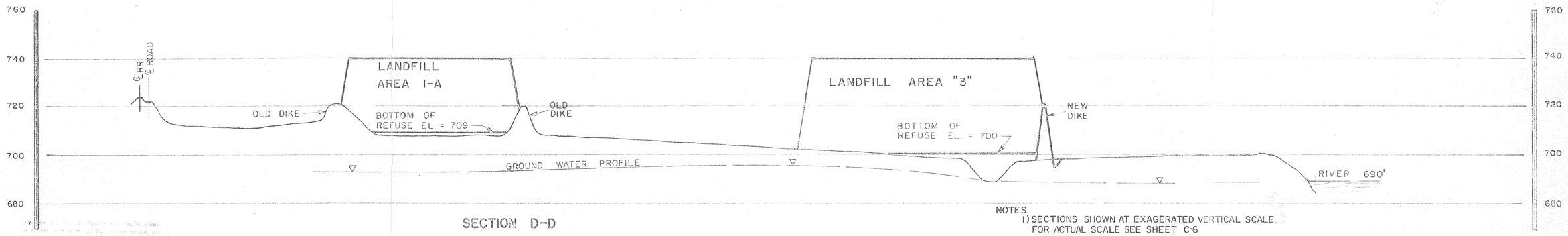


SECTION D-D

NOTES
1) SECTIONS SHOWN AT EXAGERATED VERTICAL SCALE. FOR ACTUAL SCALE SEE SHEET C-6
2) GROUND WATER INFORMATION FROM BARR ENGINEERING CONTOUR MAP

200 0 200 400
TYPICAL HORIZONTAL SCALE

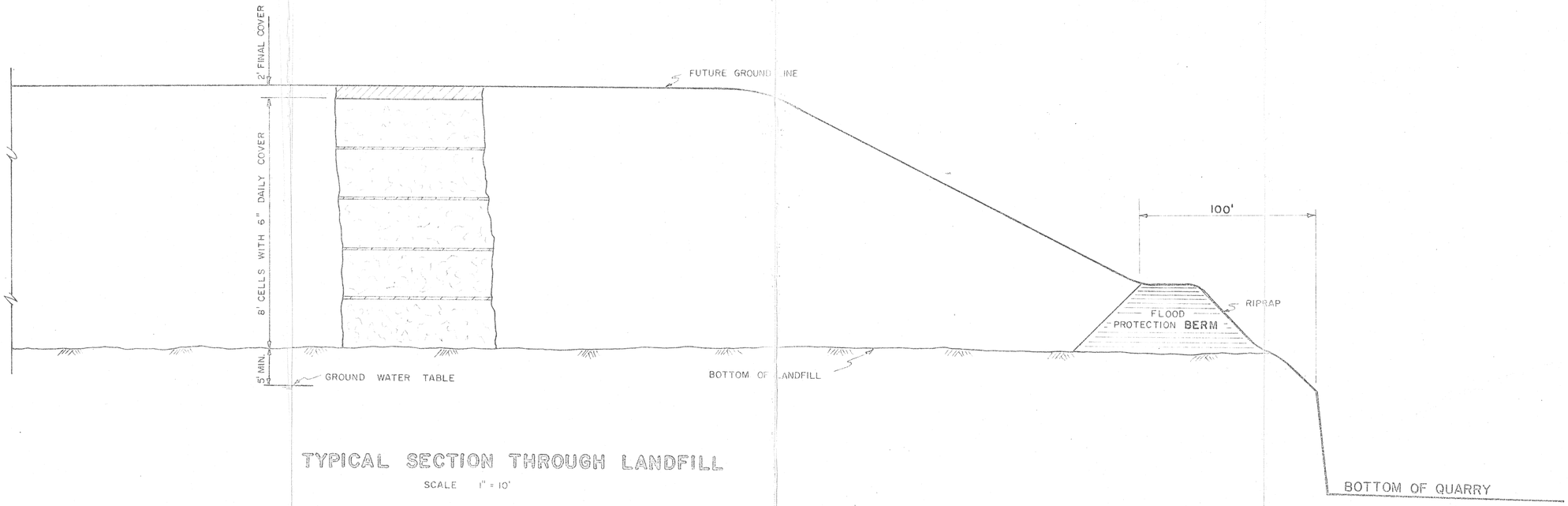
I hereby certify that this plan, specification or report was prepared by me or under my direct supervision and that I am a duly licensed Professional Engineer under the laws of the State of Minnesota.

William K. McKie
Date 8-12-71 Reg. No. 2569

William K. McKie and Assoc., Inc.
4620 West 77th Street • Minneapolis, Minnesota 55435

MIDWEST PLANNING & RESEARCH, INC.
Land Planning & Urban Research Consultants
Minneapolis, Minnesota ——— Madison, Wisconsin

JOB NAME	KRAEMER	DATE	1/15/71	DRAWN	J. MOREIRA
LOCATION	BURNSVILLE	REVISION	8/12/71	DRAWING No.	C-5



TYPICAL SECTION THROUGH LANDFILL

SCALE 1" = 10'

William K. McKie
Date 8-12-71 1967

William K. McKie and Assoc., Inc.
4620 West 77th Street • Minneapolis, Minnesota 55435

MIDWEST PLANNING & RESEARCH, INC.
Land Planning & Urban Research Consultants
Minneapolis, Minnesota ——— Madison, Wisconsin

JOB NAME	KRAEMER	DATE	1/20/71	DRAWN	J. ROOS
LOCATION	BURNSVILLE	REVISION	8/12/71	DRAWING No.	C-6

I hereby certify that these plans, specifications or report was prepared by me or under my direct supervision and that I am a duly Registered Professional Engineer under the laws of the State of Minnesota.

William K. McKie
9/21/73
Date Reg. No. 8569

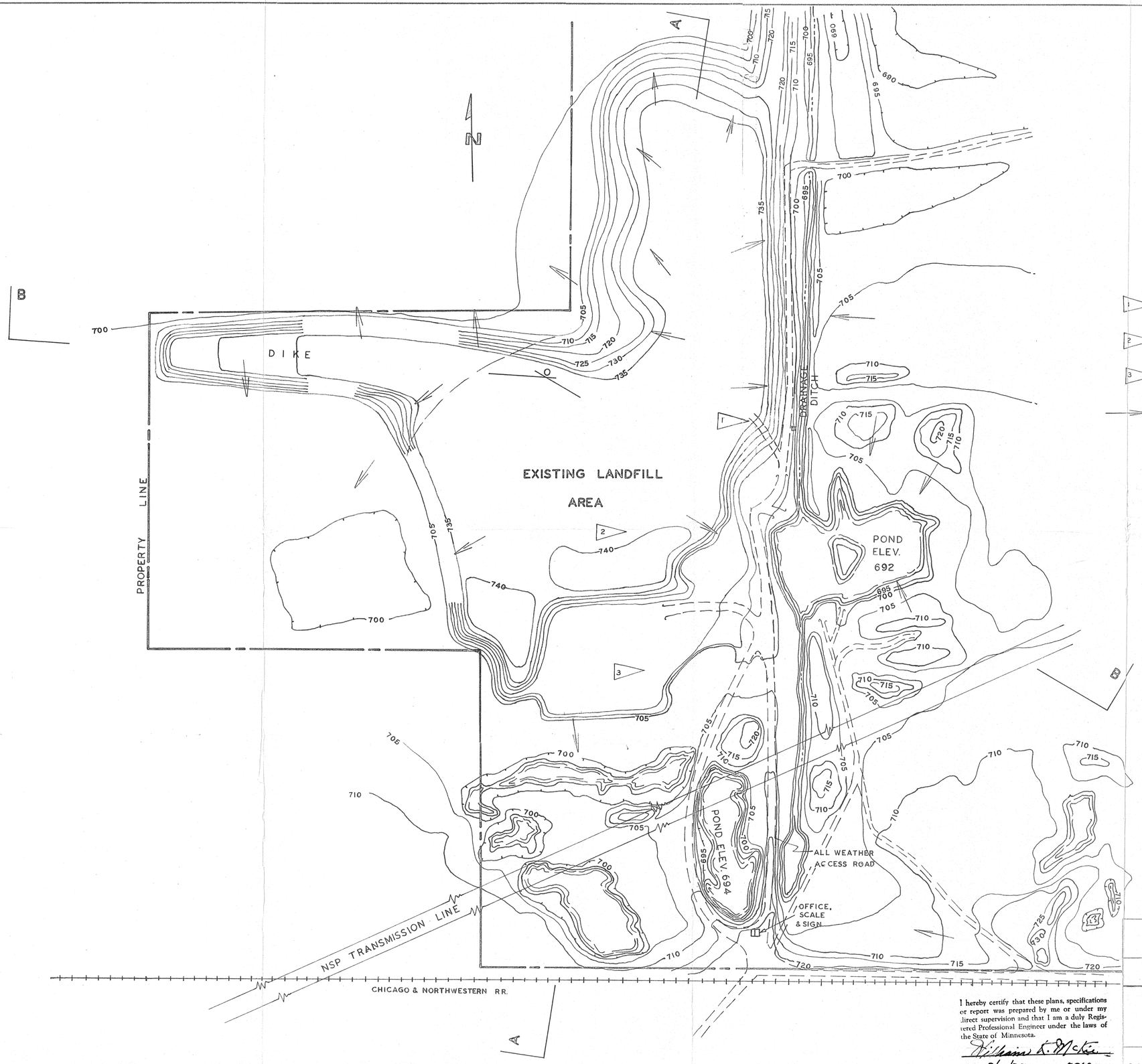
William K. McKie and Assoc., Inc.
201 W. Burnsville Crosstown • Burnsville, Minnesota 55337

BURNSVILLE SANITARY LANDFILL

GENERAL CONTOUR MAP

Drawn by: N
Designed by:
Checked by:
Date: 9/18/73
Scale: 1" = 400'

Job No. 343
CLIENT_ E. KRAEMER & SONS, INC.
Sheet 1 of 4 sheets



1. CONSTRUCT AN ALL WEATHER ACCESS ROAD TO THE TOP OF PRESENT FILL AREA
2. START FILLING OPERATIONS ON TOP OF CURRENT FILLING AREA
3. PRESENT ACTIVE AREA (SOUTH END) IS TO REMAIN AS HOUSE HOLDERS DUMPING AREA

→ REPRESENTS DRAINAGE PATTERN

I hereby certify that these plans, specifications or report was prepared by me or under my direct supervision and that I am a duly Registered Professional Engineer under the laws of the State of Minnesota.

William K. McKie

Date 9/21/73 Reg. No. 8569

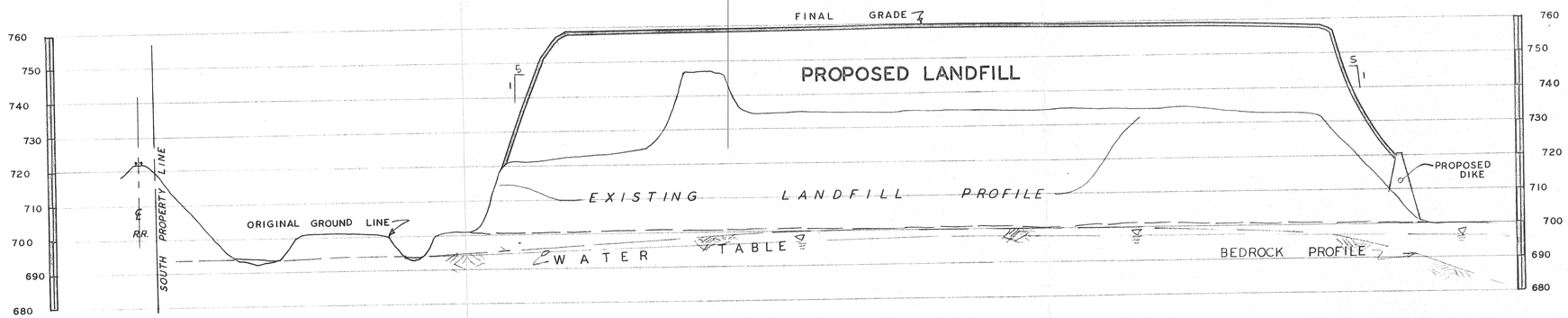
William K. McKie and Assoc., Inc.
201 W. Burnsville Crosstown • Burnsville, Minnesota 55337

BURNSVILLE SANITARY LANDFILL

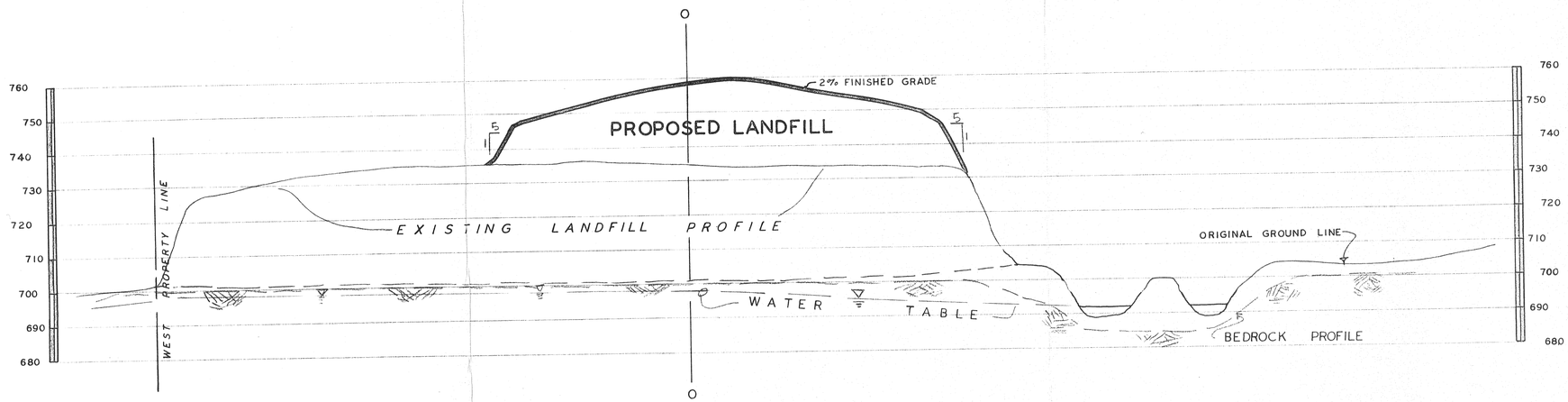
OPERATIONAL PLAN

Drawn by CM
Designed by
Checked by WK
Date 9/21/73
Scale 1" = 200'

Project No. 343
CLIENT E. KRAEMER & SONS, INC.
Sheet 2 of 4 sheets



SECTION A-A



SECTION B-B

SCALE:

HOR.- 1"= 200'

VER.- 1"= 20'

1.) SECTIONS SHOWN AT EXAGGERATED VERTICAL SCALE

I hereby certify that these plans, specifications or report was prepared by me or under my direct supervision and that I am a duly Registered Professional Engineer under the laws of the State of Minnesota.

William K. McKie

Date 9/21/73 Reg. No. 8569

William K. McKie and Assoc., Inc.
201 W. Burnsville Crosstown • Burnsville, Minnesota 55337

BURNSVILLE SANITARY LANDFILL

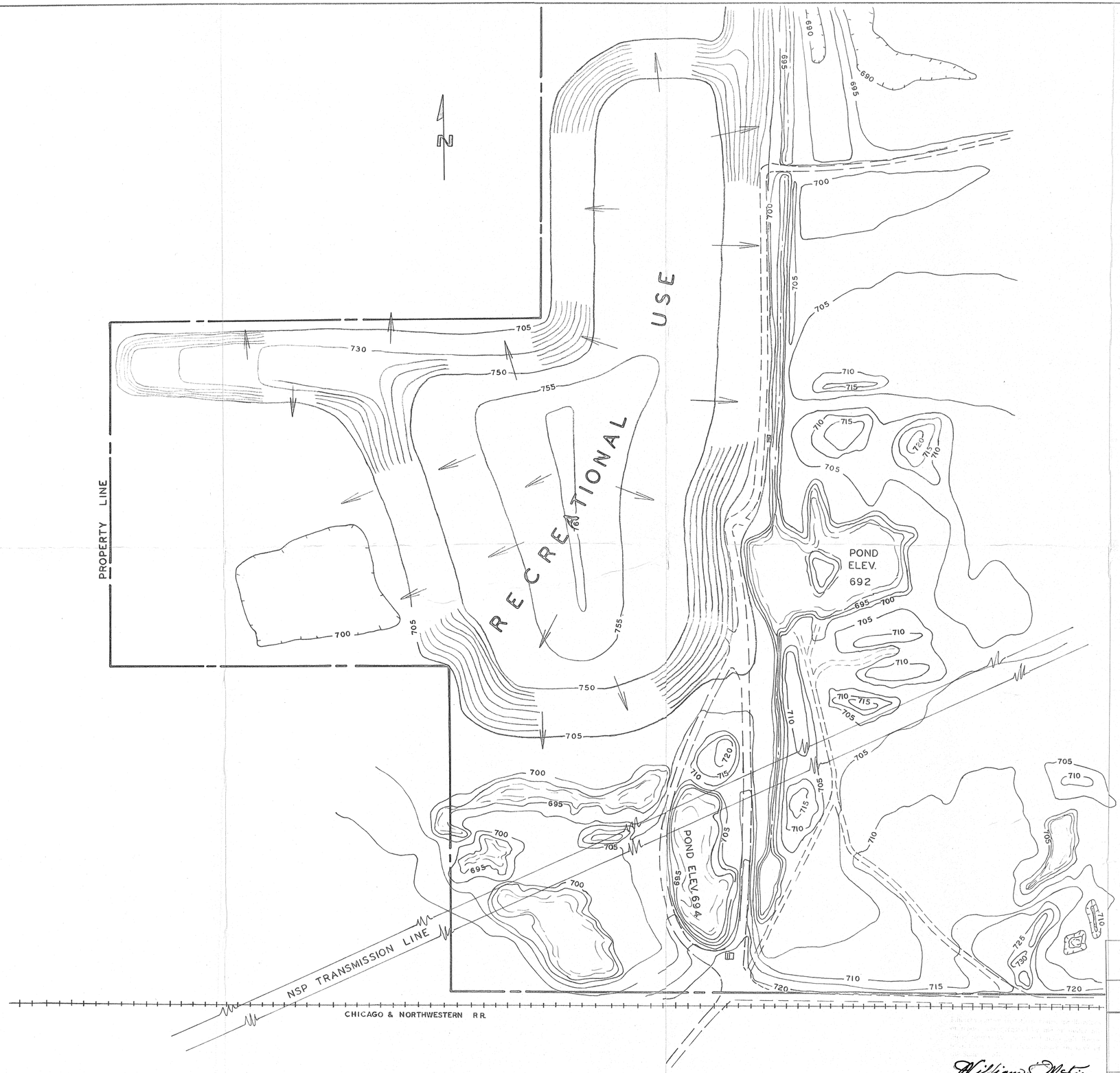
CROSS SECTIONS

Drawn by JM
Designed by
Checked by
Date
Scale

Project No. 343

CLIENT E. KRAEMER & SONS, INC.

Sheet 3 of 4 sheets



William K. McKie and Assoc., Inc.
201 W. Burnsville Crosstown • Burnsville, Minnesota 55337

BURNSVILLE SANITARY LANDFILL

FINAL GRADE PLAN

Drawn by M
Designed by
Checked by
Date
1" = 200'

Project No. 343

CLIENT - E. KRAEMER & SONS, INC.

William K. McKie
9/21/73 8569

Appendix B

Historic Topographic Maps and Air Photos

5-8-60

MCY-1-162

1960

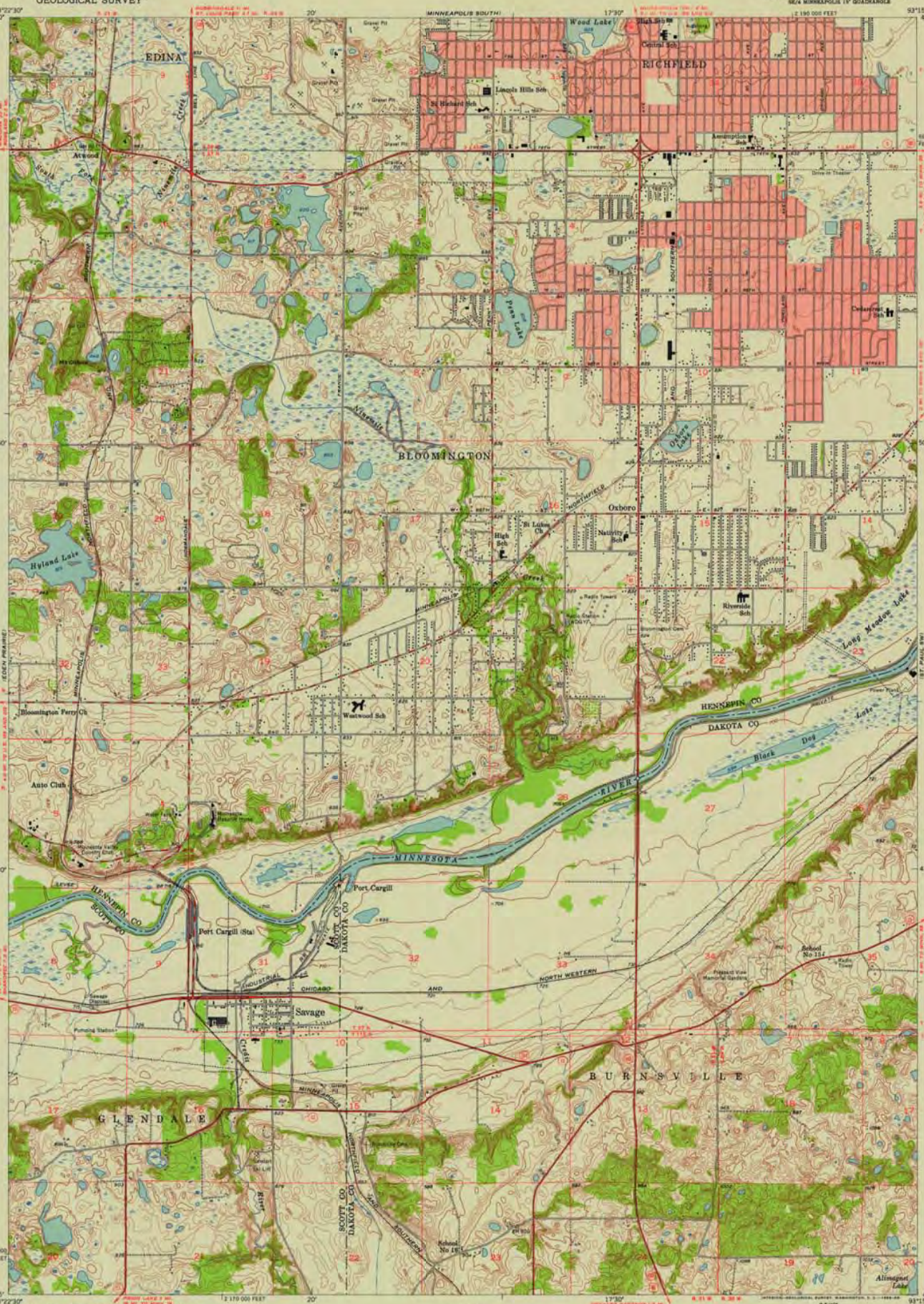
1964

1966

1970

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

BLOOMINGTON QUADRANGLE
MINNESOTA
7.5 MINUTE SERIES (TOPOGRAPHIC)
SE/4 MINNEAPOLIS 15' QUADRANGLE



Mapped, edited, and published by the Geological Survey

Control by USGS and USC&GS

Topography from aerial photographs by Kelsh plotter and by planetable surveys 1954. Aerial photographs taken 1947 and 1951

Polyconic projection. 1927 North American datum
10,000-foot grid based on Minnesota coordinate system, south zone

Red tint indicates areas in which only landmark buildings are shown

Dotted land lines were established by Hennepin County Surveyor and by private surveys

TRUE NORTH
MAGNETIC NORTH
9°
APPROXIMATE MEAN DECLINATION, 1954

SCALE 1:24000

1 ½ 0 1 MILE

1000 0 1000 2000 3000 4000 5000 6000 7000 FEET

1 .5 0 1 KILOMETER

CONTOUR INTERVAL 10 FEET
DATUM IS MEAN SEA LEVEL

MINN.
QUADRANGLE LOCATION

ROAD CLASSIFICATION

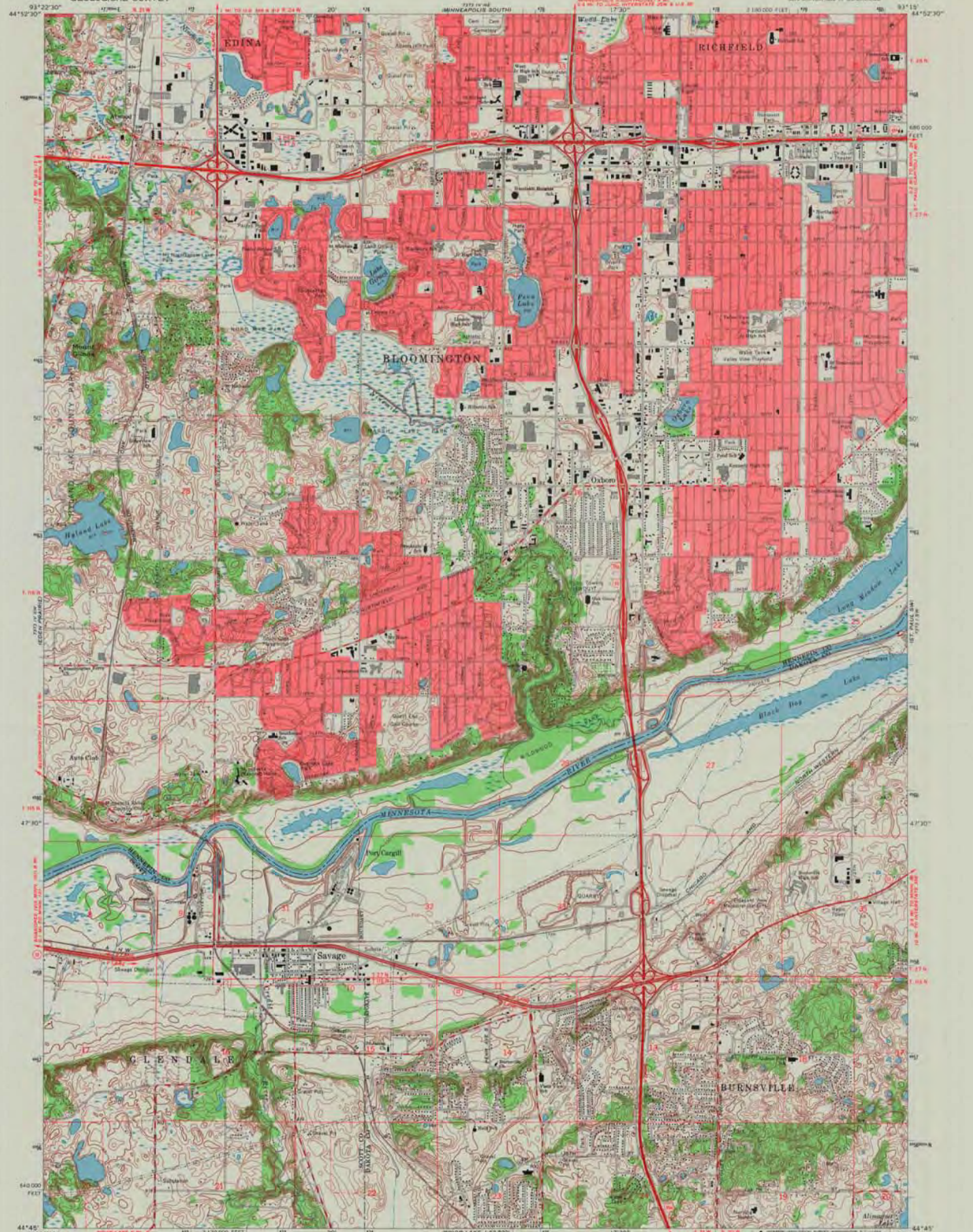
Heavy-duty — Light-duty
Medium-duty — Unimproved dirt
U. S. Route — State Route

BLOOMINGTON, MINN.
SE/4 MINNEAPOLIS 15' QUADRANGLE
N4445—W9315/7.5

1954

THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS
FOR SALE BY U. S. GEOLOGICAL SURVEY, FEDERAL CENTER, DENVER, COLORADO OR WASHINGTON 25, D. C.
A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST

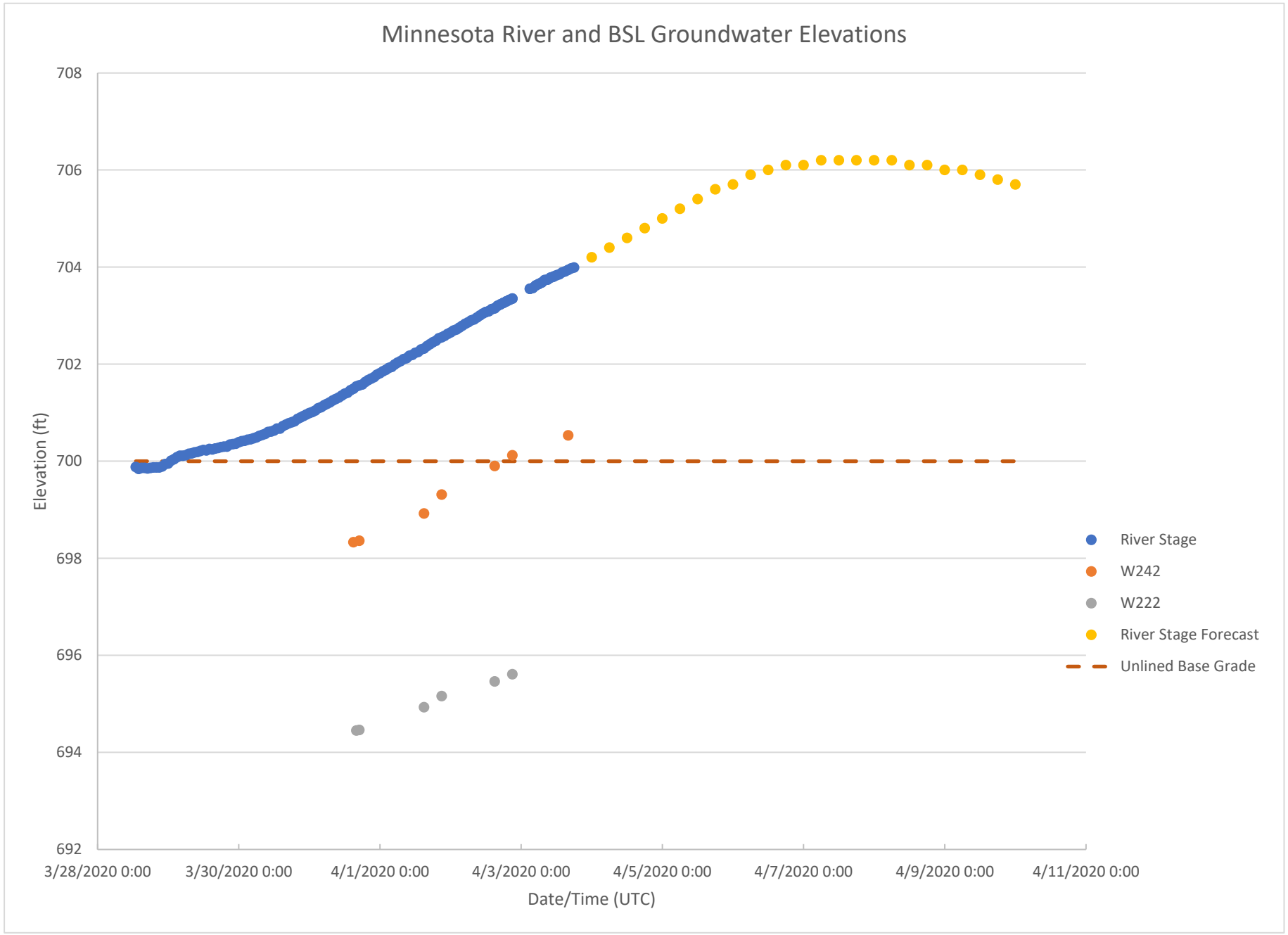
UNIVERSITY OF WISCONSIN
Department of Geography



MAP AND AIR PHOTO LIBRARY
MAR 10 1970

Appendix C

River Stage Data



River stage data from Natl. Weather Service Hydrologic Prediction Service online utility.
Groundwater elevation measured using hand-held water level indicator.

Attachment C

Surface Water Technical Reports

Attachment C-1

HydroCAD Modeling Methodology

Attachment C-1: HydroCAD Modeling Methodology and Stormwater Pond Design and Analysis Basis

Modeling Methodology of Pre-expansion and Post Project Conditions

Stormwater modeling was completed using HydroCAD 10.0 software. To model the pre-expansion conditions, the HydroCAD model used in the 2005 EIS for the West Development Area (WDA) was combined with model data from the 2002 Solid Waste Permit Modification for the North Development Area (NDA), and some additional updates were made to reflect as-built conditions. Updates to the pre-expansion model were made as discussed below:

- Catchment areas were checked and updated (if necessary) to match the catchment areas as depicted in the pre-expansion Permit Drawings.
- Subcatchments were added to model direct entry and additional areas that flow to stormwater ponds from outside disposal areas.
    - The total runoff area of models from 2002 and 2005 analyses is 210.4 acres.
    - The updated model for pre-expansion conditions totals to 228.6 acres, which more conservatively estimates expected runoff.
- Ponding areas at inlets on the final cover were checked to match the proper elevations and outlet sizes.
- Catch basins on the final cover and stormwater ponds at the base of the landfill were updated with secondary outlets (broad-crested weirs) to the routing in order to model overtopping in storm events exceeding the 100-year design storm, such as the 500-year storm.
- Drop pipes and manholes were modeled as ponds with insignificant storage and updated if necessary to match elevations and pipe sizes.
- The existing Southwest, South, and Southeast Ponds, and four East Ditches were updated to model the ponds how they are currently constructed. These ponds are modeled identically in the post-Project HydroCAD model, which allows a direct comparison to stormwater storage and discharge in the existing ponds.
- The east side of the final cover was split up into more accurate catchment areas, and drop pipes were modeled into the catchment areas
- The east side of the landfill was modeled to the permitted, complete buildout of the 2005 design, despite there being differences in the existing final cover.
    - Final cover constructed in 2010 and 2012 on the south and east sides of the landfill includes a haul ramp and gabion, reno-mattress drop structures (rather than stormwater drop pipes). To compare runoff as originally permitted in 2005, these differences were not incorporated into the pre-expansion model.
    - Conversely, the design of the proposed expansion and post-Project HydroCAD model do account for existing final cover as constructed.

The post-Project HydroCAD stormwater model was taken from the 2019 Permit Modification Application. Minor modifications were made to the model in order to analyze the proposed expansion under the extreme 500-year storm event. Updates to the post-Project model were made as discussed below:

- Broad crested weirs were added as secondary outlets for emergency spillways (which meet Minnesota General Construction Stormwater Permit Regulations) for proposed stormwater ponds.
- Reaches were routed below the secondary outlets of the proposed stormwater ponds to model discharges from emergency spillways.
- Tertiary outlets were added to proposed stormwater ponds to determine how the ponds overtop in the 500-year storm.
- Subcatchments were added to model direct entry and additional areas that flow to stormwater ponds from outside disposal areas.
- The ditches on the east side of the landfill were modeled more accurately and updated with survey data of culvert inverts.

Stormwater Pond Design and Analysis Basis

As described in the *Design Report*, submitted with the *Application for Solid Waste Permit Modification*, (Carlson McCain, 2019), final cover storm water controls of the proposed expansion were designed to accommodate the 100-year storm event, surpassing Minnesota regulations to accommodate the 25-year storm event. As per MN Rules 7035.2815 Subpart 5, the expansion was designed to prevent erosion, particularly of liner and final cover materials. Slopes greater than 200 feet long include diversion drainageways, which flow to drop structure flumes reinforced with tied-concrete block mat. Drop flumes discharge to existing and proposed sedimentation ponds around the site to prevent excessive sediment from being carried off the property. Wet and dry sedimentation ponds exist on the south and east sides of the site and are employed as Best Management Practices (BMP's) for both the pre-expansion and post-Project stormwater management systems.

In order to meet the definition of a wet sedimentation basin under the Minnesota General Construction (MGC) Stormwater Permit, three main criteria must be met:

1. The permanent pool volume, or dead storage, shall be a minimum of 1800 cubic feet per acre of catchment draining to the pond;
2. The water quality volume, or live storage above the pond outlet, shall be a minimum of 1-inch of direct run-off from the net increase in impervious surfaces created by the project (for this item the entire catchment area was considered impervious – as the vast majority consists of final cover which includes a membrane); and
3. The discharge rate for the water quality volume must not exceed 5.66 cubic feet per second for each acre of pond surface area at peak elevation.

Each pond was modeled in the pre-expansion and post-Project condition to evaluate whether they meet the above criteria. Results are summarized in the table below:

Pond	Condition	Meets Dead Storage Criteria?	Meets Live Storage Criteria?	Meets Discharge Criteria?	Pond Meets Wet Pond Requirements?
North	Pre-Expansion	No	Yes	No	No
	Post-Project	Yes	Yes	Yes	Yes
Northwest	Pre-Expansion	No	Yes	No	No
	Post-Project	Yes	Yes	Yes	Yes
West	Pre-Expansion	-	-	-	NA
	Post-Project	Yes	Yes	Yes	Yes
Southwest	Pre-Expansion	Yes	Yes	No	No
	Post-Project	Yes	Yes	No	No
South	Pre-Expansion	No	Yes	Yes	No
	Post-Project	No	Yes	No	No
Southeast	Pre-Expansion	No	No	No	No
	Post-Project	Yes	Yes	No	No
East	Pre-Expansion	No	Yes	No	No
	Post-Project	No	Yes	No	No

The proposed new ponds in the post-Project condition (North, Northwest and West) meet the criteria for a wet sedimentation pond according to the MGC Stormwater Permit. The existing ponds do not meet the criteria. The Southwest pond meets the dead storage and live storage requirements in both conditions, but exceeds the allowable discharge rate. The South pond acts as an infiltration pond (there is no outlet) and therefore overtops, with outfall discharging across the haul road to a swale adjacent to the railroad during larger precipitation events. The southeast pond and east swales do not meet the criteria for a wet sedimentation basin. However, since the catchment area draining to the southeast and east swales was reduced from 94 to 46 acres, from the pre-expansion to the post-Project conditions, the discharge rates in the modeled water-quality event were reduced from 56 cfs to 26 cfs. In order to meet the criteria for wet sedimentation ponds, the four existing ponds would need to be expanded. Since the site is bounded by the haul road and railway to the south, and the haul road and property line to the east, there is no opportunity to expand the ponds.

Sedimentation Pond Performance Evaluation

Sedimentation pond performance was evaluated by assessing the sediment removal efficiency. Removal efficiency can be estimated by how the pond meets Minimal Impact Design Standards (MIDS) criteria. MIDS classifies stormwater pond performance into three levels to achieve the listed removal rates of Total Suspended Solids (TSS), Dissolved Phosphorus (DP), Particulate Phosphorus (PP) and Total Phosphorus (TP) based upon the design criteria for each level. The following is a summary of the classification levels, including the removal rates and design requirements.

- Design Level 1 (TSS = 60%, DP = 0%, PP =62%, TP = 34%): Must meet all of the design requirements for Design Level 1 and does not meet all design requirements for Design Level 2
  - Dead (or permanent) storage of at least 1,800 cubic feet per acre that drains to the pond

  - The pond's permanent storage volume must reach a minimum depth of at least 3 feet and must have no depth greater than 10 feet; the basin must be configured such that scour or resuspension of solids is minimized
  - Flow path length to pond width ratio < 10:1 (scouring occurs at ratios greater than 10:1)
- Design Level 2 (TSS = 84%, DP = 8%, PP = 84%, TP = 50%): Meets all of the requirements for Design Levels 1 and 2 and does not meet all design requirements for Design Level 3
  - Water quality volume (flood pool volume) ≥ 1 inch across the impervious area
  - Discharge rate of water quality volume does not exceed 5.66 cubic feet per second per acre of surface area of the pond
  - Flow path length to pond width ratio = 1:1 to 3:1 (a ratio of 3:1 is recommended)
- Design Level 3 (TSS 90%, DP = 23%, PP = 90%, TP = 60%): Must meet all of the design requirements for Design Levels 1, 2 and 3
  - Wet extended detention or multi-cell system
  - Sediment forebay at all major inflows
  - Flow path length to pond width ratio = 3:1 to 10:1
  - Water quality volume (flood pool volume) > 1.5 inch across the impervious area

Proposed stormwater ponds for the expansion were designed to meet Design Level 2 criteria. The designed water quality volume of each pond for the proposed expansion was taken as the total volume of runoff from the 25-year storm event into each pond. This volume is far greater than 1 inch of runoff multiplied across the impervious area in the watershed for each pond. The proposed expansion makes no modifications to the storage volume or outlets of existing sedimentation ponds, but does reduce the watershed areas that contributes to the existing ponds.

The sediment inputs into the ponds were based on soil loss off the final cover calculated using the Revised Universal Soil Lass Equation, Version 2 (RUSLE2). RUSLE2 computes rill and inter-rill erosion on an annual basis which can be used as a good indication for pond performance during "typical" precipitation events such as the 2 and 10-year storms. RUSLE2 does not calculate gully or stream erosion, which may be more likely to occur in "severe" storm events such as the 100 or 500-year storms. Erosion of final cover soils into the stormwater ponds was estimated using RUSLE2 for each pond in the pre-expansion and post-Project conditions. The MIDS Calculator was also used to determine BMP sediment removal efficiency of each pond. Because results for RUSLE2 and MIDS Calculator are reported in annual values, pond performance results were assumed to be similar for typical precipitation events such as the 2 and 10-year precipitation events. Each pond overtops during the 500-year rainfall for both pre-expansion and post-Project conditions, which eliminates any sediment removal capability from the ponds during this event. Sediment load obtained from RUSLE2, estimated sediment removal efficiency, and estimated escaped sediment for each pond, pre-expansion and post-Project, are tabulated in Table 5 attached to this report.

Performance of each sedimentation pond is summarized below:

<u>North Pond</u>

The North Pond of the pre-expansion model lies at the northwest edge of the North Development Area (NDA) which has not been constructed. Likewise, the North Pond has not been constructed. The pre-

expansion design of the pond provides 2-feet of dead storage which would promote an estimated 25% suspended sediment removal for typical storm events, but does not provide enough dead storage to meet standards for a Design Level 1 Pond. The North Pond in the post-Project design is located approximately 1,500 feet to the southeast, and outlets to adjacent areas to the north, onsite. The post-Project North Pond, meets criteria for a Design Level 2 Pond and attains 84% suspended solids removal during typical storm events. The post-Project north pond also has significantly greater storage of stormwater to achieve slower discharge rates as required by MIDS. Despite the North Pond receiving approximately twice the sediment load under typical storm events, the post-Project pond discharges approximately half the amount of sediment that the pre-expansion designed pond does. In the 500-year storm the post-Project North Pond overtops and has an outflow rate over six times that of the pre-expansion pond and almost twice the total outflow volume.

Northwest Pond

The northwest pond in the pre-expansion condition provides 5-feet of dead storage but does not meet MIDS Design Level 1 Criteria. The pre-expansion pond was estimated to deliver approximately 40% removal of sediment. The Northwest Pond for the post-Project, which is in a different location, meets criteria for a Design Level 2 Pond and provides significantly better sedimentation performance. It also provides significantly more storage. Using RUSLE2, the post-Project pond receives approximately twice the sediment load, but discharges about 66% the amount of sediment as the pre-expansion Pond for events such as the 2-year and 10-year rainfalls. During a 500-year storm the Post-Project northwest pond discharges at a slower rate and has less total outflow from the pond.

West Pond

There was no West Pond in the pre-expansion Design. The west pond forpPost-Project meets criteria for a Design Level 2 Pond for the 25-year storm. Routing stormwater to the additional west pond diverts stormwater runoff from the existing ponds, which do not meet Minimal Impact Design Standards. The post-Project west pond achieves 84% removal of suspended solids during regular storm events such as the 2-year and 10-year storms. The 500-year storm would see a higher degree of stormwater runoff and sediment transfer to wetlands adjacent to the pond.

Southwest Pond

The existing Southwest Pond outlets through a culvert to a swale connected to a constructed wetland west of the haul road. The pre-expansion conditions for the pond do not meet criteria for a Design Level 1 Pond. An estimated 50% sediment removal rate was determined for the pond under typical storm events. Discharge volume from the pond is reduced under post-Project conditions and thereby has a slower discharge rate, achieving an estimated 60% sediment removal rate. RUSLE2 and MIDS calculations indicate that the Southwest Pond receives approximately 0.1 more tons per year of sediment in post-Project buildout but discharges approximately the same amount of sediment (0.2 tons per year) for both the pre-expansion and post-Project buildouts. There are no significant differences in the discharges for the 500-year storm.

South Pond

The existing South Pond does not outlet, rather the stormwater entering the pond infiltrates. All sediment entering the pond is captured. The post-Project model reflects currently constructed conditions and incorporates catchment area from existing final cover on the south portion of the landfill. The pre-expansion model does not include final cover area on the landfill and does not reflect current

conditions. No changes are proposed to the South Pond for the post-Project design and no additional area flows to the pond from the proposed expansion. The pond captures approximately 0.2 tons per year of sediment. So there are no changes to potential impacts on the South Pond for the 2, 10, and 500-year storms.

Southeast Pond

The existing Southeast Pond outlets via culvert to storm sewers offsite. The existing Southeast Pond provides some dead storage, however not enough to meet Design Level 1 Criteria. The pond still does not meet Design Level 1 Criteria in the post-Project model, however the discharge rates are significantly decreased. Sediment removal efficiencies were estimated at 25% and 40% for pre-expansion and post-Project conditions, respectively. Sedimentation runoff into the storm sewer in the post-Project design is reduced by about half during storm events such as the 2 and 10-year storms. During the 500-year event, the post-Project Design discharges approximately one third the total outflow volume than the pre-expansion design, and accordingly discharges less sediment.

East Ditches

The existing ditches on the east side of the landfill provide temporary runoff detention as stormwater flows along the ditch length and ultimately outlets via culvert to the city storm sewer. The ditches act as wet swales, allowing sediment to settle along the length of the vegetated ditch. When larger storm events occur, the ditches pond water and do not slow the discharge to settle suspended particulate nearly as well. They were modeled as Wet Swales in the MIDS calculator and achieve 68% TSS, 0% DP, and 0% P removal when operating effectively in events such as the 2-year and 10-year storms. There are 12 fewer acres of catchment area that flow to the ditches for the post-Project buildout, resulting in approximately 30% less outflow for each event. Discharge rates for the ditches are approximately the same in the pre-expansion and post-Project model. RUSLE2 and MIDS calculations show approximately 0.2 tons per year of sediment transfer offsite through the east ditches for both the pre-expansion and post-Project designs. While offsite sediment transfer is about the same, there is less total outflow for the post-Project design during the 2, 10, and 500-year rainfall events.

A significant difference between the pre-expansion and post-Project pond designs is that the post-Project ponds meet an index parameter used to estimate sediment removal: the ponds control the discharge for the 25-year storm to less than 5.66 cubic feet per acre of pond surface area. To achieve this index parameter, post-Project stormwater controls provide more storage onsite, to detain more stormwater and release it over a longer time period. The discharge rates for newly constructed ponds of the post-Project meet MPCA design requirements for MIDS for discharge in the 25-year storm event. Pond outflow rates are reduced by about 60% in the post-Project model for typical storm events such as the 2-year and 10-year storms. Since peak outflows are reduced for these events, there is less possibility of erosion and sedimentation offsite.

Assessment of Final Cover Stormwater Diversion Structures During 500-year Storm Event

The stormwater control system for the post-Project (and pre-expansion) conditions is designed for the 100-year storm event; therefore, the increased runoff resulting from the 500-year storm event will exceed the design capacity of a number of final cover stormwater diversion structures. The following is a discussion of final cover stormwater diversion structures and predicted effects of the 500-year storm, based on the HydroCAD analysis.

General

Excess stormwater issues in the new expansion areas (N, NW, and W areas) mostly occur in the vicinity of the haul road and in the areas in and around the ponding areas. Issues arising in the existing final cover areas of the landfill (E, SE, and SW areas) are more widespread than in the expansion areas. Erosion issues are possible on the side slope berms and terraces, perimeter ditches, culverts and pipes, and in the stormwater ponds. Sheet flow velocities down the 3H:1V slope are maintained below 1 foot per second (fps), which is a non-erosive velocity. According to the guideline document "Stability Thresholds for Stream Restoration Materials" (Fischenich, 2001), published by the U.S. Army Engineer Research and Development Center, the maximum velocity for stream banks vegetated with long native grasses is 4 to 6 fps. This published maximum velocity, however, applies to short term flows (less than a couple of hours). For longer term exposure, a factor of safety 2 to 3 times is recommended.

Final Cover Subcatchment Run-off

Run-off from final cover subcatchments were modelled in HydroCAD. The software uses the Soil Conservation Service (SCS) method for estimating run-off, which uses the amount of rainfall and a Curve Number (CN) factor. The CN factor considers the soil type and ground cover, and ranges from 0 to 100. A higher CN factor will estimate a higher run-off volume. The software includes Table 2-2 from USDA Technical Release No. 55 (TR-55) to estimate the CN factor. Hydrologic soil group C was chosen for this site which includes sandy loam, since the final cover system includes screened drainage sand directly below the topsoil and rooting soil layers. Since the final cover vegetation is specified to include a MNDOT roadside mix of native grasses and forbes, and will typically only be mowed seasonally, the cover type chosen was "Meadow –continuous grass, non-grazed." Given these assumptions, TR-55 recommends a CN factor of 71.

Terraces and Ditches

The flow velocities in the side slope berm terraces remain below 3 fps in most areas, which is a non-erosive velocity according to Fischenich (2001). Terrace slopes along the haul road, as well as the steeper eastern terraces of upper catchment areas of the west system (nodes FC-W5 through FC-W8) are predicted to experience flow velocities between 4.74 and 5.74 fps. These velocities have the potential to cause minor erosion and scouring that would likely require repair. Sediment transport at these velocities also risks clogging the down-slope swale entrance, or the down-slope swale itself. Full washout of the terrace is not expected at these velocities.

Terrace slopes along the ditches on the east side of the landfill (nodes FC-SE10, FC-E1, P-E1, P-E2, P-E3) are predicted to experience flow velocities between 5.52 and 9.87 fps. These velocities have the potential to cause erosion and scouring that would require repair.

Side Slope Berms

Slope berms are predicted to be overtopped during the 500-year, 24-hour storm event at nodes B-E11, B-E12, B-SE1, B-SE2, B-SE3, B-SW1, B-SW2, B-SW3, and B-N4A. The results of overtopping would likely cause erosion of the berm crest and creation of deeply scoured notches in the berm where the overflow occurs. Once the berm is crested, the overflow could erode a channel in the final cover soils overlying the geomembrane, which may propagate down to the next side slope terrace. The width and depth of the erosion channel would depend on the volume of water released from the breached side slope berm.

Eroded cover soils would be deposited at downstream side slope terraces and berms, which may decrease the flow capacity of the downstream control and cause further overtopping at those locations.

Down-Slope Swales

The down-slope stormwater swales are armored with a tied concrete block mat that is designed to protect against erosion at velocities up to 30 fps. For a 500-year, 24-hour storm event, the maximum velocity in all of the swales is below 20 fps, therefore erosion of the armored swale is not expected. Some swales are predicted to overtop: namely, nodes CH-W7, CH-N7, CH-N8, and CH-N11. These areas may experience erosion of final cover soils along the top edge of the armored mat, and could undermine the edges of the mat. This occurrence is likely to be most pronounced at the flow-line transition between the side-slope berms and the down-slope swales. The underlying geomembrane is not erodible in the same manner as the final cover soils, and it is unlikely that waste would be exposed.

Culverts, Pipes, and Drop Structures

The culverts into the ponds (CUL-NW1, CUL-N1, and CUL-W1), as well as culverts under the haul road are expected to be overwhelmed by runoff from a 500-year, 24-hour storm. The berms and roadbeds through which these culverts pass would likely be overtopped, causing erosion of the berm crest and roadbed, and possibly erosion under the culvert entrance. Severe erosion under the culvert could result in a berm failure.

The eastern drop structures and pipes (MH-E1, MH-E3, DP-E11, DP-E5) are expected to be overwhelmed by a 500-year, 24-hour storm. The berms and roadbeds through which these culverts pass would likely be overtopped, causing erosion of the berm crest and roadbed.

References:

Fischenich, C. (2001). “Stability Thresholds for Stream Restoration Materials,” EMRRP Technical Notes Collection (ERDC TN-EMRRP-SR-29), U.S. Army Engineer Research and Development Center, Vicksburg, MS.

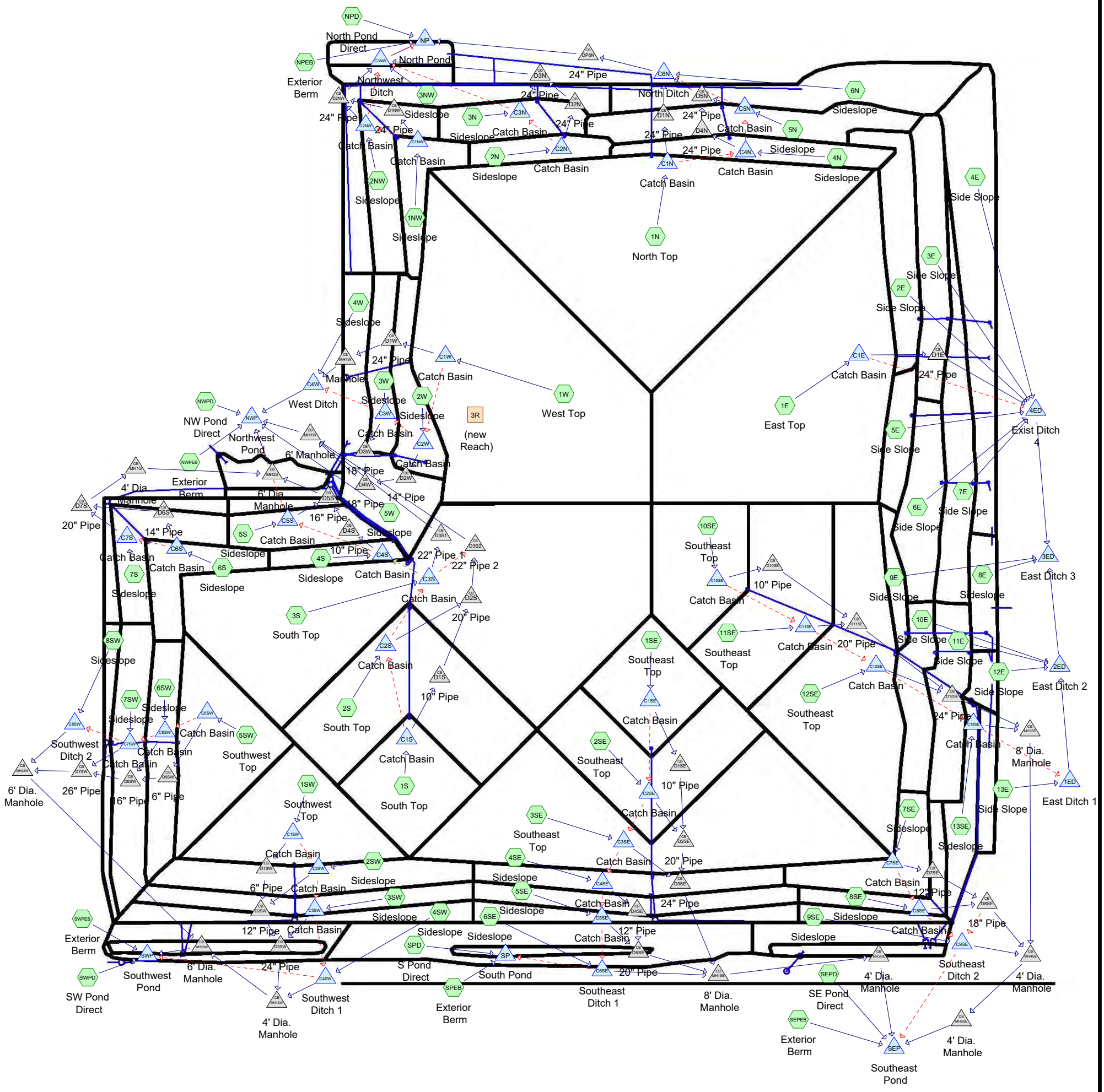
United States Department of Agriculture (1986). Urban Hydrology for Small Watersheds. USDA Technical Release 55. Washington DC.

Attachment C-2

HydroCAD Model of Pre-Expansion vs Post-Project

2-Year, 10-Year and 500-Year Storm Events

Pre-Expansion 2-Year Storm HydroCAD Analysis



Routing Diagram for BSLI WDA&NDA Combined Existing Model

Prepared by Carlson McCain, Inc., Printed 12/18/2019

HydroCAD® 10.00-19 s/n 02263 © 2016 HydroCAD Software Solutions LLC

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
223.437	71	Meadow, non-grazed, HSG C (1E, 1N, 1NW, 1S, 1SE, 1SW, 1W, 2E, 2N, 2NW, 2S, 2SE, 2SW, 2W, 3E, 3N, 3NW, 3S, 3SE, 3SW, 3W, 4E, 4N, 4S, 4SE, 4SW, 4W, 5E, 5N, 5S, 5SE, 5SW, 5W, 6E, 6N, 6S, 6SE, 6SW, 7E, 7S, 7SE, 7SW, 8E, 8SE, 8SW, 9E, 9SE, 10E, 10SE, 11E, 11SE, 12E, 12SE, 13E, 13SE, NPEB, NWPEB, SEPEB, SPEB, SWPEB)
1.192	91	Urban industrial, 72% imp, HSG C (SPEB)
3.962	98	Water Surface, HSG C (NPD, NWPD, SEPD, SPD, SWPD)
228.591	**72**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
228.591	HSG C	1E, 1N, 1NW, 1S, 1SE, 1SW, 1W, 2E, 2N, 2NW, 2S, 2SE, 2SW, 2W, 3E, 3N, 3NW, 3S, 3SE, 3SW, 3W, 4E, 4N, 4S, 4SE, 4SW, 4W, 5E, 5N, 5S, 5SE, 5SW, 5W, 6E, 6N, 6S, 6SE, 6SW, 7E, 7S, 7SE, 7SW, 8E, 8SE, 8SW, 9E, 9SE, 10E, 10SE, 11E, 11SE, 12E, 12SE, 13E, 13SE, NPD, NPEB, NWPD, NWPEB, SEPD, SEPEB, SPD, SPEB, SWPD, SWPEB
0.000	HSG D	
0.000	Other	
228.591		**TOTAL AREA**

Pipe Listing (all nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Diam/Width (inches)	Height (inches)	Inside-Fill (inches)
1	2E	0.00	0.00	280.0	0.3300	0.010	18.0	0.0	0.0
2	3E	0.00	0.00	170.0	0.3300	0.010	18.0	0.0	0.0
3	5E	0.00	0.00	315.0	0.3300	0.010	18.0	0.0	0.0
4	6E	0.00	0.00	185.0	0.3300	0.010	18.0	0.0	0.0
5	7E	0.00	0.00	60.0	0.3300	0.010	18.0	0.0	0.0
6	9E	0.00	0.00	300.0	0.3333	0.010	18.0	0.0	0.0
7	10E	0.00	0.00	210.0	0.3333	0.010	18.0	0.0	0.0
8	11E	0.00	0.00	210.0	0.3333	0.010	18.0	0.0	0.0
9	13E	0.00	0.00	266.0	0.0050	0.010	18.0	0.0	0.0
10	1ED	711.50	709.00	230.0	0.0109	0.010	16.0	0.0	0.0
11	2ED	709.50	708.50	90.0	0.0111	0.011	16.0	0.0	0.0
12	3ED	708.19	707.50	75.0	0.0092	0.011	16.0	0.0	0.0
13	4ED	709.72	709.24	65.0	0.0074	0.010	16.0	0.0	0.0
14	C3NW	719.00	705.00	100.0	0.1400	0.018	24.0	0.0	0.0
15	C4W	717.00	716.00	90.0	0.0111	0.024	30.0	0.0	0.0
16	C6N	719.00	718.50	50.0	0.0100	0.018	22.2	0.0	0.0
17	D10SE	807.00	800.00	350.0	0.0200	0.010	9.9	0.0	0.0
18	D11SE	800.00	794.50	265.0	0.0208	0.010	18.5	0.0	0.0
19	D12SE	794.50	720.00	350.0	0.2129	0.010	22.2	0.0	0.0
20	D1E	794.50	720.00	330.0	0.2258	0.010	22.2	0.0	0.0
21	D1N	798.00	720.00	330.0	0.2364	0.010	22.2	0.0	0.0
22	D1NW	782.00	742.00	200.0	0.2000	0.010	22.2	0.0	0.0
23	D1S	806.00	797.00	420.0	0.0214	0.010	9.9	0.0	0.0
24	D1SE	807.00	801.00	360.0	0.0167	0.010	9.9	0.0	0.0
25	D1SW	808.00	773.00	120.0	0.2917	0.010	6.1	0.0	0.0
26	D1W	796.00	724.00	280.0	0.2571	0.010	22.2	0.0	0.0
27	D2N	779.00	739.00	170.0	0.2353	0.010	22.2	0.0	0.0
28	D2NW	742.00	726.00	60.0	0.2667	0.010	22.2	0.0	0.0
29	D2S	797.00	793.70	195.0	0.0169	0.010	18.5	0.0	0.0
30	D2SE	801.00	796.00	120.0	0.0417	0.010	18.5	0.0	0.0
31	D2SW	773.00	749.50	75.0	0.3133	0.010	11.8	0.0	0.0
32	D2W	766.00	720.00	200.0	0.2300	0.010	12.9	0.0	0.0
33	D3N	739.00	726.00	60.0	0.2167	0.010	22.2	0.0	0.0
34	D3S1	793.70	716.50	475.0	0.1625	0.010	20.3	0.0	0.0
35	D3S2	793.70	716.50	475.0	0.1625	0.010	20.3	0.0	0.0
36	D3SE	796.00	740.00	190.0	0.2947	0.010	22.2	0.0	0.0
37	D3SW	749.50	740.00	25.0	0.3800	0.010	22.2	0.0	0.0
38	D3W	739.00	720.00	88.0	0.2159	0.010	16.6	0.0	0.0
39	D4N	779.00	746.00	118.0	0.2797	0.010	22.2	0.0	0.0
40	D4S	777.50	728.00	160.0	0.3094	0.010	9.9	0.0	0.0
41	D4SE	773.00	749.50	65.0	0.3615	0.010	11.8	0.0	0.0
42	D4W	720.00	716.00	95.0	0.0421	0.010	16.6	0.0	0.0
43	D5N	746.00	726.00	84.0	0.2381	0.010	22.2	0.0	0.0
44	D5S	729.00	714.00	142.0	0.1056	0.010	14.8	0.0	0.0
45	D5SE	749.50	740.00	30.0	0.3167	0.010	18.5	0.0	0.0
46	D5SW	808.00	773.00	125.0	0.2800	0.010	6.1	0.0	0.0

Pipe Listing (all nodes) (continued)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Diam/Width (inches)	Height (inches)	Inside-Fill (inches)
47	D6S	774.00	728.50	185.0	0.2459	0.010	12.9	0.0	0.0
48	D6SW	773.00	729.50	165.0	0.2636	0.010	14.8	0.0	0.0
49	D7S	729.50	716.50	70.0	0.1857	0.010	18.5	0.0	0.0
50	D7SE	772.00	750.00	90.0	0.2444	0.010	11.8	0.0	0.0
51	D7SW	729.50	722.00	30.0	0.2500	0.010	24.0	0.0	0.0
52	D8SE	750.00	740.00	36.0	0.2778	0.010	16.6	0.0	0.0
53	DP6N	718.50	700.00	780.0	0.0237	0.010	22.2	0.0	0.0
54	MH1S	716.50	712.50	830.0	0.0048	0.010	22.2	0.0	0.0
55	MH1SE	738.00	718.00	590.0	0.0339	0.010	22.2	0.0	0.0
56	MH1SW	738.00	717.00	550.0	0.0382	0.010	20.3	0.0	0.0
57	MH1W	714.00	713.00	5.0	0.2000	0.024	24.0	0.0	0.0
58	MH2SE	716.00	715.00	10.0	0.1000	0.024	30.0	0.0	0.0
59	MH2SW	722.00	717.00	1,050.0	0.0048	0.010	24.0	0.0	0.0
60	MH3S	716.00	712.00	10.0	0.4000	0.010	22.2	0.0	0.0
61	MH3SE	720.00	715.00	1,400.0	0.0036	0.010	24.0	0.0	0.0
62	MH3SW	717.00	717.00	5.0	0.0000	0.024	24.0	0.0	0.0
63	MH4SE	720.30	717.20	620.0	0.0050	0.010	24.0	0.0	0.0
64	MH4W	720.00	719.00	5.0	0.2000	0.024	24.0	0.0	0.0
65	MH5SE	716.00	715.00	10.0	0.1000	0.024	30.0	0.0	0.0
66	NP	696.00	694.00	60.0	0.0333	0.018	36.0	0.0	0.0
67	NWP	707.00	706.00	40.0	0.0250	0.012	30.0	0.0	0.0
68	SEP	712.00	710.90	73.0	0.0151	0.015	36.0	0.0	0.0
69	SWP	715.05	714.37	134.0	0.0051	0.015	18.0	0.0	0.0

Time span=0.00-48.00 hrs, dt=0.01 hrs, 4801 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1E: East Top Runoff Area=17.841 ac 0.00% Impervious Runoff Depth=0.66"
Flow Length=970' Tc=34.1 min CN=71 Runoff=7.89 cfs 0.988 af

Subcatchment 1N: North Top Runoff Area=17.691 ac 0.00% Impervious Runoff Depth=0.66"
Flow Length=770' Tc=32.5 min CN=71 Runoff=8.14 cfs 0.980 af

Subcatchment 1NW: Sideslope Runoff Area=1.506 ac 0.00% Impervious Runoff Depth=0.66"
Flow Length=535' Tc=5.3 min CN=71 Runoff=1.75 cfs 0.083 af

Subcatchment 1S: South Top Runoff Area=3.455 ac 0.00% Impervious Runoff Depth=0.66"
Flow Length=550' Slope=0.0200 '/' Tc=15.2 min CN=71 Runoff=2.63 cfs 0.191 af

Subcatchment 1SE: Southeast Top Runoff Area=3.373 ac 0.00% Impervious Runoff Depth=0.66"
Flow Length=510' Slope=0.0200 '/' Tc=14.9 min CN=71 Runoff=2.60 cfs 0.187 af

Subcatchment 1SW: Southwest Top Runoff Area=4.734 ac 0.00% Impervious Runoff Depth=0.66"
Flow Length=470' Slope=0.0200 '/' Tc=14.6 min CN=71 Runoff=3.69 cfs 0.262 af

Subcatchment 1W: West Top Runoff Area=16.760 ac 0.00% Impervious Runoff Depth=0.66"
Flow Length=970' Tc=20.0 min CN=71 Runoff=10.78 cfs 0.928 af

Subcatchment 2E: Side Slope Runoff Area=2.590 ac 0.00% Impervious Runoff Depth=0.66"
Flow Length=980' Tc=10.4 min CN=71 Runoff=2.40 cfs 0.143 af

Subcatchment 2N: Sideslope Runoff Area=1.145 ac 0.00% Impervious Runoff Depth=0.66"
Flow Length=424' Tc=6.5 min CN=71 Runoff=1.26 cfs 0.063 af

Subcatchment 2NW: Sideslope Runoff Area=2.338 ac 0.00% Impervious Runoff Depth=0.66"
Flow Length=1,113' Tc=11.8 min CN=71 Runoff=2.05 cfs 0.129 af

Subcatchment 2S: South Top Runoff Area=7.410 ac 0.00% Impervious Runoff Depth=0.66"
Flow Length=800' Tc=27.8 min CN=71 Runoff=3.81 cfs 0.410 af

Subcatchment 2SE: Southeast Top Runoff Area=5.356 ac 0.00% Impervious Runoff Depth=0.66"
Flow Length=700' Tc=27.0 min CN=71 Runoff=2.80 cfs 0.297 af

Subcatchment 2SW: Sideslope Runoff Area=2.975 ac 0.00% Impervious Runoff Depth=0.66"
Flow Length=725' Tc=6.8 min CN=71 Runoff=3.24 cfs 0.165 af

Subcatchment 2W: Sideslope Runoff Area=1.924 ac 0.00% Impervious Runoff Depth=0.66"
Flow Length=770' Tc=7.6 min CN=71 Runoff=2.02 cfs 0.107 af

Subcatchment 3E: Side Slope Runoff Area=2.825 ac 0.00% Impervious Runoff Depth=0.66"
Flow Length=1,010' Tc=11.5 min CN=71 Runoff=2.50 cfs 0.156 af

Subcatchment 3N: Sideslope Runoff Area=1.762 ac 0.00% Impervious Runoff Depth=0.66"
Flow Length=398' Tc=7.9 min CN=71 Runoff=1.83 cfs 0.098 af

Subcatchment 3NW: Sideslope Runoff Area=3.104 ac 0.00% Impervious Runoff Depth=0.66"
Flow Length=1,190' Tc=9.7 min CN=71 Runoff=2.97 cfs 0.172 af

Subcatchment 3S: South Top Runoff Area=20.973 ac 0.00% Impervious Runoff Depth=0.66"
Flow Length=950' Tc=29.0 min CN=71 Runoff=10.45 cfs 1.162 af

Subcatchment 3SE: Southeast Top Runoff Area=12.185 ac 0.00% Impervious Runoff Depth=0.66"
Flow Length=730' Tc=27.3 min CN=71 Runoff=6.32 cfs 0.675 af

Subcatchment 3SW: Sideslope Runoff Area=2.085 ac 0.00% Impervious Runoff Depth=0.66"
Flow Length=756' Tc=7.4 min CN=71 Runoff=2.21 cfs 0.115 af

Subcatchment 3W: Sideslope Runoff Area=1.543 ac 0.00% Impervious Runoff Depth=0.66"
Flow Length=740' Tc=7.7 min CN=71 Runoff=1.62 cfs 0.085 af

Subcatchment 4E: Side Slope Runoff Area=5.342 ac 0.00% Impervious Runoff Depth=0.66"
Flow Length=820' Tc=11.2 min CN=71 Runoff=4.79 cfs 0.296 af

Subcatchment 4N: Sideslope Runoff Area=1.933 ac 0.00% Impervious Runoff Depth=0.66"
Flow Length=632' Tc=7.1 min CN=71 Runoff=2.08 cfs 0.107 af

Subcatchment 4S: Sideslope Runoff Area=0.872 ac 0.00% Impervious Runoff Depth=0.66"
Flow Length=530' Tc=6.6 min CN=71 Runoff=0.96 cfs 0.048 af

Subcatchment 4SE: Sideslope Runoff Area=2.200 ac 0.00% Impervious Runoff Depth=0.66"
Flow Length=730' Tc=6.8 min CN=71 Runoff=2.40 cfs 0.122 af

Subcatchment 4SW: Sideslope Runoff Area=1.671 ac 0.00% Impervious Runoff Depth=0.66"
Flow Length=730' Tc=6.2 min CN=71 Runoff=1.87 cfs 0.093 af

Subcatchment 4W: Sideslope Runoff Area=1.561 ac 0.00% Impervious Runoff Depth=0.66"
Flow Length=350' Tc=6.6 min CN=71 Runoff=1.72 cfs 0.086 af

Subcatchment 5E: Side Slope Runoff Area=1.195 ac 0.00% Impervious Runoff Depth=0.66"
Flow Length=730' Tc=7.0 min CN=71 Runoff=1.29 cfs 0.066 af

Subcatchment 5N: Sideslope Runoff Area=3.175 ac 0.00% Impervious Runoff Depth=0.66"
Flow Length=766' Tc=8.1 min CN=71 Runoff=3.26 cfs 0.176 af

Subcatchment 5S: Sideslope Runoff Area=1.778 ac 0.00% Impervious Runoff Depth=0.66"
Flow Length=565' Tc=7.1 min CN=71 Runoff=1.91 cfs 0.098 af

Subcatchment 5SE: Sideslope Runoff Area=2.043 ac 0.00% Impervious Runoff Depth=0.66"
Flow Length=750' Tc=7.3 min CN=71 Runoff=2.18 cfs 0.113 af

Subcatchment 5SW: Southwest Top Runoff Area=4.496 ac 0.00% Impervious Runoff Depth=0.66"
Flow Length=440' Slope=0.0200 '/' Tc=14.4 min CN=71 Runoff=3.54 cfs 0.249 af

Subcatchment 5W: Sideslope Runoff Area=2.191 ac 0.00% Impervious Runoff Depth=0.66"
Flow Length=385' Tc=6.1 min CN=71 Runoff=2.46 cfs 0.121 af

Subcatchment 6E: Side Slope Runoff Area=2.437 ac 0.00% Impervious Runoff Depth=0.66"
Flow Length=735' Tc=9.2 min CN=71 Runoff=2.38 cfs 0.135 af

Subcatchment 6N: Sideslope Runoff Area=3.870 ac 0.00% Impervious Runoff Depth=0.66"
Flow Length=1,070' Tc=13.5 min CN=71 Runoff=3.15 cfs 0.214 af

Subcatchment 6S: Sideslope Runoff Area=1.820 ac 0.00% Impervious Runoff Depth=0.66"
Flow Length=490' Tc=6.5 min CN=71 Runoff=2.01 cfs 0.101 af

Subcatchment 6SE: Sideslope Runoff Area=1.487 ac 0.00% Impervious Runoff Depth=0.66"
Flow Length=725' Tc=6.4 min CN=71 Runoff=1.65 cfs 0.082 af

Subcatchment 6SW: Sideslope Runoff Area=2.314 ac 0.00% Impervious Runoff Depth=0.66"
Flow Length=530' Tc=6.6 min CN=71 Runoff=2.54 cfs 0.128 af

Subcatchment 7E: Side Slope Runoff Area=3.018 ac 0.00% Impervious Runoff Depth=0.66"
Flow Length=1,050' Tc=8.9 min CN=71 Runoff=2.99 cfs 0.167 af

Subcatchment 7S: Sideslope Runoff Area=2.118 ac 0.00% Impervious Runoff Depth=0.66"
Flow Length=560' Tc=7.0 min CN=71 Runoff=2.29 cfs 0.117 af

Subcatchment 7SE: Sideslope Runoff Area=2.211 ac 0.00% Impervious Runoff Depth=0.66"
Flow Length=930' Tc=9.1 min CN=71 Runoff=2.18 cfs 0.122 af

Subcatchment 7SW: Sideslope Runoff Area=3.196 ac 0.00% Impervious Runoff Depth=0.66"
Flow Length=696' Tc=8.3 min CN=71 Runoff=3.26 cfs 0.177 af

Subcatchment 8E: Sideslope Runoff Area=1.052 ac 0.00% Impervious Runoff Depth=0.66"
Flow Length=70' Slope=0.3333 '/' Tc=3.7 min CN=71 Runoff=1.31 cfs 0.058 af

Subcatchment 8SE: Sideslope Runoff Area=1.308 ac 0.00% Impervious Runoff Depth=0.66"
Flow Length=580' Tc=4.9 min CN=71 Runoff=1.55 cfs 0.072 af

Subcatchment 8SW: Sideslope Runoff Area=0.953 ac 0.00% Impervious Runoff Depth=0.66"
Flow Length=710' Tc=5.8 min CN=71 Runoff=1.09 cfs 0.053 af

Subcatchment 9E: Side Slope Runoff Area=0.680 ac 0.00% Impervious Runoff Depth=0.66"
Flow Length=870' Tc=7.7 min CN=71 Runoff=0.71 cfs 0.038 af

Subcatchment 9SE: Sideslope Runoff Area=0.641 ac 0.00% Impervious Runoff Depth=0.66"
Flow Length=640' Tc=5.6 min CN=71 Runoff=0.74 cfs 0.036 af

Subcatchment 10E: Side Slope Runoff Area=0.614 ac 0.00% Impervious Runoff Depth=0.66"
Flow Length=850' Tc=8.9 min CN=71 Runoff=0.61 cfs 0.034 af

Subcatchment 10SE: Southeast Top Runoff Area=3.918 ac 0.00% Impervious Runoff Depth=0.66"
Flow Length=490' Slope=0.0200 '/' Tc=14.8 min CN=71 Runoff=3.03 cfs 0.217 af

Subcatchment 11E: Side Slope Runoff Area=1.017 ac 0.00% Impervious Runoff Depth=0.66"
Flow Length=890' Tc=10.2 min CN=71 Runoff=0.95 cfs 0.056 af

Subcatchment 11SE: Southeast Top Runoff Area=5.848 ac 0.00% Impervious Runoff Depth=0.66"
Flow Length=675' Tc=26.8 min CN=71 Runoff=3.08 cfs 0.324 af

Subcatchment 12E: Side Slope Runoff Area=0.535 ac 0.00% Impervious Runoff Depth=0.66"
Flow Length=100' Slope=0.3333 '/' Tc=4.9 min CN=71 Runoff=0.63 cfs 0.030 af

Subcatchment 12SE: Southeast Top Runoff Area=9.055 ac 0.00% Impervious Runoff Depth=0.66"
Flow Length=700' Tc=27.0 min CN=71 Runoff=4.74 cfs 0.502 af

Subcatchment 13E: Side Slope Runoff Area=0.855 ac 0.00% Impervious Runoff Depth=0.66"
Flow Length=686' Tc=5.3 min CN=71 Runoff=1.00 cfs 0.047 af

Subcatchment 13SE: Sideslope Runoff Area=2.473 ac 0.00% Impervious Runoff Depth=0.66"
Flow Length=665' Tc=7.3 min CN=71 Runoff=2.64 cfs 0.137 af

Subcatchment NPD: North Pond Direct Runoff Area=0.982 ac 100.00% Impervious Runoff Depth=2.60"
Tc=0.0 min CN=98 Runoff=4.66 cfs 0.213 af

Subcatchment NPEB: Exterior Berm Runoff Area=0.750 ac 0.00% Impervious Runoff Depth=0.66"
Flow Length=40' Slope=0.3333 '/' Tc=2.4 min CN=71 Runoff=0.99 cfs 0.042 af

Subcatchment NWPD: NW Pond Direct Runoff Area=0.938 ac 100.00% Impervious Runoff Depth=2.60"
Tc=0.0 min CN=98 Runoff=4.45 cfs 0.203 af

Subcatchment NWPEB: Exterior Berm Runoff Area=1.839 ac 0.00% Impervious Runoff Depth=0.66"
Flow Length=1,030' Tc=14.1 min CN=71 Runoff=1.46 cfs 0.102 af

Subcatchment SEPD: SE Pond Direct Runoff Area=0.678 ac 100.00% Impervious Runoff Depth=2.60"
Tc=0.0 min CN=98 Runoff=3.22 cfs 0.147 af

Subcatchment SEPEB: Exterior Berm Runoff Area=1.488 ac 0.00% Impervious Runoff Depth=0.66"
Flow Length=80' Slope=0.3333 '/' Tc=4.1 min CN=71 Runoff=1.83 cfs 0.082 af

Subcatchment SPD: S Pond Direct Runoff Area=0.527 ac 100.00% Impervious Runoff Depth=2.60"
Tc=0.0 min CN=98 Runoff=2.50 cfs 0.114 af

Subcatchment SPEB: Exterior Berm Runoff Area=5.014 ac 17.12% Impervious Runoff Depth=0.90"
Flow Length=440' Tc=6.0 min CN=76 Runoff=8.01 cfs 0.377 af

Subcatchment SWPD: SW Pond Direct Runoff Area=0.837 ac 100.00% Impervious Runoff Depth=2.60"
Tc=0.0 min CN=98 Runoff=3.98 cfs 0.181 af

Subcatchment SWPEB: Exterior Berm Runoff Area=2.086 ac 0.00% Impervious Runoff Depth=0.66"
Flow Length=80' Slope=0.2500 '/' Tc=4.6 min CN=71 Runoff=2.50 cfs 0.116 af

Reach 3R: (new Reach)

Pond 1ED: East Ditch 1 Peak Elev=711.76' Storage=562 cf Inflow=1.00 cfs 0.047 af
Primary=0.34 cfs 0.041 af Secondary=0.00 cfs 0.000 af Outflow=0.34 cfs 0.041 af

Pond 2ED: East Ditch 2 Peak Elev=710.10' Storage=939 cf Inflow=2.27 cfs 0.161 af
Primary=1.61 cfs 0.156 af Secondary=0.00 cfs 0.000 af Outflow=1.61 cfs 0.156 af

Pond 3ED: East Ditch 3 Peak Elev=710.95' Storage=5,360 cf Inflow=11.13 cfs 2.196 af
Primary=9.73 cfs 2.195 af Secondary=0.00 cfs 0.000 af Outflow=9.73 cfs 2.195 af

Pond 4ED: Exist Ditch 4 Peak Elev=712.45' Storage=10,550 cf Inflow=18.22 cfs 1.952 af
Primary=9.67 cfs 1.943 af Secondary=0.00 cfs 0.000 af Outflow=9.67 cfs 1.943 af

Pond C10SE: Catch Basin Peak Elev=810.31' Storage=351 cf Inflow=3.03 cfs 0.217 af
Primary=2.96 cfs 0.217 af Secondary=0.00 cfs 0.000 af Outflow=2.96 cfs 0.217 af

Pond C11SE: Catch Basin Peak Elev=803.31' Storage=418 cf Inflow=3.08 cfs 0.324 af
Primary=3.04 cfs 0.324 af Secondary=0.00 cfs 0.000 af Outflow=3.04 cfs 0.324 af

Pond C12SE: Catch Basin Peak Elev=797.76' Storage=11 cf Inflow=4.74 cfs 0.502 af
Primary=4.74 cfs 0.502 af Secondary=0.00 cfs 0.000 af Outflow=4.74 cfs 0.502 af

Pond C13SE: Catch Basin Peak Elev=724.28' Storage=33 cf Inflow=2.64 cfs 0.137 af
Primary=2.63 cfs 0.137 af Secondary=0.00 cfs 0.000 af Outflow=2.63 cfs 0.137 af

Pond C1E: Catch Basin Peak Elev=797.78' Storage=12 cf Inflow=7.89 cfs 0.988 af
Primary=7.89 cfs 0.988 af Secondary=0.00 cfs 0.000 af Outflow=7.89 cfs 0.988 af

Pond C1N: Catch Basin Peak Elev=801.29' Storage=359 cf Inflow=8.14 cfs 0.980 af
Primary=8.12 cfs 0.980 af Secondary=0.00 cfs 0.000 af Outflow=8.12 cfs 0.980 af

Pond C1NW: Catch Basin Peak Elev=785.21' Storage=29 cf Inflow=1.75 cfs 0.083 af
Primary=1.75 cfs 0.083 af Secondary=0.00 cfs 0.000 af Outflow=1.75 cfs 0.083 af

Pond C1S: Catch Basin Peak Elev=809.28' Storage=166 cf Inflow=2.63 cfs 0.191 af
Primary=2.62 cfs 0.191 af Secondary=0.00 cfs 0.000 af Outflow=2.62 cfs 0.191 af

Pond C1SE: Catch Basin Peak Elev=810.28' Storage=164 cf Inflow=2.60 cfs 0.187 af
Primary=2.58 cfs 0.187 af Secondary=0.00 cfs 0.000 af Outflow=2.58 cfs 0.187 af

Pond C1SW: Catch Basin Peak Elev=811.34' Storage=763 cf Inflow=3.69 cfs 0.262 af
Primary=3.43 cfs 0.262 af Secondary=0.00 cfs 0.000 af Outflow=3.43 cfs 0.262 af

Pond C1W: Catch Basin Peak Elev=799.35' Storage=640 cf Inflow=10.78 cfs 0.928 af
Primary=10.74 cfs 0.928 af Secondary=0.00 cfs 0.000 af Outflow=10.74 cfs 0.928 af

Pond C2N: Catch Basin Peak Elev=782.17' Storage=23 cf Inflow=1.26 cfs 0.063 af
Primary=1.26 cfs 0.063 af Secondary=0.00 cfs 0.000 af Outflow=1.26 cfs 0.063 af

Pond C2NW: Catch Basin Peak Elev=745.24' Storage=126 cf Inflow=2.05 cfs 0.129 af
Primary=2.03 cfs 0.129 af Secondary=0.00 cfs 0.000 af Outflow=2.03 cfs 0.129 af

Pond C2S: Catch Basin Peak Elev=800.36' Storage=213 cf Inflow=3.81 cfs 0.410 af
Primary=3.80 cfs 0.410 af Secondary=0.00 cfs 0.000 af Outflow=3.80 cfs 0.410 af

Pond C2SE: Catch Basin Peak Elev=804.29' Storage=173 cf Inflow=2.80 cfs 0.297 af
Primary=2.80 cfs 0.297 af Secondary=0.00 cfs 0.000 af Outflow=2.80 cfs 0.297 af

Pond C2SW: Catch Basin Peak Elev=776.32' Storage=103 cf Inflow=3.24 cfs 0.165 af
Primary=3.23 cfs 0.165 af Secondary=0.00 cfs 0.000 af Outflow=3.23 cfs 0.165 af

Pond C2W: Catch Basin Peak Elev=769.24' Storage=27 cf Inflow=2.02 cfs 0.107 af
Primary=2.02 cfs 0.107 af Secondary=0.00 cfs 0.000 af Outflow=2.02 cfs 0.107 af

Pond C3N: Catch Basin Peak Elev=742.22' Storage=117 cf Inflow=1.83 cfs 0.098 af
Primary=1.81 cfs 0.098 af Secondary=0.00 cfs 0.000 af Outflow=1.81 cfs 0.098 af

Pond C3NW: Northwest Ditch Peak Elev=720.32' Storage=567 cf Inflow=9.23 cfs 0.546 af
Primary=8.66 cfs 0.546 af Secondary=0.00 cfs 0.000 af Outflow=8.66 cfs 0.546 af

Pond C3S: Catch Basin Peak Elev=797.04' Storage=853 cf Inflow=10.45 cfs 1.162 af
Primary=6.94 cfs 0.774 af Secondary=3.47 cfs 0.387 af Tertiary=0.00 cfs 0.000 af Outflow=10.42 cfs 1.162 af

Pond C3SE: Catch Basin Peak Elev=799.32' Storage=92 cf Inflow=6.32 cfs 0.675 af
Primary=6.31 cfs 0.675 af Secondary=0.00 cfs 0.000 af Outflow=6.31 cfs 0.675 af

Pond C3SW: Catch Basin Peak Elev=752.75' Storage=29 cf Inflow=2.21 cfs 0.115 af
Primary=2.21 cfs 0.115 af Secondary=0.00 cfs 0.000 af Outflow=2.21 cfs 0.115 af

Pond C3W: Catch Basin Peak Elev=742.20' Storage=24 cf Inflow=1.62 cfs 0.085 af
Primary=1.61 cfs 0.085 af Secondary=0.00 cfs 0.000 af Outflow=1.61 cfs 0.085 af

Pond C4N: Catch Basin Peak Elev=782.24' Storage=32 cf Inflow=2.08 cfs 0.107 af
Primary=2.08 cfs 0.107 af Secondary=0.00 cfs 0.000 af Outflow=2.08 cfs 0.107 af

Pond C4S: Catch Basin Peak Elev=777.64' Storage=27 cf Inflow=0.96 cfs 0.048 af
Primary=0.95 cfs 0.048 af Secondary=0.00 cfs 0.000 af Outflow=0.95 cfs 0.048 af

Pond C4SE: Catch Basin Peak Elev=776.26' Storage=84 cf Inflow=2.40 cfs 0.122 af
Primary=2.39 cfs 0.122 af Secondary=0.00 cfs 0.000 af Outflow=2.39 cfs 0.122 af

Pond C4SW: Southwest Ditch 1 Peak Elev=744.22' Storage=26 cf Inflow=1.87 cfs 0.093 af
Primary=1.87 cfs 0.093 af Secondary=0.00 cfs 0.000 af Outflow=1.87 cfs 0.093 af

Pond C4W: West Ditch Peak Elev=718.57' Storage=2,221 cf Inflow=11.14 cfs 1.015 af
Primary=10.21 cfs 1.015 af Secondary=0.00 cfs 0.000 af Outflow=10.21 cfs 1.015 af

Pond C5N: Catch Basin Peak Elev=749.20' Storage=27 cf Inflow=3.26 cfs 0.176 af
Primary=3.26 cfs 0.176 af Secondary=0.00 cfs 0.000 af Outflow=3.26 cfs 0.176 af

Pond C5S: Catch Basin Peak Elev=732.23' Storage=11 cf Inflow=1.91 cfs 0.098 af
Primary=1.91 cfs 0.098 af Secondary=0.00 cfs 0.000 af Outflow=1.91 cfs 0.098 af

Pond C5SE: Catch Basin Peak Elev=752.75' Storage=29 cf Inflow=2.18 cfs 0.113 af
Primary=2.17 cfs 0.113 af Secondary=0.00 cfs 0.000 af Outflow=2.17 cfs 0.113 af

Pond C5SW: Catch Basin Peak Elev=811.34' Storage=397 cf Inflow=3.54 cfs 0.249 af
Primary=3.46 cfs 0.249 af Secondary=0.00 cfs 0.000 af Outflow=3.46 cfs 0.249 af

Pond C6N: North Ditch Peak Elev=720.76' Storage=1,154 cf Inflow=10.12 cfs 1.477 af
Primary=10.03 cfs 1.477 af Secondary=0.00 cfs 0.000 af Outflow=10.03 cfs 1.477 af

Pond C6S: Catch Basin Peak Elev=777.23' Storage=63 cf Inflow=2.01 cfs 0.101 af
Primary=2.00 cfs 0.101 af Secondary=0.00 cfs 0.000 af Outflow=2.00 cfs 0.101 af

Pond C6SE: Southeast Ditch 1 Peak Elev=744.21' Storage=24 cf Inflow=1.65 cfs 0.082 af
Primary=1.65 cfs 0.082 af Secondary=0.00 cfs 0.000 af Outflow=1.65 cfs 0.082 af

Pond C6SW: Catch Basin Peak Elev=776.27' Storage=87 cf Inflow=2.54 cfs 0.128 af
Primary=2.53 cfs 0.128 af Secondary=0.00 cfs 0.000 af Outflow=2.53 cfs 0.128 af

Pond C7S: Catch Basin Peak Elev=732.76' Storage=31 cf Inflow=2.29 cfs 0.117 af
Primary=2.28 cfs 0.117 af Secondary=0.00 cfs 0.000 af Outflow=2.28 cfs 0.117 af

Pond C7SE: Catch Basin Peak Elev=775.25' Storage=66 cf Inflow=2.18 cfs 0.122 af
Primary=2.17 cfs 0.122 af Secondary=0.00 cfs 0.000 af Outflow=2.17 cfs 0.122 af

Pond C7SW: Catch Basin Peak Elev=732.82' Storage=38 cf Inflow=3.26 cfs 0.177 af
Primary=3.25 cfs 0.177 af Secondary=0.00 cfs 0.000 af Outflow=3.25 cfs 0.177 af

Pond C8SE: Catch Basin Peak Elev=753.20' Storage=24 cf Inflow=1.55 cfs 0.072 af
Primary=1.55 cfs 0.072 af Secondary=0.00 cfs 0.000 af Outflow=1.55 cfs 0.072 af

Pond C8SW: Southwest Ditch 2 Peak Elev=726.16' Storage=18 cf Inflow=1.09 cfs 0.053 af
Primary=1.08 cfs 0.053 af Secondary=0.00 cfs 0.000 af Outflow=1.08 cfs 0.053 af

Pond C9SE: Southeast Ditch 2 Peak Elev=735.12' Storage=7 cf Inflow=0.74 cfs 0.036 af
Primary=0.74 cfs 0.036 af Secondary=0.00 cfs 0.000 af Outflow=0.74 cfs 0.036 af

Pond D10SE: 10" Pipe Peak Elev=808.74' Inflow=2.96 cfs 0.217 af
9.9" Round Culvert n=0.010 L=350.0' S=0.0200 '/' Outflow=2.96 cfs 0.217 af

Pond D11SE: 20" Pipe Peak Elev=801.11' Inflow=5.19 cfs 0.541 af
18.5" Round Culvert n=0.010 L=265.0' S=0.0208 '/' Outflow=5.19 cfs 0.541 af

Pond D12SE: 24" Pipe Peak Elev=796.00' Inflow=9.75 cfs 1.042 af
22.2" Round Culvert n=0.010 L=350.0' S=0.2129 '/' Outflow=9.75 cfs 1.042 af

Pond D1E: 24" Pipe Peak Elev=795.81' Inflow=7.89 cfs 0.988 af
22.2" Round Culvert n=0.010 L=330.0' S=0.2258 '/' Outflow=7.89 cfs 0.988 af

Pond D1N: 24" Pipe Peak Elev=799.33' Inflow=8.12 cfs 0.980 af
22.2" Round Culvert n=0.010 L=330.0' S=0.2364 '/' Outflow=8.12 cfs 0.980 af

Pond D1NW: 24" Pipe Peak Elev=782.56' Inflow=1.75 cfs 0.083 af
22.2" Round Culvert n=0.010 L=200.0' S=0.2000 '/' Outflow=1.75 cfs 0.083 af

Pond D1S: 10" Pipe Peak Elev=807.45' Inflow=2.62 cfs 0.191 af
9.9" Round Culvert n=0.010 L=420.0' S=0.0214 '/' Outflow=2.62 cfs 0.191 af

Pond D1SE: 10" Pipe Peak Elev=808.42' Inflow=2.58 cfs 0.187 af
9.9" Round Culvert n=0.010 L=360.0' S=0.0167 '/' Outflow=2.58 cfs 0.187 af

Pond D1SW: 6" Pipe Peak Elev=820.60' Inflow=3.43 cfs 0.262 af
6.1" Round Culvert n=0.010 L=120.0' S=0.2917 '/' Outflow=3.43 cfs 0.262 af

Pond D1W: 24" Pipe Peak Elev=797.61' Inflow=10.74 cfs 0.928 af
22.2" Round Culvert n=0.010 L=280.0' S=0.2571 '/' Outflow=10.74 cfs 0.928 af

Pond D2N: 24" Pipe Peak Elev=779.47' Inflow=1.26 cfs 0.063 af
22.2" Round Culvert n=0.010 L=170.0' S=0.2353 '/' Outflow=1.26 cfs 0.063 af

Pond D2NW: 24" Pipe Peak Elev=742.79' Inflow=3.28 cfs 0.213 af
22.2" Round Culvert n=0.010 L=60.0' S=0.2667 '/' Outflow=3.28 cfs 0.213 af

Pond D2S: 20" Pipe Peak Elev=798.17' Inflow=5.56 cfs 0.602 af
18.5" Round Culvert n=0.010 L=195.0' S=0.0169 '/' Outflow=5.56 cfs 0.602 af

Pond D2SE: 20" Pipe Peak Elev=802.04' Inflow=4.68 cfs 0.483 af
18.5" Round Culvert n=0.010 L=120.0' S=0.0417 '/' Outflow=4.68 cfs 0.483 af

Pond D2SW: 12" Pipe Peak Elev=775.51' Inflow=5.19 cfs 0.427 af
11.8" Round Culvert n=0.010 L=75.0' S=0.3133 '/' Outflow=5.19 cfs 0.427 af

Pond D2W: 14" Pipe Peak Elev=766.76' Inflow=2.02 cfs 0.107 af
12.9" Round Culvert n=0.010 L=200.0' S=0.2300 '/' Outflow=2.02 cfs 0.107 af

Pond D3N: 24" Pipe Peak Elev=739.75' Inflow=3.03 cfs 0.161 af
22.2" Round Culvert n=0.010 L=60.0' S=0.2167 '/' Outflow=3.03 cfs 0.161 af

Pond D3S1: 22" Pipe 1 Peak Elev=794.97' Inflow=6.94 cfs 0.774 af
20.3" Round Culvert n=0.010 L=475.0' S=0.1625 '/' Outflow=6.94 cfs 0.774 af

Pond D3S2: 22" Pipe 2 Peak Elev=795.20' Inflow=8.75 cfs 0.989 af
20.3" Round Culvert n=0.010 L=475.0' S=0.1625 '/' Outflow=8.75 cfs 0.989 af

Pond D3SE: 24" Pipe Peak Elev=797.61' Inflow=10.70 cfs 1.158 af
22.2" Round Culvert n=0.010 L=190.0' S=0.2947 '/' Outflow=10.70 cfs 1.158 af

Pond D3SW: 24" Pipe Peak Elev=750.74' Inflow=7.26 cfs 0.542 af
22.2" Round Culvert n=0.010 L=25.0' S=0.3800 '/' Outflow=7.26 cfs 0.542 af

Pond D3W: 18" Pipe Peak Elev=739.59' Inflow=1.61 cfs 0.085 af
16.6" Round Culvert n=0.010 L=88.0' S=0.2159 '/' Outflow=1.61 cfs 0.085 af

Pond D4N: 24" Pipe Peak Elev=779.61' Inflow=2.08 cfs 0.107 af
22.2" Round Culvert n=0.010 L=118.0' S=0.2797 '/' Outflow=2.08 cfs 0.107 af

Pond D4S: 10" Pipe Peak Elev=778.05' Inflow=0.95 cfs 0.048 af
9.9" Round Culvert n=0.010 L=160.0' S=0.3094 '/' Outflow=0.95 cfs 0.048 af

Pond D4SE: 12" Pipe Peak Elev=773.91' Inflow=2.39 cfs 0.122 af
11.8" Round Culvert n=0.010 L=65.0' S=0.3615 '/' Outflow=2.39 cfs 0.122 af

Pond D4W: 18" Pipe Peak Elev=720.95' Inflow=3.63 cfs 0.192 af
16.6" Round Culvert n=0.010 L=95.0' S=0.0421 '/' Outflow=3.63 cfs 0.192 af

Pond D5N: 24" Pipe Peak Elev=747.03' Inflow=5.33 cfs 0.283 af
22.2" Round Culvert n=0.010 L=84.0' S=0.2381 '/' Outflow=5.33 cfs 0.283 af

Pond D5S: 16" Pipe Peak Elev=729.87' Inflow=2.86 cfs 0.147 af
14.8" Round Culvert n=0.010 L=142.0' S=0.1056 '/' Outflow=2.86 cfs 0.147 af

Pond D5SE: 20" Pipe Peak Elev=750.53' Inflow=4.56 cfs 0.235 af
18.5" Round Culvert n=0.010 L=30.0' S=0.3167 '/' Outflow=4.56 cfs 0.235 af

Pond D5SW: 6" Pipe Peak Elev=820.79' Inflow=3.46 cfs 0.249 af
6.1" Round Culvert n=0.010 L=125.0' S=0.2800 '/' Outflow=3.46 cfs 0.249 af

Pond D6S: 14" Pipe Peak Elev=774.75' Inflow=2.00 cfs 0.101 af
12.9" Round Culvert n=0.010 L=185.0' S=0.2459 '/' Outflow=2.00 cfs 0.101 af

Pond D6SW: 16" Pipe Peak Elev=774.37' Inflow=4.98 cfs 0.377 af
14.8" Round Culvert n=0.010 L=165.0' S=0.2636 '/' Outflow=4.98 cfs 0.377 af

Pond D7S: 20" Pipe Peak Elev=730.49' Inflow=4.28 cfs 0.218 af
18.5" Round Culvert n=0.010 L=70.0' S=0.1857 '/' Outflow=4.28 cfs 0.218 af

Pond D7SE: 12" Pipe Peak Elev=772.84' Inflow=2.17 cfs 0.122 af
11.8" Round Culvert n=0.010 L=90.0' S=0.2444 '/' Outflow=2.17 cfs 0.122 af

Pond D7SW: 26" Pipe Peak Elev=730.78' Inflow=8.13 cfs 0.554 af
24.0" Round Culvert n=0.010 L=30.0' S=0.2500 '/' Outflow=8.13 cfs 0.554 af

Pond D8SE: 18" Pipe Peak Elev=750.92' Inflow=3.48 cfs 0.195 af
16.6" Round Culvert n=0.010 L=36.0' S=0.2778 '/' Outflow=3.48 cfs 0.195 af

Pond DP6N: 24" Pipe Peak Elev=720.03' Inflow=10.03 cfs 1.477 af
22.2" Round Culvert n=0.010 L=780.0' S=0.0237 '/' Outflow=10.03 cfs 1.477 af

Pond MH1S: 4' Dia. Manhole Peak Elev=717.41' Inflow=4.28 cfs 0.218 af
22.2" Round Culvert n=0.010 L=830.0' S=0.0048 '/' Outflow=4.28 cfs 0.218 af

Pond MH1SE: 8' Dia. Manhole Peak Elev=739.77' Inflow=11.98 cfs 1.476 af
22.2" Round Culvert n=0.010 L=590.0' S=0.0339 '/' Outflow=11.98 cfs 1.476 af

Pond MH1SW: 4' Dia. Manhole Peak Elev=739.53' Inflow=8.98 cfs 0.635 af
20.3" Round Culvert n=0.010 L=550.0' S=0.0382 '/' Outflow=8.98 cfs 0.635 af

Pond MH1W: 6' Manhole Peak Elev=716.16' Inflow=16.26 cfs 1.955 af
24.0" Round Culvert n=0.024 L=5.0' S=0.2000 '/' Outflow=16.26 cfs 1.955 af

Pond MH2SE: 4' Dia. Manhole Peak Elev=717.44' Inflow=11.98 cfs 1.476 af
30.0" Round Culvert n=0.024 L=10.0' S=0.1000 '/' Outflow=11.98 cfs 1.476 af

Pond MH2SW: 6' Dia. Manhole Peak Elev=723.36' Inflow=9.06 cfs 0.607 af
24.0" Round Culvert n=0.010 L=1,050.0' S=0.0048 '/' Outflow=9.06 cfs 0.607 af

Pond MH3S: 6' Dia. Manhole Peak Elev=717.23' Inflow=7.15 cfs 0.365 af
22.2" Round Culvert n=0.010 L=10.0' S=0.4000 '/' Outflow=7.15 cfs 0.365 af

Pond MH3SE: 8' Dia. Manhole Peak Elev=721.51' Inflow=10.32 cfs 1.179 af
24.0" Round Culvert n=0.010 L=1,400.0' S=0.0036 '/' Outflow=10.32 cfs 1.179 af

Pond MH3SW: 6' Dia. Manhole Peak Elev=719.88' Inflow=18.03 cfs 1.242 af
24.0" Round Culvert n=0.024 L=5.0' S=0.0000 '/' Outflow=18.03 cfs 1.242 af

Pond MH4SE: 4' Dia. Manhole Peak Elev=721.89' Inflow=11.46 cfs 1.410 af
24.0" Round Culvert n=0.010 L=620.0' S=0.0050 '/' Outflow=11.46 cfs 1.410 af

Pond MH4W: Manhole Peak Elev=721.52' Inflow=10.74 cfs 0.928 af
24.0" Round Culvert n=0.024 L=5.0' S=0.2000 '/' Outflow=10.74 cfs 0.928 af

Pond MH5SE: 4' Dia. Manhole Peak Elev=717.40' Inflow=11.46 cfs 1.410 af
30.0" Round Culvert n=0.024 L=10.0' S=0.1000 '/' Outflow=11.46 cfs 1.410 af

Pond NP: North Pond Peak Elev=697.11' Storage=60,068 cf Inflow=18.38 cfs 2.277 af
Primary=8.58 cfs 2.263 af Secondary=0.00 cfs 0.000 af Tertiary=0.00 cfs 0.000 af Outflow=8.58 cfs 2.263 af

Pond NWP: Northwest Pond Peak Elev=708.82' Storage=108,836 cf Inflow=29.35 cfs 3.761 af
Primary=17.64 cfs 3.755 af Secondary=0.00 cfs 0.000 af Tertiary=0.00 cfs 0.000 af Outflow=17.64 cfs 3.755 af

Pond SEP: Southeast Pond Peak Elev=713.71' Storage=57,222 cf Inflow=23.98 cfs 3.115 af
Primary=18.62 cfs 3.113 af Secondary=0.00 cfs 0.000 af Outflow=18.62 cfs 3.113 af

Pond SP: South Pond Peak Elev=718.97' Storage=18,868 cf Inflow=8.92 cfs 0.491 af
Discarded=0.06 cfs 0.163 af Secondary=0.00 cfs 0.000 af Tertiary=0.00 cfs 0.000 af Outflow=0.06 cfs 0.163 af

Pond SWP: Southwest Pond Peak Elev=720.05' Storage=58,053 cf Inflow=20.45 cfs 1.539 af
Primary=0.52 cfs 0.238 af Secondary=0.00 cfs 0.000 af Outflow=0.52 cfs 0.238 af

Total Runoff Area = 228.591 ac Runoff Volume = 13.398 af Average Runoff Depth = 0.70"
97.89% Pervious = 223.771 ac 2.11% Impervious = 4.820 ac

Summary for Subcatchment 1E: East Top

Runoff = 7.89 cfs @ 12.32 hrs, Volume= 0.988 af, Depth= 0.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 2 year - 24 hour Rainfall=2.83"

Area (ac)	CN	Description
17.841	71	Meadow, non-grazed, HSG C
17.841		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
28.6	270	0.0300	0.16		**Sheet Flow, 3% Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
5.5	700	0.0200	2.12		**Shallow Concentrated Flow, 2% Channel Flow** Grassed Waterway Kv= 15.0 fps
34.1	970	Total			

Summary for Subcatchment 1N: North Top

Runoff = 8.14 cfs @ 12.31 hrs, Volume= 0.980 af, Depth= 0.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 2 year - 24 hour Rainfall=2.83"

Area (ac)	CN	Description
17.691	71	Meadow, non-grazed, HSG C
17.691		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
28.6	270	0.0300	0.16		**Sheet Flow, 3% Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
3.9	500	0.0200	2.12		**Shallow Concentrated Flow, 2% Shallow Flow** Grassed Waterway Kv= 15.0 fps
32.5	770	Total			

Summary for Subcatchment 1NW: Sideslope

Runoff = 1.75 cfs @ 11.98 hrs, Volume= 0.083 af, Depth= 0.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 2 year - 24 hour Rainfall=2.83"

Area (ac)	CN	Description
1.506	71	Meadow, non-grazed, HSG C
1.506		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.1	35	0.3333	0.27		**Sheet Flow, 3:1 Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
3.2	500	0.0300	2.60		**Shallow Concentrated Flow, 3% Shallow Flow** Grassed Waterway Kv= 15.0 fps
5.3	535	Total			

Summary for Subcatchment 1S: South Top

Runoff = 2.63 cfs @ 12.09 hrs, Volume= 0.191 af, Depth= 0.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 2 year - 24 hour Rainfall=2.83"

Area (ac)	CN	Description
3.455	71	Meadow, non-grazed, HSG C
3.455		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.7	100	0.0200	0.14		**Sheet Flow, 2% Sheet Flow** Grass: Dense n= 0.240 P2= 4.80"
3.5	450	0.0200	2.12		**Shallow Concentrated Flow, 2% Shallow Flow** Grassed Waterway Kv= 15.0 fps
15.2	550	Total			

Summary for Subcatchment 1SE: Southeast Top

Runoff = 2.60 cfs @ 12.09 hrs, Volume= 0.187 af, Depth= 0.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 2 year - 24 hour Rainfall=2.83"

Area (ac)	CN	Description
3.373	71	Meadow, non-grazed, HSG C
3.373		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.7	100	0.0200	0.14		**Sheet Flow, 2% Sheet Flow** Grass: Dense n= 0.240 P2= 4.80"
3.2	410	0.0200	2.12		**Shallow Concentrated Flow, 2% Shallow Flow** Grassed Waterway Kv= 15.0 fps
14.9	510	Total			

Summary for Subcatchment 1SW: Southwest Top

Runoff = 3.69 cfs @ 12.09 hrs, Volume= 0.262 af, Depth= 0.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 2 year - 24 hour Rainfall=2.83"

Area (ac)	CN	Description
4.734	71	Meadow, non-grazed, HSG C
4.734		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.7	100	0.0200	0.14		**Sheet Flow, 2% Sheet Flow** Grass: Dense n= 0.240 P2= 4.80"
2.9	370	0.0200	2.12		**Shallow Concentrated Flow, 2% ShallowFlow** Grassed Waterway Kv= 15.0 fps
14.6	470	Total			

Summary for Subcatchment 1W: West Top

Runoff = 10.78 cfs @ 12.15 hrs, Volume= 0.928 af, Depth= 0.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 2 year - 24 hour Rainfall=2.83"

Area (ac)	CN	Description
16.760	71	Meadow, non-grazed, HSG C
16.760		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.7	150	0.0300	0.18		**Sheet Flow, 3% Sheet Flow** Grass: Dense n= 0.240 P2= 4.80"
1.0	150	0.0300	2.60		**Shallow Concentrated Flow, 3% Shallow Flow** Grassed Waterway Kv= 15.0 fps
5.3	670	0.0200	2.12		**Shallow Concentrated Flow, 2% Concentrated Flow** Grassed Waterway Kv= 15.0 fps
20.0	970	Total			

Summary for Subcatchment 2E: Side Slope

Runoff = 2.40 cfs @ 12.04 hrs, Volume= 0.143 af, Depth= 0.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 2 year - 24 hour Rainfall=2.83"

Area (ac)	CN	Description
2.590	71	Meadow, non-grazed, HSG C
2.590		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	120	0.3333	0.35		**Sheet Flow, 3:1 Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
4.6	580	0.0200	2.12		**Shallow Concentrated Flow, 2% Shallow Flow** Grassed Waterway Kv= 15.0 fps
0.1	280	0.3300	44.39	78.45	**Pipe Channel, Drop Pipe** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.010 PVC, smooth interior
10.4	980	Total			

Summary for Subcatchment 2N: Sideslope

Runoff = 1.26 cfs @ 11.99 hrs, Volume= 0.063 af, Depth= 0.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 2 year - 24 hour Rainfall=2.83"

Area (ac)	CN	Description
1.145	71	Meadow, non-grazed, HSG C
1.145		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.3	84	0.3333	0.33		**Sheet Flow, 3:1 Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
2.2	340	0.0300	2.60		**Shallow Concentrated Flow, 3% Concentrated Flow** Grassed Waterway Kv= 15.0 fps
6.5	424	Total			

Summary for Subcatchment 2NW: Sideslope

Runoff = 2.05 cfs @ 12.05 hrs, Volume= 0.129 af, Depth= 0.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 2 year - 24 hour Rainfall=2.83"

Area (ac)	CN	Description
2.338	71	Meadow, non-grazed, HSG C
2.338		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.4	113	0.3333	0.35		**Sheet Flow, 3:1 Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
6.4	1,000	0.0300	2.60		**Shallow Concentrated Flow, 3% Shallow Flow** Grassed Waterway Kv= 15.0 fps
11.8	1,113	Total			

Summary for Subcatchment 2S: South Top

Runoff = 3.81 cfs @ 12.26 hrs, Volume= 0.410 af, Depth= 0.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 2 year - 24 hour Rainfall=2.83"

Area (ac)	CN	Description
7.410	71	Meadow, non-grazed, HSG C
7.410		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
23.9	300	0.0300	0.21		**Sheet Flow, 3% Sheet Flow** Grass: Dense n= 0.240 P2= 4.80"
3.9	500	0.0200	2.12		**Shallow Concentrated Flow, 2% Shallow Flow** Grassed Waterway Kv= 15.0 fps
27.8	800	Total			

Summary for Subcatchment 2SE: Southeast Top

Runoff = 2.80 cfs @ 12.24 hrs, Volume= 0.297 af, Depth= 0.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 2 year - 24 hour Rainfall=2.83"

Area (ac)	CN	Description
5.356	71	Meadow, non-grazed, HSG C
5.356		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
23.9	300	0.0300	0.21		**Sheet Flow, 3% Sheet Flow** Grass: Dense n= 0.240 P2= 4.80"
3.1	400	0.0200	2.12		**Shallow Concentrated Flow, 2% Shallow Flow** Grassed Waterway Kv= 15.0 fps
27.0	700	Total			

Summary for Subcatchment 2SW: Sideslope

Runoff = 3.24 cfs @ 11.99 hrs, Volume= 0.165 af, Depth= 0.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 2 year - 24 hour Rainfall=2.83"

Area (ac)	CN	Description
2.975	71	Meadow, non-grazed, HSG C
2.975		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.5	60	0.3300	0.40		**Sheet Flow, 3:1 Sheet Flow** Grass: Dense n= 0.240 P2= 4.80"
4.3	665	0.0300	2.60		**Shallow Concentrated Flow, 3% Shallow Flow** Grassed Waterway Kv= 15.0 fps
6.8	725	Total			

Summary for Subcatchment 2W: Sideslope

Runoff = 2.02 cfs @ 12.00 hrs, Volume= 0.107 af, Depth= 0.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 2 year - 24 hour Rainfall=2.83"

Area (ac)	CN	Description
1.924	71	Meadow, non-grazed, HSG C
1.924		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.2	80	0.3300	0.42		**Sheet Flow, 3:1 Sheet Flow** Grass: Dense n= 0.240 P2= 4.80"
4.4	690	0.0300	2.60		**Shallow Concentrated Flow, 3% Shallow Flow** Grassed Waterway Kv= 15.0 fps
7.6	770	Total			

Summary for Subcatchment 3E: Side Slope

Runoff = 2.50 cfs @ 12.05 hrs, Volume= 0.156 af, Depth= 0.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 2 year - 24 hour Rainfall=2.83"

Area (ac)	CN	Description
2.825	71	Meadow, non-grazed, HSG C
2.825		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	120	0.3333	0.35		**Sheet Flow, 3:1 Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
5.7	720	0.0200	2.12		**Shallow Concentrated Flow, 2% Shallow Flow** Grassed Waterway Kv= 15.0 fps
0.1	170	0.3300	44.39	78.45	**Pipe Channel, Drop Pipe** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.010 PVC, smooth interior
11.5	1,010	Total			

Summary for Subcatchment 3N: Sideslope

Runoff = 1.83 cfs @ 12.01 hrs, Volume= 0.098 af, Depth= 0.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 2 year - 24 hour Rainfall=2.83"

Area (ac)	CN	Description
1.762	71	Meadow, non-grazed, HSG C
1.762		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.2	133	0.3333	0.36		**Sheet Flow, 3:1 Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
1.7	265	0.0300	2.60		**Shallow Concentrated Flow, 3% Shallow Flow** Grassed Waterway Kv= 15.0 fps
7.9	398	Total			

Summary for Subcatchment 3NW: Sideslope

Runoff = 2.97 cfs @ 12.03 hrs, Volume= 0.172 af, Depth= 0.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 2 year - 24 hour Rainfall=2.83"

Area (ac)	CN	Description
3.104	71	Meadow, non-grazed, HSG C
3.104		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.5	90	0.3333	0.33		**Sheet Flow, 3:1 Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
5.2	1,100	0.0300	3.52		**Shallow Concentrated Flow, 3% Concentrated Channel** Paved Kv= 20.3 fps
9.7	1,190	Total			

Summary for Subcatchment 3S: South Top

Runoff = 10.45 cfs @ 12.27 hrs, Volume= 1.162 af, Depth= 0.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 2 year - 24 hour Rainfall=2.83"

Area (ac)	CN	Description
20.973	71	Meadow, non-grazed, HSG C
20.973		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
23.9	300	0.0300	0.21		**Sheet Flow, 3% Sheet Flow** Grass: Dense n= 0.240 P2= 4.80"
5.1	650	0.0200	2.12		**Shallow Concentrated Flow, 2% Shallow Flow** Grassed Waterway Kv= 15.0 fps
29.0	950	Total			

Summary for Subcatchment 3SE: Southeast Top

Runoff = 6.32 cfs @ 12.25 hrs, Volume= 0.675 af, Depth= 0.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 2 year - 24 hour Rainfall=2.83"

Area (ac)	CN	Description
12.185	71	Meadow, non-grazed, HSG C
12.185		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
23.9	300	0.0300	0.21		**Sheet Flow, 3% Sheet Flow** Grass: Dense n= 0.240 P2= 4.80"
3.4	430	0.0200	2.12		**Shallow Concentrated Flow, 2% Shallow Flow** Grassed Waterway Kv= 15.0 fps
27.3	730	Total			

Summary for Subcatchment 3SW: Sideslope

Runoff = 2.21 cfs @ 12.00 hrs, Volume= 0.115 af, Depth= 0.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 2 year - 24 hour Rainfall=2.83"

Area (ac)	CN	Description
2.085	71	Meadow, non-grazed, HSG C
2.085		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.0	76	0.3300	0.42		**Sheet Flow, 3:1 Sheet Flow** Grass: Dense n= 0.240 P2= 4.80"
4.4	680	0.0300	2.60		**Shallow Concentrated Flow, 3% Shallow Flow** Grassed Waterway Kv= 15.0 fps
7.4	756	Total			

Summary for Subcatchment 3W: Sideslope

Runoff = 1.62 cfs @ 12.00 hrs, Volume= 0.085 af, Depth= 0.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 2 year - 24 hour Rainfall=2.83"

Area (ac)	CN	Description
1.543	71	Meadow, non-grazed, HSG C
1.543		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.5	90	0.3300	0.43		**Sheet Flow, 3:1 Sheet Flow** Grass: Dense n= 0.240 P2= 4.80"
4.2	650	0.0300	2.60		**Shallow Concentrated Flow, 3% Shallow Flow** Grassed Waterway Kv= 15.0 fps
7.7	740	Total			

Summary for Subcatchment 4E: Side Slope

Runoff = 4.79 cfs @ 12.05 hrs, Volume= 0.296 af, Depth= 0.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 2 year - 24 hour Rainfall=2.83"

Area (ac)	CN	Description
5.342	71	Meadow, non-grazed, HSG C
5.342		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	120	0.3333	0.35		**Sheet Flow, 3:1 Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
5.5	700	0.0200	2.12		**Shallow Concentrated Flow, 2% Shallow Flow** Grassed Waterway Kv= 15.0 fps
11.2	820	Total			

Summary for Subcatchment 4N: Sideslope

Runoff = 2.08 cfs @ 12.00 hrs, Volume= 0.107 af, Depth= 0.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 2 year - 24 hour Rainfall=2.83"

Area (ac)	CN	Description
1.933	71	Meadow, non-grazed, HSG C
1.933		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.4	63	0.3333	0.31		**Sheet Flow, 3:1 Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
3.7	569	0.0300	2.60		**Shallow Concentrated Flow, 3% Shallow Flow** Grassed Waterway Kv= 15.0 fps
7.1	632	Total			

Summary for Subcatchment 4S: Sideslope

Runoff = 0.96 cfs @ 11.99 hrs, Volume= 0.048 af, Depth= 0.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 2 year - 24 hour Rainfall=2.83"

Area (ac)	CN	Description
0.872	71	Meadow, non-grazed, HSG C
0.872		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.8	100	0.3300	0.44		**Sheet Flow, 3:1 Sheet Flow** Grass: Dense n= 0.240 P2= 4.80"
2.8	430	0.0300	2.60		**Shallow Concentrated Flow, 3% Shallow Flow** Grassed Waterway Kv= 15.0 fps
6.6	530	Total			

Summary for Subcatchment 4SE: Sideslope

Runoff = 2.40 cfs @ 11.99 hrs, Volume= 0.122 af, Depth= 0.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 2 year - 24 hour Rainfall=2.83"

Area (ac)	CN	Description
2.200	71	Meadow, non-grazed, HSG C
2.200		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.5	60	0.3300	0.40		**Sheet Flow, 3:1 Sheet Flow** Grass: Dense n= 0.240 P2= 4.80"
4.3	670	0.0300	2.60		**Shallow Concentrated Flow, 3% Shallow Flow** Grassed Waterway Kv= 15.0 fps
6.8	730	Total			

Summary for Subcatchment 4SW: Sideslope

Runoff = 1.87 cfs @ 11.99 hrs, Volume= 0.093 af, Depth= 0.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 2 year - 24 hour Rainfall=2.83"

Area (ac)	CN	Description
1.671	71	Meadow, non-grazed, HSG C
1.671		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.8	40	0.3300	0.37		**Sheet Flow, 3:1 Sheet Flow** Grass: Dense n= 0.240 P2= 4.80"
4.4	690	0.0300	2.60		**Shallow Concentrated Flow, 3% Shallow Flow** Grassed Waterway Kv= 15.0 fps
6.2	730	Total			

Summary for Subcatchment 4W: Sideslope

Runoff = 1.72 cfs @ 11.99 hrs, Volume= 0.086 af, Depth= 0.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 2 year - 24 hour Rainfall=2.83"

Area (ac)	CN	Description
1.561	71	Meadow, non-grazed, HSG C
1.561		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.3	150	0.3300	0.48		**Sheet Flow, 3:1 Sheet Flow** Grass: Dense n= 0.240 P2= 4.80"
1.3	200	0.0300	2.60		**Shallow Concentrated Flow, 3% Shallow Flow** Grassed Waterway Kv= 15.0 fps
6.6	350	Total			

Summary for Subcatchment 5E: Side Slope

Runoff = 1.29 cfs @ 12.00 hrs, Volume= 0.066 af, Depth= 0.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 2 year - 24 hour Rainfall=2.83"

Area (ac)	CN	Description
1.195	71	Meadow, non-grazed, HSG C
1.195		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.3	85	0.3333	0.33		**Sheet Flow, 3:1 Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
2.6	330	0.0200	2.12		**Shallow Concentrated Flow, 2% Shallow Flow** Grassed Waterway Kv= 15.0 fps
0.1	315	0.3300	44.39	78.45	**Pipe Channel, Drop Pipe** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.010 PVC, smooth interior
7.0	730	Total			

Summary for Subcatchment 5N: Sideslope

Runoff = 3.26 cfs @ 12.01 hrs, Volume= 0.176 af, Depth= 0.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 2 year - 24 hour Rainfall=2.83"

Area (ac)	CN	Description
3.175	71	Meadow, non-grazed, HSG C
3.175		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.5	56	0.2500	0.27		**Sheet Flow, 4:1 Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
4.6	710	0.0300	2.60		**Shallow Concentrated Flow, 3% Concentrated Flow** Grassed Waterway Kv= 15.0 fps
8.1	766	Total			

Summary for Subcatchment 5S: Sideslope

Runoff = 1.91 cfs @ 12.00 hrs, Volume= 0.098 af, Depth= 0.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 2 year - 24 hour Rainfall=2.83"

Area (ac)	CN	Description
1.778	71	Meadow, non-grazed, HSG C
1.778		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.2	115	0.3300	0.45		**Sheet Flow, 3:1 Sheet Flow** Grass: Dense n= 0.240 P2= 4.80"
2.9	450	0.0300	2.60		**Shallow Concentrated Flow, 3% Shallow Flow** Grassed Waterway Kv= 15.0 fps
7.1	565	Total			

Summary for Subcatchment 5SE: Sideslope

Runoff = 2.18 cfs @ 12.00 hrs, Volume= 0.113 af, Depth= 0.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 2 year - 24 hour Rainfall=2.83"

Area (ac)	CN	Description
2.043	71	Meadow, non-grazed, HSG C
2.043		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.9	70	0.3300	0.41		**Sheet Flow, 3:1 Sheet Flow** Grass: Dense n= 0.240 P2= 4.80"
4.4	680	0.0300	2.60		**Shallow Concentrated Flow, 3% Shallow Flow** Grassed Waterway Kv= 15.0 fps
7.3	750	Total			

Summary for Subcatchment 5SW: Southwest Top

Runoff = 3.54 cfs @ 12.08 hrs, Volume= 0.249 af, Depth= 0.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 2 year - 24 hour Rainfall=2.83"

Area (ac)	CN	Description
4.496	71	Meadow, non-grazed, HSG C
4.496		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.7	100	0.0200	0.14		**Sheet Flow, 2% Sheet Flow** Grass: Dense n= 0.240 P2= 4.80"
2.7	340	0.0200	2.12		**Shallow Concentrated Flow, 2% Shallow Flow** Grassed Waterway Kv= 15.0 fps
14.4	440	Total			

Summary for Subcatchment 5W: Sideslope

Runoff = 2.46 cfs @ 11.99 hrs, Volume= 0.121 af, Depth= 0.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 2 year - 24 hour Rainfall=2.83"

Area (ac)	CN	Description
2.191	71	Meadow, non-grazed, HSG C
2.191		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.3	150	0.3300	0.48		**Sheet Flow, 3:1 Sheet Flow** Grass: Dense n= 0.240 P2= 4.80"
0.4	200	0.3300	8.62		**Shallow Concentrated Flow, 3:1 Shallow Flow** Grassed Waterway Kv= 15.0 fps
0.4	35	0.0200	1.37		**Sheet Flow, 2% Concentrated Flow** Smooth surfaces n= 0.011 P2= 4.80"
6.1	385	Total			

Summary for Subcatchment 6E: Side Slope

Runoff = 2.38 cfs @ 12.02 hrs, Volume= 0.135 af, Depth= 0.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 2 year - 24 hour Rainfall=2.83"

Area (ac)	CN	Description
2.437	71	Meadow, non-grazed, HSG C
2.437		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	120	0.3333	0.35		**Sheet Flow, 3:1 Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
3.4	430	0.0200	2.12		**Shallow Concentrated Flow, 2% Shallow Flow** Grassed Waterway Kv= 15.0 fps
0.1	185	0.3300	44.39	78.45	**Pipe Channel, Drop Pipe** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.010 PVC, smooth interior
9.2	735	Total			

Summary for Subcatchment 6N: Sideslope

Runoff = 3.15 cfs @ 12.07 hrs, Volume= 0.214 af, Depth= 0.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 2 year - 24 hour Rainfall=2.83"

Area (ac)	CN	Description
3.870	71	Meadow, non-grazed, HSG C
3.870		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	120	0.3333	0.35		**Sheet Flow, 3:1 Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
7.8	950	0.0100	2.03		**Shallow Concentrated Flow, 1% Channel** Paved Kv= 20.3 fps
13.5	1,070	Total			

Summary for Subcatchment 6S: Sideslope

Runoff = 2.01 cfs @ 11.99 hrs, Volume= 0.101 af, Depth= 0.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 2 year - 24 hour Rainfall=2.83"

Area (ac)	CN	Description
1.820	71	Meadow, non-grazed, HSG C
1.820		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.1	110	0.3300	0.45		**Sheet Flow, 3:1 Sheet Flow** Grass: Dense n= 0.240 P2= 4.80"
2.4	380	0.0300	2.60		**Shallow Concentrated Flow, 3% Shallow Flow** Grassed Waterway Kv= 15.0 fps
6.5	490	Total			

Summary for Subcatchment 6SE: Sideslope

Runoff = 1.65 cfs @ 11.99 hrs, Volume= 0.082 af, Depth= 0.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 2 year - 24 hour Rainfall=2.83"

Area (ac)	CN	Description
1.487	71	Meadow, non-grazed, HSG C
1.487		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.0	45	0.3300	0.37		**Sheet Flow, 3:1 Sheet Flow** Grass: Dense n= 0.240 P2= 4.80"
4.4	680	0.0300	2.60		**Shallow Concentrated Flow, 3% Shallow Flow** Grassed Waterway Kv= 15.0 fps
6.4	725	Total			

Summary for Subcatchment 6SW: Sideslope

Runoff = 2.54 cfs @ 11.99 hrs, Volume= 0.128 af, Depth= 0.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 2 year - 24 hour Rainfall=2.83"

Area (ac)	CN	Description
2.314	71	Meadow, non-grazed, HSG C
2.314		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.8	100	0.3300	0.44		**Sheet Flow, 3:1 Sheet Flow** Grass: Dense n= 0.240 P2= 4.80"
2.8	430	0.0300	2.60		**Shallow Concentrated Flow, 3% Shallow Flow** Grassed Waterway Kv= 15.0 fps
6.6	530	Total			

Summary for Subcatchment 7E: Side Slope

Runoff = 2.99 cfs @ 12.02 hrs, Volume= 0.167 af, Depth= 0.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 2 year - 24 hour Rainfall=2.83"

Area (ac)	CN	Description
3.018	71	Meadow, non-grazed, HSG C
3.018		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.4	40	0.3333	0.28		**Sheet Flow, 3:1 Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
4.5	700	0.0300	2.60		**Shallow Concentrated Flow, 3% Shallow Flow** Grassed Waterway Kv= 15.0 fps
2.0	250	0.0200	2.12		**Shallow Concentrated Flow, 2% Concentrated Flow** Grassed Waterway Kv= 15.0 fps
0.0	60	0.3300	44.39	78.45	**Pipe Channel, Drop Pipe** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.010 PVC, smooth interior
8.9	1,050	Total			

Summary for Subcatchment 7S: Sideslope

Runoff = 2.29 cfs @ 12.00 hrs, Volume= 0.117 af, Depth= 0.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 2 year - 24 hour Rainfall=2.83"

Area (ac)	CN	Description
2.118	71	Meadow, non-grazed, HSG C
2.118		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.1	110	0.3300	0.45		**Sheet Flow, 3:1 Sheet Flow** Grass: Dense n= 0.240 P2= 4.80"
2.9	450	0.0300	2.60		**Shallow Concentrated Flow, 3% Shallow Flow** Grassed Waterway Kv= 15.0 fps
7.0	560	Total			

Summary for Subcatchment 7SE: Sideslope

Runoff = 2.18 cfs @ 12.02 hrs, Volume= 0.122 af, Depth= 0.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 2 year - 24 hour Rainfall=2.83"

Area (ac)	CN	Description
2.211	71	Meadow, non-grazed, HSG C
2.211		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.8	100	0.3300	0.44		**Sheet Flow, 3:1 Sheet Flow** Grass: Dense n= 0.240 P2= 4.80"
5.3	830	0.0300	2.60		**Shallow Concentrated Flow, 3% Shallow Flow** Grassed Waterway Kv= 15.0 fps
9.1	930	Total			

Summary for Subcatchment 7SW: Sideslope

Runoff = 3.26 cfs @ 12.01 hrs, Volume= 0.177 af, Depth= 0.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 2 year - 24 hour Rainfall=2.83"

Area (ac)	CN	Description
3.196	71	Meadow, non-grazed, HSG C
3.196		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.6	126	0.3300	0.46		**Sheet Flow, 3:1 Sheet Flow** Grass: Dense n= 0.240 P2= 4.80"
3.7	570	0.0300	2.60		**Shallow Concentrated Flow, 3% Shallow Flow** Grassed Waterway Kv= 15.0 fps
8.3	696	Total			

Summary for Subcatchment 8E: Sideslope

Runoff = 1.31 cfs @ 11.96 hrs, Volume= 0.058 af, Depth= 0.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 2 year - 24 hour Rainfall=2.83"

Area (ac)	CN	Description
1.052	71	Meadow, non-grazed, HSG C
1.052		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.7	70	0.3333	0.32		**Sheet Flow, 3:1 Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"

Summary for Subcatchment 8SE: Sideslope

Runoff = 1.55 cfs @ 11.97 hrs, Volume= 0.072 af, Depth= 0.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 2 year - 24 hour Rainfall=2.83"

Area (ac)	CN	Description
1.308	71	Meadow, non-grazed, HSG C
1.308		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.4	30	0.3300	0.35		**Sheet Flow, 3:1 Sheet Flow** Grass: Dense n= 0.240 P2= 4.80"
3.5	550	0.0300	2.60		**Shallow Concentrated Flow, 3% Shallow Flow** Grassed Waterway Kv= 15.0 fps
4.9	580	Total			

Summary for Subcatchment 8SW: Sideslope

Runoff = 1.09 cfs @ 11.98 hrs, Volume= 0.053 af, Depth= 0.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 2 year - 24 hour Rainfall=2.83"

Area (ac)	CN	Description
0.953	71	Meadow, non-grazed, HSG C
0.953		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.4	30	0.3300	0.35		**Sheet Flow, 3:1 Sheet Flow** Grass: Dense n= 0.240 P2= 4.80"
4.4	680	0.0300	2.60		**Shallow Concentrated Flow, 3% Shallow Flow** Grassed Waterway Kv= 15.0 fps
5.8	710	Total			

Summary for Subcatchment 9E: Side Slope

Runoff = 0.71 cfs @ 12.00 hrs, Volume= 0.038 af, Depth= 0.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 2 year - 24 hour Rainfall=2.83"

Area (ac)	CN	Description
0.680	71	Meadow, non-grazed, HSG C
0.680		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.7	70	0.3333	0.32		**Sheet Flow, 3:1 Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
3.9	500	0.0200	2.12		**Shallow Concentrated Flow, 2% Shallow Flow** Grassed Waterway Kv= 15.0 fps
0.1	300	0.3333	44.61	78.84	**Pipe Channel, Drop Pipe** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.010 PVC, smooth interior
7.7	870	Total			

Summary for Subcatchment 9SE: Sideslope

Runoff = 0.74 cfs @ 11.98 hrs, Volume= 0.036 af, Depth= 0.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 2 year - 24 hour Rainfall=2.83"

Area (ac)	CN	Description
0.641	71	Meadow, non-grazed, HSG C
0.641		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.8	40	0.3300	0.37		**Sheet Flow, 3:1 Sheet Flow** Grass: Dense n= 0.240 P2= 4.80"
3.8	600	0.0300	2.60		**Shallow Concentrated Flow, 3% Shallow Flow** Grassed Waterway Kv= 15.0 fps
5.6	640	Total			

Summary for Subcatchment 10E: Side Slope

Runoff = 0.61 cfs @ 12.02 hrs, Volume= 0.034 af, Depth= 0.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 2 year - 24 hour Rainfall=2.83"

Area (ac)	CN	Description
0.614	71	Meadow, non-grazed, HSG C
0.614		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.5	90	0.3333	0.33		**Sheet Flow, 3:1 Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
4.3	550	0.0200	2.12		**Shallow Concentrated Flow, 2% Shallow Flow** Grassed Waterway Kv= 15.0 fps
0.1	210	0.3333	44.61	78.84	**Pipe Channel, Drop Pipe** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.010 PVC, smooth interior
8.9	850	Total			

Summary for Subcatchment 10SE: Southeast Top

Runoff = 3.03 cfs @ 12.09 hrs, Volume= 0.217 af, Depth= 0.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 2 year - 24 hour Rainfall=2.83"

Area (ac)	CN	Description
3.918	71	Meadow, non-grazed, HSG C
3.918		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.7	100	0.0200	0.14		**Sheet Flow, 2% Sheet Flow** Grass: Dense n= 0.240 P2= 4.80"
3.1	390	0.0200	2.12		**Shallow Concentrated Flow, 2% Shallow Flow** Grassed Waterway Kv= 15.0 fps
14.8	490	Total			

Summary for Subcatchment 11E: Side Slope

Runoff = 0.95 cfs @ 12.03 hrs, Volume= 0.056 af, Depth= 0.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 2 year - 24 hour Rainfall=2.83"

Area (ac)	CN	Description
1.017	71	Meadow, non-grazed, HSG C
1.017		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	120	0.3333	0.35		**Sheet Flow, 3:1 Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
4.4	560	0.0200	2.12		**Shallow Concentrated Flow, 2% Shallow Flow** Grassed Waterway Kv= 15.0 fps
0.1	210	0.3333	44.61	78.84	**Pipe Channel, Drop Pipe** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.010 PVC, smooth interior
10.2	890	Total			

Summary for Subcatchment 11SE: Southeast Top

Runoff = 3.08 cfs @ 12.24 hrs, Volume= 0.324 af, Depth= 0.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 2 year - 24 hour Rainfall=2.83"

Area (ac)	CN	Description
5.848	71	Meadow, non-grazed, HSG C
5.848		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
23.9	300	0.0300	0.21		**Sheet Flow, 3% Sheet Flow** Grass: Dense n= 0.240 P2= 4.80"
2.9	375	0.0200	2.12		**Shallow Concentrated Flow, 2% Shallow Flow** Grassed Waterway Kv= 15.0 fps
26.8	675	Total			

Summary for Subcatchment 12E: Side Slope

Runoff = 0.63 cfs @ 11.97 hrs, Volume= 0.030 af, Depth= 0.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 2 year - 24 hour Rainfall=2.83"

Area (ac)	CN	Description
0.535	71	Meadow, non-grazed, HSG C
0.535		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.9	100	0.3333	0.34		**Sheet Flow, 3:1 Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"

Summary for Subcatchment 12SE: Southeast Top

Runoff = 4.74 cfs @ 12.24 hrs, Volume= 0.502 af, Depth= 0.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 2 year - 24 hour Rainfall=2.83"

Area (ac)	CN	Description
9.055	71	Meadow, non-grazed, HSG C
9.055		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
23.9	300	0.0300	0.21		**Sheet Flow, 3% Sheet Flow** Grass: Dense n= 0.240 P2= 4.80"
3.1	400	0.0200	2.12		**Shallow Concentrated Flow, 2% Shallow Flow** Grassed Waterway Kv= 15.0 fps
27.0	700	Total			

Summary for Subcatchment 13E: Side Slope

Runoff = 1.00 cfs @ 11.98 hrs, Volume= 0.047 af, Depth= 0.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 2 year - 24 hour Rainfall=2.83"

Area (ac)	CN	Description
0.855	71	Meadow, non-grazed, HSG C
0.855		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.4	20	0.3333	0.25		**Sheet Flow, 3:1 Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
3.1	400	0.0200	2.12		**Shallow Concentrated Flow, 2% Shallow Flow** Grassed Waterway Kv= 15.0 fps
0.8	266	0.0050	5.46	9.66	**Pipe Channel, Culvert** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.010 PVC, smooth interior
5.3	686	Total			

Summary for Subcatchment 13SE: Sideslope

Runoff = 2.64 cfs @ 12.00 hrs, Volume= 0.137 af, Depth= 0.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 2 year - 24 hour Rainfall=2.83"

Area (ac)	CN	Description
2.473	71	Meadow, non-grazed, HSG C
2.473		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.6	95	0.3300	0.43		**Sheet Flow, 3:1 Sheet Flow** Grass: Dense n= 0.240 P2= 4.80"
3.7	570	0.0300	2.60		**Shallow Concentrated Flow, 3% Shallow Flow** Grassed Waterway Kv= 15.0 fps
7.3	665	Total			

Summary for Subcatchment NPD: North Pond Direct

[46] Hint: Tc=0 (Instant runoff peak depends on dt)

Runoff = 4.66 cfs @ 11.90 hrs, Volume= 0.213 af, Depth= 2.60"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 2 year - 24 hour Rainfall=2.83"

Area (ac)	CN	Description
0.982	98	Water Surface, HSG C
0.982		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0					**Direct Entry, Direct Entry**

Summary for Subcatchment NPEB: Exterior Berm

Runoff = 0.99 cfs @ 11.94 hrs, Volume= 0.042 af, Depth= 0.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 2 year - 24 hour Rainfall=2.83"

Area (ac)	CN	Description
0.750	71	Meadow, non-grazed, HSG C
0.750		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.4	40	0.3333	0.28		**Sheet Flow, 2% Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"

Summary for Subcatchment NWPD: NW Pond Direct

[46] Hint: Tc=0 (Instant runoff peak depends on dt)

Runoff = 4.45 cfs @ 11.90 hrs, Volume= 0.203 af, Depth= 2.60"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 2 year - 24 hour Rainfall=2.83"

Area (ac)	CN	Description
0.938	98	Water Surface, HSG C
0.938		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0					**Direct Entry, Direct Entry**

Summary for Subcatchment NWPEB: Exterior Berm

Runoff = 1.46 cfs @ 12.08 hrs, Volume= 0.102 af, Depth= 0.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 2 year - 24 hour Rainfall=2.83"

Area (ac)	CN	Description
1.839	71	Meadow, non-grazed, HSG C
1.839		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.3	60	0.3333	0.31		**Sheet Flow, 3:1 Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
10.8	970	0.0100	1.50		**Shallow Concentrated Flow, 1% Shallow Flow** Grassed Waterway Kv= 15.0 fps
14.1	1,030	Total			

Summary for Subcatchment SEPD: SE Pond Direct

[46] Hint: Tc=0 (Instant runoff peak depends on dt)

Runoff = 3.22 cfs @ 11.90 hrs, Volume= 0.147 af, Depth= 2.60"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 2 year - 24 hour Rainfall=2.83"

Area (ac)	CN	Description
0.678	98	Water Surface, HSG C
0.678		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0					**Direct Entry, Direct Entry**

Summary for Subcatchment SEPEB: Exterior Berm

Runoff = 1.83 cfs @ 11.96 hrs, Volume= 0.082 af, Depth= 0.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 2 year - 24 hour Rainfall=2.83"

Area (ac)	CN	Description
1.488	71	Meadow, non-grazed, HSG C
1.488		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.1	80	0.3333	0.32		**Sheet Flow, 3:1 Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"

Summary for Subcatchment SPD: S Pond Direct

[46] Hint: Tc=0 (Instant runoff peak depends on dt)

Runoff = 2.50 cfs @ 11.90 hrs, Volume= 0.114 af, Depth= 2.60"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 2 year - 24 hour Rainfall=2.83"

Area (ac)	CN	Description
0.527	98	Water Surface, HSG C
0.527		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0					**Direct Entry, Direct Entry**

Summary for Subcatchment SPEB: Exterior Berm

Runoff = 8.01 cfs @ 11.98 hrs, Volume= 0.377 af, Depth= 0.90"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 2 year - 24 hour Rainfall=2.83"

Area (ac)	CN	Description
3.822	71	Meadow, non-grazed, HSG C
1.192	91	Urban industrial, 72% imp, HSG C
5.014	76	Weighted Average
4.156		82.88% Pervious Area
0.858		17.12% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.8	50	0.3333	0.29		**Sheet Flow, 3:1 Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
3.2	390	0.0100	2.03		**Shallow Concentrated Flow, 1% Shallow Flow** Paved Kv= 20.3 fps
6.0	440	Total			

Summary for Subcatchment SWPD: SW Pond Direct

[46] Hint: Tc=0 (Instant runoff peak depends on dt)

Runoff = 3.98 cfs @ 11.90 hrs, Volume= 0.181 af, Depth= 2.60"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 2 year - 24 hour Rainfall=2.83"

Area (ac)	CN	Description
0.837	98	Water Surface, HSG C
0.837		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0					**Direct Entry, Direct Entry**

Summary for Subcatchment SWPEB: Exterior Berm

Runoff = 2.50 cfs @ 11.97 hrs, Volume= 0.116 af, Depth= 0.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 2 year - 24 hour Rainfall=2.83"

Area (ac)	CN	Description
2.086	71	Meadow, non-grazed, HSG C
2.086		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.6	80	0.2500	0.29		**Sheet Flow, 4:1 Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"

Summary for Reach 3R: (new Reach)

[40] Hint: Not Described (Outflow=Inflow)

Summary for Pond 1ED: East Ditch 1

Inflow Area = 0.855 ac, 0.00% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 1.00 cfs @ 11.98 hrs, Volume= 0.047 af
Outflow = 0.34 cfs @ 12.08 hrs, Volume= 0.041 af, Atten= 66%, Lag= 6.4 min
Primary = 0.34 cfs @ 12.08 hrs, Volume= 0.041 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 711.76' @ 12.08 hrs Surf.Area= 1,220 sf Storage= 562 cf
Flood Elev= 715.00' Surf.Area= 4,659 sf Storage= 9,544 cf

Plug-Flow detention time= 125.2 min calculated for 0.041 af (86% of inflow)
Center-of-Mass det. time= 58.4 min (936.4 - 878.0)

Volume	Invert	Avail.Storage	Storage Description
#1	711.00'	14,929 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
711.00	254	0	0
712.00	1,520	887	887
714.00	3,205	4,725	5,612
716.00	6,112	9,317	14,929

Device	Routing	Invert	Outlet Devices
#1	Primary	711.50'	**16.0" Round Culvert** L= 230.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 711.50' / 709.00' S= 0.0109 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 1.40 sf

#2	Secondary	715.00'	**115.0' long x 30.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=0.34 cfs @ 12.08 hrs HW=711.76' (Free Discharge)
1=Culvert (Inlet Controls 0.34 cfs @ 1.74 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=711.00' (Free Discharge)
2=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Summary for Pond 2ED: East Ditch 2

[79] Warning: Submerged Pond 1ED Primary device # 1 OUTLET by 1.10'

Inflow Area = 3.021 ac, 0.00% Impervious, Inflow Depth = 0.64" for 2 year - 24 hour event
Inflow = 2.27 cfs @ 12.02 hrs, Volume= 0.161 af
Outflow = 1.61 cfs @ 12.10 hrs, Volume= 0.156 af, Atten= 29%, Lag= 4.8 min
Primary = 1.61 cfs @ 12.10 hrs, Volume= 0.156 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 710.10' @ 12.10 hrs Surf.Area= 1,643 sf Storage= 939 cf
Flood Elev= 713.80' Surf.Area= 6,136 sf Storage= 14,023 cf

Plug-Flow detention time= 37.3 min calculated for 0.156 af (97% of inflow)
Center-of-Mass det. time= 21.7 min (916.8 - 895.0)

Volume	Invert	Avail.Storage	Storage Description
#1	709.00'	15,282 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
709.00	0	0	0
710.00	1,558	779	779
712.00	3,244	4,802	5,581
714.00	6,457	9,701	15,282

Device	Routing	Invert	Outlet Devices
#1	Primary	709.50'	**16.0" Round Culvert** L= 90.0' RCP, end-section conforming to fill, Ke= 0.500 Inlet / Outlet Invert= 709.50' / 708.50' S= 0.0111 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 1.40 sf
#2	Secondary	713.80'	**115.0' long x 30.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=1.61 cfs @ 12.10 hrs HW=710.10' (Free Discharge)
1=Culvert (Inlet Controls 1.61 cfs @ 2.64 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=709.00' (Free Discharge)
2=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Summary for Pond 3ED: East Ditch 3

[81] Warning: Exceeded Pond 2ED by 1.18' @ 12.80 hrs
[79] Warning: Submerged Pond 4ED Primary device # 1 INLET by 1.23'

Inflow Area = 40.001 ac, 0.00% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 11.13 cfs @ 12.13 hrs, Volume= 2.196 af
Outflow = 9.73 cfs @ 12.75 hrs, Volume= 2.195 af, Atten= 13%, Lag= 37.1 min
Primary = 9.73 cfs @ 12.75 hrs, Volume= 2.195 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 710.95' @ 12.75 hrs Surf.Area= 5,663 sf Storage= 5,360 cf
Flood Elev= 713.80' Surf.Area= 20,308 sf Storage= 40,715 cf

Plug-Flow detention time= 5.3 min calculated for 2.195 af (100% of inflow)
Center-of-Mass det. time= 5.1 min (911.3 - 906.3)

Volume	Invert	Avail.Storage	Storage Description
#1	708.00'	44,892 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
708.00	0	0	0
710.00	1,805	1,805	1,805
712.00	9,909	11,714	13,519
714.00	21,464	31,373	44,892

Device	Routing	Invert	Outlet Devices
#1	Primary	708.19'	**16.0" Round Culvert** L= 75.0' RCP, end-section conforming to fill, Ke= 0.500 Inlet / Outlet Invert= 708.19' / 707.50' S= 0.0092 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 1.40 sf
#2	Secondary	713.80'	**300.0' long x 30.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=9.73 cfs @ 12.75 hrs HW=710.95' (Free Discharge)
1=Culvert (Inlet Controls 9.73 cfs @ 6.97 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=708.00' (Free Discharge)
2=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Summary for Pond 4ED: Exist Ditch 4

Inflow Area = 35.248 ac, 0.00% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 18.22 cfs @ 12.04 hrs, Volume= 1.952 af
Outflow = 9.67 cfs @ 12.47 hrs, Volume= 1.943 af, Atten= 47%, Lag= 25.5 min
Primary = 9.67 cfs @ 12.47 hrs, Volume= 1.943 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 712.45' @ 12.47 hrs Surf.Area= 12,393 sf Storage= 10,550 cf
Flood Elev= 713.80' Surf.Area= 35,801 sf Storage= 42,961 cf

Plug-Flow detention time= 15.7 min calculated for 1.943 af (100% of inflow)
Center-of-Mass det. time= 13.1 min (906.8 - 893.8)

Volume	Invert	Avail.Storage	Storage Description
#1	709.00'	106,611 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
709.00	0	0	0
712.00	4,475	6,713	6,713
714.00	39,282	43,757	50,470
715.00	73,000	56,141	106,611

Device	Routing	Invert	Outlet Devices
#1	Primary	709.72'	**16.0" Round Culvert** L= 65.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 709.72' / 709.24' S= 0.0074 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 1.40 sf
#2	Secondary	713.80'	**510.0' long x 30.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=9.67 cfs @ 12.47 hrs HW=712.45' (Free Discharge)
1=Culvert (Inlet Controls 9.67 cfs @ 6.92 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=709.00' (Free Discharge)
2=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Summary for Pond C10SE: Catch Basin

Inflow Area = 3.918 ac, 0.00% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 3.03 cfs @ 12.09 hrs, Volume= 0.217 af
Outflow = 2.96 cfs @ 12.11 hrs, Volume= 0.217 af, Atten= 2%, Lag= 1.3 min
Primary = 2.96 cfs @ 12.11 hrs, Volume= 0.217 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 810.31' @ 12.11 hrs Surf.Area= 702 sf Storage= 351 cf
Flood Elev= 813.00' Surf.Area= 18,960 sf Storage= 19,070 cf

Plug-Flow detention time= 3.9 min calculated for 0.217 af (100% of inflow)
Center-of-Mass det. time= 3.9 min (890.7 - 886.8)

Volume	Invert	Avail.Storage	Storage Description
#1	810.00'	46,175 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
810.00	0	0	0
811.00	2,300	1,150	1,150
812.00	7,290	4,795	5,945
813.00	18,960	13,125	19,070
814.00	35,250	27,105	46,175

Device	Routing	Invert	Outlet Devices
#1	Primary	810.00'	**20.5" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Secondary	813.00'	**100.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73

2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=2.96 cfs @ 12.11 hrs HW=810.31' (Free Discharge)
1=Orifice/Grate (Weir Controls 2.96 cfs @ 1.81 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=810.00' (Free Discharge)
2=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Summary for Pond C11SE: Catch Basin

Inflow Area = 5.848 ac, 0.00% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 3.08 cfs @ 12.24 hrs, Volume= 0.324 af
Outflow = 3.04 cfs @ 12.26 hrs, Volume= 0.324 af, Atten= 1%, Lag= 1.5 min
Primary = 3.04 cfs @ 12.26 hrs, Volume= 0.324 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 803.31' @ 12.26 hrs Surf.Area= 836 sf Storage= 418 cf
Flood Elev= 806.00' Surf.Area= 13,540 sf Storage= 16,100 cf

Plug-Flow detention time= 4.2 min calculated for 0.324 af (100% of inflow)
Center-of-Mass det. time= 4.2 min (902.2 - 897.9)

Volume	Invert	Avail.Storage	Storage Description
#1	803.00'	33,425 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
803.00	0	0	0
804.00	2,690	1,345	1,345
805.00	6,640	4,665	6,010
806.00	13,540	10,090	16,100
807.00	21,110	17,325	33,425

Device	Routing	Invert	Outlet Devices
#1	Primary	803.00'	**20.5" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Secondary	806.00'	**100.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=3.04 cfs @ 12.26 hrs HW=803.31' (Free Discharge)
1=Orifice/Grate (Weir Controls 3.04 cfs @ 1.82 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=803.00' (Free Discharge)
2=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Summary for Pond C12SE: Catch Basin

Inflow Area = 9.055 ac, 0.00% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 4.74 cfs @ 12.24 hrs, Volume= 0.502 af
Outflow = 4.74 cfs @ 12.24 hrs, Volume= 0.502 af, Atten= 0%, Lag= 0.0 min
Primary = 4.74 cfs @ 12.24 hrs, Volume= 0.502 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 797.76' @ 12.24 hrs Surf.Area= 42 sf Storage= 11 cf
Flood Elev= 801.50' Surf.Area= 15,910 sf Storage= 24,215 cf

Plug-Flow detention time= 0.1 min calculated for 0.501 af (100% of inflow)
Center-of-Mass det. time= 0.1 min (898.2 - 898.1)

Volume	Invert	Avail.Storage	Storage Description
#1	797.50'	92,310 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
797.50	0	0	0
798.00	80	20	20
800.00	5,470	5,550	5,570
802.00	19,390	24,860	30,430
804.00	42,490	61,880	92,310

Device	Routing	Invert	Outlet Devices
#1	Primary	797.50'	**20.5" Horiz. Orifice/Grate X 2.00** C= 0.600 Limited to weir flow at low heads
#2	Secondary	801.50'	**100.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=4.73 cfs @ 12.24 hrs HW=797.76' (Free Discharge)
└**1=Orifice/Grate** (Weir Controls 4.73 cfs @ 1.68 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=797.50' (Free Discharge)
└**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond C13SE: Catch Basin

Inflow Area = 2.473 ac, 0.00% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 2.64 cfs @ 12.00 hrs, Volume= 0.137 af
Outflow = 2.63 cfs @ 12.00 hrs, Volume= 0.137 af, Atten= 0%, Lag= 0.1 min
Primary = 2.63 cfs @ 12.00 hrs, Volume= 0.137 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 724.28' @ 12.00 hrs Surf.Area= 66 sf Storage= 33 cf
Flood Elev= 727.00' Surf.Area= 2,097 sf Storage= 2,214 cf

Plug-Flow detention time= 0.4 min calculated for 0.137 af (100% of inflow)
Center-of-Mass det. time= 0.4 min (880.3 - 879.8)

Volume	Invert	Avail.Storage	Storage Description
#1	724.00'	5,126 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
724.00	0	0	0
725.00	233	117	117
726.00	932	583	699
727.00	2,097	1,515	2,214
728.00	3,728	2,913	5,126

Device	Routing	Invert	Outlet Devices
#1	Primary	724.00'	**20.5" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Secondary	727.00'	**100.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=2.63 cfs @ 12.00 hrs HW=724.28' (Free Discharge)
└**1=Orifice/Grate** (Weir Controls 2.63 cfs @ 1.74 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=724.00' (Free Discharge)
└**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond C1E: Catch Basin

Inflow Area = 17.841 ac, 0.00% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 7.89 cfs @ 12.32 hrs, Volume= 0.988 af
Outflow = 7.89 cfs @ 12.32 hrs, Volume= 0.988 af, Atten= 0%, Lag= 0.0 min
Primary = 7.89 cfs @ 12.32 hrs, Volume= 0.988 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 797.78' @ 12.32 hrs Surf.Area= 46 sf Storage= 12 cf
Flood Elev= 801.50' Surf.Area= 16,283 sf Storage= 24,828 cf

Plug-Flow detention time= 0.0 min calculated for 0.988 af (100% of inflow)
Center-of-Mass det. time= 0.0 min (904.7 - 904.7)

Volume	Invert	Avail.Storage	Storage Description
#1	797.50'	31,194 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
797.50	0	0	0
798.00	82	21	21
800.00	5,628	5,710	5,731
802.00	19,835	25,463	31,194

Device	Routing	Invert	Outlet Devices
#1	Primary	797.50'	**20.5" Horiz. Orifice/Grate X 3.00** C= 0.600 Limited to weir flow at low heads
#2	Secondary	801.50'	**100.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=7.87 cfs @ 12.32 hrs HW=797.78' (Free Discharge)
└**1=Orifice/Grate** (Weir Controls 7.87 cfs @ 1.74 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=797.50' (Free Discharge)
└**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond C1N: Catch Basin

Inflow Area = 17.691 ac, 0.00% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 8.14 cfs @ 12.31 hrs, Volume= 0.980 af
Outflow = 8.12 cfs @ 12.32 hrs, Volume= 0.980 af, Atten= 0%, Lag= 0.5 min
Primary = 8.12 cfs @ 12.32 hrs, Volume= 0.980 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 801.29' @ 12.32 hrs Surf.Area= 718 sf Storage= 359 cf
Flood Elev= 804.00' Surf.Area= 18,200 sf Storage= 21,950 cf

Plug-Flow detention time= 1.3 min calculated for 0.980 af (100% of inflow)
Center-of-Mass det. time= 1.3 min (904.5 - 903.2)

Volume	Invert	Avail.Storage	Storage Description
#1	801.00'	91,900 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
801.00	0	0	0
802.00	2,500	1,250	1,250
804.00	18,200	20,700	21,950
806.00	51,750	69,950	91,900

Device	Routing	Invert	Outlet Devices
#1	Primary	801.00'	**20.5" Horiz. Orifice/Grate X 3.00** C= 0.600 Limited to weir flow at low heads
#2	Secondary	804.00'	**100.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=8.10 cfs @ 12.32 hrs HW=801.29' (Free Discharge)
↑—**1=Orifice/Grate** (Weir Controls 8.10 cfs @ 1.75 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=801.00' (Free Discharge)
↑—**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond C1NW: Catch Basin

Inflow Area = 1.506 ac, 0.00% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 1.75 cfs @ 11.98 hrs, Volume= 0.083 af
Outflow = 1.75 cfs @ 11.98 hrs, Volume= 0.083 af, Atten= 0%, Lag= 0.2 min
Primary = 1.75 cfs @ 11.98 hrs, Volume= 0.083 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 785.21' @ 11.98 hrs Surf.Area= 57 sf Storage= 29 cf
Flood Elev= 788.00' Surf.Area= 2,403 sf Storage= 2,804 cf

Plug-Flow detention time= 0.5 min calculated for 0.083 af (100% of inflow)
Center-of-Mass det. time= 0.5 min (878.5 - 878.0)

Volume	Invert	Avail.Storage	Storage Description
#1	785.00'	11,882 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
785.00	0	0	0
786.00	267	134	134
788.00	2,403	2,670	2,804
790.00	6,675	9,078	11,882

Device	Routing	Invert	Outlet Devices
#1	Primary	785.00'	**20.5" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Secondary	788.00'	**100.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=1.74 cfs @ 11.98 hrs HW=785.21' (Free Discharge)
└**1=Orifice/Grate** (Weir Controls 1.74 cfs @ 1.51 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=785.00' (Free Discharge)
└**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond C1S: Catch Basin

Inflow Area = 3.455 ac, 0.00% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 2.63 cfs @ 12.09 hrs, Volume= 0.191 af
Outflow = 2.62 cfs @ 12.10 hrs, Volume= 0.191 af, Atten= 1%, Lag= 0.8 min
Primary = 2.62 cfs @ 12.10 hrs, Volume= 0.191 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 809.28' @ 12.10 hrs Surf.Area= 332 sf Storage= 166 cf
Flood Elev= 812.00' Surf.Area= 12,050 sf Storage= 12,985 cf

Plug-Flow detention time= 2.1 min calculated for 0.191 af (100% of inflow)
Center-of-Mass det. time= 2.1 min (889.2 - 887.2)

Volume	Invert	Avail.Storage	Storage Description
#1	809.00'	30,580 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
809.00	0	0	0
810.00	1,180	590	590
811.00	5,780	3,480	4,070
812.00	12,050	8,915	12,985
813.00	23,140	17,595	30,580

Device	Routing	Invert	Outlet Devices
#1	Primary	809.00'	**20.5" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Secondary	812.00'	**100.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73

2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=2.61 cfs @ 12.10 hrs HW=809.28' (Free Discharge)
└**1=Orifice/Grate** (Weir Controls 2.61 cfs @ 1.73 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=809.00' (Free Discharge)
└**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond C1SE: Catch Basin

Inflow Area = 3.373 ac, 0.00% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 2.60 cfs @ 12.09 hrs, Volume= 0.187 af
Outflow = 2.58 cfs @ 12.10 hrs, Volume= 0.187 af, Atten= 1%, Lag= 0.7 min
Primary = 2.58 cfs @ 12.10 hrs, Volume= 0.187 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 810.28' @ 12.10 hrs Surf.Area= 329 sf Storage= 164 cf
Flood Elev= 813.00' Surf.Area= 12,050 sf Storage= 12,985 cf

Plug-Flow detention time= 2.1 min calculated for 0.187 af (100% of inflow)
Center-of-Mass det. time= 2.1 min (889.0 - 886.9)

Volume	Invert	Avail.Storage	Storage Description
#1	810.00'	30,580 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
810.00	0	0	0
811.00	1,180	590	590
812.00	5,780	3,480	4,070
813.00	12,050	8,915	12,985
814.00	23,140	17,595	30,580

Device	Routing	Invert	Outlet Devices
#1	Primary	810.00'	**20.5" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Secondary	813.00'	**100.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=2.58 cfs @ 12.10 hrs HW=810.28' (Free Discharge)
└**1=Orifice/Grate** (Weir Controls 2.58 cfs @ 1.73 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=810.00' (Free Discharge)
└**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond C1SW: Catch Basin

Inflow Area = 4.734 ac, 0.00% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 3.69 cfs @ 12.09 hrs, Volume= 0.262 af
Outflow = 3.43 cfs @ 12.13 hrs, Volume= 0.262 af, Atten= 7%, Lag= 2.5 min
Primary = 3.43 cfs @ 12.13 hrs, Volume= 0.262 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 811.34' @ 12.13 hrs Surf.Area= 1,526 sf Storage= 763 cf
Flood Elev= 815.00' Surf.Area= 44,099 sf Storage= 76,190 cf

Plug-Flow detention time= 7.1 min calculated for 0.262 af (100% of inflow)
Center-of-Mass det. time= 7.1 min (893.7 - 886.6)

Volume	Invert	Avail.Storage	Storage Description
#1	811.00'	120,289 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
811.00	0	0	0
812.00	4,533	2,267	2,267
814.00	25,292	29,825	32,092
816.00	62,905	88,197	120,289

Device	Routing	Invert	Outlet Devices
#1	Primary	811.00'	**20.5" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Secondary	815.00'	**100.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=3.43 cfs @ 12.13 hrs HW=811.34' (Free Discharge)
└**1=Orifice/Grate** (Weir Controls 3.43 cfs @ 1.90 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=811.00' (Free Discharge)
└**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond C1W: Catch Basin

Inflow Area = 16.760 ac, 0.00% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 10.78 cfs @ 12.15 hrs, Volume= 0.928 af
Outflow = 10.74 cfs @ 12.16 hrs, Volume= 0.928 af, Atten= 0%, Lag= 0.6 min
Primary = 10.74 cfs @ 12.16 hrs, Volume= 0.928 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 799.35' @ 12.16 hrs Surf.Area= 1,280 sf Storage= 640 cf
Flood Elev= 803.00' Surf.Area= 25,337 sf Storage= 46,529 cf

Plug-Flow detention time= 1.9 min calculated for 0.928 af (100% of inflow)
Center-of-Mass det. time= 1.9 min (893.5 - 891.6)

Volume	Invert	Avail.Storage	Storage Description
#1	799.00'	71,866 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
799.00	0	0	0
800.00	3,697	1,849	1,849
802.00	15,646	19,343	21,192
804.00	35,028	50,674	71,866

Device	Routing	Invert	Outlet Devices
#1	Primary	799.00'	**20.5" Horiz. Orifice/Grate X 3.00** C= 0.600 Limited to weir flow at low heads
#2	Secondary	803.00'	**100.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=10.72 cfs @ 12.16 hrs HW=799.35' (Free Discharge)
1=Orifice/Grate (Weir Controls 10.72 cfs @ 1.92 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=799.00' (Free Discharge)
2=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Summary for Pond C2N: Catch Basin

Inflow Area = 1.145 ac, 0.00% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 1.26 cfs @ 11.99 hrs, Volume= 0.063 af
Outflow = 1.26 cfs @ 11.99 hrs, Volume= 0.063 af, Atten= 0%, Lag= 0.2 min
Primary = 1.26 cfs @ 11.99 hrs, Volume= 0.063 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 782.17' @ 11.99 hrs Surf.Area= 46 sf Storage= 23 cf
Flood Elev= 785.00' Surf.Area= 2,403 sf Storage= 2,804 cf

Plug-Flow detention time= 0.5 min calculated for 0.063 af (100% of inflow)
Center-of-Mass det. time= 0.5 min (879.6 - 879.1)

Volume	Invert	Avail.Storage	Storage Description
#1	782.00'	11,882 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
782.00	0	0	0
783.00	267	134	134
785.00	2,403	2,670	2,804
787.00	6,675	9,078	11,882

Device	Routing	Invert	Outlet Devices
#1	Primary	782.00'	**20.5" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Secondary	785.00'	**100.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=1.25 cfs @ 11.99 hrs HW=782.17' (Free Discharge)
1=Orifice/Grate (Weir Controls 1.25 cfs @ 1.36 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=782.00' (Free Discharge)
2=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Summary for Pond C2NW: Catch Basin

Inflow Area = 2.338 ac, 0.00% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 2.05 cfs @ 12.05 hrs, Volume= 0.129 af
Outflow = 2.03 cfs @ 12.06 hrs, Volume= 0.129 af, Atten= 1%, Lag= 0.7 min
Primary = 2.03 cfs @ 12.06 hrs, Volume= 0.129 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 745.24' @ 12.06 hrs Surf.Area= 253 sf Storage= 126 cf
Flood Elev= 748.00' Surf.Area= 4,272 sf Storage= 5,874 cf

Plug-Flow detention time= 1.9 min calculated for 0.129 af (100% of inflow)
Center-of-Mass det. time= 1.9 min (885.9 - 884.0)

Volume	Invert	Avail.Storage	Storage Description
#1	745.00'	16,821 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
745.00	0	0	0
746.00	1,068	534	534
748.00	4,272	5,340	5,874
750.00	6,675	10,947	16,821

Device	Routing	Invert	Outlet Devices
#1	Primary	745.00'	**20.5" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Secondary	748.00'	**100.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=2.02 cfs @ 12.06 hrs HW=745.24' (Free Discharge)
└**1=Orifice/Grate** (Weir Controls 2.02 cfs @ 1.59 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=745.00' (Free Discharge)
└**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond C2S: Catch Basin

Inflow Area = 7.410 ac, 0.00% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 3.81 cfs @ 12.26 hrs, Volume= 0.410 af
Outflow = 3.80 cfs @ 12.27 hrs, Volume= 0.410 af, Atten= 0%, Lag= 0.5 min
Primary = 3.80 cfs @ 12.27 hrs, Volume= 0.410 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 800.36' @ 12.27 hrs Surf.Area= 425 sf Storage= 213 cf
Flood Elev= 803.00' Surf.Area= 12,050 sf Storage= 12,985 cf

Plug-Flow detention time= 1.7 min calculated for 0.410 af (100% of inflow)
Center-of-Mass det. time= 1.7 min (900.6 - 898.9)

Volume	Invert	Avail.Storage	Storage Description
#1	800.00'	30,580 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
800.00	0	0	0
801.00	1,180	590	590
802.00	5,780	3,480	4,070
803.00	12,050	8,915	12,985
804.00	23,140	17,595	30,580

Device	Routing	Invert	Outlet Devices
#1	Primary	800.00'	**20.5" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Secondary	803.00'	**100.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=3.80 cfs @ 12.27 hrs HW=800.36' (Free Discharge)
↑—**1=Orifice/Grate** (Weir Controls 3.80 cfs @ 1.96 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=800.00' (Free Discharge)
↑—**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond C2SE: Catch Basin

Inflow Area = 5.356 ac, 0.00% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 2.80 cfs @ 12.24 hrs, Volume= 0.297 af
Outflow = 2.80 cfs @ 12.25 hrs, Volume= 0.297 af, Atten= 0%, Lag= 0.8 min
Primary = 2.80 cfs @ 12.25 hrs, Volume= 0.297 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 804.29' @ 12.25 hrs Surf.Area= 346 sf Storage= 173 cf
Flood Elev= 807.00' Surf.Area= 12,050 sf Storage= 12,985 cf

Plug-Flow detention time= 1.9 min calculated for 0.297 af (100% of inflow)
Center-of-Mass det. time= 1.9 min (900.0 - 898.1)

Volume	Invert	Avail.Storage	Storage Description
#1	804.00'	30,580 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
804.00	0	0	0
805.00	1,180	590	590
806.00	5,780	3,480	4,070
807.00	12,050	8,915	12,985
808.00	23,140	17,595	30,580

Device	Routing	Invert	Outlet Devices
#1	Primary	804.00'	**20.5" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Secondary	807.00'	**100.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50

Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=2.79 cfs @ 12.25 hrs HW=804.29' (Free Discharge)
1=Orifice/Grate (Weir Controls 2.79 cfs @ 1.77 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=804.00' (Free Discharge)
2=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Summary for Pond C2SW: Catch Basin

Inflow Area = 2.975 ac, 0.00% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 3.24 cfs @ 11.99 hrs, Volume= 0.165 af
Outflow = 3.23 cfs @ 12.00 hrs, Volume= 0.165 af, Atten= 0%, Lag= 0.4 min
Primary = 3.23 cfs @ 12.00 hrs, Volume= 0.165 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 776.32' @ 12.00 hrs Surf.Area= 205 sf Storage= 103 cf
Flood Elev= 779.00' Surf.Area= 2,509 sf Storage= 3,360 cf

Plug-Flow detention time= 1.1 min calculated for 0.165 af (100% of inflow)
Center-of-Mass det. time= 1.1 min (880.5 - 879.4)

Volume	Invert	Avail.Storage	Storage Description
#1	776.00'	7,403 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
776.00	0	0	0
777.00	634	317	317
778.00	1,471	1,053	1,370
779.00	2,509	1,990	3,360
780.00	5,577	4,043	7,403

Device	Routing	Invert	Outlet Devices
#1	Primary	776.00'	**20.5" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Secondary	779.00'	**100.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=3.23 cfs @ 12.00 hrs HW=776.32' (Free Discharge)
1=Orifice/Grate (Weir Controls 3.23 cfs @ 1.86 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=776.00' (Free Discharge)
2=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Summary for Pond C2W: Catch Basin

Inflow Area = 1.924 ac, 0.00% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 2.02 cfs @ 12.00 hrs, Volume= 0.107 af
Outflow = 2.02 cfs @ 12.01 hrs, Volume= 0.107 af, Atten= 0%, Lag= 0.2 min
Primary = 2.02 cfs @ 12.01 hrs, Volume= 0.107 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 769.24' @ 12.01 hrs Surf.Area= 55 sf Storage= 27 cf
Flood Elev= 772.00' Surf.Area= 2,097 sf Storage= 2,214 cf

Plug-Flow detention time= 0.4 min calculated for 0.107 af (100% of inflow)
Center-of-Mass det. time= 0.4 min (880.5 - 880.1)

Volume	Invert	Avail.Storage	Storage Description
#1	769.00'	9,903 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
769.00	0	0	0
770.00	233	117	117
771.00	932	583	699
772.00	2,097	1,515	2,214
773.00	3,728	2,913	5,126
774.00	5,825	4,777	9,903

Device	Routing	Invert	Outlet Devices
#1	Primary	769.00'	**20.5" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Secondary	772.00'	**100.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=2.01 cfs @ 12.01 hrs HW=769.24' (Free Discharge)
1=Orifice/Grate (Weir Controls 2.01 cfs @ 1.59 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=769.00' (Free Discharge)
2=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Summary for Pond C3N: Catch Basin

Inflow Area = 1.762 ac, 0.00% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 1.83 cfs @ 12.01 hrs, Volume= 0.098 af
Outflow = 1.81 cfs @ 12.02 hrs, Volume= 0.098 af, Atten= 1%, Lag= 0.7 min
Primary = 1.81 cfs @ 12.02 hrs, Volume= 0.098 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 742.22' @ 12.02 hrs Surf.Area= 117 sf Storage= 117 cf
Flood Elev= 745.00' Surf.Area= 2,670 sf Storage= 3,738 cf

Plug-Flow detention time= 1.9 min calculated for 0.098 af (100% of inflow)
Center-of-Mass det. time= 1.9 min (882.3 - 880.4)

Volume	Invert	Avail.Storage	Storage Description
#1	742.00'	11,882 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
742.00	0	0	0
744.00	1,068	1,068	1,068
746.00	4,272	5,340	6,408
747.00	6,675	5,474	11,882

Device	Routing	Invert	Outlet Devices
#1	Primary	742.00'	**20.5" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Secondary	745.00'	**100.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=1.80 cfs @ 12.02 hrs HW=742.22' (Free Discharge)
1=Orifice/Grate (Weir Controls 1.80 cfs @ 1.53 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=742.00' (Free Discharge)
2=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Summary for Pond C3NW: Northwest Ditch

Inflow Area = 9.855 ac, 0.00% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 9.23 cfs @ 12.02 hrs, Volume= 0.546 af
Outflow = 8.66 cfs @ 12.05 hrs, Volume= 0.546 af, Atten= 6%, Lag= 1.8 min
Primary = 8.66 cfs @ 12.05 hrs, Volume= 0.546 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 720.32' @ 12.05 hrs Surf.Area= 614 sf Storage= 567 cf
Flood Elev= 723.00' Surf.Area= 4,539 sf Storage= 7,343 cf

Plug-Flow detention time= 1.2 min calculated for 0.546 af (100% of inflow)
Center-of-Mass det. time= 1.2 min (883.4 - 882.2)

Volume	Invert	Avail.Storage	Storage Description
#1	719.00'	11,882 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
719.00	0	0	0
720.00	267	134	134
722.00	2,403	2,670	2,804
724.00	6,675	9,078	11,882

Device	Routing	Invert	Outlet Devices
#1	Primary	719.00'	**24.0" Round Culvert** L= 100.0' CMP, end-section conforming to fill, Ke= 0.500 Inlet / Outlet Invert= 719.00' / 705.00' S= 0.1400 '/' Cc= 0.900 n= 0.018, Flow Area= 3.14 sf
#2	Secondary	723.00'	**100.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=8.64 cfs @ 12.05 hrs HW=720.32' (Free Discharge)
└**1=Culvert** (Inlet Controls 8.64 cfs @ 3.92 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=719.00' (Free Discharge)
└**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond C3S: Catch Basin

Inflow Area = 20.973 ac, 0.00% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 10.45 cfs @ 12.27 hrs, Volume= 1.162 af
Outflow = 10.42 cfs @ 12.28 hrs, Volume= 1.162 af, Atten= 0%, Lag= 0.7 min
Primary = 6.94 cfs @ 12.28 hrs, Volume= 0.774 af
Secondary = 3.47 cfs @ 12.28 hrs, Volume= 0.387 af
Tertiary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 797.04' @ 12.28 hrs Surf.Area= 1,313 sf Storage= 853 cf
Flood Elev= 800.70' Surf.Area= 41,310 sf Storage= 68,694 cf

Plug-Flow detention time= 2.3 min calculated for 1.161 af (100% of inflow)
Center-of-Mass det. time= 2.3 min (902.3 - 900.0)

Volume	Invert	Avail.Storage	Storage Description
#1	796.70'	322,396 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
796.70	0	0	0
798.00	5,040	3,276	3,276
800.00	27,240	32,280	35,556
802.00	67,440	94,680	130,236
804.00	124,720	192,160	322,396

Device	Routing	Invert	Outlet Devices
#1	Primary	796.70'	**20.5" Horiz. Orifice/Grate X 2.00** C= 0.600 Limited to weir flow at low heads
#2	Secondary	796.70'	**20.5" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Tertiary	800.70'	**100.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=6.91 cfs @ 12.28 hrs HW=797.04' (Free Discharge)
└**1=Orifice/Grate** (Weir Controls 6.91 cfs @ 1.90 fps)

Secondary OutFlow Max=3.46 cfs @ 12.28 hrs HW=797.04' (Free Discharge)
└**2=Orifice/Grate** (Weir Controls 3.46 cfs @ 1.90 fps)

Tertiary OutFlow Max=0.00 cfs @ 0.00 hrs HW=796.70' (Free Discharge)
└**3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond C3SE: Catch Basin

Inflow Area = 12.185 ac, 0.00% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 6.32 cfs @ 12.25 hrs, Volume= 0.675 af
Outflow = 6.31 cfs @ 12.25 hrs, Volume= 0.675 af, Atten= 0%, Lag= 0.0 min
Primary = 6.31 cfs @ 12.25 hrs, Volume= 0.675 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 799.32' @ 12.25 hrs Surf.Area= 183 sf Storage= 92 cf
Flood Elev= 803.00' Surf.Area= 27,802 sf Storage= 41,827 cf

Plug-Flow detention time= 0.4 min calculated for 0.675 af (100% of inflow)
Center-of-Mass det. time= 0.4 min (898.8 - 898.4)

Volume	Invert	Avail.Storage	Storage Description
#1	799.00'	200,239 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
799.00	0	0	0
800.00	577	289	289
802.00	13,160	13,737	14,026
804.00	42,443	55,603	69,629
806.00	88,167	130,610	200,239

Device	Routing	Invert	Outlet Devices
#1	Primary	799.00'	**20.5" Horiz. Orifice/Grate X 2.00** C= 0.600 Limited to weir flow at low heads
#2	Secondary	803.00'	**100.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=6.28 cfs @ 12.25 hrs HW=799.32' (Free Discharge)
↑—**1=Orifice/Grate** (Weir Controls 6.28 cfs @ 1.84 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=799.00' (Free Discharge)
↑—**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond C3SW: Catch Basin

Inflow Area = 2.085 ac, 0.00% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 2.21 cfs @ 12.00 hrs, Volume= 0.115 af
Outflow = 2.21 cfs @ 12.00 hrs, Volume= 0.115 af, Atten= 0%, Lag= 0.1 min
Primary = 2.21 cfs @ 12.00 hrs, Volume= 0.115 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 752.75' @ 12.00 hrs Surf.Area= 59 sf Storage= 29 cf
Flood Elev= 755.50' Surf.Area= 2,097 sf Storage= 2,214 cf

Plug-Flow detention time= 0.4 min calculated for 0.115 af (100% of inflow)
Center-of-Mass det. time= 0.4 min (880.3 - 879.9)

Volume	Invert	Avail.Storage	Storage Description
#1	752.50'	9,903 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
752.50	0	0	0
753.50	233	117	117
754.50	932	583	699
755.50	2,097	1,515	2,214
756.50	3,728	2,913	5,126
757.50	5,825	4,777	9,903

Device	Routing	Invert	Outlet Devices
#1	Primary	752.50'	**20.5" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Secondary	755.50'	**100.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=2.20 cfs @ 12.00 hrs HW=752.75' (Free Discharge)
└**1=Orifice/Grate** (Weir Controls 2.20 cfs @ 1.64 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=752.50' (Free Discharge)
└**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond C3W: Catch Basin

Inflow Area = 1.543 ac, 0.00% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 1.62 cfs @ 12.00 hrs, Volume= 0.085 af
Outflow = 1.61 cfs @ 12.01 hrs, Volume= 0.085 af, Atten= 0%, Lag= 0.2 min
Primary = 1.61 cfs @ 12.01 hrs, Volume= 0.085 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 742.20' @ 12.01 hrs Surf.Area= 47 sf Storage= 24 cf
Flood Elev= 744.00' Surf.Area= 932 sf Storage= 699 cf

Plug-Flow detention time= 0.5 min calculated for 0.085 af (100% of inflow)
Center-of-Mass det. time= 0.5 min (880.7 - 880.2)

Volume	Invert	Avail.Storage	Storage Description
#1	742.00'	5,126 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
742.00	0	0	0
743.00	233	117	117
744.00	932	583	699
745.00	2,097	1,515	2,214
746.00	3,728	2,913	5,126

Device	Routing	Invert	Outlet Devices
#1	Primary	742.00'	**20.5" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Secondary	744.00'	**100.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00

3.50 4.00 4.50 5.00 5.50
Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73
2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=1.61 cfs @ 12.01 hrs HW=742.20' (Free Discharge)
1=Orifice/Grate (Weir Controls 1.61 cfs @ 1.47 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=742.00' (Free Discharge)
2=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Summary for Pond C4N: Catch Basin

Inflow Area = 1.933 ac, 0.00% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 2.08 cfs @ 12.00 hrs, Volume= 0.107 af
Outflow = 2.08 cfs @ 12.00 hrs, Volume= 0.107 af, Atten= 0%, Lag= 0.2 min
Primary = 2.08 cfs @ 12.00 hrs, Volume= 0.107 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 782.24' @ 12.00 hrs Surf.Area= 64 sf Storage= 32 cf
Flood Elev= 785.00' Surf.Area= 2,403 sf Storage= 2,804 cf

Plug-Flow detention time= 0.5 min calculated for 0.107 af (100% of inflow)
Center-of-Mass det. time= 0.5 min (880.1 - 879.7)

Volume	Invert	Avail.Storage	Storage Description
#1	782.00'	11,882 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
782.00	0	0	0
783.00	267	134	134
785.00	2,403	2,670	2,804
787.00	6,675	9,078	11,882

Device	Routing	Invert	Outlet Devices
#1	Primary	782.00'	**20.5" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Secondary	785.00'	**100.0' long x 4.0' breadth Broad-Crested Rectangular Weir**
			Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50
			Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=2.07 cfs @ 12.00 hrs HW=782.24' (Free Discharge)
1=Orifice/Grate (Weir Controls 2.07 cfs @ 1.60 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=782.00' (Free Discharge)
2=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Summary for Pond C4S: Catch Basin

Inflow Area = 0.872 ac, 0.00% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 0.96 cfs @ 11.99 hrs, Volume= 0.048 af
Outflow = 0.95 cfs @ 12.00 hrs, Volume= 0.048 af, Atten= 0%, Lag= 0.3 min
Primary = 0.95 cfs @ 12.00 hrs, Volume= 0.048 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 777.64' @ 12.00 hrs Surf.Area= 54 sf Storage= 27 cf
Flood Elev= 780.25' Surf.Area= 1,479 sf Storage= 1,816 cf

Plug-Flow detention time= 0.9 min calculated for 0.048 af (100% of inflow)
Center-of-Mass det. time= 0.9 min (880.1 - 879.2)

Volume	Invert	Avail.Storage	Storage Description
#1	777.50'	2,141 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
777.50	0	0	0
778.50	378	189	189
779.50	932	655	844
780.50	1,661	1,297	2,141

Device	Routing	Invert	Outlet Devices
#1	Primary	777.50'	**20.5" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Secondary	780.25'	**100.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=0.95 cfs @ 12.00 hrs HW=777.64' (Free Discharge)
1=Orifice/Grate (Weir Controls 0.95 cfs @ 1.24 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=777.50' (Free Discharge)
2=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Summary for Pond C4SE: Catch Basin

Inflow Area = 2.200 ac, 0.00% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 2.40 cfs @ 11.99 hrs, Volume= 0.122 af
Outflow = 2.39 cfs @ 12.00 hrs, Volume= 0.122 af, Atten= 0%, Lag= 0.4 min
Primary = 2.39 cfs @ 12.00 hrs, Volume= 0.122 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 776.26' @ 12.00 hrs Surf.Area= 167 sf Storage= 84 cf
Flood Elev= 779.00' Surf.Area= 2,509 sf Storage= 3,360 cf

Plug-Flow detention time= 1.1 min calculated for 0.122 af (100% of inflow)
Center-of-Mass det. time= 1.1 min (880.5 - 879.4)

Volume	Invert	Avail.Storage	Storage Description
#1	776.00'	10,959 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
776.00	0	0	0
777.00	634	317	317
778.00	1,471	1,053	1,370
779.00	2,509	1,990	3,360
780.00	3,750	3,130	6,489
781.00	5,190	4,470	10,959

Device	Routing	Invert	Outlet Devices
#1	Primary	776.00'	**20.5" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Secondary	779.00'	**100.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=2.38 cfs @ 12.00 hrs HW=776.26' (Free Discharge)
└**1=Orifice/Grate** (Weir Controls 2.38 cfs @ 1.68 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=776.00' (Free Discharge)
└**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond C4SW: Southwest Ditch 1

Inflow Area = 1.671 ac, 0.00% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 1.87 cfs @ 11.99 hrs, Volume= 0.093 af
Outflow = 1.87 cfs @ 11.99 hrs, Volume= 0.093 af, Atten= 0%, Lag= 0.2 min
Primary = 1.87 cfs @ 11.99 hrs, Volume= 0.093 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 744.22' @ 11.99 hrs Surf.Area= 52 sf Storage= 26 cf
Flood Elev= 747.00' Surf.Area= 2,097 sf Storage= 2,214 cf

Plug-Flow detention time= 0.4 min calculated for 0.093 af (100% of inflow)
Center-of-Mass det. time= 0.4 min (879.2 - 878.8)

Volume	Invert	Avail.Storage	Storage Description
#1	744.00'	9,903 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
744.00	0	0	0
745.00	233	117	117
746.00	932	583	699
747.00	2,097	1,515	2,214
748.00	3,728	2,913	5,126
749.00	5,825	4,777	9,903

Device	Routing	Invert	Outlet Devices
#1	Primary	744.00'	**20.5" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Secondary	747.00'	**100.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=1.86 cfs @ 11.99 hrs HW=744.22' (Free Discharge)
└**1=Orifice/Grate** (Weir Controls 1.86 cfs @ 1.55 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=744.00' (Free Discharge)
└**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond C4W: West Ditch

Inflow Area = 18.321 ac, 0.00% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 11.14 cfs @ 12.16 hrs, Volume= 1.015 af
Outflow = 10.21 cfs @ 12.22 hrs, Volume= 1.015 af, Atten= 8%, Lag= 3.8 min
Primary = 10.21 cfs @ 12.22 hrs, Volume= 1.015 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 718.57' @ 12.22 hrs Surf.Area= 2,131 sf Storage= 2,221 cf
Flood Elev= 721.50' Surf.Area= 7,097 sf Storage= 15,551 cf

Plug-Flow detention time= 4.9 min calculated for 1.015 af (100% of inflow)
Center-of-Mass det. time= 4.9 min (897.1 - 892.3)

Volume	Invert	Avail.Storage	Storage Description
#1	717.00'	34,968 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
717.00	0	0	0
718.00	1,206	603	603
720.00	4,430	5,636	6,239
722.00	7,986	12,416	18,655
724.00	8,327	16,313	34,968

Device	Routing	Invert	Outlet Devices
#1	Primary	717.00'	**30.0" Round Culvert** L= 90.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 717.00' / 716.00' S= 0.0111 '/' Cc= 0.900 n= 0.024, Flow Area= 4.91 sf
#2	Secondary	722.00'	**400.0' long x 40.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=10.20 cfs @ 12.22 hrs HW=718.57' (Free Discharge)
└**1=Culvert** (Barrel Controls 10.20 cfs @ 4.47 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=717.00' (Free Discharge)
└**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond C5N: Catch Basin

Inflow Area = 3.175 ac, 0.00% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 3.26 cfs @ 12.01 hrs, Volume= 0.176 af
Outflow = 3.26 cfs @ 12.01 hrs, Volume= 0.176 af, Atten= 0%, Lag= 0.1 min
Primary = 3.26 cfs @ 12.01 hrs, Volume= 0.176 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Peak Elev= 749.20' @ 12.01 hrs Surf.Area= 55 sf Storage= 27 cf
Flood Elev= 752.00' Surf.Area= 2,403 sf Storage= 2,804 cf

Plug-Flow detention time= 0.2 min calculated for 0.176 af (100% of inflow)
Center-of-Mass det. time= 0.2 min (880.8 - 880.6)

Volume	Invert	Avail.Storage	Storage Description
#1	749.00'	11,882 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
749.00	0	0	0
750.00	267	134	134
752.00	2,403	2,670	2,804
754.00	6,675	9,078	11,882

Device	Routing	Invert	Outlet Devices
#1	Primary	749.00'	**20.5" Horiz. Orifice/Grate X 2.00** C= 0.600 Limited to weir flow at low heads
#2	Secondary	752.00'	**100.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=3.26 cfs @ 12.01 hrs HW=749.20' (Free Discharge)
1=Orifice/Grate (Weir Controls 3.26 cfs @ 1.48 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=749.00' (Free Discharge)
2=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Summary for Pond C5S: Catch Basin

Inflow Area = 1.778 ac, 0.00% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 1.91 cfs @ 12.00 hrs, Volume= 0.098 af
Outflow = 1.91 cfs @ 12.00 hrs, Volume= 0.098 af, Atten= 0%, Lag= 0.1 min
Primary = 1.91 cfs @ 12.00 hrs, Volume= 0.098 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 732.23' @ 12.00 hrs Surf.Area= 23 sf Storage= 11 cf
Flood Elev= 735.00' Surf.Area= 891 sf Storage= 941 cf

Plug-Flow detention time= 0.2 min calculated for 0.098 af (100% of inflow)
Center-of-Mass det. time= 0.2 min (879.8 - 879.7)

Volume	Invert	Avail.Storage	Storage Description
#1	732.00'	1,986 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
732.00	0	0	0
733.00	99	50	50
734.00	396	248	297
735.00	891	644	941
736.00	1,200	1,046	1,986

Device	Routing	Invert	Outlet Devices
#1	Primary	732.00'	**20.5" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Secondary	735.00'	**100.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=1.90 cfs @ 12.00 hrs HW=732.23' (Free Discharge)
1=Orifice/Grate (Weir Controls 1.90 cfs @ 1.56 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=732.00' (Free Discharge)
2=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Summary for Pond C5SE: Catch Basin

Inflow Area = 2.043 ac, 0.00% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 2.18 cfs @ 12.00 hrs, Volume= 0.113 af
Outflow = 2.17 cfs @ 12.00 hrs, Volume= 0.113 af, Atten= 0%, Lag= 0.2 min
Primary = 2.17 cfs @ 12.00 hrs, Volume= 0.113 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 752.75' @ 12.00 hrs Surf.Area= 58 sf Storage= 29 cf
Flood Elev= 755.50' Surf.Area= 2,097 sf Storage= 2,214 cf

Plug-Flow detention time= 0.4 min calculated for 0.113 af (100% of inflow)
Center-of-Mass det. time= 0.4 min (880.3 - 879.8)

Volume	Invert	Avail.Storage	Storage Description
#1	752.50'	9,903 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
752.50	0	0	0
753.50	233	117	117
754.50	932	583	699
755.50	2,097	1,515	2,214
756.50	3,728	2,913	5,126
757.50	5,825	4,777	9,903

Device	Routing	Invert	Outlet Devices
#1	Primary	752.50'	**20.5" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Secondary	755.50'	**100.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=2.17 cfs @ 12.00 hrs HW=752.75' (Free Discharge)
1=Orifice/Grate (Weir Controls 2.17 cfs @ 1.63 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=752.50' (Free Discharge)
2=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Summary for Pond C5SW: Catch Basin

Inflow Area = 4.496 ac, 0.00% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 3.54 cfs @ 12.08 hrs, Volume= 0.249 af
Outflow = 3.46 cfs @ 12.10 hrs, Volume= 0.249 af, Atten= 2%, Lag= 1.4 min
Primary = 3.46 cfs @ 12.10 hrs, Volume= 0.249 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 811.34' @ 12.10 hrs Surf.Area= 793 sf Storage= 397 cf
Flood Elev= 815.00' Surf.Area= 37,030 sf Storage= 60,372 cf

Plug-Flow detention time= 3.7 min calculated for 0.249 af (100% of inflow)
Center-of-Mass det. time= 3.7 min (890.1 - 886.4)

Volume	Invert	Avail.Storage	Storage Description
#1	811.00'	97,402 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
811.00	0	0	0
812.00	2,344	1,172	1,172
814.00	19,826	22,170	23,342
816.00	54,234	74,060	97,402

Device	Routing	Invert	Outlet Devices
#1	Primary	811.00'	**20.5" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Secondary	815.00'	**100.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=3.45 cfs @ 12.10 hrs HW=811.34' (Free Discharge)
1=Orifice/Grate (Weir Controls 3.45 cfs @ 1.90 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=811.00' (Free Discharge)
2=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Summary for Pond C6N: North Ditch

[79] Warning: Submerged Pond D1N Primary device # 1 OUTLET by 0.76'

Inflow Area = 26.669 ac, 0.00% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 10.12 cfs @ 12.05 hrs, Volume= 1.477 af
Outflow = 10.03 cfs @ 12.32 hrs, Volume= 1.477 af, Atten= 1%, Lag= 16.4 min
Primary = 10.03 cfs @ 12.32 hrs, Volume= 1.477 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 720.76' @ 12.32 hrs Surf.Area= 1,084 sf Storage= 1,154 cf
Flood Elev= 723.00' Surf.Area= 4,539 sf Storage= 7,343 cf

Plug-Flow detention time= 1.3 min calculated for 1.477 af (100% of inflow)
Center-of-Mass det. time= 1.3 min (898.5 - 897.2)

Volume	Invert	Avail.Storage	Storage Description
#1	719.00'	11,882 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
719.00	0	0	0
720.00	267	134	134
722.00	2,403	2,670	2,804
724.00	6,675	9,078	11,882

Device	Routing	Invert	Outlet Devices
#1	Primary	719.00'	**22.2" Round Culvert** L= 50.0' CMP, end-section conforming to fill, Ke= 0.500 Inlet / Outlet Invert= 719.00' / 718.50' S= 0.0100 '/' Cc= 0.900 n= 0.018, Flow Area= 2.69 sf
#2	Secondary	723.00'	**100.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=10.04 cfs @ 12.32 hrs HW=720.76' (Free Discharge)
1=Culvert (Barrel Controls 10.04 cfs @ 4.88 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=719.00' (Free Discharge)
2=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Summary for Pond C6S: Catch Basin

Inflow Area = 1.820 ac, 0.00% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 2.01 cfs @ 11.99 hrs, Volume= 0.101 af
Outflow = 2.00 cfs @ 12.00 hrs, Volume= 0.101 af, Atten= 0%, Lag= 0.4 min
Primary = 2.00 cfs @ 12.00 hrs, Volume= 0.101 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 777.23' @ 12.00 hrs Surf.Area= 125 sf Storage= 63 cf
Flood Elev= 780.00' Surf.Area= 1,600 sf Storage= 2,399 cf

Plug-Flow detention time= 1.1 min calculated for 0.101 af (100% of inflow)
Center-of-Mass det. time= 1.1 min (880.2 - 879.1)

Volume	Invert	Avail.Storage	Storage Description
#1	777.00'	2,399 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
777.00	0	0	0
778.00	533	267	267
779.00	1,066	800	1,066
780.00	1,600	1,333	2,399

Device	Routing	Invert	Outlet Devices
#1	Primary	777.00'	**20.5" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Secondary	780.00'	**100.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50

Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=1.99 cfs @ 12.00 hrs HW=777.23' (Free Discharge)
└**1=Orifice/Grate** (Weir Controls 1.99 cfs @ 1.58 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=777.00' (Free Discharge)
└**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond C6SE: Southeast Ditch 1

Inflow Area = 1.487 ac, 0.00% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 1.65 cfs @ 11.99 hrs, Volume= 0.082 af
Outflow = 1.65 cfs @ 11.99 hrs, Volume= 0.082 af, Atten= 0%, Lag= 0.2 min
Primary = 1.65 cfs @ 11.99 hrs, Volume= 0.082 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 744.21' @ 11.99 hrs Surf.Area= 48 sf Storage= 24 cf
Flood Elev= 747.00' Surf.Area= 2,097 sf Storage= 2,214 cf

Plug-Flow detention time= 0.4 min calculated for 0.082 af (100% of inflow)
Center-of-Mass det. time= 0.4 min (879.4 - 879.0)

Volume	Invert	Avail.Storage	Storage Description
#1	744.00'	9,903 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
744.00	0	0	0
745.00	233	117	117
746.00	932	583	699
747.00	2,097	1,515	2,214
748.00	3,728	2,913	5,126
749.00	5,825	4,777	9,903

Device	Routing	Invert	Outlet Devices
#1	Primary	744.00'	**20.5" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Secondary	747.00'	**100.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=1.64 cfs @ 11.99 hrs HW=744.21' (Free Discharge)
└**1=Orifice/Grate** (Weir Controls 1.64 cfs @ 1.48 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=744.00' (Free Discharge)
└**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond C6SW: Catch Basin

Inflow Area = 2.314 ac, 0.00% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 2.54 cfs @ 11.99 hrs, Volume= 0.128 af
Outflow = 2.53 cfs @ 12.00 hrs, Volume= 0.128 af, Atten= 0%, Lag= 0.4 min
Primary = 2.53 cfs @ 12.00 hrs, Volume= 0.128 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 776.27' @ 12.00 hrs Surf.Area= 174 sf Storage= 87 cf
Flood Elev= 779.00' Surf.Area= 2,509 sf Storage= 3,360 cf

Plug-Flow detention time= 1.1 min calculated for 0.128 af (100% of inflow)
Center-of-Mass det. time= 1.1 min (880.3 - 879.2)

Volume	Invert	Avail.Storage	Storage Description
#1	776.00'	10,959 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
776.00	0	0	0
777.00	634	317	317
778.00	1,471	1,053	1,370
779.00	2,509	1,990	3,360
780.00	3,750	3,130	6,489
781.00	5,190	4,470	10,959

Device	Routing	Invert	Outlet Devices
#1	Primary	776.00'	**20.5" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Secondary	779.00'	**100.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=2.52 cfs @ 12.00 hrs HW=776.27' (Free Discharge)
└**1=Orifice/Grate** (Weir Controls 2.52 cfs @ 1.71 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=776.00' (Free Discharge)
└**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond C7S: Catch Basin

Inflow Area = 2.118 ac, 0.00% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 2.29 cfs @ 12.00 hrs, Volume= 0.117 af
Outflow = 2.28 cfs @ 12.00 hrs, Volume= 0.117 af, Atten= 0%, Lag= 0.1 min
Primary = 2.28 cfs @ 12.00 hrs, Volume= 0.117 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 732.76' @ 12.00 hrs Surf.Area= 62 sf Storage= 31 cf
Flood Elev= 735.50' Surf.Area= 2,172 sf Storage= 2,292 cf

Plug-Flow detention time= 0.5 min calculated for 0.117 af (100% of inflow)
Center-of-Mass det. time= 0.5 min (880.0 - 879.6)

Volume	Invert	Avail.Storage	Storage Description
#1	732.50'	3,460 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
732.50	0	0	0
733.50	241	121	121
734.50	965	603	724
735.50	2,172	1,569	2,292
736.00	2,500	1,168	3,460

Device	Routing	Invert	Outlet Devices
#1	Primary	732.50'	**20.5" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Secondary	735.50'	**100.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=2.28 cfs @ 12.00 hrs HW=732.76' (Free Discharge)
└**1=Orifice/Grate** (Weir Controls 2.28 cfs @ 1.66 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=732.50' (Free Discharge)
└**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond C7SE: Catch Basin

Inflow Area = 2.211 ac, 0.00% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 2.18 cfs @ 12.02 hrs, Volume= 0.122 af
Outflow = 2.17 cfs @ 12.03 hrs, Volume= 0.122 af, Atten= 0%, Lag= 0.4 min
Primary = 2.17 cfs @ 12.03 hrs, Volume= 0.122 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 775.25' @ 12.03 hrs Surf.Area= 132 sf Storage= 66 cf
Flood Elev= 778.00' Surf.Area= 1,600 sf Storage= 2,399 cf

Plug-Flow detention time= 0.9 min calculated for 0.122 af (100% of inflow)
Center-of-Mass det. time= 0.9 min (882.4 - 881.5)

Volume	Invert	Avail.Storage	Storage Description
#1	775.00'	11,332 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
775.00	0	0	0
776.00	533	267	267
777.00	1,066	800	1,066
778.00	1,600	1,333	2,399
780.00	7,333	8,933	11,332

Device	Routing	Invert	Outlet Devices
#1	Primary	775.00'	**20.5" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Secondary	778.00'	**100.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50

Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=2.16 cfs @ 12.03 hrs HW=775.25' (Free Discharge)
1=Orifice/Grate (Weir Controls 2.16 cfs @ 1.63 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=775.00' (Free Discharge)
2=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Summary for Pond C7SW: Catch Basin

Inflow Area = 3.196 ac, 0.00% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 3.26 cfs @ 12.01 hrs, Volume= 0.177 af
Outflow = 3.25 cfs @ 12.01 hrs, Volume= 0.177 af, Atten= 0%, Lag= 0.1 min
Primary = 3.25 cfs @ 12.01 hrs, Volume= 0.177 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 732.82' @ 12.01 hrs Surf.Area= 76 sf Storage= 38 cf
Flood Elev= 735.50' Surf.Area= 2,097 sf Storage= 2,214 cf

Plug-Flow detention time= 0.4 min calculated for 0.177 af (100% of inflow)
Center-of-Mass det. time= 0.4 min (881.2 - 880.8)

Volume	Invert	Avail.Storage	Storage Description
#1	732.50'	9,903 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
732.50	0	0	0
733.50	233	117	117
734.50	932	583	699
735.50	2,097	1,515	2,214
736.50	3,728	2,913	5,126
737.50	5,825	4,777	9,903

Device	Routing	Invert	Outlet Devices
#1	Primary	732.50'	**20.5" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Secondary	735.50'	**100.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=3.24 cfs @ 12.01 hrs HW=732.82' (Free Discharge)
1=Orifice/Grate (Weir Controls 3.24 cfs @ 1.86 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=732.50' (Free Discharge)
2=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Summary for Pond C8SE: Catch Basin

Inflow Area = 1.308 ac, 0.00% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 1.55 cfs @ 11.97 hrs, Volume= 0.072 af
Outflow = 1.55 cfs @ 11.97 hrs, Volume= 0.072 af, Atten= 0%, Lag= 0.2 min
Primary = 1.55 cfs @ 11.97 hrs, Volume= 0.072 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 753.20' @ 11.97 hrs Surf.Area= 48 sf Storage= 24 cf
Flood Elev= 756.00' Surf.Area= 2,172 sf Storage= 2,292 cf

Plug-Flow detention time= 0.5 min calculated for 0.072 af (100% of inflow)
Center-of-Mass det. time= 0.5 min (878.1 - 877.6)

Volume	Invert	Avail.Storage	Storage Description
#1	753.00'	2,292 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
753.00	0	0	0
754.00	241	121	121
755.00	965	603	724
756.00	2,172	1,569	2,292

Device	Routing	Invert	Outlet Devices
#1	Primary	753.00'	**20.5" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Secondary	756.00'	**100.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=1.54 cfs @ 11.97 hrs HW=753.20' (Free Discharge)
↑—**1=Orifice/Grate** (Weir Controls 1.54 cfs @ 1.45 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=753.00' (Free Discharge)
↑—**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond C8SW: Southwest Ditch 2

Inflow Area = 0.953 ac, 0.00% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 1.09 cfs @ 11.98 hrs, Volume= 0.053 af
Outflow = 1.08 cfs @ 11.99 hrs, Volume= 0.053 af, Atten= 0%, Lag= 0.2 min
Primary = 1.08 cfs @ 11.99 hrs, Volume= 0.053 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 726.16' @ 11.99 hrs Surf.Area= 36 sf Storage= 18 cf
Flood Elev= 729.00' Surf.Area= 2,097 sf Storage= 2,214 cf

Plug-Flow detention time= 0.4 min calculated for 0.053 af (100% of inflow)
Center-of-Mass det. time= 0.4 min (878.9 - 878.5)

Volume	Invert	Avail.Storage	Storage Description
#1	726.00'	9,903 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
726.00	0	0	0
727.00	233	117	117
728.00	932	583	699
729.00	2,097	1,515	2,214
730.00	3,728	2,913	5,126
731.00	5,825	4,777	9,903

Device	Routing	Invert	Outlet Devices
#1	Primary	726.00'	**20.5" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Secondary	729.00'	**100.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=1.08 cfs @ 11.99 hrs HW=726.16' (Free Discharge)
└**1=Orifice/Grate** (Weir Controls 1.08 cfs @ 1.29 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=726.00' (Free Discharge)
└**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond C9SE: Southeast Ditch 2

Inflow Area = 0.641 ac, 0.00% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 0.74 cfs @ 11.98 hrs, Volume= 0.036 af
Outflow = 0.74 cfs @ 11.98 hrs, Volume= 0.036 af, Atten= 0%, Lag= 0.1 min
Primary = 0.74 cfs @ 11.98 hrs, Volume= 0.036 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 735.12' @ 11.98 hrs Surf.Area= 14 sf Storage= 7 cf
Flood Elev= 738.00' Surf.Area= 1,100 sf Storage= 1,150 cf

Plug-Flow detention time= 0.3 min calculated for 0.035 af (100% of inflow)
Center-of-Mass det. time= 0.3 min (878.5 - 878.3)

Volume	Invert	Avail.Storage	Storage Description
#1	735.00'	1,150 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
735.00	0	0	0
736.00	120	60	60
737.00	480	300	360
738.00	1,100	790	1,150

Device	Routing	Invert	Outlet Devices
#1	Primary	735.00'	**20.5" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Secondary	738.00'	**100.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=0.73 cfs @ 11.98 hrs HW=735.12' (Free Discharge)
└**1=Orifice/Grate** (Weir Controls 0.73 cfs @ 1.14 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=735.00' (Free Discharge)
└**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond D10SE: 10" Pipe

Inflow Area = 3.918 ac, 0.00% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 2.96 cfs @ 12.11 hrs, Volume= 0.217 af
Outflow = 2.96 cfs @ 12.11 hrs, Volume= 0.217 af, Atten= 0%, Lag= 0.0 min
Primary = 2.96 cfs @ 12.11 hrs, Volume= 0.217 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 808.74' @ 12.11 hrs
Flood Elev= 810.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	807.00'	**9.9" Round Culvert** L= 350.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 807.00' / 800.00' S= 0.0200 '/' Cc= 0.900 n= 0.010, Flow Area= 0.53 sf

Primary OutFlow Max=2.96 cfs @ 12.11 hrs HW=808.74' (Free Discharge)
└**1=Culvert** (Inlet Controls 2.96 cfs @ 5.55 fps)

Summary for Pond D11SE: 20" Pipe

[79] Warning: Submerged Pond D10SE Primary device # 1 OUTLET by 1.11'

Inflow Area = 9.766 ac, 0.00% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 5.19 cfs @ 12.17 hrs, Volume= 0.541 af
Outflow = 5.19 cfs @ 12.17 hrs, Volume= 0.541 af, Atten= 0%, Lag= 0.0 min
Primary = 5.19 cfs @ 12.17 hrs, Volume= 0.541 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 801.11' @ 12.17 hrs
Flood Elev= 809.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	800.00'	**18.5" Round Culvert** L= 265.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 800.00' / 794.50' S= 0.0208 '/' Cc= 0.900 n= 0.010, Flow Area= 1.87 sf

Primary OutFlow Max=5.19 cfs @ 12.17 hrs HW=801.11' (Free Discharge)
└**1=Culvert** (Inlet Controls 5.19 cfs @ 3.59 fps)

Summary for Pond D12SE: 24" Pipe

[79] Warning: Submerged Pond D11SE Primary device # 1 OUTLET by 1.50'

Inflow Area = 18.821 ac, 0.00% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 9.75 cfs @ 12.21 hrs, Volume= 1.042 af
Outflow = 9.75 cfs @ 12.21 hrs, Volume= 1.042 af, Atten= 0%, Lag= 0.0 min
Primary = 9.75 cfs @ 12.21 hrs, Volume= 1.042 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 796.00' @ 12.21 hrs
Flood Elev= 797.50'

Device	Routing	Invert	Outlet Devices
#1	Primary	794.50'	**22.2" Round Culvert** L= 350.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 794.50' / 720.00' S= 0.2129 '/' Cc= 0.900 n= 0.010, Flow Area= 2.69 sf

Primary OutFlow Max=9.75 cfs @ 12.21 hrs HW=796.00' (Free Discharge)
1=Culvert (Inlet Controls 9.75 cfs @ 4.17 fps)

Summary for Pond D1E: 24" Pipe

Inflow Area = 17.841 ac, 0.00% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 7.89 cfs @ 12.32 hrs, Volume= 0.988 af
Outflow = 7.89 cfs @ 12.32 hrs, Volume= 0.988 af, Atten= 0%, Lag= 0.0 min
Primary = 7.89 cfs @ 12.32 hrs, Volume= 0.988 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 795.81' @ 12.32 hrs
Flood Elev= 797.50'

Device	Routing	Invert	Outlet Devices
#1	Primary	794.50'	**22.2" Round Culvert** L= 330.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 794.50' / 720.00' S= 0.2258 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 2.69 sf

Primary OutFlow Max=7.89 cfs @ 12.32 hrs HW=795.81' (Free Discharge)
1=Culvert (Inlet Controls 7.89 cfs @ 3.89 fps)

Summary for Pond D1N: 24" Pipe

Inflow Area = 17.691 ac, 0.00% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 8.12 cfs @ 12.32 hrs, Volume= 0.980 af
Outflow = 8.12 cfs @ 12.32 hrs, Volume= 0.980 af, Atten= 0%, Lag= 0.0 min
Primary = 8.12 cfs @ 12.32 hrs, Volume= 0.980 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 799.33' @ 12.32 hrs
Flood Elev= 801.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	798.00'	**22.2" Round Culvert** L= 330.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 798.00' / 720.00' S= 0.2364 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 2.69 sf

Primary OutFlow Max=8.12 cfs @ 12.32 hrs HW=799.33' (Free Discharge)
1=Culvert (Inlet Controls 8.12 cfs @ 3.93 fps)

Summary for Pond D1NW: 24" Pipe

Inflow Area = 1.506 ac, 0.00% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 1.75 cfs @ 11.98 hrs, Volume= 0.083 af
Outflow = 1.75 cfs @ 11.98 hrs, Volume= 0.083 af, Atten= 0%, Lag= 0.0 min
Primary = 1.75 cfs @ 11.98 hrs, Volume= 0.083 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 782.56' @ 11.98 hrs
Flood Elev= 785.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	782.00'	**22.2" Round Culvert** L= 200.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 782.00' / 742.00' S= 0.2000 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 2.69 sf

Primary OutFlow Max=1.75 cfs @ 11.98 hrs HW=782.56' (Free Discharge)
1=Culvert (Inlet Controls 1.75 cfs @ 2.55 fps)

Summary for Pond D1S: 10" Pipe

Inflow Area = 3.455 ac, 0.00% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 2.62 cfs @ 12.10 hrs, Volume= 0.191 af
Outflow = 2.62 cfs @ 12.10 hrs, Volume= 0.191 af, Atten= 0%, Lag= 0.0 min
Primary = 2.62 cfs @ 12.10 hrs, Volume= 0.191 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 807.45' @ 12.10 hrs
Flood Elev= 809.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	806.00'	**9.9" Round Culvert** L= 420.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 806.00' / 797.00' S= 0.0214 '/' Cc= 0.900 n= 0.010, Flow Area= 0.53 sf

Primary OutFlow Max=2.61 cfs @ 12.10 hrs HW=807.44' (Free Discharge)
1=Culvert (Inlet Controls 2.61 cfs @ 4.89 fps)

Summary for Pond D1SE: 10" Pipe

Inflow Area = 3.373 ac, 0.00% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 2.58 cfs @ 12.10 hrs, Volume= 0.187 af
Outflow = 2.58 cfs @ 12.10 hrs, Volume= 0.187 af, Atten= 0%, Lag= 0.0 min
Primary = 2.58 cfs @ 12.10 hrs, Volume= 0.187 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 808.42' @ 12.10 hrs
Flood Elev= 810.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	807.00'	**9.9" Round Culvert** L= 360.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 807.00' / 801.00' S= 0.0167 '/' Cc= 0.900 n= 0.010, Flow Area= 0.53 sf

Primary OutFlow Max=2.58 cfs @ 12.10 hrs HW=808.42' (Free Discharge)
1=Culvert (Inlet Controls 2.58 cfs @ 4.83 fps)

Summary for Pond D1SW: 6" Pipe

[58] Hint: Peaked 9.60' above defined flood level
[81] Warning: Exceeded Pond C1SW by 9.25' @ 12.13 hrs

Inflow Area = 4.734 ac, 0.00% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 3.43 cfs @ 12.13 hrs, Volume= 0.262 af
Outflow = 3.43 cfs @ 12.13 hrs, Volume= 0.262 af, Atten= 0%, Lag= 0.0 min
Primary = 3.43 cfs @ 12.13 hrs, Volume= 0.262 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 820.60' @ 12.13 hrs
Flood Elev= 811.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	808.00'	**6.1" Round Culvert** L= 120.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 808.00' / 773.00' S= 0.2917 '/' Cc= 0.900 n= 0.010, Flow Area= 0.20 sf

Primary OutFlow Max=3.43 cfs @ 12.13 hrs HW=820.58' (Free Discharge)
1=Culvert (Inlet Controls 3.43 cfs @ 16.90 fps)

Summary for Pond D1W: 24" Pipe

Inflow Area = 16.760 ac, 0.00% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 10.74 cfs @ 12.16 hrs, Volume= 0.928 af
Outflow = 10.74 cfs @ 12.16 hrs, Volume= 0.928 af, Atten= 0%, Lag= 0.0 min
Primary = 10.74 cfs @ 12.16 hrs, Volume= 0.928 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 797.61' @ 12.16 hrs
Flood Elev= 799.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	796.00'	**22.2" Round Culvert** L= 280.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 796.00' / 724.00' S= 0.2571 '/' Cc= 0.900 n= 0.010, Flow Area= 2.69 sf

Primary OutFlow Max=10.73 cfs @ 12.16 hrs HW=797.61' (Free Discharge)
1=Culvert (Inlet Controls 10.73 cfs @ 4.32 fps)

Summary for Pond D2N: 24" Pipe

Inflow Area = 1.145 ac, 0.00% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 1.26 cfs @ 11.99 hrs, Volume= 0.063 af
Outflow = 1.26 cfs @ 11.99 hrs, Volume= 0.063 af, Atten= 0%, Lag= 0.0 min
Primary = 1.26 cfs @ 11.99 hrs, Volume= 0.063 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 779.47' @ 11.99 hrs
Flood Elev= 782.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	779.00'	**22.2" Round Culvert** L= 170.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 779.00' / 739.00' S= 0.2353 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 2.69 sf

Primary OutFlow Max=1.26 cfs @ 11.99 hrs HW=779.47' (Free Discharge)
1=Culvert (Inlet Controls 1.26 cfs @ 2.34 fps)

Summary for Pond D2NW: 24" Pipe

[79] Warning: Submerged Pond D1NW Primary device # 1 OUTLET by 0.79'

Inflow Area = 3.844 ac, 0.00% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 3.28 cfs @ 12.01 hrs, Volume= 0.213 af
Outflow = 3.28 cfs @ 12.01 hrs, Volume= 0.213 af, Atten= 0%, Lag= 0.0 min
Primary = 3.28 cfs @ 12.01 hrs, Volume= 0.213 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 742.79' @ 12.01 hrs
Flood Elev= 745.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	742.00'	**22.2" Round Culvert** L= 60.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 742.00' / 726.00' S= 0.2667 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 2.69 sf

Primary OutFlow Max=3.27 cfs @ 12.01 hrs HW=742.78' (Free Discharge)
1=Culvert (Inlet Controls 3.27 cfs @ 3.02 fps)

Summary for Pond D2S: 20" Pipe

[58] Hint: Peaked 20.67' above defined flood level
[79] Warning: Submerged Pond D1S Primary device # 1 OUTLET by 1.17'

Inflow Area = 10.865 ac, 0.00% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 5.56 cfs @ 12.18 hrs, Volume= 0.602 af
Outflow = 5.56 cfs @ 12.18 hrs, Volume= 0.602 af, Atten= 0%, Lag= 0.0 min
Primary = 5.56 cfs @ 12.18 hrs, Volume= 0.602 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 798.17' @ 12.18 hrs
Flood Elev= 777.50'

Device	Routing	Invert	Outlet Devices
#1	Primary	797.00'	**18.5" Round Culvert** L= 195.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 797.00' / 793.70' S= 0.0169 '/' Cc= 0.900 n= 0.010, Flow Area= 1.87 sf

Primary OutFlow Max=5.56 cfs @ 12.18 hrs HW=798.17' (Free Discharge)
1=Culvert (Inlet Controls 5.56 cfs @ 3.68 fps)

Summary for Pond D2SE: 20" Pipe

[79] Warning: Submerged Pond D1SE Primary device # 1 OUTLET by 1.04'

Inflow Area = 8.729 ac, 0.00% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 4.68 cfs @ 12.16 hrs, Volume= 0.483 af
Outflow = 4.68 cfs @ 12.16 hrs, Volume= 0.483 af, Atten= 0%, Lag= 0.0 min
Primary = 4.68 cfs @ 12.16 hrs, Volume= 0.483 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 802.04' @ 12.16 hrs
Flood Elev= 809.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	801.00'	**18.5" Round Culvert** L= 120.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 801.00' / 796.00' S= 0.0417 '/' Cc= 0.900 n= 0.010, Flow Area= 1.87 sf

Primary OutFlow Max=4.67 cfs @ 12.16 hrs HW=802.04' (Free Discharge)
1=Culvert (Inlet Controls 4.67 cfs @ 3.48 fps)

Summary for Pond D2SW: 12" Pipe

[79] Warning: Submerged Pond D1SW Primary device # 1 OUTLET by 2.51'

Inflow Area = 7.709 ac, 0.00% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 5.19 cfs @ 12.04 hrs, Volume= 0.427 af
Outflow = 5.19 cfs @ 12.04 hrs, Volume= 0.427 af, Atten= 0%, Lag= 0.0 min
Primary = 5.19 cfs @ 12.04 hrs, Volume= 0.427 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 775.51' @ 12.04 hrs
Flood Elev= 776.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	773.00'	**11.8" Round Culvert** L= 75.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 773.00' / 749.50' S= 0.3133 '/' Cc= 0.900 n= 0.010, Flow Area= 0.76 sf

Primary OutFlow Max=5.19 cfs @ 12.04 hrs HW=775.50' (Free Discharge)
1=Culvert (Inlet Controls 5.19 cfs @ 6.83 fps)

Summary for Pond D2W: 14" Pipe

Inflow Area = 1.924 ac, 0.00% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 2.02 cfs @ 12.01 hrs, Volume= 0.107 af
Outflow = 2.02 cfs @ 12.01 hrs, Volume= 0.107 af, Atten= 0%, Lag= 0.0 min
Primary = 2.02 cfs @ 12.01 hrs, Volume= 0.107 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 766.76' @ 12.01 hrs
Flood Elev= 769.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	766.00'	**12.9" Round Culvert** L= 200.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 766.00' / 720.00' S= 0.2300 '/' Cc= 0.900 n= 0.010, Flow Area= 0.91 sf

Primary OutFlow Max=2.02 cfs @ 12.01 hrs HW=766.76' (Free Discharge)
1=Culvert (Inlet Controls 2.02 cfs @ 2.96 fps)

Summary for Pond D3N: 24" Pipe

[79] Warning: Submerged Pond D2N Primary device # 1 OUTLET by 0.75'

Inflow Area = 2.907 ac, 0.00% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 3.03 cfs @ 12.01 hrs, Volume= 0.161 af
Outflow = 3.03 cfs @ 12.01 hrs, Volume= 0.161 af, Atten= 0%, Lag= 0.0 min
Primary = 3.03 cfs @ 12.01 hrs, Volume= 0.161 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 739.75' @ 12.01 hrs
Flood Elev= 742.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	739.00'	**22.2" Round Culvert** L= 60.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 739.00' / 726.00' S= 0.2167 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 2.69 sf

Primary OutFlow Max=3.02 cfs @ 12.01 hrs HW=739.75' (Free Discharge)
1=Culvert (Inlet Controls 3.02 cfs @ 2.95 fps)

Summary for Pond D3S1: 22" Pipe 1

Inflow Area = 20.973 ac, 0.00% Impervious, Inflow Depth = 0.44" for 2 year - 24 hour event
Inflow = 6.94 cfs @ 12.28 hrs, Volume= 0.774 af
Outflow = 6.94 cfs @ 12.28 hrs, Volume= 0.774 af, Atten= 0%, Lag= 0.0 min
Primary = 6.94 cfs @ 12.28 hrs, Volume= 0.774 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 794.97' @ 12.28 hrs
Flood Elev= 796.70'

Device	Routing	Invert	Outlet Devices
#1	Primary	793.70'	**20.3" Round Culvert** L= 475.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 793.70' / 716.50' S= 0.1625 '/' Cc= 0.900 n= 0.010, Flow Area= 2.25 sf

Primary OutFlow Max=6.94 cfs @ 12.28 hrs HW=794.97' (Free Discharge)
1=Culvert (Inlet Controls 6.94 cfs @ 3.84 fps)

Summary for Pond D3S2: 22" Pipe 2

[79] Warning: Submerged Pond D2S Primary device # 1 OUTLET by 1.49'

Inflow Area = 10.865 ac, 0.00% Impervious, Inflow Depth = 1.09" for 2 year - 24 hour event
Inflow = 8.75 cfs @ 12.22 hrs, Volume= 0.989 af
Outflow = 8.75 cfs @ 12.22 hrs, Volume= 0.989 af, Atten= 0%, Lag= 0.0 min
Primary = 8.75 cfs @ 12.22 hrs, Volume= 0.989 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 795.20' @ 12.22 hrs
Flood Elev= 796.70'

Device	Routing	Invert	Outlet Devices
#1	Primary	793.70'	**20.3" Round Culvert** L= 475.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 793.70' / 716.50' S= 0.1625 '/' Cc= 0.900

n= 0.010, Flow Area= 2.25 sf

Primary OutFlow Max=8.75 cfs @ 12.22 hrs HW=795.19' (Free Discharge)
1=Culvert (Inlet Controls 8.75 cfs @ 4.16 fps)

Summary for Pond D3SE: 24" Pipe

[79] Warning: Submerged Pond D2SE Primary device # 1 OUTLET by 1.61'

Inflow Area = 20.914 ac, 0.00% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 10.70 cfs @ 12.22 hrs, Volume= 1.158 af
Outflow = 10.70 cfs @ 12.22 hrs, Volume= 1.158 af, Atten= 0%, Lag= 0.0 min
Primary = 10.70 cfs @ 12.22 hrs, Volume= 1.158 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 4
Peak Elev= 797.61' @ 12.22 hrs
Flood Elev= 799.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	796.00'	**22.2" Round Culvert** L= 190.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 796.00' / 740.00' S= 0.2947 '/' Cc= 0.900 n= 0.010, Flow Area= 2.69 sf

Primary OutFlow Max=10.70 cfs @ 12.22 hrs HW=797.61' (Free Discharge)
1=Culvert (Inlet Controls 10.70 cfs @ 4.32 fps)

Summary for Pond D3SW: 24" Pipe

[79] Warning: Submerged Pond D2SW Primary device # 1 OUTLET by 1.24'

Inflow Area = 9.794 ac, 0.00% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 7.26 cfs @ 12.02 hrs, Volume= 0.542 af
Outflow = 7.26 cfs @ 12.02 hrs, Volume= 0.542 af, Atten= 0%, Lag= 0.0 min
Primary = 7.26 cfs @ 12.02 hrs, Volume= 0.542 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 4
Peak Elev= 750.74' @ 12.02 hrs
Flood Elev= 752.50'

Device	Routing	Invert	Outlet Devices
#1	Primary	749.50'	**22.2" Round Culvert** L= 25.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 749.50' / 740.00' S= 0.3800 '/' Cc= 0.900 n= 0.010, Flow Area= 2.69 sf

Primary OutFlow Max=7.25 cfs @ 12.02 hrs HW=750.74' (Free Discharge)
1=Culvert (Inlet Controls 7.25 cfs @ 3.79 fps)

Summary for Pond D3W: 18" Pipe

Inflow Area = 1.543 ac, 0.00% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 1.61 cfs @ 12.01 hrs, Volume= 0.085 af
Outflow = 1.61 cfs @ 12.01 hrs, Volume= 0.085 af, Atten= 0%, Lag= 0.0 min
Primary = 1.61 cfs @ 12.01 hrs, Volume= 0.085 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2

Peak Elev= 739.59' @ 12.01 hrs
Flood Elev= 742.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	739.00'	**16.6" Round Culvert** L= 88.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 739.00' / 720.00' S= 0.2159 '/' Cc= 0.900 n= 0.010, Flow Area= 1.50 sf

Primary OutFlow Max=1.61 cfs @ 12.01 hrs HW=739.59' (Free Discharge)
1=Culvert (Inlet Controls 1.61 cfs @ 2.62 fps)

Summary for Pond D4N: 24" Pipe

Inflow Area = 1.933 ac, 0.00% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 2.08 cfs @ 12.00 hrs, Volume= 0.107 af
Outflow = 2.08 cfs @ 12.00 hrs, Volume= 0.107 af, Atten= 0%, Lag= 0.0 min
Primary = 2.08 cfs @ 12.00 hrs, Volume= 0.107 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 779.61' @ 12.00 hrs
Flood Elev= 782.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	779.00'	**22.2" Round Culvert** L= 118.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 779.00' / 746.00' S= 0.2797 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 2.69 sf

Primary OutFlow Max=2.07 cfs @ 12.00 hrs HW=779.61' (Free Discharge)
1=Culvert (Inlet Controls 2.07 cfs @ 2.67 fps)

Summary for Pond D4S: 10" Pipe

[58] Hint: Peaked 0.55' above defined flood level
[81] Warning: Exceeded Pond C4S by 0.41' @ 12.00 hrs

Inflow Area = 0.872 ac, 0.00% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 0.95 cfs @ 12.00 hrs, Volume= 0.048 af
Outflow = 0.95 cfs @ 12.00 hrs, Volume= 0.048 af, Atten= 0%, Lag= 0.0 min
Primary = 0.95 cfs @ 12.00 hrs, Volume= 0.048 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 778.05' @ 12.00 hrs
Flood Elev= 777.50'

Device	Routing	Invert	Outlet Devices
#1	Primary	777.50'	**9.9" Round Culvert** L= 160.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 777.50' / 728.00' S= 0.3094 '/' Cc= 0.900 n= 0.010, Flow Area= 0.53 sf

Primary OutFlow Max=0.95 cfs @ 12.00 hrs HW=778.05' (Free Discharge)
1=Culvert (Inlet Controls 0.95 cfs @ 2.52 fps)

Summary for Pond D4SE: 12" Pipe

Inflow Area = 2.200 ac, 0.00% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 2.39 cfs @ 12.00 hrs, Volume= 0.122 af
Outflow = 2.39 cfs @ 12.00 hrs, Volume= 0.122 af, Atten= 0%, Lag= 0.0 min
Primary = 2.39 cfs @ 12.00 hrs, Volume= 0.122 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 773.91' @ 12.00 hrs
Flood Elev= 776.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	773.00'	**11.8" Round Culvert** L= 65.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 773.00' / 749.50' S= 0.3615 '/' Cc= 0.900 n= 0.010, Flow Area= 0.76 sf

Primary OutFlow Max=2.39 cfs @ 12.00 hrs HW=773.91' (Free Discharge)
1=Culvert (Inlet Controls 2.39 cfs @ 3.25 fps)

Summary for Pond D4W: 18" Pipe

[79] Warning: Submerged Pond D2W Primary device # 1 OUTLET by 0.95'
[79] Warning: Submerged Pond D3W Primary device # 1 OUTLET by 0.95'

Inflow Area = 3.467 ac, 0.00% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 3.63 cfs @ 12.01 hrs, Volume= 0.192 af
Outflow = 3.63 cfs @ 12.01 hrs, Volume= 0.192 af, Atten= 0%, Lag= 0.0 min
Primary = 3.63 cfs @ 12.01 hrs, Volume= 0.192 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 720.95' @ 12.01 hrs
Flood Elev= 742.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	720.00'	**16.6" Round Culvert** L= 95.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 720.00' / 716.00' S= 0.0421 '/' Cc= 0.900 n= 0.010, Flow Area= 1.50 sf

Primary OutFlow Max=3.63 cfs @ 12.01 hrs HW=720.95' (Free Discharge)
1=Culvert (Inlet Controls 3.63 cfs @ 3.31 fps)

Summary for Pond D5N: 24" Pipe

[79] Warning: Submerged Pond D4N Primary device # 1 OUTLET by 1.03'

Inflow Area = 5.108 ac, 0.00% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 5.33 cfs @ 12.01 hrs, Volume= 0.283 af
Outflow = 5.33 cfs @ 12.01 hrs, Volume= 0.283 af, Atten= 0%, Lag= 0.0 min
Primary = 5.33 cfs @ 12.01 hrs, Volume= 0.283 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 747.03' @ 12.01 hrs
Flood Elev= 749.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	746.00'	**22.2" Round Culvert** L= 84.0' CPP, square edge headwall, Ke= 0.500

Inlet / Outlet Invert= 746.00' / 726.00' S= 0.2381 '/' Cc= 0.900
n= 0.010 PVC, smooth interior, Flow Area= 2.69 sf

Primary OutFlow Max=5.32 cfs @ 12.01 hrs HW=747.03' (Free Discharge)
└**1=Culvert** (Inlet Controls 5.32 cfs @ 3.46 fps)

Summary for Pond D5S: 16" Pipe

[79] Warning: Submerged Pond D4S Primary device # 1 OUTLET by 1.87'

Inflow Area = 2.650 ac, 0.00% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 2.86 cfs @ 12.00 hrs, Volume= 0.147 af
Outflow = 2.86 cfs @ 12.00 hrs, Volume= 0.147 af, Atten= 0%, Lag= 0.0 min
Primary = 2.86 cfs @ 12.00 hrs, Volume= 0.147 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 729.87' @ 12.00 hrs
Flood Elev= 732.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	729.00'	**14.8" Round Culvert** L= 142.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 729.00' / 714.00' S= 0.1056 '/' Cc= 0.900 n= 0.010, Flow Area= 1.19 sf

Primary OutFlow Max=2.86 cfs @ 12.00 hrs HW=729.87' (Free Discharge)
└**1=Culvert** (Inlet Controls 2.86 cfs @ 3.18 fps)

Summary for Pond D5SE: 20" Pipe

[79] Warning: Submerged Pond D4SE Primary device # 1 OUTLET by 1.03'

Inflow Area = 4.243 ac, 0.00% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 4.56 cfs @ 12.00 hrs, Volume= 0.235 af
Outflow = 4.56 cfs @ 12.00 hrs, Volume= 0.235 af, Atten= 0%, Lag= 0.0 min
Primary = 4.56 cfs @ 12.00 hrs, Volume= 0.235 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 750.53' @ 12.00 hrs
Flood Elev= 752.50'

Device	Routing	Invert	Outlet Devices
#1	Primary	749.50'	**18.5" Round Culvert** L= 30.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 749.50' / 740.00' S= 0.3167 '/' Cc= 0.900 n= 0.010, Flow Area= 1.87 sf

Primary OutFlow Max=4.55 cfs @ 12.00 hrs HW=750.53' (Free Discharge)
└**1=Culvert** (Inlet Controls 4.55 cfs @ 3.45 fps)

Summary for Pond D5SW: 6" Pipe

[58] Hint: Peaked 9.79' above defined flood level
[81] Warning: Exceeded Pond C5SW by 9.43' @ 12.10 hrs

Inflow Area = 4.496 ac, 0.00% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 3.46 cfs @ 12.10 hrs, Volume= 0.249 af
Outflow = 3.46 cfs @ 12.10 hrs, Volume= 0.249 af, Atten= 0%, Lag= 0.0 min
Primary = 3.46 cfs @ 12.10 hrs, Volume= 0.249 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 820.79' @ 12.10 hrs
Flood Elev= 811.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	808.00'	**6.1" Round Culvert** L= 125.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 808.00' / 773.00' S= 0.2800 '/' Cc= 0.900 n= 0.010, Flow Area= 0.20 sf

Primary OutFlow Max=3.46 cfs @ 12.10 hrs HW=820.76' (Free Discharge)
1=Culvert (Inlet Controls 3.46 cfs @ 17.03 fps)

Summary for Pond D6S: 14" Pipe

Inflow Area = 1.820 ac, 0.00% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 2.00 cfs @ 12.00 hrs, Volume= 0.101 af
Outflow = 2.00 cfs @ 12.00 hrs, Volume= 0.101 af, Atten= 0%, Lag= 0.0 min
Primary = 2.00 cfs @ 12.00 hrs, Volume= 0.101 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 774.75' @ 12.00 hrs
Flood Elev= 777.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	774.00'	**12.9" Round Culvert** L= 185.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 774.00' / 728.50' S= 0.2459 '/' Cc= 0.900 n= 0.010, Flow Area= 0.91 sf

Primary OutFlow Max=2.00 cfs @ 12.00 hrs HW=774.75' (Free Discharge)
1=Culvert (Inlet Controls 2.00 cfs @ 2.95 fps)

Summary for Pond D6SW: 16" Pipe

[79] Warning: Submerged Pond D5SW Primary device # 1 OUTLET by 1.36'

Inflow Area = 6.810 ac, 0.00% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 4.98 cfs @ 12.05 hrs, Volume= 0.377 af
Outflow = 4.98 cfs @ 12.05 hrs, Volume= 0.377 af, Atten= 0%, Lag= 0.0 min
Primary = 4.98 cfs @ 12.05 hrs, Volume= 0.377 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 774.37' @ 12.05 hrs
Flood Elev= 776.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	773.00'	**14.8" Round Culvert** L= 165.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 773.00' / 729.50' S= 0.2636 '/' Cc= 0.900 n= 0.010, Flow Area= 1.19 sf

Primary OutFlow Max=4.97 cfs @ 12.05 hrs HW=774.36' (Free Discharge)
1=Culvert (Inlet Controls 4.97 cfs @ 4.16 fps)

Summary for Pond D7S: 20" Pipe

[79] Warning: Submerged Pond D6S Primary device # 1 OUTLET by 1.99'

Inflow Area = 3.938 ac, 0.00% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 4.28 cfs @ 12.00 hrs, Volume= 0.218 af
Outflow = 4.28 cfs @ 12.00 hrs, Volume= 0.218 af, Atten= 0%, Lag= 0.0 min
Primary = 4.28 cfs @ 12.00 hrs, Volume= 0.218 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 730.49' @ 12.00 hrs
Flood Elev= 732.50'

Device	Routing	Invert	Outlet Devices
#1	Primary	729.50'	**18.5" Round Culvert** L= 70.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 729.50' / 716.50' S= 0.1857 '/' Cc= 0.900 n= 0.010, Flow Area= 1.87 sf

Primary OutFlow Max=4.28 cfs @ 12.00 hrs HW=730.49' (Free Discharge)
1=Culvert (Inlet Controls 4.28 cfs @ 3.38 fps)

Summary for Pond D7SE: 12" Pipe

Inflow Area = 2.211 ac, 0.00% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 2.17 cfs @ 12.03 hrs, Volume= 0.122 af
Outflow = 2.17 cfs @ 12.03 hrs, Volume= 0.122 af, Atten= 0%, Lag= 0.0 min
Primary = 2.17 cfs @ 12.03 hrs, Volume= 0.122 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 772.84' @ 12.03 hrs
Flood Elev= 775.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	772.00'	**11.8" Round Culvert** L= 90.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 772.00' / 750.00' S= 0.2444 '/' Cc= 0.900 n= 0.010, Flow Area= 0.76 sf

Primary OutFlow Max=2.16 cfs @ 12.03 hrs HW=772.84' (Free Discharge)
1=Culvert (Inlet Controls 2.16 cfs @ 3.12 fps)

Summary for Pond D7SW: 26" Pipe

[79] Warning: Submerged Pond D6SW Primary device # 1 OUTLET by 1.27'

Inflow Area = 10.006 ac, 0.00% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 8.13 cfs @ 12.03 hrs, Volume= 0.554 af
Outflow = 8.13 cfs @ 12.03 hrs, Volume= 0.554 af, Atten= 0%, Lag= 0.0 min
Primary = 8.13 cfs @ 12.03 hrs, Volume= 0.554 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 730.78' @ 12.03 hrs
Flood Elev= 732.50'

Device	Routing	Invert	Outlet Devices
#1	Primary	729.50'	**24.0" Round Culvert** L= 30.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 729.50' / 722.00' S= 0.2500 '/' Cc= 0.900

n= 0.010, Flow Area= 3.14 sf

Primary OutFlow Max=8.12 cfs @ 12.03 hrs HW=730.77' (Free Discharge)
1=Culvert (Inlet Controls 8.12 cfs @ 3.84 fps)

Summary for Pond D8SE: 18" Pipe

[79] Warning: Submerged Pond D7SE Primary device # 1 OUTLET by 0.92'

Inflow Area = 3.519 ac, 0.00% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 3.48 cfs @ 12.00 hrs, Volume= 0.195 af
Outflow = 3.48 cfs @ 12.00 hrs, Volume= 0.195 af, Atten= 0%, Lag= 0.0 min
Primary = 3.48 cfs @ 12.00 hrs, Volume= 0.195 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 750.92' @ 12.00 hrs
Flood Elev= 753.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	750.00'	**16.6" Round Culvert** L= 36.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 750.00' / 740.00' S= 0.2778 '/' Cc= 0.900 n= 0.010, Flow Area= 1.50 sf

Primary OutFlow Max=3.48 cfs @ 12.00 hrs HW=750.92' (Free Discharge)
1=Culvert (Inlet Controls 3.48 cfs @ 3.27 fps)

Summary for Pond DP6N: 24" Pipe

[79] Warning: Submerged Pond C6N Primary device # 1 INLET by 1.03'

Inflow Area = 26.669 ac, 0.00% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 10.03 cfs @ 12.32 hrs, Volume= 1.477 af
Outflow = 10.03 cfs @ 12.32 hrs, Volume= 1.477 af, Atten= 0%, Lag= 0.0 min
Primary = 10.03 cfs @ 12.32 hrs, Volume= 1.477 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 720.03' @ 12.32 hrs
Flood Elev= 724.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	718.50'	**22.2" Round Culvert** L= 780.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 718.50' / 700.00' S= 0.0237 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 2.69 sf

Primary OutFlow Max=10.04 cfs @ 12.32 hrs HW=720.03' (Free Discharge)
1=Culvert (Inlet Controls 10.04 cfs @ 4.21 fps)

Summary for Pond MH1S: 4' Dia. Manhole

[79] Warning: Submerged Pond D7S Primary device # 1 OUTLET by 0.91'

Inflow Area = 3.938 ac, 0.00% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 4.28 cfs @ 12.00 hrs, Volume= 0.218 af
Outflow = 4.28 cfs @ 12.00 hrs, Volume= 0.218 af, Atten= 0%, Lag= 0.0 min
Primary = 4.28 cfs @ 12.00 hrs, Volume= 0.218 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 717.41' @ 12.00 hrs
Flood Elev= 720.50'

Device	Routing	Invert	Outlet Devices
#1	Primary	716.50'	**22.2" Round Culvert** L= 830.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 716.50' / 712.50' S= 0.0048 '/' Cc= 0.900 n= 0.010, Flow Area= 2.69 sf

Primary OutFlow Max=4.28 cfs @ 12.00 hrs HW=717.41' (Free Discharge)
1=Culvert (Inlet Controls 4.28 cfs @ 3.25 fps)

Summary for Pond MH1SE: 8' Dia. Manhole

Inflow Area = 26.644 ac, 0.00% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 11.98 cfs @ 12.20 hrs, Volume= 1.476 af
Outflow = 11.98 cfs @ 12.20 hrs, Volume= 1.476 af, Atten= 0%, Lag= 0.0 min
Primary = 11.98 cfs @ 12.20 hrs, Volume= 1.476 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 739.77' @ 12.20 hrs
Flood Elev= 742.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	738.00'	**22.2" Round Culvert** L= 590.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 738.00' / 718.00' S= 0.0339 '/' Cc= 0.900 n= 0.010, Flow Area= 2.69 sf

Primary OutFlow Max=11.98 cfs @ 12.20 hrs HW=739.77' (Free Discharge)
1=Culvert (Inlet Controls 11.98 cfs @ 4.53 fps)

Summary for Pond MH1SW: 4' Dia. Manhole

[57] Hint: Peaked at 739.53' (Flood elevation advised)

Inflow Area = 11.465 ac, 0.00% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 8.98 cfs @ 12.01 hrs, Volume= 0.635 af
Outflow = 8.98 cfs @ 12.01 hrs, Volume= 0.635 af, Atten= 0%, Lag= 0.0 min
Primary = 8.98 cfs @ 12.01 hrs, Volume= 0.635 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 739.53' @ 12.01 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	738.00'	**20.3" Round Culvert** L= 550.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 738.00' / 717.00' S= 0.0382 '/' Cc= 0.900 n= 0.010, Flow Area= 2.25 sf

Primary OutFlow Max=8.97 cfs @ 12.01 hrs HW=739.52' (Free Discharge)
1=Culvert (Inlet Controls 8.97 cfs @ 4.20 fps)

Summary for Pond MH1W: 6' Manhole

[79] Warning: Submerged Pond D4W Primary device # 1 OUTLET by 0.16'

Inflow Area = 35.305 ac, 0.00% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 16.26 cfs @ 12.25 hrs, Volume= 1.955 af
Outflow = 16.26 cfs @ 12.25 hrs, Volume= 1.955 af, Atten= 0%, Lag= 0.0 min
Primary = 16.26 cfs @ 12.25 hrs, Volume= 1.955 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 716.16' @ 12.25 hrs
Flood Elev= 720.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	714.00'	**24.0" Round Culvert** L= 5.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 714.00' / 713.00' S= 0.2000 '/' Cc= 0.900 n= 0.024, Flow Area= 3.14 sf

Primary OutFlow Max=16.26 cfs @ 12.25 hrs HW=716.15' (Free Discharge)
1=Culvert (Inlet Controls 16.26 cfs @ 5.17 fps)

Summary for Pond MH2SE: 4' Dia. Manhole

Inflow Area = 26.644 ac, 0.00% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 11.98 cfs @ 12.20 hrs, Volume= 1.476 af
Outflow = 11.98 cfs @ 12.20 hrs, Volume= 1.476 af, Atten= 0%, Lag= 0.0 min
Primary = 11.98 cfs @ 12.20 hrs, Volume= 1.476 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 717.44' @ 12.20 hrs
Flood Elev= 722.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	716.00'	**30.0" Round Culvert** L= 10.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 716.00' / 715.00' S= 0.1000 '/' Cc= 0.900 n= 0.024, Flow Area= 4.91 sf

Primary OutFlow Max=11.98 cfs @ 12.20 hrs HW=717.44' (Free Discharge)
1=Culvert (Inlet Controls 11.98 cfs @ 4.09 fps)

Summary for Pond MH2SW: 6' Dia. Manhole

[79] Warning: Submerged Pond D7SW Primary device # 1 OUTLET by 1.36'

Inflow Area = 10.959 ac, 0.00% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 9.06 cfs @ 12.02 hrs, Volume= 0.607 af
Outflow = 9.06 cfs @ 12.02 hrs, Volume= 0.607 af, Atten= 0%, Lag= 0.0 min
Primary = 9.06 cfs @ 12.02 hrs, Volume= 0.607 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 723.36' @ 12.02 hrs
Flood Elev= 726.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	722.00'	**24.0" Round Culvert** L= 1,050.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 722.00' / 717.00' S= 0.0048 '/' Cc= 0.900

n= 0.010, Flow Area= 3.14 sf

Primary OutFlow Max=9.06 cfs @ 12.02 hrs HW=723.36' (Free Discharge)
1=Culvert (Inlet Controls 9.06 cfs @ 3.97 fps)

Summary for Pond MH3S: 6' Dia. Manhole

[79] Warning: Submerged Pond D5S Primary device # 1 OUTLET by 3.23'
[79] Warning: Submerged Pond MH1S Primary device # 1 INLET by 0.73'

Inflow Area = 6.588 ac, 0.00% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 7.15 cfs @ 12.00 hrs, Volume= 0.365 af
Outflow = 7.15 cfs @ 12.00 hrs, Volume= 0.365 af, Atten= 0%, Lag= 0.0 min
Primary = 7.15 cfs @ 12.00 hrs, Volume= 0.365 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 717.23' @ 12.00 hrs
Flood Elev= 720.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	716.00'	**22.2" Round Culvert** L= 10.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 716.00' / 712.00' S= 0.4000 '/' Cc= 0.900 n= 0.010, Flow Area= 2.69 sf

Primary OutFlow Max=7.14 cfs @ 12.00 hrs HW=717.23' (Free Discharge)
1=Culvert (Inlet Controls 7.14 cfs @ 3.77 fps)

Summary for Pond MH3SE: 8' Dia. Manhole

[79] Warning: Submerged Pond D12SE Primary device # 1 OUTLET by 1.51'

Inflow Area = 21.294 ac, 0.00% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 10.32 cfs @ 12.20 hrs, Volume= 1.179 af
Outflow = 10.32 cfs @ 12.20 hrs, Volume= 1.179 af, Atten= 0%, Lag= 0.0 min
Primary = 10.32 cfs @ 12.20 hrs, Volume= 1.179 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 721.51' @ 12.20 hrs
Flood Elev= 728.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	720.00'	**24.0" Round Culvert** L= 1,400.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 720.00' / 715.00' S= 0.0036 '/' Cc= 0.900 n= 0.010, Flow Area= 3.14 sf

Primary OutFlow Max=10.32 cfs @ 12.20 hrs HW=721.51' (Free Discharge)
1=Culvert (Barrel Controls 10.32 cfs @ 5.64 fps)

Summary for Pond MH3SW: 6' Dia. Manhole

[79] Warning: Submerged Pond MH1SW Primary device # 1 OUTLET by 2.88'
[79] Warning: Submerged Pond MH2SW Primary device # 1 OUTLET by 2.88'

Inflow Area = 22.424 ac, 0.00% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 18.03 cfs @ 12.02 hrs, Volume= 1.242 af
Outflow = 18.03 cfs @ 12.02 hrs, Volume= 1.242 af, Atten= 0%, Lag= 0.0 min
Primary = 18.03 cfs @ 12.02 hrs, Volume= 1.242 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 719.88' @ 12.02 hrs
Flood Elev= 721.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	717.00'	**24.0" Round Culvert** L= 5.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 717.00' / 717.00' S= 0.0000 '/' Cc= 0.900 n= 0.024, Flow Area= 3.14 sf

Primary OutFlow Max=18.01 cfs @ 12.02 hrs HW=719.87' (Free Discharge)
1=Culvert (Barrel Controls 18.01 cfs @ 5.73 fps)

Summary for Pond MH4SE: 4' Dia. Manhole

[81] Warning: Exceeded Pond MH3SE by 0.68' @ 11.99 hrs

Inflow Area = 25.454 ac, 0.00% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 11.46 cfs @ 12.16 hrs, Volume= 1.410 af
Outflow = 11.46 cfs @ 12.16 hrs, Volume= 1.410 af, Atten= 0%, Lag= 0.0 min
Primary = 11.46 cfs @ 12.16 hrs, Volume= 1.410 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 721.89' @ 12.16 hrs
Flood Elev= 735.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	720.30'	**24.0" Round Culvert** L= 620.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 720.30' / 717.20' S= 0.0050 '/' Cc= 0.900 n= 0.010, Flow Area= 3.14 sf

Primary OutFlow Max=11.46 cfs @ 12.16 hrs HW=721.89' (Free Discharge)
1=Culvert (Inlet Controls 11.46 cfs @ 4.29 fps)

Summary for Pond MH4W: Manhole

[57] Hint: Peaked at 721.52' (Flood elevation advised)

Inflow Area = 16.760 ac, 0.00% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 10.74 cfs @ 12.16 hrs, Volume= 0.928 af
Outflow = 10.74 cfs @ 12.16 hrs, Volume= 0.928 af, Atten= 0%, Lag= 0.0 min
Primary = 10.74 cfs @ 12.16 hrs, Volume= 0.928 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 721.52' @ 12.16 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	720.00'	**24.0" Round Culvert** L= 5.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 720.00' / 719.00' S= 0.2000 '/' Cc= 0.900 n= 0.024, Flow Area= 3.14 sf

Primary OutFlow Max=10.73 cfs @ 12.16 hrs HW=721.52' (Free Discharge)
└**1=Culvert** (Inlet Controls 10.73 cfs @ 4.19 fps)

Summary for Pond MH5SE: 4' Dia. Manhole

[79] Warning: Submerged Pond MH4SE Primary device # 1 OUTLET by 0.20'

Inflow Area = 25.454 ac, 0.00% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 11.46 cfs @ 12.16 hrs, Volume= 1.410 af
Outflow = 11.46 cfs @ 12.16 hrs, Volume= 1.410 af, Atten= 0%, Lag= 0.0 min
Primary = 11.46 cfs @ 12.16 hrs, Volume= 1.410 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 717.40' @ 12.16 hrs
Flood Elev= 722.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	716.00'	**30.0" Round Culvert** L= 10.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 716.00' / 715.00' S= 0.1000 '/' Cc= 0.900 n= 0.024, Flow Area= 4.91 sf

Primary OutFlow Max=11.45 cfs @ 12.16 hrs HW=717.40' (Free Discharge)
└**1=Culvert** (Inlet Controls 11.45 cfs @ 4.03 fps)

Summary for Pond NP: North Pond

Inflow Area = 38.256 ac, 2.57% Impervious, Inflow Depth = 0.71" for 2 year - 24 hour event
Inflow = 18.38 cfs @ 12.06 hrs, Volume= 2.277 af
Outflow = 8.58 cfs @ 12.59 hrs, Volume= 2.263 af, Atten= 53%, Lag= 31.4 min
Primary = 8.58 cfs @ 12.59 hrs, Volume= 2.263 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Tertiary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Starting Elev= 696.00' Surf.Area= 20,300 sf Storage= 34,300 cf
Peak Elev= 697.11' @ 12.59 hrs Surf.Area= 23,472 sf Storage= 60,068 cf (25,768 cf above start)
Flood Elev= 702.00' Surf.Area= 39,000 sf Storage= 210,400 cf (176,100 cf above start)

Plug-Flow detention time= 348.7 min calculated for 1.475 af (65% of inflow)
Center-of-Mass det. time= 101.1 min (981.7 - 880.5)

Volume	Invert	Avail.Storage	Storage Description
#1	694.00'	230,713 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
694.00	14,000	0	0
696.00	20,300	34,300	34,300
698.00	26,000	46,300	80,600
700.00	32,400	58,400	139,000
702.00	39,000	71,400	210,400
702.50	42,250	20,313	230,713

Device	Routing	Invert	Outlet Devices
#1	Primary	696.00'	**36.0" Round Culvert** L= 60.0' CMP, end-section conforming to fill, Ke= 0.500 Inlet / Outlet Invert= 696.00' / 694.00' S= 0.0333 '/' Cc= 0.900 n= 0.018, Flow Area= 7.07 sf
#2	Secondary	701.50'	**40.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88
#3	Tertiary	702.00'	**600.0' long x 2.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32

Primary OutFlow Max=8.57 cfs @ 12.59 hrs HW=697.11' (Free Discharge)
1=Culvert (Inlet Controls 8.57 cfs @ 3.59 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=696.00' (Free Discharge)
2=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Tertiary OutFlow Max=0.00 cfs @ 0.00 hrs HW=696.00' (Free Discharge)
3=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Summary for Pond NWP: Northwest Pond

Inflow Area = 65.182 ac, 1.44% Impervious, Inflow Depth = 0.69" for 2 year - 24 hour event
Inflow = 29.35 cfs @ 12.22 hrs, Volume= 3.761 af
Outflow = 17.64 cfs @ 12.50 hrs, Volume= 3.755 af, Atten= 40%, Lag= 16.7 min
Primary = 17.64 cfs @ 12.50 hrs, Volume= 3.755 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Tertiary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Starting Elev= 707.00' Surf.Area= 18,591 sf Storage= 71,995 cf
Peak Elev= 708.82' @ 12.50 hrs Surf.Area= 21,862 sf Storage= 108,836 cf (36,842 cf above start)
Flood Elev= 716.00' Surf.Area= 35,795 sf Storage= 314,850 cf (242,856 cf above start)

Plug-Flow detention time= 365.8 min calculated for 2.102 af (56% of inflow)
Center-of-Mass det. time= 69.9 min (957.3 - 887.3)

Volume	Invert	Avail.Storage	Storage Description
#1	702.00'	333,326 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
702.00	10,381	0	0
704.00	13,520	23,901	23,901
706.00	16,852	30,372	54,273
708.00	20,330	37,182	91,455
710.00	24,050	44,380	135,835
712.00	27,835	51,885	187,720
714.00	31,750	59,585	247,305
716.00	35,795	67,545	314,850
716.50	38,110	18,476	333,326

Device	Routing	Invert	Outlet Devices
#1	Primary	707.00'	**30.0" Round Culvert** L= 40.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 707.00' / 706.00' S= 0.0250 '/' Cc= 0.900 n= 0.012, Flow Area= 4.91 sf
#2	Secondary	715.50'	**40.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88
#3	Tertiary	716.00'	**530.0' long x 2.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32

Primary OutFlow Max=17.64 cfs @ 12.50 hrs HW=708.82' (Free Discharge)
1=Culvert (Inlet Controls 17.64 cfs @ 4.60 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=707.00' (Free Discharge)
2=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Tertiary OutFlow Max=0.00 cfs @ 0.00 hrs HW=707.00' (Free Discharge)
3=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Summary for Pond SEP: Southeast Pond

Inflow Area = 54.264 ac, 1.25% Impervious, Inflow Depth = 0.69" for 2 year - 24 hour event
Inflow = 23.98 cfs @ 12.18 hrs, Volume= 3.115 af
Outflow = 18.62 cfs @ 12.37 hrs, Volume= 3.113 af, Atten= 22%, Lag= 11.4 min
Primary = 18.62 cfs @ 12.37 hrs, Volume= 3.113 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Starting Elev= 712.00' Surf.Area= 11,817 sf Storage= 33,961 cf
Peak Elev= 713.71' @ 12.37 hrs Surf.Area= 14,817 sf Storage= 57,222 cf (23,261 cf above start)
Flood Elev= 718.00' Surf.Area= 22,487 sf Storage= 136,385 cf (102,424 cf above start)

Plug-Flow detention time= 222.1 min calculated for 2.334 af (75% of inflow)
Center-of-Mass det. time= 50.1 min (936.4 - 886.3)

Volume	Invert	Avail.Storage	Storage Description
#1	708.00'	187,373 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
708.00	5,158	0	0
710.00	8,493	13,651	13,651
712.00	11,817	20,310	33,961
714.00	15,317	27,134	61,095
716.00	18,743	34,060	95,155
718.00	22,487	41,230	136,385
720.00	28,501	50,988	187,373

Device	Routing	Invert	Outlet Devices
#1	Primary	712.00'	**36.0" Round Culvert** L= 73.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 712.00' / 710.90' S= 0.0151 '/' Cc= 0.900 n= 0.015 Concrete sewer w/manholes & inlets, Flow Area= 7.07 sf

#2	Secondary	718.00'	**600.0' long x 60.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=18.61 cfs @ 12.37 hrs HW=713.71' (Free Discharge)
1=Culvert (Inlet Controls 18.61 cfs @ 4.46 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=712.00' (Free Discharge)
2=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Summary for Pond SP: South Pond

Inflow Area = 5.541 ac, 25.00% Impervious, Inflow Depth = 1.06" for 2 year - 24 hour event
Inflow = 8.92 cfs @ 11.97 hrs, Volume= 0.491 af
Outflow = 0.06 cfs @ 24.08 hrs, Volume= 0.163 af, Atten= 99%, Lag= 726.8 min
Discarded = 0.06 cfs @ 24.08 hrs, Volume= 0.163 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Tertiary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 718.97' @ 24.08 hrs Surf.Area= 15,419 sf Storage= 18,868 cf
Flood Elev= 720.00' Surf.Area= 22,003 sf Storage= 38,164 cf

Plug-Flow detention time= 1,073.5 min calculated for 0.163 af (33% of inflow)
Center-of-Mass det. time= 921.8 min (1,756.0 - 834.2)

Volume	Invert	Avail.Storage	Storage Description
#1	716.50'	95,942 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
716.50	0	0	0
718.00	9,235	6,926	6,926
720.00	22,003	31,238	38,164
722.00	35,775	57,778	95,942

Device	Routing	Invert	Outlet Devices
#1	Discarded	716.50'	**0.150 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 700.00'
#2	Secondary	720.00'	**80.0' long x 30.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63
#3	Tertiary	720.50'	**100.0' long x 30.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Discarded OutFlow Max=0.06 cfs @ 24.08 hrs HW=718.97' (Free Discharge)
1=Exfiltration (Controls 0.06 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=716.50' (Free Discharge)
2=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Tertiary OutFlow Max=0.00 cfs @ 0.00 hrs HW=716.50' (Free Discharge)
3=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Summary for Pond SWP: Southwest Pond

[81] Warning: Exceeded Pond MH3SW by 3.01' @ 25.33 hrs

Inflow Area = 25.347 ac, 3.30% Impervious, Inflow Depth = 0.73" for 2 year - 24 hour event
Inflow = 20.45 cfs @ 12.01 hrs, Volume= 1.539 af
Outflow = 0.52 cfs @ 20.19 hrs, Volume= 0.238 af, Atten= 97%, Lag= 490.9 min
Primary = 0.52 cfs @ 20.19 hrs, Volume= 0.238 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 720.05' @ 20.19 hrs Surf.Area= 23,763 sf Storage= 58,053 cf
Flood Elev= 723.00' Surf.Area= 40,614 sf Storage= 151,443 cf

Plug-Flow detention time= 640.3 min calculated for 0.238 af (15% of inflow)
Center-of-Mass det. time= 452.4 min (1,321.0 - 868.6)

Volume	Invert	Avail.Storage	Storage Description
#1	715.00'	192,056 cf	**Custom Stage Data (Prismatic)** Listed below

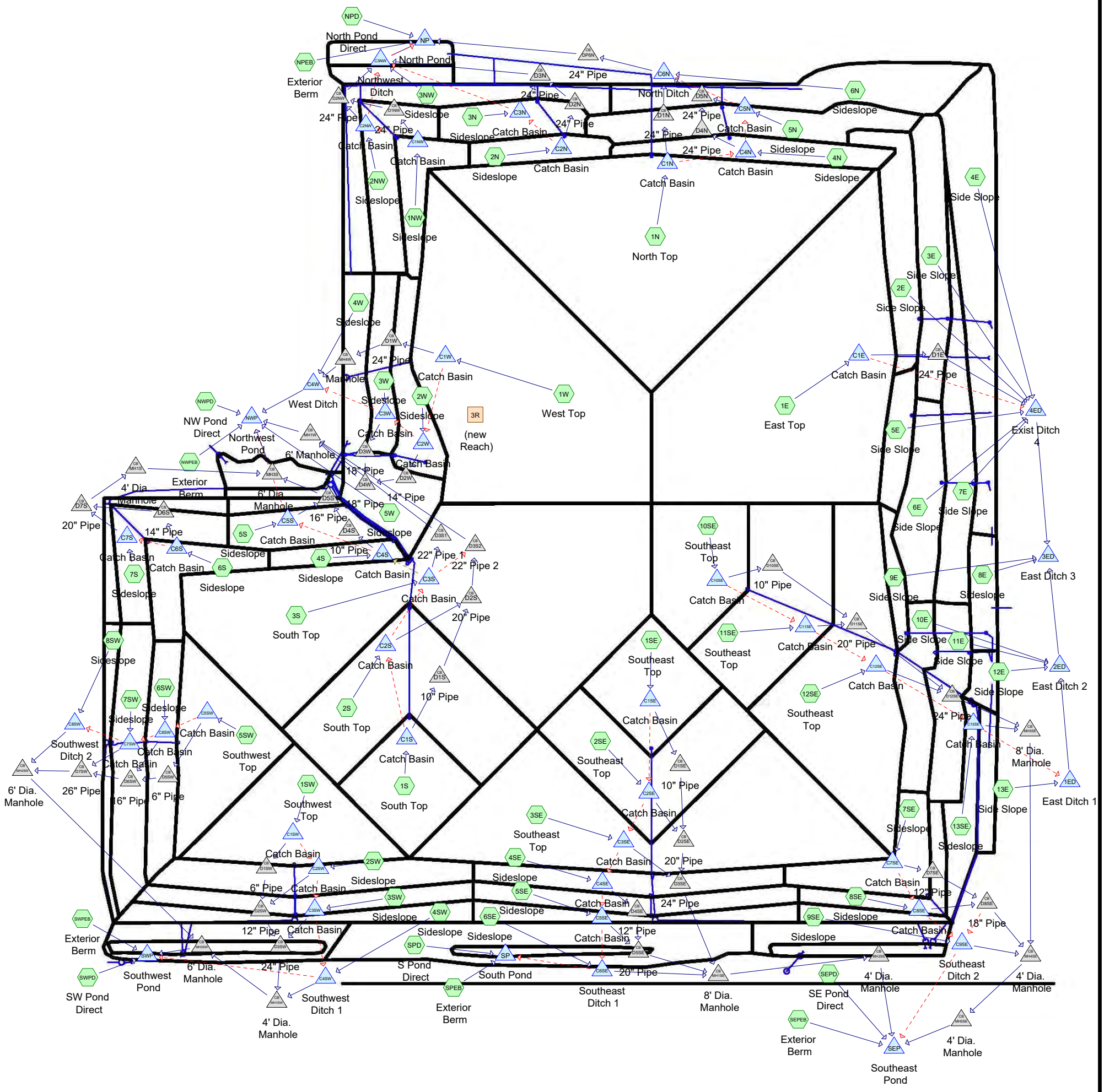
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
715.00	0	0	0
716.00	950	475	475
718.00	15,835	16,785	17,260
720.00	23,586	39,421	56,681
722.00	30,562	54,148	110,829
724.00	50,665	81,227	192,056

Device	Routing	Invert	Outlet Devices
#1	Primary	715.05'	**18.0" Round Culvert** L= 134.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 715.05' / 714.37' S= 0.0051 '/' Cc= 0.900 n= 0.015 Concrete sewer w/manholes & inlets, Flow Area= 1.77 sf
#2	Device 1	720.00'	**48.0" Horiz. Orifice/Grate** C= 0.600 in 48.0" Grate (100% open area) Limited to weir flow at low heads
#3	Secondary	723.00'	**300.0' long x 60.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=0.47 cfs @ 20.19 hrs HW=720.05' (Free Discharge)
└**1=Culvert** (Passes 0.47 cfs of 13.29 cfs potential flow)
└**2=Orifice/Grate** (Weir Controls 0.47 cfs @ 0.74 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=715.00' (Free Discharge)
└**3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pre-Expansion 10-Year Storm HydroCAD Analysis



Routing Diagram for BSLI WDA&NDA Combined Existing Model

Prepared by Carlson McCain, Inc., Printed 12/18/2019

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Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
223.437	71	Meadow, non-grazed, HSG C (1E, 1N, 1NW, 1S, 1SE, 1SW, 1W, 2E, 2N, 2NW, 2S, 2SE, 2SW, 2W, 3E, 3N, 3NW, 3S, 3SE, 3SW, 3W, 4E, 4N, 4S, 4SE, 4SW, 4W, 5E, 5N, 5S, 5SE, 5SW, 5W, 6E, 6N, 6S, 6SE, 6SW, 7E, 7S, 7SE, 7SW, 8E, 8SE, 8SW, 9E, 9SE, 10E, 10SE, 11E, 11SE, 12E, 12SE, 13E, 13SE, NPEB, NWPEB, SEPEB, SPEB, SWPEB)
1.192	91	Urban industrial, 72% imp, HSG C (SPEB)
3.962	98	Water Surface, HSG C (NPD, NWPD, SEPD, SPD, SWPD)
228.591	**72**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
228.591	HSG C	1E, 1N, 1NW, 1S, 1SE, 1SW, 1W, 2E, 2N, 2NW, 2S, 2SE, 2SW, 2W, 3E, 3N, 3NW, 3S, 3SE, 3SW, 3W, 4E, 4N, 4S, 4SE, 4SW, 4W, 5E, 5N, 5S, 5SE, 5SW, 5W, 6E, 6N, 6S, 6SE, 6SW, 7E, 7S, 7SE, 7SW, 8E, 8SE, 8SW, 9E, 9SE, 10E, 10SE, 11E, 11SE, 12E, 12SE, 13E, 13SE, NPD, NPEB, NWPD, NWPEB, SEPD, SEPEB, SPD, SPEB, SWPD, SWPEB
0.000	HSG D	
0.000	Other	
228.591		**TOTAL AREA**

Pipe Listing (all nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Diam/Width (inches)	Height (inches)	Inside-Fill (inches)
1	2E	0.00	0.00	280.0	0.3300	0.010	18.0	0.0	0.0
2	3E	0.00	0.00	170.0	0.3300	0.010	18.0	0.0	0.0
3	5E	0.00	0.00	315.0	0.3300	0.010	18.0	0.0	0.0
4	6E	0.00	0.00	185.0	0.3300	0.010	18.0	0.0	0.0
5	7E	0.00	0.00	60.0	0.3300	0.010	18.0	0.0	0.0
6	9E	0.00	0.00	300.0	0.3333	0.010	18.0	0.0	0.0
7	10E	0.00	0.00	210.0	0.3333	0.010	18.0	0.0	0.0
8	11E	0.00	0.00	210.0	0.3333	0.010	18.0	0.0	0.0
9	13E	0.00	0.00	266.0	0.0050	0.010	18.0	0.0	0.0
10	1ED	711.50	709.00	230.0	0.0109	0.010	16.0	0.0	0.0
11	2ED	709.50	708.50	90.0	0.0111	0.011	16.0	0.0	0.0
12	3ED	708.19	707.50	75.0	0.0092	0.011	16.0	0.0	0.0
13	4ED	709.72	709.24	65.0	0.0074	0.010	16.0	0.0	0.0
14	C3NW	719.00	705.00	100.0	0.1400	0.018	24.0	0.0	0.0
15	C4W	717.00	716.00	90.0	0.0111	0.024	30.0	0.0	0.0
16	C6N	719.00	718.50	50.0	0.0100	0.018	22.2	0.0	0.0
17	D10SE	807.00	800.00	350.0	0.0200	0.010	9.9	0.0	0.0
18	D11SE	800.00	794.50	265.0	0.0208	0.010	18.5	0.0	0.0
19	D12SE	794.50	720.00	350.0	0.2129	0.010	22.2	0.0	0.0
20	D1E	794.50	720.00	330.0	0.2258	0.010	22.2	0.0	0.0
21	D1N	798.00	720.00	330.0	0.2364	0.010	22.2	0.0	0.0
22	D1NW	782.00	742.00	200.0	0.2000	0.010	22.2	0.0	0.0
23	D1S	806.00	797.00	420.0	0.0214	0.010	9.9	0.0	0.0
24	D1SE	807.00	801.00	360.0	0.0167	0.010	9.9	0.0	0.0
25	D1SW	808.00	773.00	120.0	0.2917	0.010	6.1	0.0	0.0
26	D1W	796.00	724.00	280.0	0.2571	0.010	22.2	0.0	0.0
27	D2N	779.00	739.00	170.0	0.2353	0.010	22.2	0.0	0.0
28	D2NW	742.00	726.00	60.0	0.2667	0.010	22.2	0.0	0.0
29	D2S	797.00	793.70	195.0	0.0169	0.010	18.5	0.0	0.0
30	D2SE	801.00	796.00	120.0	0.0417	0.010	18.5	0.0	0.0
31	D2SW	773.00	749.50	75.0	0.3133	0.010	11.8	0.0	0.0
32	D2W	766.00	720.00	200.0	0.2300	0.010	12.9	0.0	0.0
33	D3N	739.00	726.00	60.0	0.2167	0.010	22.2	0.0	0.0
34	D3S1	793.70	716.50	475.0	0.1625	0.010	20.3	0.0	0.0
35	D3S2	793.70	716.50	475.0	0.1625	0.010	20.3	0.0	0.0
36	D3SE	796.00	740.00	190.0	0.2947	0.010	22.2	0.0	0.0
37	D3SW	749.50	740.00	25.0	0.3800	0.010	22.2	0.0	0.0
38	D3W	739.00	720.00	88.0	0.2159	0.010	16.6	0.0	0.0
39	D4N	779.00	746.00	118.0	0.2797	0.010	22.2	0.0	0.0
40	D4S	777.50	728.00	160.0	0.3094	0.010	9.9	0.0	0.0
41	D4SE	773.00	749.50	65.0	0.3615	0.010	11.8	0.0	0.0
42	D4W	720.00	716.00	95.0	0.0421	0.010	16.6	0.0	0.0
43	D5N	746.00	726.00	84.0	0.2381	0.010	22.2	0.0	0.0
44	D5S	729.00	714.00	142.0	0.1056	0.010	14.8	0.0	0.0
45	D5SE	749.50	740.00	30.0	0.3167	0.010	18.5	0.0	0.0
46	D5SW	808.00	773.00	125.0	0.2800	0.010	6.1	0.0	0.0

Pipe Listing (all nodes) (continued)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Diam/Width (inches)	Height (inches)	Inside-Fill (inches)
47	D6S	774.00	728.50	185.0	0.2459	0.010	12.9	0.0	0.0
48	D6SW	773.00	729.50	165.0	0.2636	0.010	14.8	0.0	0.0
49	D7S	729.50	716.50	70.0	0.1857	0.010	18.5	0.0	0.0
50	D7SE	772.00	750.00	90.0	0.2444	0.010	11.8	0.0	0.0
51	D7SW	729.50	722.00	30.0	0.2500	0.010	24.0	0.0	0.0
52	D8SE	750.00	740.00	36.0	0.2778	0.010	16.6	0.0	0.0
53	DP6N	718.50	700.00	780.0	0.0237	0.010	22.2	0.0	0.0
54	MH1S	716.50	712.50	830.0	0.0048	0.010	22.2	0.0	0.0
55	MH1SE	738.00	718.00	590.0	0.0339	0.010	22.2	0.0	0.0
56	MH1SW	738.00	717.00	550.0	0.0382	0.010	20.3	0.0	0.0
57	MH1W	714.00	713.00	5.0	0.2000	0.024	24.0	0.0	0.0
58	MH2SE	716.00	715.00	10.0	0.1000	0.024	30.0	0.0	0.0
59	MH2SW	722.00	717.00	1,050.0	0.0048	0.010	24.0	0.0	0.0
60	MH3S	716.00	712.00	10.0	0.4000	0.010	22.2	0.0	0.0
61	MH3SE	720.00	715.00	1,400.0	0.0036	0.010	24.0	0.0	0.0
62	MH3SW	717.00	717.00	5.0	0.0000	0.024	24.0	0.0	0.0
63	MH4SE	720.30	717.20	620.0	0.0050	0.010	24.0	0.0	0.0
64	MH4W	720.00	719.00	5.0	0.2000	0.024	24.0	0.0	0.0
65	MH5SE	716.00	715.00	10.0	0.1000	0.024	30.0	0.0	0.0
66	NP	696.00	694.00	60.0	0.0333	0.018	36.0	0.0	0.0
67	NWP	707.00	706.00	40.0	0.0250	0.012	30.0	0.0	0.0
68	SEP	712.00	710.90	73.0	0.0151	0.015	36.0	0.0	0.0
69	SWP	715.05	714.37	134.0	0.0051	0.015	18.0	0.0	0.0

Time span=0.00-48.00 hrs, dt=0.01 hrs, 4801 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1E: East Top Runoff Area=17.841 ac 0.00% Impervious Runoff Depth=1.54"
Flow Length=970' Tc=34.1 min CN=71 Runoff=20.88 cfs 2.289 af

Subcatchment 1N: North Top Runoff Area=17.691 ac 0.00% Impervious Runoff Depth=1.54"
Flow Length=770' Tc=32.5 min CN=71 Runoff=21.34 cfs 2.270 af

Subcatchment 1NW: Sideslope Runoff Area=1.506 ac 0.00% Impervious Runoff Depth=1.54"
Flow Length=535' Tc=5.3 min CN=71 Runoff=4.26 cfs 0.193 af

Subcatchment 1S: South Top Runoff Area=3.455 ac 0.00% Impervious Runoff Depth=1.54"
Flow Length=550' Slope=0.0200 '/' Tc=15.2 min CN=71 Runoff=6.70 cfs 0.443 af

Subcatchment 1SE: Southeast Top Runoff Area=3.373 ac 0.00% Impervious Runoff Depth=1.54"
Flow Length=510' Slope=0.0200 '/' Tc=14.9 min CN=71 Runoff=6.61 cfs 0.433 af

Subcatchment 1SW: Southwest Top Runoff Area=4.734 ac 0.00% Impervious Runoff Depth=1.54"
Flow Length=470' Slope=0.0200 '/' Tc=14.6 min CN=71 Runoff=9.37 cfs 0.607 af

Subcatchment 1W: West Top Runoff Area=16.760 ac 0.00% Impervious Runoff Depth=1.54"
Flow Length=970' Tc=20.0 min CN=71 Runoff=27.77 cfs 2.150 af

Subcatchment 2E: Side Slope Runoff Area=2.590 ac 0.00% Impervious Runoff Depth=1.54"
Flow Length=980' Tc=10.4 min CN=71 Runoff=6.00 cfs 0.332 af

Subcatchment 2N: Sideslope Runoff Area=1.145 ac 0.00% Impervious Runoff Depth=1.54"
Flow Length=424' Tc=6.5 min CN=71 Runoff=3.09 cfs 0.147 af

Subcatchment 2NW: Sideslope Runoff Area=2.338 ac 0.00% Impervious Runoff Depth=1.54"
Flow Length=1,113' Tc=11.8 min CN=71 Runoff=5.13 cfs 0.300 af

Subcatchment 2S: South Top Runoff Area=7.410 ac 0.00% Impervious Runoff Depth=1.54"
Flow Length=800' Tc=27.8 min CN=71 Runoff=9.95 cfs 0.951 af

Subcatchment 2SE: Southeast Top Runoff Area=5.356 ac 0.00% Impervious Runoff Depth=1.54"
Flow Length=700' Tc=27.0 min CN=71 Runoff=7.35 cfs 0.687 af

Subcatchment 2SW: Sideslope Runoff Area=2.975 ac 0.00% Impervious Runoff Depth=1.54"
Flow Length=725' Tc=6.8 min CN=71 Runoff=7.93 cfs 0.382 af

Subcatchment 2W: Sideslope Runoff Area=1.924 ac 0.00% Impervious Runoff Depth=1.54"
Flow Length=770' Tc=7.6 min CN=71 Runoff=4.97 cfs 0.247 af

Subcatchment 3E: Side Slope Runoff Area=2.825 ac 0.00% Impervious Runoff Depth=1.54"
Flow Length=1,010' Tc=11.5 min CN=71 Runoff=6.26 cfs 0.362 af

Subcatchment 3N: Sideslope Runoff Area=1.762 ac 0.00% Impervious Runoff Depth=1.54"
Flow Length=398' Tc=7.9 min CN=71 Runoff=4.50 cfs 0.226 af

Subcatchment 3NW: Sideslope Runoff Area=3.104 ac 0.00% Impervious Runoff Depth=1.54"
Flow Length=1,190' Tc=9.7 min CN=71 Runoff=7.38 cfs 0.398 af

Subcatchment 3S: South Top Runoff Area=20.973 ac 0.00% Impervious Runoff Depth=1.54"
Flow Length=950' Tc=29.0 min CN=71 Runoff=27.37 cfs 2.691 af

Subcatchment 3SE: Southeast Top Runoff Area=12.185 ac 0.00% Impervious Runoff Depth=1.54"
Flow Length=730' Tc=27.3 min CN=71 Runoff=16.59 cfs 1.563 af

Subcatchment 3SW: Sideslope Runoff Area=2.085 ac 0.00% Impervious Runoff Depth=1.54"
Flow Length=756' Tc=7.4 min CN=71 Runoff=5.43 cfs 0.268 af

Subcatchment 3W: Sideslope Runoff Area=1.543 ac 0.00% Impervious Runoff Depth=1.54"
Flow Length=740' Tc=7.7 min CN=71 Runoff=3.97 cfs 0.198 af

Subcatchment 4E: Side Slope Runoff Area=5.342 ac 0.00% Impervious Runoff Depth=1.54"
Flow Length=820' Tc=11.2 min CN=71 Runoff=11.98 cfs 0.685 af

Subcatchment 4N: Sideslope Runoff Area=1.933 ac 0.00% Impervious Runoff Depth=1.54"
Flow Length=632' Tc=7.1 min CN=71 Runoff=5.09 cfs 0.248 af

Subcatchment 4S: Sideslope Runoff Area=0.872 ac 0.00% Impervious Runoff Depth=1.54"
Flow Length=530' Tc=6.6 min CN=71 Runoff=2.34 cfs 0.112 af

Subcatchment 4SE: Sideslope Runoff Area=2.200 ac 0.00% Impervious Runoff Depth=1.54"
Flow Length=730' Tc=6.8 min CN=71 Runoff=5.87 cfs 0.282 af

Subcatchment 4SW: Sideslope Runoff Area=1.671 ac 0.00% Impervious Runoff Depth=1.54"
Flow Length=730' Tc=6.2 min CN=71 Runoff=4.56 cfs 0.214 af

Subcatchment 4W: Sideslope Runoff Area=1.561 ac 0.00% Impervious Runoff Depth=1.54"
Flow Length=350' Tc=6.6 min CN=71 Runoff=4.20 cfs 0.200 af

Subcatchment 5E: Side Slope Runoff Area=1.195 ac 0.00% Impervious Runoff Depth=1.54"
Flow Length=730' Tc=7.0 min CN=71 Runoff=3.16 cfs 0.153 af

Subcatchment 5N: Sideslope Runoff Area=3.175 ac 0.00% Impervious Runoff Depth=1.54"
Flow Length=766' Tc=8.1 min CN=71 Runoff=8.04 cfs 0.407 af

Subcatchment 5S: Sideslope Runoff Area=1.778 ac 0.00% Impervious Runoff Depth=1.54"
Flow Length=565' Tc=7.1 min CN=71 Runoff=4.68 cfs 0.228 af

Subcatchment 5SE: Sideslope Runoff Area=2.043 ac 0.00% Impervious Runoff Depth=1.54"
Flow Length=750' Tc=7.3 min CN=71 Runoff=5.34 cfs 0.262 af

Subcatchment 5SW: Southwest Top Runoff Area=4.496 ac 0.00% Impervious Runoff Depth=1.54"
Flow Length=440' Slope=0.0200 '/' Tc=14.4 min CN=71 Runoff=8.96 cfs 0.577 af

Subcatchment 5W: Sideslope Runoff Area=2.191 ac 0.00% Impervious Runoff Depth=1.54"
Flow Length=385' Tc=6.1 min CN=71 Runoff=6.00 cfs 0.281 af

Subcatchment 6E: Side Slope Runoff Area=2.437 ac 0.00% Impervious Runoff Depth=1.54"
Flow Length=735' Tc=9.2 min CN=71 Runoff=5.91 cfs 0.313 af

Subcatchment 6N: Sideslope Runoff Area=3.870 ac 0.00% Impervious Runoff Depth=1.54"
Flow Length=1,070' Tc=13.5 min CN=71 Runoff=7.97 cfs 0.497 af

Subcatchment 6S: Sideslope Runoff Area=1.820 ac 0.00% Impervious Runoff Depth=1.54"
Flow Length=490' Tc=6.5 min CN=71 Runoff=4.91 cfs 0.234 af

Subcatchment 6SE: Sideslope Runoff Area=1.487 ac 0.00% Impervious Runoff Depth=1.54"
Flow Length=725' Tc=6.4 min CN=71 Runoff=4.03 cfs 0.191 af

Subcatchment 6SW: Sideslope Runoff Area=2.314 ac 0.00% Impervious Runoff Depth=1.54"
Flow Length=530' Tc=6.6 min CN=71 Runoff=6.22 cfs 0.297 af

Subcatchment 7E: Side Slope Runoff Area=3.018 ac 0.00% Impervious Runoff Depth=1.54"
Flow Length=1,050' Tc=8.9 min CN=71 Runoff=7.41 cfs 0.387 af

Subcatchment 7S: Sideslope Runoff Area=2.118 ac 0.00% Impervious Runoff Depth=1.54"
Flow Length=560' Tc=7.0 min CN=71 Runoff=5.60 cfs 0.272 af

Subcatchment 7SE: Sideslope Runoff Area=2.211 ac 0.00% Impervious Runoff Depth=1.54"
Flow Length=930' Tc=9.1 min CN=71 Runoff=5.38 cfs 0.284 af

Subcatchment 7SW: Sideslope Runoff Area=3.196 ac 0.00% Impervious Runoff Depth=1.54"
Flow Length=696' Tc=8.3 min CN=71 Runoff=8.03 cfs 0.410 af

Subcatchment 8E: Sideslope Runoff Area=1.052 ac 0.00% Impervious Runoff Depth=1.54"
Flow Length=70' Slope=0.3333 '/' Tc=3.7 min CN=71 Runoff=3.17 cfs 0.135 af

Subcatchment 8SE: Sideslope Runoff Area=1.308 ac 0.00% Impervious Runoff Depth=1.54"
Flow Length=580' Tc=4.9 min CN=71 Runoff=3.76 cfs 0.168 af

Subcatchment 8SW: Sideslope Runoff Area=0.953 ac 0.00% Impervious Runoff Depth=1.54"
Flow Length=710' Tc=5.8 min CN=71 Runoff=2.64 cfs 0.122 af

Subcatchment 9E: Side Slope Runoff Area=0.680 ac 0.00% Impervious Runoff Depth=1.54"
Flow Length=870' Tc=7.7 min CN=71 Runoff=1.75 cfs 0.087 af

Subcatchment 9SE: Sideslope Runoff Area=0.641 ac 0.00% Impervious Runoff Depth=1.54"
Flow Length=640' Tc=5.6 min CN=71 Runoff=1.79 cfs 0.082 af

Subcatchment 10E: Side Slope Runoff Area=0.614 ac 0.00% Impervious Runoff Depth=1.54"
Flow Length=850' Tc=8.9 min CN=71 Runoff=1.51 cfs 0.079 af

Subcatchment 10SE: Southeast Top Runoff Area=3.918 ac 0.00% Impervious Runoff Depth=1.54"
Flow Length=490' Slope=0.0200 '/' Tc=14.8 min CN=71 Runoff=7.70 cfs 0.503 af

Subcatchment 11E: Side Slope Runoff Area=1.017 ac 0.00% Impervious Runoff Depth=1.54"
Flow Length=890' Tc=10.2 min CN=71 Runoff=2.37 cfs 0.130 af

Subcatchment 11SE: Southeast Top Runoff Area=5.848 ac 0.00% Impervious Runoff Depth=1.54"
Flow Length=675' Tc=26.8 min CN=71 Runoff=8.04 cfs 0.750 af

Subcatchment 12E: Side Slope Runoff Area=0.535 ac 0.00% Impervious Runoff Depth=1.54"
Flow Length=100' Slope=0.3333 '/' Tc=4.9 min CN=71 Runoff=1.54 cfs 0.069 af

Subcatchment 12SE: Southeast Top Runoff Area=9.055 ac 0.00% Impervious Runoff Depth=1.54"
Flow Length=700' Tc=27.0 min CN=71 Runoff=12.42 cfs 1.162 af

Subcatchment 13E: Side Slope Runoff Area=0.855 ac 0.00% Impervious Runoff Depth=1.54"
Flow Length=686' Tc=5.3 min CN=71 Runoff=2.42 cfs 0.110 af

Subcatchment 13SE: Sideslope Runoff Area=2.473 ac 0.00% Impervious Runoff Depth=1.54"
Flow Length=665' Tc=7.3 min CN=71 Runoff=6.46 cfs 0.317 af

Subcatchment NPD: North Pond Direct Runoff Area=0.982 ac 100.00% Impervious Runoff Depth=3.97"
Tc=0.0 min CN=98 Runoff=6.99 cfs 0.325 af

Subcatchment NPEB: Exterior Berm Runoff Area=0.750 ac 0.00% Impervious Runoff Depth=1.54"
Flow Length=40' Slope=0.3333 '/' Tc=2.4 min CN=71 Runoff=2.37 cfs 0.096 af

Subcatchment NWPD: NW Pond Direct Runoff Area=0.938 ac 100.00% Impervious Runoff Depth=3.97"
Tc=0.0 min CN=98 Runoff=6.67 cfs 0.311 af

Subcatchment NWPEB: Exterior Berm Runoff Area=1.839 ac 0.00% Impervious Runoff Depth=1.54"
Flow Length=1,030' Tc=14.1 min CN=71 Runoff=3.70 cfs 0.236 af

Subcatchment SEPD: SE Pond Direct Runoff Area=0.678 ac 100.00% Impervious Runoff Depth=3.97"
Tc=0.0 min CN=98 Runoff=4.82 cfs 0.225 af

Subcatchment SEPEB: Exterior Berm Runoff Area=1.488 ac 0.00% Impervious Runoff Depth=1.54"
Flow Length=80' Slope=0.3333 '/' Tc=4.1 min CN=71 Runoff=4.41 cfs 0.191 af

Subcatchment SPD: S Pond Direct Runoff Area=0.527 ac 100.00% Impervious Runoff Depth=3.97"
Tc=0.0 min CN=98 Runoff=3.75 cfs 0.175 af

Subcatchment SPEB: Exterior Berm Runoff Area=5.014 ac 17.12% Impervious Runoff Depth=1.90"
Flow Length=440' Tc=6.0 min CN=76 Runoff=17.09 cfs 0.794 af

Subcatchment SWPD: SW Pond Direct Runoff Area=0.837 ac 100.00% Impervious Runoff Depth=3.97"
Tc=0.0 min CN=98 Runoff=5.96 cfs 0.277 af

Subcatchment SWPEB: Exterior Berm Runoff Area=2.086 ac 0.00% Impervious Runoff Depth=1.54"
Flow Length=80' Slope=0.2500 '/' Tc=4.6 min CN=71 Runoff=6.06 cfs 0.268 af

Reach 3R: (new Reach)

Pond 1ED: East Ditch 1 Peak Elev=712.12' Storage=1,074 cf Inflow=2.42 cfs 0.110 af
Primary=1.70 cfs 0.103 af Secondary=0.00 cfs 0.000 af Outflow=1.70 cfs 0.103 af

Pond 2ED: East Ditch 2 Peak Elev=710.75' Storage=2,189 cf Inflow=6.74 cfs 0.381 af
Primary=5.19 cfs 0.377 af Secondary=0.00 cfs 0.000 af Outflow=5.19 cfs 0.377 af

Pond 3ED: East Ditch 3 Peak Elev=712.32' Storage=17,011 cf Inflow=18.80 cfs 4.827 af
Primary=12.52 cfs 4.826 af Secondary=0.00 cfs 0.000 af Outflow=12.52 cfs 4.826 af

Pond 4ED: Exist Ditch 4 Peak Elev=713.84' Storage=44,454 cf Inflow=47.88 cfs 4.522 af
Primary=12.50 cfs 4.228 af Secondary=13.83 cfs 0.285 af Outflow=26.32 cfs 4.513 af

Pond C10SE: Catch Basin Peak Elev=810.57' Storage=659 cf Inflow=7.70 cfs 0.503 af
Primary=7.62 cfs 0.503 af Secondary=0.00 cfs 0.000 af Outflow=7.62 cfs 0.503 af

Pond C11SE: Catch Basin Peak Elev=803.59' Storage=797 cf Inflow=8.04 cfs 0.750 af
Primary=8.01 cfs 0.750 af Secondary=0.00 cfs 0.000 af Outflow=8.01 cfs 0.750 af

Pond C12SE: Catch Basin Peak Elev=798.00' Storage=20 cf Inflow=12.42 cfs 1.162 af
Primary=12.41 cfs 1.162 af Secondary=0.00 cfs 0.000 af Outflow=12.41 cfs 1.162 af

Pond C13SE: Catch Basin Peak Elev=724.51' Storage=60 cf Inflow=6.46 cfs 0.317 af
Primary=6.45 cfs 0.317 af Secondary=0.00 cfs 0.000 af Outflow=6.45 cfs 0.317 af

Pond C1E: Catch Basin Peak Elev=798.04' Storage=131 cf Inflow=20.88 cfs 2.289 af
Primary=20.81 cfs 2.288 af Secondary=0.00 cfs 0.000 af Outflow=20.81 cfs 2.288 af

Pond C1N: Catch Basin Peak Elev=801.55' Storage=685 cf Inflow=21.34 cfs 2.270 af
Primary=21.34 cfs 2.270 af Secondary=0.00 cfs 0.000 af Outflow=21.34 cfs 2.270 af

Pond C1NW: Catch Basin Peak Elev=785.39' Storage=52 cf Inflow=4.26 cfs 0.193 af
Primary=4.26 cfs 0.193 af Secondary=0.00 cfs 0.000 af Outflow=4.26 cfs 0.193 af

Pond C1S: Catch Basin Peak Elev=809.53' Storage=310 cf Inflow=6.70 cfs 0.443 af
Primary=6.68 cfs 0.443 af Secondary=0.00 cfs 0.000 af Outflow=6.68 cfs 0.443 af

Pond C1SE: Catch Basin Peak Elev=810.52' Storage=307 cf Inflow=6.61 cfs 0.433 af
Primary=6.58 cfs 0.433 af Secondary=0.00 cfs 0.000 af Outflow=6.58 cfs 0.433 af

Pond C1SW: Catch Basin Peak Elev=811.65' Storage=1,479 cf Inflow=9.37 cfs 0.607 af
Primary=8.92 cfs 0.607 af Secondary=0.00 cfs 0.000 af Outflow=8.92 cfs 0.607 af

Pond C1W: Catch Basin Peak Elev=799.69' Storage=1,278 cf Inflow=27.77 cfs 2.150 af
Primary=27.53 cfs 2.150 af Secondary=0.00 cfs 0.000 af Outflow=27.53 cfs 2.150 af

Pond C2N: Catch Basin Peak Elev=782.31' Storage=42 cf Inflow=3.09 cfs 0.147 af
Primary=3.09 cfs 0.147 af Secondary=0.00 cfs 0.000 af Outflow=3.09 cfs 0.147 af

Pond C2NW: Catch Basin Peak Elev=745.44' Storage=234 cf Inflow=5.13 cfs 0.300 af
Primary=5.11 cfs 0.300 af Secondary=0.00 cfs 0.000 af Outflow=5.11 cfs 0.300 af

Pond C2S: Catch Basin Peak Elev=800.80' Storage=472 cf Inflow=9.95 cfs 0.951 af
Primary=9.87 cfs 0.951 af Secondary=0.00 cfs 0.000 af Outflow=9.87 cfs 0.951 af

Pond C2SE: Catch Basin Peak Elev=804.56' Storage=330 cf Inflow=7.35 cfs 0.687 af
Primary=7.33 cfs 0.687 af Secondary=0.00 cfs 0.000 af Outflow=7.33 cfs 0.687 af

Pond C2SW: Catch Basin Peak Elev=776.59' Storage=186 cf Inflow=7.93 cfs 0.382 af
Primary=7.92 cfs 0.382 af Secondary=0.00 cfs 0.000 af Outflow=7.92 cfs 0.382 af

Pond C2W: Catch Basin Peak Elev=769.43' Storage=50 cf Inflow=4.97 cfs 0.247 af
Primary=4.96 cfs 0.247 af Secondary=0.00 cfs 0.000 af Outflow=4.96 cfs 0.247 af

Pond C3N: Catch Basin Peak Elev=742.40' Storage=215 cf Inflow=4.50 cfs 0.226 af
Primary=4.47 cfs 0.226 af Secondary=0.00 cfs 0.000 af Outflow=4.47 cfs 0.226 af

Pond C3NW: Northwest Ditch Peak Elev=721.85' Storage=2,603 cf Inflow=23.08 cfs 1.264 af
Primary=20.57 cfs 1.264 af Secondary=0.00 cfs 0.000 af Outflow=20.57 cfs 1.264 af

Pond C3S: Catch Basin Peak Elev=797.37' Storage=1,700 cf Inflow=27.37 cfs 2.691 af
Primary=18.12 cfs 1.794 af Secondary=9.06 cfs 0.897 af Tertiary=0.00 cfs 0.000 af Outflow=27.18 cfs 2.691 af

Pond C3SE: Catch Basin Peak Elev=799.61' Storage=175 cf Inflow=16.59 cfs 1.563 af
Primary=16.58 cfs 1.563 af Secondary=0.00 cfs 0.000 af Outflow=16.58 cfs 1.563 af

Pond C3SW: Catch Basin Peak Elev=752.96' Storage=53 cf Inflow=5.43 cfs 0.268 af
Primary=5.42 cfs 0.268 af Secondary=0.00 cfs 0.000 af Outflow=5.42 cfs 0.268 af

Pond C3W: Catch Basin Peak Elev=742.37' Storage=43 cf Inflow=3.97 cfs 0.198 af
Primary=3.97 cfs 0.198 af Secondary=0.00 cfs 0.000 af Outflow=3.97 cfs 0.198 af

Pond C4N: Catch Basin Peak Elev=782.44' Storage=58 cf Inflow=5.09 cfs 0.248 af
Primary=5.09 cfs 0.248 af Secondary=0.00 cfs 0.000 af Outflow=5.09 cfs 0.248 af

Pond C4S: Catch Basin Peak Elev=777.76' Storage=49 cf Inflow=2.34 cfs 0.112 af
Primary=2.34 cfs 0.112 af Secondary=0.00 cfs 0.000 af Outflow=2.34 cfs 0.112 af

Pond C4SE: Catch Basin Peak Elev=776.48' Storage=152 cf Inflow=5.87 cfs 0.282 af
Primary=5.85 cfs 0.282 af Secondary=0.00 cfs 0.000 af Outflow=5.85 cfs 0.282 af

Pond C4SW: Southwest Ditch 1 Peak Elev=744.41' Storage=47 cf Inflow=4.56 cfs 0.214 af
Primary=4.56 cfs 0.214 af Secondary=0.00 cfs 0.000 af Outflow=4.56 cfs 0.214 af

Pond C4W: West Ditch Peak Elev=720.04' Storage=6,504 cf Inflow=28.45 cfs 2.351 af
Primary=25.77 cfs 2.351 af Secondary=0.00 cfs 0.000 af Outflow=25.77 cfs 2.351 af

Pond C5N: Catch Basin Peak Elev=749.37' Storage=50 cf Inflow=8.04 cfs 0.407 af
Primary=8.04 cfs 0.407 af Secondary=0.00 cfs 0.000 af Outflow=8.04 cfs 0.407 af

Pond C5S: Catch Basin Peak Elev=732.41' Storage=20 cf Inflow=4.68 cfs 0.228 af
Primary=4.68 cfs 0.228 af Secondary=0.00 cfs 0.000 af Outflow=4.68 cfs 0.228 af

Pond C5SE: Catch Basin Peak Elev=752.95' Storage=53 cf Inflow=5.34 cfs 0.262 af
Primary=5.33 cfs 0.262 af Secondary=0.00 cfs 0.000 af Outflow=5.33 cfs 0.262 af

Pond C5SW: Catch Basin Peak Elev=811.64' Storage=756 cf Inflow=8.96 cfs 0.577 af
Primary=8.82 cfs 0.577 af Secondary=0.00 cfs 0.000 af Outflow=8.82 cfs 0.577 af

Pond C6N: North Ditch Peak Elev=723.08' Storage=7,687 cf Inflow=28.06 cfs 3.422 af
Primary=21.19 cfs 3.323 af Secondary=5.18 cfs 0.099 af Outflow=26.37 cfs 3.422 af

Pond C6S: Catch Basin Peak Elev=777.43' Storage=114 cf Inflow=4.91 cfs 0.234 af
Primary=4.90 cfs 0.234 af Secondary=0.00 cfs 0.000 af Outflow=4.90 cfs 0.234 af

Pond C6SE: Southeast Ditch 1 Peak Elev=744.37' Storage=44 cf Inflow=4.03 cfs 0.191 af
Primary=4.02 cfs 0.191 af Secondary=0.00 cfs 0.000 af Outflow=4.02 cfs 0.191 af

Pond C6SW: Catch Basin Peak Elev=776.50' Storage=159 cf Inflow=6.22 cfs 0.297 af
Primary=6.21 cfs 0.297 af Secondary=0.00 cfs 0.000 af Outflow=6.21 cfs 0.297 af

Pond C7S: Catch Basin Peak Elev=732.97' Storage=56 cf Inflow=5.60 cfs 0.272 af
Primary=5.59 cfs 0.272 af Secondary=0.00 cfs 0.000 af Outflow=5.59 cfs 0.272 af

Pond C7SE: Catch Basin Peak Elev=775.45' Storage=121 cf Inflow=5.38 cfs 0.284 af
Primary=5.37 cfs 0.284 af Secondary=0.00 cfs 0.000 af Outflow=5.37 cfs 0.284 af

Pond C7SW: Catch Basin Peak Elev=733.09' Storage=69 cf Inflow=8.03 cfs 0.410 af
Primary=8.02 cfs 0.410 af Secondary=0.00 cfs 0.000 af Outflow=8.02 cfs 0.410 af

Pond C8SE: Catch Basin Peak Elev=753.36' Storage=43 cf Inflow=3.76 cfs 0.168 af
Primary=3.75 cfs 0.168 af Secondary=0.00 cfs 0.000 af Outflow=3.75 cfs 0.168 af

Pond C8SW: Southwest Ditch 2 Peak Elev=726.28' Storage=33 cf Inflow=2.64 cfs 0.122 af
Primary=2.64 cfs 0.122 af Secondary=0.00 cfs 0.000 af Outflow=2.64 cfs 0.122 af

Pond C9SE: Southeast Ditch 2 Peak Elev=735.22' Storage=13 cf Inflow=1.79 cfs 0.082 af
Primary=1.79 cfs 0.082 af Secondary=0.00 cfs 0.000 af Outflow=1.79 cfs 0.082 af

Pond D10SE: 10" Pipe Peak Elev=832.07' Inflow=7.62 cfs 0.503 af
9.9" Round Culvert n=0.010 L=350.0' S=0.0200 '/' Outflow=7.62 cfs 0.503 af

Pond D11SE: 20" Pipe Peak Elev=803.14' Inflow=13.83 cfs 1.253 af
18.5" Round Culvert n=0.010 L=265.0' S=0.0208 '/' Outflow=13.83 cfs 1.253 af

Pond D12SE: 24" Pipe Peak Elev=799.34' Inflow=25.62 cfs 2.415 af
22.2" Round Culvert n=0.010 L=350.0' S=0.2129 '/' Outflow=25.62 cfs 2.415 af

Pond D1E: 24" Pipe Peak Elev=798.01' Inflow=20.81 cfs 2.288 af
22.2" Round Culvert n=0.010 L=330.0' S=0.2258 '/' Outflow=20.81 cfs 2.288 af

Pond D1N: 24" Pipe Peak Elev=801.64' Inflow=21.34 cfs 2.270 af
22.2" Round Culvert n=0.010 L=330.0' S=0.2364 '/' Outflow=21.34 cfs 2.270 af

Pond D1NW: 24" Pipe Peak Elev=782.91' Inflow=4.26 cfs 0.193 af
22.2" Round Culvert n=0.010 L=200.0' S=0.2000 '/' Outflow=4.26 cfs 0.193 af

Pond D1S: 10" Pipe Peak Elev=825.92' Inflow=6.68 cfs 0.443 af
9.9" Round Culvert n=0.010 L=420.0' S=0.0214 '/' Outflow=6.68 cfs 0.443 af

Pond D1SE: 10" Pipe Peak Elev=825.71' Inflow=6.58 cfs 0.433 af
9.9" Round Culvert n=0.010 L=360.0' S=0.0167 '/' Outflow=6.58 cfs 0.433 af

Pond D1SW: 6" Pipe Peak Elev=983.08' Inflow=8.92 cfs 0.607 af
6.1" Round Culvert n=0.010 L=120.0' S=0.2917 '/' Outflow=8.92 cfs 0.607 af

Pond D1W: 24" Pipe Peak Elev=801.45' Inflow=27.53 cfs 2.150 af
22.2" Round Culvert n=0.010 L=280.0' S=0.2571 '/' Outflow=27.53 cfs 2.150 af

Pond D2N: 24" Pipe Peak Elev=779.76' Inflow=3.09 cfs 0.147 af
22.2" Round Culvert n=0.010 L=170.0' S=0.2353 '/' Outflow=3.09 cfs 0.147 af

Pond D2NW: 24" Pipe Peak Elev=743.35' Inflow=8.35 cfs 0.493 af
22.2" Round Culvert n=0.010 L=60.0' S=0.2667 '/' Outflow=8.35 cfs 0.493 af

Pond D2S: 20" Pipe Peak Elev=800.43' Inflow=14.65 cfs 1.394 af
18.5" Round Culvert n=0.010 L=195.0' S=0.0169 '/' Outflow=14.65 cfs 1.394 af

Pond D2SE: 20" Pipe Peak Elev=803.66' Inflow=12.34 cfs 1.120 af
18.5" Round Culvert n=0.010 L=120.0' S=0.0417 '/' Outflow=12.34 cfs 1.120 af

Pond D2SW: 12" Pipe Peak Elev=788.59' Inflow=14.21 cfs 0.989 af
11.8" Round Culvert n=0.010 L=75.0' S=0.3133 '/' Outflow=14.21 cfs 0.989 af

Pond D2W: 14" Pipe Peak Elev=767.83' Inflow=4.96 cfs 0.247 af
12.9" Round Culvert n=0.010 L=200.0' S=0.2300 '/' Outflow=4.96 cfs 0.247 af

Pond D3N: 24" Pipe Peak Elev=740.26' Inflow=7.48 cfs 0.373 af
22.2" Round Culvert n=0.010 L=60.0' S=0.2167 '/' Outflow=7.48 cfs 0.373 af

Pond D3S1: 22" Pipe 1 Peak Elev=797.35' Inflow=18.12 cfs 1.794 af
20.3" Round Culvert n=0.010 L=475.0' S=0.1625 '/' Outflow=18.12 cfs 1.794 af

Pond D3S2: 22" Pipe 2 Peak Elev=798.98' Inflow=22.79 cfs 2.291 af
20.3" Round Culvert n=0.010 L=475.0' S=0.1625 '/' Outflow=22.79 cfs 2.291 af

Pond D3SE: 24" Pipe Peak Elev=801.62' Inflow=28.05 cfs 2.683 af
22.2" Round Culvert n=0.010 L=190.0' S=0.2947 '/' Outflow=28.05 cfs 2.683 af

Pond D3SW: 24" Pipe Peak Elev=752.67' Inflow=19.38 cfs 1.257 af
22.2" Round Culvert n=0.010 L=25.0' S=0.3800 '/' Outflow=19.38 cfs 1.257 af

Pond D3W: 18" Pipe Peak Elev=740.00' Inflow=3.97 cfs 0.198 af
16.6" Round Culvert n=0.010 L=88.0' S=0.2159 '/' Outflow=3.97 cfs 0.198 af

Pond D4N: 24" Pipe Peak Elev=780.00' Inflow=5.09 cfs 0.248 af
22.2" Round Culvert n=0.010 L=118.0' S=0.2797 '/' Outflow=5.09 cfs 0.248 af

Pond D4S: 10" Pipe Peak Elev=778.74' Inflow=2.34 cfs 0.112 af
9.9" Round Culvert n=0.010 L=160.0' S=0.3094 '/' Outflow=2.34 cfs 0.112 af

Pond D4SE: 12" Pipe Peak Elev=776.05' Inflow=5.85 cfs 0.282 af
11.8" Round Culvert n=0.010 L=65.0' S=0.3615 '/' Outflow=5.85 cfs 0.282 af

Pond D4W: 18" Pipe Peak Elev=722.22' Inflow=8.93 cfs 0.445 af
16.6" Round Culvert n=0.010 L=95.0' S=0.0421 '/' Outflow=8.93 cfs 0.445 af

Pond D5N: 24" Pipe Peak Elev=747.95' Inflow=13.10 cfs 0.655 af
22.2" Round Culvert n=0.010 L=84.0' S=0.2381 '/' Outflow=13.10 cfs 0.655 af

Pond D5S: 16" Pipe Peak Elev=731.10' Inflow=7.01 cfs 0.340 af
14.8" Round Culvert n=0.010 L=142.0' S=0.1056 '/' Outflow=7.01 cfs 0.340 af

Pond D5SE: 20" Pipe Peak Elev=751.82' Inflow=11.18 cfs 0.544 af
18.5" Round Culvert n=0.010 L=30.0' S=0.3167 '/' Outflow=11.18 cfs 0.544 af

Pond D5SW: 6" Pipe Peak Elev=985.29' Inflow=8.82 cfs 0.577 af
6.1" Round Culvert n=0.010 L=125.0' S=0.2800 '/' Outflow=8.82 cfs 0.577 af

Pond D6S: 14" Pipe Peak Elev=775.79' Inflow=4.90 cfs 0.234 af
12.9" Round Culvert n=0.010 L=185.0' S=0.2459 '/' Outflow=4.90 cfs 0.234 af

Pond D6SW: 16" Pipe Peak Elev=778.78' Inflow=13.07 cfs 0.874 af
14.8" Round Culvert n=0.010 L=165.0' S=0.2636 '/' Outflow=13.07 cfs 0.874 af

Pond D7S: 20" Pipe Peak Elev=731.63' Inflow=10.49 cfs 0.505 af
18.5" Round Culvert n=0.010 L=70.0' S=0.1857 '/' Outflow=10.49 cfs 0.505 af

Pond D7SE: 12" Pipe Peak Elev=774.65' Inflow=5.37 cfs 0.284 af
11.8" Round Culvert n=0.010 L=90.0' S=0.2444 '/' Outflow=5.37 cfs 0.284 af

Pond D7SW: 26" Pipe Peak Elev=732.42' Inflow=20.94 cfs 1.284 af
24.0" Round Culvert n=0.010 L=30.0' S=0.2500 '/' Outflow=20.94 cfs 1.284 af

Pond D8SE: 18" Pipe Peak Elev=752.12' Inflow=8.64 cfs 0.452 af
16.6" Round Culvert n=0.010 L=36.0' S=0.2778 '/' Outflow=8.64 cfs 0.452 af

Pond DP6N: 24" Pipe Peak Elev=722.10' Inflow=21.19 cfs 3.323 af
22.2" Round Culvert n=0.010 L=780.0' S=0.0237 '/' Outflow=21.19 cfs 3.323 af

Pond MH1S: 4' Dia. Manhole Peak Elev=718.08' Inflow=10.49 cfs 0.505 af
22.2" Round Culvert n=0.010 L=830.0' S=0.0048 '/' Outflow=10.49 cfs 0.505 af

Pond MH1SE: 8' Dia. Manhole Peak Elev=744.76' Inflow=31.26 cfs 3.419 af
22.2" Round Culvert n=0.010 L=590.0' S=0.0339 '/' Outflow=31.26 cfs 3.419 af

Pond MH1SW: 4' Dia. Manhole Peak Elev=743.61' Inflow=23.63 cfs 1.471 af
20.3" Round Culvert n=0.010 L=550.0' S=0.0382 '/' Outflow=23.63 cfs 1.471 af

Pond MH1W: 6' Manhole Peak Elev=722.83' Inflow=42.32 cfs 4.530 af
24.0" Round Culvert n=0.024 L=5.0' S=0.2000 '/' Outflow=42.32 cfs 4.530 af

Pond MH2SE: 4' Dia. Manhole Peak Elev=719.00' Inflow=31.26 cfs 3.419 af
30.0" Round Culvert n=0.024 L=10.0' S=0.1000 '/' Outflow=31.26 cfs 3.419 af

Pond MH2SW: 6' Dia. Manhole Peak Elev=726.87' Inflow=23.26 cfs 1.406 af
24.0" Round Culvert n=0.010 L=1,050.0' S=0.0048 '/' Outflow=23.26 cfs 1.406 af

Pond MH3S: 6' Dia. Manhole Peak Elev=718.75' Inflow=17.50 cfs 0.845 af
22.2" Round Culvert n=0.010 L=10.0' S=0.4000 '/' Outflow=17.50 cfs 0.845 af

Pond MH3SE: 8' Dia. Manhole Peak Elev=730.62' Inflow=27.06 cfs 2.732 af
24.0" Round Culvert n=0.010 L=1,400.0' S=0.0036 '/' Outflow=27.06 cfs 2.732 af

Pond MH3SW: 6' Dia. Manhole Peak Elev=727.60' Inflow=46.87 cfs 2.877 af
24.0" Round Culvert n=0.024 L=5.0' S=0.0000 '/' Outflow=46.87 cfs 2.877 af

Pond MH4SE: 4' Dia. Manhole Peak Elev=728.71' Inflow=31.55 cfs 3.266 af
24.0" Round Culvert n=0.010 L=620.0' S=0.0050 '/' Outflow=31.55 cfs 3.266 af

Pond MH4W: Manhole Peak Elev=724.31' Inflow=27.53 cfs 2.150 af
24.0" Round Culvert n=0.024 L=5.0' S=0.2000 '/' Outflow=27.53 cfs 2.150 af

Pond MH5SE: 4' Dia. Manhole Peak Elev=719.03' Inflow=31.55 cfs 3.266 af
30.0" Round Culvert n=0.024 L=10.0' S=0.1000 '/' Outflow=31.55 cfs 3.266 af

Pond NP: North Pond Peak Elev=698.00' Storage=80,641 cf Inflow=40.80 cfs 5.009 af
Primary=24.13 cfs 4.995 af Secondary=0.00 cfs 0.000 af Tertiary=0.00 cfs 0.000 af Outflow=24.13 cfs 4.995 af

Pond NWP: Northwest Pond Peak Elev=711.19' Storage=165,750 cf Inflow=74.73 cfs 8.554 af
Primary=40.51 cfs 8.547 af Secondary=0.00 cfs 0.000 af Tertiary=0.00 cfs 0.000 af Outflow=40.51 cfs 8.547 af

Pond SEP: Southeast Pond Peak Elev=715.48' Storage=86,354 cf Inflow=65.42 cfs 7.100 af
Primary=47.93 cfs 7.099 af Secondary=0.00 cfs 0.000 af Outflow=47.93 cfs 7.099 af

Pond SP: South Pond Peak Elev=720.00' Storage=38,251 cf Inflow=18.52 cfs 0.969 af
Discarded=0.08 cfs 0.243 af Secondary=0.12 cfs 0.006 af Tertiary=0.00 cfs 0.000 af Outflow=0.20 cfs 0.249 af

Pond SWP: Southwest Pond Peak Elev=720.39' Storage=67,108 cf Inflow=52.71 cfs 3.422 af
Primary=9.85 cfs 2.121 af Secondary=0.00 cfs 0.000 af Outflow=9.85 cfs 2.121 af

Total Runoff Area = 228.591 ac Runoff Volume = 30.285 af Average Runoff Depth = 1.59"
97.89% Pervious = 223.771 ac 2.11% Impervious = 4.820 ac

Summary for Subcatchment 1E: East Top

Runoff = 20.88 cfs @ 12.31 hrs, Volume= 2.289 af, Depth= 1.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 year - 24 hour Rainfall=4.21"

Area (ac)	CN	Description
17.841	71	Meadow, non-grazed, HSG C
17.841		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
28.6	270	0.0300	0.16		**Sheet Flow, 3% Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
5.5	700	0.0200	2.12		**Shallow Concentrated Flow, 2% Channel Flow** Grassed Waterway Kv= 15.0 fps
34.1	970	Total			

Summary for Subcatchment 1N: North Top

Runoff = 21.34 cfs @ 12.29 hrs, Volume= 2.270 af, Depth= 1.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 year - 24 hour Rainfall=4.21"

Area (ac)	CN	Description
17.691	71	Meadow, non-grazed, HSG C
17.691		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
28.6	270	0.0300	0.16		**Sheet Flow, 3% Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
3.9	500	0.0200	2.12		**Shallow Concentrated Flow, 2% Shallow Flow** Grassed Waterway Kv= 15.0 fps
32.5	770	Total			

Summary for Subcatchment 1NW: Sideslope

Runoff = 4.26 cfs @ 11.97 hrs, Volume= 0.193 af, Depth= 1.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 year - 24 hour Rainfall=4.21"

Area (ac)	CN	Description
1.506	71	Meadow, non-grazed, HSG C
1.506		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.1	35	0.3333	0.27		**Sheet Flow, 3:1 Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
3.2	500	0.0300	2.60		**Shallow Concentrated Flow, 3% Shallow Flow** Grassed Waterway Kv= 15.0 fps
5.3	535	Total			

Summary for Subcatchment 1S: South Top

Runoff = 6.70 cfs @ 12.08 hrs, Volume= 0.443 af, Depth= 1.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 year - 24 hour Rainfall=4.21"

Area (ac)	CN	Description
3.455	71	Meadow, non-grazed, HSG C
3.455		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.7	100	0.0200	0.14		**Sheet Flow, 2% Sheet Flow** Grass: Dense n= 0.240 P2= 4.80"
3.5	450	0.0200	2.12		**Shallow Concentrated Flow, 2% Shallow Flow** Grassed Waterway Kv= 15.0 fps
15.2	550	Total			

Summary for Subcatchment 1SE: Southeast Top

Runoff = 6.61 cfs @ 12.08 hrs, Volume= 0.433 af, Depth= 1.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 year - 24 hour Rainfall=4.21"

Area (ac)	CN	Description
3.373	71	Meadow, non-grazed, HSG C
3.373		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.7	100	0.0200	0.14		**Sheet Flow, 2% Sheet Flow** Grass: Dense n= 0.240 P2= 4.80"
3.2	410	0.0200	2.12		**Shallow Concentrated Flow, 2% Shallow Flow** Grassed Waterway Kv= 15.0 fps
14.9	510	Total			

Summary for Subcatchment 1SW: Southwest Top

Runoff = 9.37 cfs @ 12.08 hrs, Volume= 0.607 af, Depth= 1.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 year - 24 hour Rainfall=4.21"

Area (ac)	CN	Description
4.734	71	Meadow, non-grazed, HSG C
4.734		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.7	100	0.0200	0.14		**Sheet Flow, 2% Sheet Flow** Grass: Dense n= 0.240 P2= 4.80"
2.9	370	0.0200	2.12		**Shallow Concentrated Flow, 2% ShallowFlow** Grassed Waterway Kv= 15.0 fps
14.6	470	Total			

Summary for Subcatchment 1W: West Top

Runoff = 27.77 cfs @ 12.14 hrs, Volume= 2.150 af, Depth= 1.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 year - 24 hour Rainfall=4.21"

Area (ac)	CN	Description
16.760	71	Meadow, non-grazed, HSG C
16.760		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.7	150	0.0300	0.18		**Sheet Flow, 3% Sheet Flow** Grass: Dense n= 0.240 P2= 4.80"
1.0	150	0.0300	2.60		**Shallow Concentrated Flow, 3% Shallow Flow** Grassed Waterway Kv= 15.0 fps
5.3	670	0.0200	2.12		**Shallow Concentrated Flow, 2% Concentrated Flow** Grassed Waterway Kv= 15.0 fps
20.0	970	Total			

Summary for Subcatchment 2E: Side Slope

Runoff = 6.00 cfs @ 12.03 hrs, Volume= 0.332 af, Depth= 1.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 year - 24 hour Rainfall=4.21"

Area (ac)	CN	Description
2.590	71	Meadow, non-grazed, HSG C
2.590		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	120	0.3333	0.35		**Sheet Flow, 3:1 Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
4.6	580	0.0200	2.12		**Shallow Concentrated Flow, 2% Shallow Flow** Grassed Waterway Kv= 15.0 fps
0.1	280	0.3300	44.39	78.45	**Pipe Channel, Drop Pipe** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.010 PVC, smooth interior
10.4	980	Total			

Summary for Subcatchment 2N: Sideslope

Runoff = 3.09 cfs @ 11.98 hrs, Volume= 0.147 af, Depth= 1.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 year - 24 hour Rainfall=4.21"

Area (ac)	CN	Description
1.145	71	Meadow, non-grazed, HSG C
1.145		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.3	84	0.3333	0.33		**Sheet Flow, 3:1 Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
2.2	340	0.0300	2.60		**Shallow Concentrated Flow, 3% Concentrated Flow** Grassed Waterway Kv= 15.0 fps
6.5	424	Total			

Summary for Subcatchment 2NW: Sideslope

Runoff = 5.13 cfs @ 12.04 hrs, Volume= 0.300 af, Depth= 1.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 year - 24 hour Rainfall=4.21"

Area (ac)	CN	Description
2.338	71	Meadow, non-grazed, HSG C
2.338		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.4	113	0.3333	0.35		**Sheet Flow, 3:1 Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
6.4	1,000	0.0300	2.60		**Shallow Concentrated Flow, 3% Shallow Flow** Grassed Waterway Kv= 15.0 fps
11.8	1,113	Total			

Summary for Subcatchment 2S: South Top

Runoff = 9.95 cfs @ 12.23 hrs, Volume= 0.951 af, Depth= 1.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 year - 24 hour Rainfall=4.21"

Area (ac)	CN	Description
7.410	71	Meadow, non-grazed, HSG C
7.410		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
23.9	300	0.0300	0.21		**Sheet Flow, 3% Sheet Flow** Grass: Dense n= 0.240 P2= 4.80"
3.9	500	0.0200	2.12		**Shallow Concentrated Flow, 2% Shallow Flow** Grassed Waterway Kv= 15.0 fps
27.8	800	Total			

Summary for Subcatchment 2SE: Southeast Top

Runoff = 7.35 cfs @ 12.21 hrs, Volume= 0.687 af, Depth= 1.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 year - 24 hour Rainfall=4.21"

Area (ac)	CN	Description
5.356	71	Meadow, non-grazed, HSG C
5.356		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
23.9	300	0.0300	0.21		**Sheet Flow, 3% Sheet Flow** Grass: Dense n= 0.240 P2= 4.80"
3.1	400	0.0200	2.12		**Shallow Concentrated Flow, 2% Shallow Flow** Grassed Waterway Kv= 15.0 fps
27.0	700	Total			

Summary for Subcatchment 2SW: Sideslope

Runoff = 7.93 cfs @ 11.99 hrs, Volume= 0.382 af, Depth= 1.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 year - 24 hour Rainfall=4.21"

Area (ac)	CN	Description
2.975	71	Meadow, non-grazed, HSG C
2.975		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.5	60	0.3300	0.40		**Sheet Flow, 3:1 Sheet Flow** Grass: Dense n= 0.240 P2= 4.80"
4.3	665	0.0300	2.60		**Shallow Concentrated Flow, 3% Shallow Flow** Grassed Waterway Kv= 15.0 fps
6.8	725	Total			

Summary for Subcatchment 2W: Sideslope

Runoff = 4.97 cfs @ 12.00 hrs, Volume= 0.247 af, Depth= 1.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 year - 24 hour Rainfall=4.21"

Area (ac)	CN	Description
1.924	71	Meadow, non-grazed, HSG C
1.924		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.2	80	0.3300	0.42		**Sheet Flow, 3:1 Sheet Flow** Grass: Dense n= 0.240 P2= 4.80"
4.4	690	0.0300	2.60		**Shallow Concentrated Flow, 3% Shallow Flow** Grassed Waterway Kv= 15.0 fps
7.6	770	Total			

Summary for Subcatchment 3E: Side Slope

Runoff = 6.26 cfs @ 12.04 hrs, Volume= 0.362 af, Depth= 1.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 year - 24 hour Rainfall=4.21"

Area (ac)	CN	Description
2.825	71	Meadow, non-grazed, HSG C
2.825		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	120	0.3333	0.35		**Sheet Flow, 3:1 Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
5.7	720	0.0200	2.12		**Shallow Concentrated Flow, 2% Shallow Flow** Grassed Waterway Kv= 15.0 fps
0.1	170	0.3300	44.39	78.45	**Pipe Channel, Drop Pipe** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.010 PVC, smooth interior
11.5	1,010	Total			

Summary for Subcatchment 3N: Sideslope

Runoff = 4.50 cfs @ 12.00 hrs, Volume= 0.226 af, Depth= 1.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 year - 24 hour Rainfall=4.21"

Area (ac)	CN	Description
1.762	71	Meadow, non-grazed, HSG C
1.762		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.2	133	0.3333	0.36		**Sheet Flow, 3:1 Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
1.7	265	0.0300	2.60		**Shallow Concentrated Flow, 3% Shallow Flow** Grassed Waterway Kv= 15.0 fps
7.9	398	Total			

Summary for Subcatchment 3NW: Sideslope

Runoff = 7.38 cfs @ 12.02 hrs, Volume= 0.398 af, Depth= 1.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 year - 24 hour Rainfall=4.21"

Area (ac)	CN	Description
3.104	71	Meadow, non-grazed, HSG C
3.104		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.5	90	0.3333	0.33		**Sheet Flow, 3:1 Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
5.2	1,100	0.0300	3.52		**Shallow Concentrated Flow, 3% Concentrated Channel** Paved Kv= 20.3 fps
9.7	1,190	Total			

Summary for Subcatchment 3S: South Top

Runoff = 27.37 cfs @ 12.25 hrs, Volume= 2.691 af, Depth= 1.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 year - 24 hour Rainfall=4.21"

Area (ac)	CN	Description
20.973	71	Meadow, non-grazed, HSG C
20.973		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
23.9	300	0.0300	0.21		**Sheet Flow, 3% Sheet Flow** Grass: Dense n= 0.240 P2= 4.80"
5.1	650	0.0200	2.12		**Shallow Concentrated Flow, 2% Shallow Flow** Grassed Waterway Kv= 15.0 fps
29.0	950	Total			

Summary for Subcatchment 3SE: Southeast Top

Runoff = 16.59 cfs @ 12.22 hrs, Volume= 1.563 af, Depth= 1.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 year - 24 hour Rainfall=4.21"

Area (ac)	CN	Description
12.185	71	Meadow, non-grazed, HSG C
12.185		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
23.9	300	0.0300	0.21		**Sheet Flow, 3% Sheet Flow** Grass: Dense n= 0.240 P2= 4.80"
3.4	430	0.0200	2.12		**Shallow Concentrated Flow, 2% Shallow Flow** Grassed Waterway Kv= 15.0 fps
27.3	730	Total			

Summary for Subcatchment 3SW: Sideslope

Runoff = 5.43 cfs @ 11.99 hrs, Volume= 0.268 af, Depth= 1.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 year - 24 hour Rainfall=4.21"

Area (ac)	CN	Description
2.085	71	Meadow, non-grazed, HSG C
2.085		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.0	76	0.3300	0.42		**Sheet Flow, 3:1 Sheet Flow** Grass: Dense n= 0.240 P2= 4.80"
4.4	680	0.0300	2.60		**Shallow Concentrated Flow, 3% Shallow Flow** Grassed Waterway Kv= 15.0 fps
7.4	756	Total			

Summary for Subcatchment 3W: Sideslope

Runoff = 3.97 cfs @ 12.00 hrs, Volume= 0.198 af, Depth= 1.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 year - 24 hour Rainfall=4.21"

Area (ac)	CN	Description
1.543	71	Meadow, non-grazed, HSG C
1.543		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.5	90	0.3300	0.43		**Sheet Flow, 3:1 Sheet Flow** Grass: Dense n= 0.240 P2= 4.80"
4.2	650	0.0300	2.60		**Shallow Concentrated Flow, 3% Shallow Flow** Grassed Waterway Kv= 15.0 fps
7.7	740	Total			

Summary for Subcatchment 4E: Side Slope

Runoff = 11.98 cfs @ 12.04 hrs, Volume= 0.685 af, Depth= 1.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 year - 24 hour Rainfall=4.21"

Area (ac)	CN	Description
5.342	71	Meadow, non-grazed, HSG C
5.342		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	120	0.3333	0.35		**Sheet Flow, 3:1 Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
5.5	700	0.0200	2.12		**Shallow Concentrated Flow, 2% Shallow Flow** Grassed Waterway Kv= 15.0 fps
11.2	820	Total			

Summary for Subcatchment 4N: Sideslope

Runoff = 5.09 cfs @ 11.99 hrs, Volume= 0.248 af, Depth= 1.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 year - 24 hour Rainfall=4.21"

Area (ac)	CN	Description
1.933	71	Meadow, non-grazed, HSG C
1.933		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.4	63	0.3333	0.31		**Sheet Flow, 3:1 Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
3.7	569	0.0300	2.60		**Shallow Concentrated Flow, 3% Shallow Flow** Grassed Waterway Kv= 15.0 fps
7.1	632	Total			

Summary for Subcatchment 4S: Sideslope

Runoff = 2.34 cfs @ 11.99 hrs, Volume= 0.112 af, Depth= 1.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 year - 24 hour Rainfall=4.21"

Area (ac)	CN	Description
0.872	71	Meadow, non-grazed, HSG C
0.872		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.8	100	0.3300	0.44		**Sheet Flow, 3:1 Sheet Flow** Grass: Dense n= 0.240 P2= 4.80"
2.8	430	0.0300	2.60		**Shallow Concentrated Flow, 3% Shallow Flow** Grassed Waterway Kv= 15.0 fps
6.6	530	Total			

Summary for Subcatchment 4SE: Sideslope

Runoff = 5.87 cfs @ 11.99 hrs, Volume= 0.282 af, Depth= 1.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 year - 24 hour Rainfall=4.21"

Area (ac)	CN	Description
2.200	71	Meadow, non-grazed, HSG C
2.200		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.5	60	0.3300	0.40		**Sheet Flow, 3:1 Sheet Flow** Grass: Dense n= 0.240 P2= 4.80"
4.3	670	0.0300	2.60		**Shallow Concentrated Flow, 3% Shallow Flow** Grassed Waterway Kv= 15.0 fps
6.8	730	Total			

Summary for Subcatchment 4SW: Sideslope

Runoff = 4.56 cfs @ 11.98 hrs, Volume= 0.214 af, Depth= 1.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 year - 24 hour Rainfall=4.21"

Area (ac)	CN	Description
1.671	71	Meadow, non-grazed, HSG C
1.671		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.8	40	0.3300	0.37		**Sheet Flow, 3:1 Sheet Flow** Grass: Dense n= 0.240 P2= 4.80"
4.4	690	0.0300	2.60		**Shallow Concentrated Flow, 3% Shallow Flow** Grassed Waterway Kv= 15.0 fps
6.2	730	Total			

Summary for Subcatchment 4W: Sideslope

Runoff = 4.20 cfs @ 11.99 hrs, Volume= 0.200 af, Depth= 1.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 year - 24 hour Rainfall=4.21"

Area (ac)	CN	Description
1.561	71	Meadow, non-grazed, HSG C
1.561		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.3	150	0.3300	0.48		**Sheet Flow, 3:1 Sheet Flow** Grass: Dense n= 0.240 P2= 4.80"
1.3	200	0.0300	2.60		**Shallow Concentrated Flow, 3% Shallow Flow** Grassed Waterway Kv= 15.0 fps
6.6	350	Total			

Summary for Subcatchment 5E: Side Slope

Runoff = 3.16 cfs @ 11.99 hrs, Volume= 0.153 af, Depth= 1.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 year - 24 hour Rainfall=4.21"

Area (ac)	CN	Description
1.195	71	Meadow, non-grazed, HSG C
1.195		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.3	85	0.3333	0.33		**Sheet Flow, 3:1 Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
2.6	330	0.0200	2.12		**Shallow Concentrated Flow, 2% Shallow Flow** Grassed Waterway Kv= 15.0 fps
0.1	315	0.3300	44.39	78.45	**Pipe Channel, Drop Pipe** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.010 PVC, smooth interior
7.0	730	Total			

Summary for Subcatchment 5N: Sideslope

Runoff = 8.04 cfs @ 12.00 hrs, Volume= 0.407 af, Depth= 1.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 year - 24 hour Rainfall=4.21"

Area (ac)	CN	Description
3.175	71	Meadow, non-grazed, HSG C
3.175		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.5	56	0.2500	0.27		**Sheet Flow, 4:1 Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
4.6	710	0.0300	2.60		**Shallow Concentrated Flow, 3% Concentrated Flow** Grassed Waterway Kv= 15.0 fps
8.1	766	Total			

Summary for Subcatchment 5S: Sideslope

Runoff = 4.68 cfs @ 11.99 hrs, Volume= 0.228 af, Depth= 1.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 year - 24 hour Rainfall=4.21"

Area (ac)	CN	Description
1.778	71	Meadow, non-grazed, HSG C
1.778		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.2	115	0.3300	0.45		**Sheet Flow, 3:1 Sheet Flow** Grass: Dense n= 0.240 P2= 4.80"
2.9	450	0.0300	2.60		**Shallow Concentrated Flow, 3% Shallow Flow** Grassed Waterway Kv= 15.0 fps
7.1	565	Total			

Summary for Subcatchment 5SE: Sideslope

Runoff = 5.34 cfs @ 11.99 hrs, Volume= 0.262 af, Depth= 1.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 year - 24 hour Rainfall=4.21"

Area (ac)	CN	Description
2.043	71	Meadow, non-grazed, HSG C
2.043		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.9	70	0.3300	0.41		**Sheet Flow, 3:1 Sheet Flow** Grass: Dense n= 0.240 P2= 4.80"
4.4	680	0.0300	2.60		**Shallow Concentrated Flow, 3% Shallow Flow** Grassed Waterway Kv= 15.0 fps
7.3	750	Total			

Summary for Subcatchment 5SW: Southwest Top

Runoff = 8.96 cfs @ 12.07 hrs, Volume= 0.577 af, Depth= 1.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 year - 24 hour Rainfall=4.21"

Area (ac)	CN	Description
4.496	71	Meadow, non-grazed, HSG C
4.496		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.7	100	0.0200	0.14		**Sheet Flow, 2% Sheet Flow** Grass: Dense n= 0.240 P2= 4.80"
2.7	340	0.0200	2.12		**Shallow Concentrated Flow, 2% Shallow Flow** Grassed Waterway Kv= 15.0 fps
14.4	440	Total			

Summary for Subcatchment 5W: Sideslope

Runoff = 6.00 cfs @ 11.98 hrs, Volume= 0.281 af, Depth= 1.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 year - 24 hour Rainfall=4.21"

Area (ac)	CN	Description
2.191	71	Meadow, non-grazed, HSG C
2.191		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.3	150	0.3300	0.48		**Sheet Flow, 3:1 Sheet Flow** Grass: Dense n= 0.240 P2= 4.80"
0.4	200	0.3300	8.62		**Shallow Concentrated Flow, 3:1 Shallow Flow** Grassed Waterway Kv= 15.0 fps
0.4	35	0.0200	1.37		**Sheet Flow, 2% Concentrated Flow** Smooth surfaces n= 0.011 P2= 4.80"
6.1	385	Total			

Summary for Subcatchment 6E: Side Slope

Runoff = 5.91 cfs @ 12.01 hrs, Volume= 0.313 af, Depth= 1.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 year - 24 hour Rainfall=4.21"

Area (ac)	CN	Description
2.437	71	Meadow, non-grazed, HSG C
2.437		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	120	0.3333	0.35		**Sheet Flow, 3:1 Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
3.4	430	0.0200	2.12		**Shallow Concentrated Flow, 2% Shallow Flow** Grassed Waterway Kv= 15.0 fps
0.1	185	0.3300	44.39	78.45	**Pipe Channel, Drop Pipe** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.010 PVC, smooth interior
9.2	735	Total			

Summary for Subcatchment 6N: Sideslope

Runoff = 7.97 cfs @ 12.06 hrs, Volume= 0.497 af, Depth= 1.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 year - 24 hour Rainfall=4.21"

Area (ac)	CN	Description
3.870	71	Meadow, non-grazed, HSG C
3.870		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	120	0.3333	0.35		**Sheet Flow, 3:1 Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
7.8	950	0.0100	2.03		**Shallow Concentrated Flow, 1% Channel** Paved Kv= 20.3 fps
13.5	1,070	Total			

Summary for Subcatchment 6S: Sideslope

Runoff = 4.91 cfs @ 11.98 hrs, Volume= 0.234 af, Depth= 1.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 year - 24 hour Rainfall=4.21"

Area (ac)	CN	Description
1.820	71	Meadow, non-grazed, HSG C
1.820		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.1	110	0.3300	0.45		**Sheet Flow, 3:1 Sheet Flow** Grass: Dense n= 0.240 P2= 4.80"
2.4	380	0.0300	2.60		**Shallow Concentrated Flow, 3% Shallow Flow** Grassed Waterway Kv= 15.0 fps
6.5	490	Total			

Summary for Subcatchment 6SE: Sideslope

Runoff = 4.03 cfs @ 11.98 hrs, Volume= 0.191 af, Depth= 1.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 year - 24 hour Rainfall=4.21"

Area (ac)	CN	Description
1.487	71	Meadow, non-grazed, HSG C
1.487		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.0	45	0.3300	0.37		**Sheet Flow, 3:1 Sheet Flow** Grass: Dense n= 0.240 P2= 4.80"
4.4	680	0.0300	2.60		**Shallow Concentrated Flow, 3% Shallow Flow** Grassed Waterway Kv= 15.0 fps
6.4	725	Total			

Summary for Subcatchment 6SW: Sideslope

Runoff = 6.22 cfs @ 11.99 hrs, Volume= 0.297 af, Depth= 1.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 year - 24 hour Rainfall=4.21"

Area (ac)	CN	Description
2.314	71	Meadow, non-grazed, HSG C
2.314		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.8	100	0.3300	0.44		**Sheet Flow, 3:1 Sheet Flow** Grass: Dense n= 0.240 P2= 4.80"
2.8	430	0.0300	2.60		**Shallow Concentrated Flow, 3% Shallow Flow** Grassed Waterway Kv= 15.0 fps
6.6	530	Total			

Summary for Subcatchment 7E: Side Slope

Runoff = 7.41 cfs @ 12.01 hrs, Volume= 0.387 af, Depth= 1.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 year - 24 hour Rainfall=4.21"

Area (ac)	CN	Description
3.018	71	Meadow, non-grazed, HSG C
3.018		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.4	40	0.3333	0.28		**Sheet Flow, 3:1 Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
4.5	700	0.0300	2.60		**Shallow Concentrated Flow, 3% Shallow Flow** Grassed Waterway Kv= 15.0 fps
2.0	250	0.0200	2.12		**Shallow Concentrated Flow, 2% Concentrated Flow** Grassed Waterway Kv= 15.0 fps
0.0	60	0.3300	44.39	78.45	**Pipe Channel, Drop Pipe** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.010 PVC, smooth interior
8.9	1,050	Total			

Summary for Subcatchment 7S: Sideslope

Runoff = 5.60 cfs @ 11.99 hrs, Volume= 0.272 af, Depth= 1.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 year - 24 hour Rainfall=4.21"

Area (ac)	CN	Description
2.118	71	Meadow, non-grazed, HSG C
2.118		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.1	110	0.3300	0.45		**Sheet Flow, 3:1 Sheet Flow** Grass: Dense n= 0.240 P2= 4.80"
2.9	450	0.0300	2.60		**Shallow Concentrated Flow, 3% Shallow Flow** Grassed Waterway Kv= 15.0 fps
7.0	560	Total			

Summary for Subcatchment 7SE: Sideslope

Runoff = 5.38 cfs @ 12.01 hrs, Volume= 0.284 af, Depth= 1.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 year - 24 hour Rainfall=4.21"

Area (ac)	CN	Description
2.211	71	Meadow, non-grazed, HSG C
2.211		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.8	100	0.3300	0.44		**Sheet Flow, 3:1 Sheet Flow** Grass: Dense n= 0.240 P2= 4.80"
5.3	830	0.0300	2.60		**Shallow Concentrated Flow, 3% Shallow Flow** Grassed Waterway Kv= 15.0 fps
9.1	930	Total			

Summary for Subcatchment 7SW: Sideslope

Runoff = 8.03 cfs @ 12.00 hrs, Volume= 0.410 af, Depth= 1.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 year - 24 hour Rainfall=4.21"

Area (ac)	CN	Description
3.196	71	Meadow, non-grazed, HSG C
3.196		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.6	126	0.3300	0.46		**Sheet Flow, 3:1 Sheet Flow** Grass: Dense n= 0.240 P2= 4.80"
3.7	570	0.0300	2.60		**Shallow Concentrated Flow, 3% Shallow Flow** Grassed Waterway Kv= 15.0 fps
8.3	696	Total			

Summary for Subcatchment 8E: Sideslope

Runoff = 3.17 cfs @ 11.95 hrs, Volume= 0.135 af, Depth= 1.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 year - 24 hour Rainfall=4.21"

Area (ac)	CN	Description
1.052	71	Meadow, non-grazed, HSG C
1.052		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.7	70	0.3333	0.32		**Sheet Flow, 3:1 Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"

Summary for Subcatchment 8SE: Sideslope

Runoff = 3.76 cfs @ 11.96 hrs, Volume= 0.168 af, Depth= 1.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 year - 24 hour Rainfall=4.21"

Area (ac)	CN	Description
1.308	71	Meadow, non-grazed, HSG C
1.308		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.4	30	0.3300	0.35		**Sheet Flow, 3:1 Sheet Flow** Grass: Dense n= 0.240 P2= 4.80"
3.5	550	0.0300	2.60		**Shallow Concentrated Flow, 3% Shallow Flow** Grassed Waterway Kv= 15.0 fps
4.9	580	Total			

Summary for Subcatchment 8SW: Sideslope

Runoff = 2.64 cfs @ 11.98 hrs, Volume= 0.122 af, Depth= 1.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 year - 24 hour Rainfall=4.21"

Area (ac)	CN	Description
0.953	71	Meadow, non-grazed, HSG C
0.953		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.4	30	0.3300	0.35		**Sheet Flow, 3:1 Sheet Flow** Grass: Dense n= 0.240 P2= 4.80"
4.4	680	0.0300	2.60		**Shallow Concentrated Flow, 3% Shallow Flow** Grassed Waterway Kv= 15.0 fps
5.8	710	Total			

Summary for Subcatchment 9E: Side Slope

Runoff = 1.75 cfs @ 12.00 hrs, Volume= 0.087 af, Depth= 1.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 year - 24 hour Rainfall=4.21"

Area (ac)	CN	Description
0.680	71	Meadow, non-grazed, HSG C
0.680		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.7	70	0.3333	0.32		**Sheet Flow, 3:1 Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
3.9	500	0.0200	2.12		**Shallow Concentrated Flow, 2% Shallow Flow** Grassed Waterway Kv= 15.0 fps
0.1	300	0.3333	44.61	78.84	**Pipe Channel, Drop Pipe** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.010 PVC, smooth interior
7.7	870	Total			

Summary for Subcatchment 9SE: Sideslope

Runoff = 1.79 cfs @ 11.97 hrs, Volume= 0.082 af, Depth= 1.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 year - 24 hour Rainfall=4.21"

Area (ac)	CN	Description
0.641	71	Meadow, non-grazed, HSG C
0.641		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.8	40	0.3300	0.37		**Sheet Flow, 3:1 Sheet Flow** Grass: Dense n= 0.240 P2= 4.80"
3.8	600	0.0300	2.60		**Shallow Concentrated Flow, 3% Shallow Flow** Grassed Waterway Kv= 15.0 fps
5.6	640	Total			

Summary for Subcatchment 10E: Side Slope

Runoff = 1.51 cfs @ 12.01 hrs, Volume= 0.079 af, Depth= 1.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 year - 24 hour Rainfall=4.21"

Area (ac)	CN	Description
0.614	71	Meadow, non-grazed, HSG C
0.614		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.5	90	0.3333	0.33		**Sheet Flow, 3:1 Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
4.3	550	0.0200	2.12		**Shallow Concentrated Flow, 2% Shallow Flow** Grassed Waterway Kv= 15.0 fps
0.1	210	0.3333	44.61	78.84	**Pipe Channel, Drop Pipe** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.010 PVC, smooth interior
8.9	850	Total			

Summary for Subcatchment 10SE: Southeast Top

Runoff = 7.70 cfs @ 12.08 hrs, Volume= 0.503 af, Depth= 1.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 year - 24 hour Rainfall=4.21"

Area (ac)	CN	Description
3.918	71	Meadow, non-grazed, HSG C
3.918		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.7	100	0.0200	0.14		**Sheet Flow, 2% Sheet Flow** Grass: Dense n= 0.240 P2= 4.80"
3.1	390	0.0200	2.12		**Shallow Concentrated Flow, 2% Shallow Flow** Grassed Waterway Kv= 15.0 fps
14.8	490	Total			

Summary for Subcatchment 11E: Side Slope

Runoff = 2.37 cfs @ 12.03 hrs, Volume= 0.130 af, Depth= 1.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 year - 24 hour Rainfall=4.21"

Area (ac)	CN	Description
1.017	71	Meadow, non-grazed, HSG C
1.017		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	120	0.3333	0.35		**Sheet Flow, 3:1 Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
4.4	560	0.0200	2.12		**Shallow Concentrated Flow, 2% Shallow Flow** Grassed Waterway Kv= 15.0 fps
0.1	210	0.3333	44.61	78.84	**Pipe Channel, Drop Pipe** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.010 PVC, smooth interior
10.2	890	Total			

Summary for Subcatchment 11SE: Southeast Top

Runoff = 8.04 cfs @ 12.22 hrs, Volume= 0.750 af, Depth= 1.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 year - 24 hour Rainfall=4.21"

Area (ac)	CN	Description
5.848	71	Meadow, non-grazed, HSG C
5.848		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
23.9	300	0.0300	0.21		**Sheet Flow, 3% Sheet Flow** Grass: Dense n= 0.240 P2= 4.80"
2.9	375	0.0200	2.12		**Shallow Concentrated Flow, 2% Shallow Flow** Grassed Waterway Kv= 15.0 fps
26.8	675	Total			

Summary for Subcatchment 12E: Side Slope

Runoff = 1.54 cfs @ 11.96 hrs, Volume= 0.069 af, Depth= 1.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 year - 24 hour Rainfall=4.21"

Area (ac)	CN	Description
0.535	71	Meadow, non-grazed, HSG C
0.535		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.9	100	0.3333	0.34		**Sheet Flow, 3:1 Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"

Summary for Subcatchment 12SE: Southeast Top

Runoff = 12.42 cfs @ 12.21 hrs, Volume= 1.162 af, Depth= 1.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 year - 24 hour Rainfall=4.21"

Area (ac)	CN	Description
9.055	71	Meadow, non-grazed, HSG C
9.055		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
23.9	300	0.0300	0.21		**Sheet Flow, 3% Sheet Flow** Grass: Dense n= 0.240 P2= 4.80"
3.1	400	0.0200	2.12		**Shallow Concentrated Flow, 2% Shallow Flow** Grassed Waterway Kv= 15.0 fps
27.0	700	Total			

Summary for Subcatchment 13E: Side Slope

Runoff = 2.42 cfs @ 11.97 hrs, Volume= 0.110 af, Depth= 1.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 year - 24 hour Rainfall=4.21"

Area (ac)	CN	Description
0.855	71	Meadow, non-grazed, HSG C
0.855		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.4	20	0.3333	0.25		**Sheet Flow, 3:1 Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
3.1	400	0.0200	2.12		**Shallow Concentrated Flow, 2% Shallow Flow** Grassed Waterway Kv= 15.0 fps
0.8	266	0.0050	5.46	9.66	**Pipe Channel, Culvert** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.010 PVC, smooth interior
5.3	686	Total			

Summary for Subcatchment 13SE: Sideslope

Runoff = 6.46 cfs @ 11.99 hrs, Volume= 0.317 af, Depth= 1.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 year - 24 hour Rainfall=4.21"

Area (ac)	CN	Description
2.473	71	Meadow, non-grazed, HSG C
2.473		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.6	95	0.3300	0.43		**Sheet Flow, 3:1 Sheet Flow** Grass: Dense n= 0.240 P2= 4.80"
3.7	570	0.0300	2.60		**Shallow Concentrated Flow, 3% Shallow Flow** Grassed Waterway Kv= 15.0 fps
7.3	665	Total			

Summary for Subcatchment NPD: North Pond Direct

[46] Hint: Tc=0 (Instant runoff peak depends on dt)

Runoff = 6.99 cfs @ 11.90 hrs, Volume= 0.325 af, Depth= 3.97"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 year - 24 hour Rainfall=4.21"

Area (ac)	CN	Description
0.982	98	Water Surface, HSG C
0.982		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0					**Direct Entry, Direct Entry**

Summary for Subcatchment NPEB: Exterior Berm

Runoff = 2.37 cfs @ 11.93 hrs, Volume= 0.096 af, Depth= 1.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 year - 24 hour Rainfall=4.21"

Area (ac)	CN	Description
0.750	71	Meadow, non-grazed, HSG C
0.750		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.4	40	0.3333	0.28		**Sheet Flow, 2% Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"

Summary for Subcatchment NWPD: NW Pond Direct

[46] Hint: Tc=0 (Instant runoff peak depends on dt)

Runoff = 6.67 cfs @ 11.90 hrs, Volume= 0.311 af, Depth= 3.97"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 year - 24 hour Rainfall=4.21"

Area (ac)	CN	Description
0.938	98	Water Surface, HSG C
0.938		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0					**Direct Entry, Direct Entry**

Summary for Subcatchment NWPEB: Exterior Berm

Runoff = 3.70 cfs @ 12.07 hrs, Volume= 0.236 af, Depth= 1.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 year - 24 hour Rainfall=4.21"

Area (ac)	CN	Description
1.839	71	Meadow, non-grazed, HSG C
1.839		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.3	60	0.3333	0.31		**Sheet Flow, 3:1 Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
10.8	970	0.0100	1.50		**Shallow Concentrated Flow, 1% Shallow Flow** Grassed Waterway Kv= 15.0 fps
14.1	1,030	Total			

Summary for Subcatchment SEPD: SE Pond Direct

[46] Hint: Tc=0 (Instant runoff peak depends on dt)

Runoff = 4.82 cfs @ 11.90 hrs, Volume= 0.225 af, Depth= 3.97"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 year - 24 hour Rainfall=4.21"

Area (ac)	CN	Description
0.678	98	Water Surface, HSG C
0.678		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0					**Direct Entry, Direct Entry**

Summary for Subcatchment SEPEB: Exterior Berm

Runoff = 4.41 cfs @ 11.96 hrs, Volume= 0.191 af, Depth= 1.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 year - 24 hour Rainfall=4.21"

Area (ac)	CN	Description
1.488	71	Meadow, non-grazed, HSG C
1.488		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.1	80	0.3333	0.32		**Sheet Flow, 3:1 Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"

Summary for Subcatchment SPD: S Pond Direct

[46] Hint: Tc=0 (Instant runoff peak depends on dt)

Runoff = 3.75 cfs @ 11.90 hrs, Volume= 0.175 af, Depth= 3.97"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 year - 24 hour Rainfall=4.21"

Area (ac)	CN	Description
0.527	98	Water Surface, HSG C
0.527		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0					**Direct Entry, Direct Entry**

Summary for Subcatchment SPEB: Exterior Berm

Runoff = 17.09 cfs @ 11.98 hrs, Volume= 0.794 af, Depth= 1.90"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 year - 24 hour Rainfall=4.21"

Area (ac)	CN	Description
3.822	71	Meadow, non-grazed, HSG C
1.192	91	Urban industrial, 72% imp, HSG C
5.014	76	Weighted Average
4.156		82.88% Pervious Area
0.858		17.12% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.8	50	0.3333	0.29		**Sheet Flow, 3:1 Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
3.2	390	0.0100	2.03		**Shallow Concentrated Flow, 1% Shallow Flow** Paved Kv= 20.3 fps
6.0	440	Total			

Summary for Subcatchment SWPD: SW Pond Direct

[46] Hint: Tc=0 (Instant runoff peak depends on dt)

Runoff = 5.96 cfs @ 11.90 hrs, Volume= 0.277 af, Depth= 3.97"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 year - 24 hour Rainfall=4.21"

Area (ac)	CN	Description
0.837	98	Water Surface, HSG C
0.837		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0					**Direct Entry, Direct Entry**

Summary for Subcatchment SWPEB: Exterior Berm

Runoff = 6.06 cfs @ 11.96 hrs, Volume= 0.268 af, Depth= 1.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 year - 24 hour Rainfall=4.21"

Area (ac)	CN	Description
2.086	71	Meadow, non-grazed, HSG C
2.086		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.6	80	0.2500	0.29		**Sheet Flow, 4:1 Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"

Summary for Reach 3R: (new Reach)

[40] Hint: Not Described (Outflow=Inflow)

Summary for Pond 1ED: East Ditch 1

Inflow Area = 0.855 ac, 0.00% Impervious, Inflow Depth = 1.54" for 10 year - 24 hour event
Inflow = 2.42 cfs @ 11.97 hrs, Volume= 0.110 af
Outflow = 1.70 cfs @ 12.03 hrs, Volume= 0.103 af, Atten= 30%, Lag= 3.5 min
Primary = 1.70 cfs @ 12.03 hrs, Volume= 0.103 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 712.12' @ 12.03 hrs Surf.Area= 1,620 sf Storage= 1,074 cf
Flood Elev= 715.00' Surf.Area= 4,659 sf Storage= 9,544 cf

Plug-Flow detention time= 62.4 min calculated for 0.103 af (94% of inflow)
Center-of-Mass det. time= 30.0 min (880.5 - 850.6)

Volume	Invert	Avail.Storage	Storage Description
#1	711.00'	14,929 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
711.00	254	0	0
712.00	1,520	887	887
714.00	3,205	4,725	5,612
716.00	6,112	9,317	14,929

Device	Routing	Invert	Outlet Devices
#1	Primary	711.50'	**16.0" Round Culvert** L= 230.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 711.50' / 709.00' S= 0.0109 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 1.40 sf

#2	Secondary	715.00'	**115.0' long x 30.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=1.70 cfs @ 12.03 hrs HW=712.12' (Free Discharge)
└**1=Culvert** (Inlet Controls 1.70 cfs @ 2.68 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=711.00' (Free Discharge)
└**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond 2ED: East Ditch 2

[79] Warning: Submerged Pond 1ED Primary device # 1 OUTLET by 1.75'

Inflow Area = 3.021 ac, 0.00% Impervious, Inflow Depth = 1.51" for 10 year - 24 hour event
Inflow = 6.74 cfs @ 12.01 hrs, Volume= 0.381 af
Outflow = 5.19 cfs @ 12.07 hrs, Volume= 0.377 af, Atten= 23%, Lag= 4.1 min
Primary = 5.19 cfs @ 12.07 hrs, Volume= 0.377 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 710.75' @ 12.07 hrs Surf.Area= 2,192 sf Storage= 2,189 cf
Flood Elev= 713.80' Surf.Area= 6,136 sf Storage= 14,023 cf

Plug-Flow detention time= 20.7 min calculated for 0.377 af (99% of inflow)
Center-of-Mass det. time= 13.7 min (874.5 - 860.9)

Volume	Invert	Avail.Storage	Storage Description
#1	709.00'	15,282 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
709.00	0	0	0
710.00	1,558	779	779
712.00	3,244	4,802	5,581
714.00	6,457	9,701	15,282

Device	Routing	Invert	Outlet Devices
#1	Primary	709.50'	**16.0" Round Culvert** L= 90.0' RCP, end-section conforming to fill, Ke= 0.500 Inlet / Outlet Invert= 709.50' / 708.50' S= 0.0111 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 1.40 sf
#2	Secondary	713.80'	**115.0' long x 30.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=5.18 cfs @ 12.07 hrs HW=710.75' (Free Discharge)
└**1=Culvert** (Inlet Controls 5.18 cfs @ 3.81 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=709.00' (Free Discharge)
└**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond 3ED: East Ditch 3

[81] Warning: Exceeded Pond 2ED by 2.53' @ 13.60 hrs
[81] Warning: Exceeded Pond 4ED by 0.42' @ 14.87 hrs

Inflow Area = 40.001 ac, 0.00% Impervious, Inflow Depth = 1.45" for 10 year - 24 hour event
Inflow = 18.80 cfs @ 12.01 hrs, Volume= 4.827 af
Outflow = 12.52 cfs @ 13.46 hrs, Volume= 4.826 af, Atten= 33%, Lag= 86.6 min
Primary = 12.52 cfs @ 13.46 hrs, Volume= 4.826 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 712.32' @ 13.46 hrs Surf.Area= 11,770 sf Storage= 17,011 cf
Flood Elev= 713.80' Surf.Area= 20,308 sf Storage= 40,715 cf

Plug-Flow detention time= 13.4 min calculated for 4.825 af (100% of inflow)
Center-of-Mass det. time= 13.3 min (912.7 - 899.3)

Volume	Invert	Avail.Storage	Storage Description
#1	708.00'	44,892 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
708.00	0	0	0
710.00	1,805	1,805	1,805
712.00	9,909	11,714	13,519
714.00	21,464	31,373	44,892

Device	Routing	Invert	Outlet Devices
#1	Primary	708.19'	**16.0" Round Culvert** L= 75.0' RCP, end-section conforming to fill, Ke= 0.500 Inlet / Outlet Invert= 708.19' / 707.50' S= 0.0092 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 1.40 sf
#2	Secondary	713.80'	**300.0' long x 30.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=12.52 cfs @ 13.46 hrs HW=712.32' (Free Discharge)
1=Culvert (Inlet Controls 12.52 cfs @ 8.96 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=708.00' (Free Discharge)
2=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Summary for Pond 4ED: Exist Ditch 4

[58] Hint: Peaked 0.04' above defined flood level

Inflow Area = 35.248 ac, 0.00% Impervious, Inflow Depth = 1.54" for 10 year - 24 hour event
Inflow = 47.88 cfs @ 12.03 hrs, Volume= 4.522 af
Outflow = 26.32 cfs @ 12.40 hrs, Volume= 4.513 af, Atten= 45%, Lag= 22.1 min
Primary = 12.50 cfs @ 12.40 hrs, Volume= 4.228 af
Secondary = 13.83 cfs @ 12.40 hrs, Volume= 0.285 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 713.84' @ 12.40 hrs Surf.Area= 36,520 sf Storage= 44,454 cf
Flood Elev= 713.80' Surf.Area= 35,801 sf Storage= 42,961 cf

Plug-Flow detention time= 29.2 min calculated for 4.513 af (100% of inflow)

Center-of-Mass det. time= 27.9 min (894.3 - 866.4)

Volume	Invert	Avail.Storage	Storage Description
#1	709.00'	106,611 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
709.00	0	0	0
712.00	4,475	6,713	6,713
714.00	39,282	43,757	50,470
715.00	73,000	56,141	106,611

Device	Routing	Invert	Outlet Devices
#1	Primary	709.72'	**16.0" Round Culvert** L= 65.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 709.72' / 709.24' S= 0.0074 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 1.40 sf
#2	Secondary	713.80'	**510.0' long x 30.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=12.50 cfs @ 12.40 hrs HW=713.84' (Free Discharge)
1=Culvert (Inlet Controls 12.50 cfs @ 8.95 fps)

Secondary OutFlow Max=11.46 cfs @ 12.40 hrs HW=713.84' (Free Discharge)
2=Broad-Crested Rectangular Weir (Weir Controls 11.46 cfs @ 0.54 fps)

Summary for Pond C10SE: Catch Basin

Inflow Area = 3.918 ac, 0.00% Impervious, Inflow Depth = 1.54" for 10 year - 24 hour event
Inflow = 7.70 cfs @ 12.08 hrs, Volume= 0.503 af
Outflow = 7.62 cfs @ 12.09 hrs, Volume= 0.503 af, Atten= 1%, Lag= 0.9 min
Primary = 7.62 cfs @ 12.09 hrs, Volume= 0.503 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 810.57' @ 12.09 hrs Surf.Area= 1,318 sf Storage= 659 cf
Flood Elev= 813.00' Surf.Area= 18,960 sf Storage= 19,070 cf

Plug-Flow detention time= 3.1 min calculated for 0.503 af (100% of inflow)
Center-of-Mass det. time= 3.1 min (862.5 - 859.4)

Volume	Invert	Avail.Storage	Storage Description
#1	810.00'	46,175 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
810.00	0	0	0
811.00	2,300	1,150	1,150
812.00	7,290	4,795	5,945
813.00	18,960	13,125	19,070
814.00	35,250	27,105	46,175

Device	Routing	Invert	Outlet Devices
#1	Primary	810.00'	**20.5" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Secondary	813.00'	**100.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00

3.50 4.00 4.50 5.00 5.50
Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73
2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=7.61 cfs @ 12.09 hrs HW=810.57' (Free Discharge)
└**1=Orifice/Grate** (Weir Controls 7.61 cfs @ 2.48 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=810.00' (Free Discharge)
└**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond C11SE: Catch Basin

Inflow Area = 5.848 ac, 0.00% Impervious, Inflow Depth = 1.54" for 10 year - 24 hour event
Inflow = 8.04 cfs @ 12.22 hrs, Volume= 0.750 af
Outflow = 8.01 cfs @ 12.24 hrs, Volume= 0.750 af, Atten= 0%, Lag= 1.3 min
Primary = 8.01 cfs @ 12.24 hrs, Volume= 0.750 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 803.59' @ 12.24 hrs Surf.Area= 1,594 sf Storage= 797 cf
Flood Elev= 806.00' Surf.Area= 13,540 sf Storage= 16,100 cf

Plug-Flow detention time= 3.2 min calculated for 0.750 af (100% of inflow)
Center-of-Mass det. time= 3.2 min (873.7 - 870.5)

Volume	Invert	Avail.Storage	Storage Description
#1	803.00'	33,425 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
803.00	0	0	0
804.00	2,690	1,345	1,345
805.00	6,640	4,665	6,010
806.00	13,540	10,090	16,100
807.00	21,110	17,325	33,425

Device	Routing	Invert	Outlet Devices
#1	Primary	803.00'	**20.5" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Secondary	806.00'	**100.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=8.00 cfs @ 12.24 hrs HW=803.59' (Free Discharge)
└**1=Orifice/Grate** (Weir Controls 8.00 cfs @ 2.52 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=803.00' (Free Discharge)
└**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond C12SE: Catch Basin

Inflow Area = 9.055 ac, 0.00% Impervious, Inflow Depth = 1.54" for 10 year - 24 hour event
Inflow = 12.42 cfs @ 12.21 hrs, Volume= 1.162 af
Outflow = 12.41 cfs @ 12.22 hrs, Volume= 1.162 af, Atten= 0%, Lag= 0.1 min
Primary = 12.41 cfs @ 12.22 hrs, Volume= 1.162 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 798.00' @ 12.22 hrs Surf.Area= 80 sf Storage= 20 cf
Flood Elev= 801.50' Surf.Area= 15,910 sf Storage= 24,215 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 0.0 min (870.7 - 870.7)

Volume	Invert	Avail.Storage	Storage Description
#1	797.50'	92,310 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
797.50	0	0	0
798.00	80	20	20
800.00	5,470	5,550	5,570
802.00	19,390	24,860	30,430
804.00	42,490	61,880	92,310

Device	Routing	Invert	Outlet Devices
#1	Primary	797.50'	**20.5" Horiz. Orifice/Grate X 2.00** C= 0.600 Limited to weir flow at low heads
#2	Secondary	801.50'	**100.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=12.41 cfs @ 12.22 hrs HW=798.00' (Free Discharge)
└**1=Orifice/Grate** (Weir Controls 12.41 cfs @ 2.31 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=797.50' (Free Discharge)
└**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond C13SE: Catch Basin

Inflow Area = 2.473 ac, 0.00% Impervious, Inflow Depth = 1.54" for 10 year - 24 hour event
Inflow = 6.46 cfs @ 11.99 hrs, Volume= 0.317 af
Outflow = 6.45 cfs @ 12.00 hrs, Volume= 0.317 af, Atten= 0%, Lag= 0.1 min
Primary = 6.45 cfs @ 12.00 hrs, Volume= 0.317 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 724.51' @ 12.00 hrs Surf.Area= 120 sf Storage= 60 cf
Flood Elev= 727.00' Surf.Area= 2,097 sf Storage= 2,214 cf

Plug-Flow detention time= 0.4 min calculated for 0.317 af (100% of inflow)
Center-of-Mass det. time= 0.3 min (852.8 - 852.4)

Volume	Invert	Avail.Storage	Storage Description
#1	724.00'	5,126 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
724.00	0	0	0
725.00	233	117	117
726.00	932	583	699
727.00	2,097	1,515	2,214
728.00	3,728	2,913	5,126

Device	Routing	Invert	Outlet Devices
#1	Primary	724.00'	**20.5" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Secondary	727.00'	**100.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=6.44 cfs @ 12.00 hrs HW=724.51' (Free Discharge)
└**1=Orifice/Grate** (Weir Controls 6.44 cfs @ 2.34 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=724.00' (Free Discharge)
└**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond C1E: Catch Basin

Inflow Area = 17.841 ac, 0.00% Impervious, Inflow Depth = 1.54" for 10 year - 24 hour event
Inflow = 20.88 cfs @ 12.31 hrs, Volume= 2.289 af
Outflow = 20.81 cfs @ 12.32 hrs, Volume= 2.288 af, Atten= 0%, Lag= 0.7 min
Primary = 20.81 cfs @ 12.32 hrs, Volume= 2.288 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 798.04' @ 12.32 hrs Surf.Area= 189 sf Storage= 131 cf
Flood Elev= 801.50' Surf.Area= 16,283 sf Storage= 24,828 cf

Plug-Flow detention time= 0.3 min calculated for 2.288 af (100% of inflow)
Center-of-Mass det. time= 0.1 min (877.4 - 877.3)

Volume	Invert	Avail.Storage	Storage Description
#1	797.50'	31,194 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
797.50	0	0	0
798.00	82	21	21
800.00	5,628	5,710	5,731
802.00	19,835	25,463	31,194

Device	Routing	Invert	Outlet Devices
#1	Primary	797.50'	**20.5" Horiz. Orifice/Grate X 3.00** C= 0.600 Limited to weir flow at low heads
#2	Secondary	801.50'	**100.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=20.80 cfs @ 12.32 hrs HW=798.04' (Free Discharge)
└**1=Orifice/Grate** (Weir Controls 20.80 cfs @ 2.40 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=797.50' (Free Discharge)
└**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond C1N: Catch Basin

Inflow Area = 17.691 ac, 0.00% Impervious, Inflow Depth = 1.54" for 10 year - 24 hour event
Inflow = 21.34 cfs @ 12.29 hrs, Volume= 2.270 af
Outflow = 21.34 cfs @ 12.30 hrs, Volume= 2.270 af, Atten= 0%, Lag= 0.7 min
Primary = 21.34 cfs @ 12.30 hrs, Volume= 2.270 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 801.55' @ 12.30 hrs Surf.Area= 1,369 sf Storage= 685 cf
Flood Elev= 804.00' Surf.Area= 18,200 sf Storage= 21,950 cf

Plug-Flow detention time= 1.0 min calculated for 2.270 af (100% of inflow)
Center-of-Mass det. time= 1.0 min (876.8 - 875.8)

Volume	Invert	Avail.Storage	Storage Description
#1	801.00'	91,900 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
801.00	0	0	0
802.00	2,500	1,250	1,250
804.00	18,200	20,700	21,950
806.00	51,750	69,950	91,900

Device	Routing	Invert	Outlet Devices
#1	Primary	801.00'	**20.5" Horiz. Orifice/Grate X 3.00** C= 0.600 Limited to weir flow at low heads
#2	Secondary	804.00'	**100.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=21.34 cfs @ 12.30 hrs HW=801.55' (Free Discharge)
└**1=Orifice/Grate** (Weir Controls 21.34 cfs @ 2.42 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=801.00' (Free Discharge)
└**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond C1NW: Catch Basin

Inflow Area = 1.506 ac, 0.00% Impervious, Inflow Depth = 1.54" for 10 year - 24 hour event
Inflow = 4.26 cfs @ 11.97 hrs, Volume= 0.193 af
Outflow = 4.26 cfs @ 11.97 hrs, Volume= 0.193 af, Atten= 0%, Lag= 0.1 min
Primary = 4.26 cfs @ 11.97 hrs, Volume= 0.193 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Peak Elev= 785.39' @ 11.97 hrs Surf.Area= 104 sf Storage= 52 cf
Flood Elev= 788.00' Surf.Area= 2,403 sf Storage= 2,804 cf

Plug-Flow detention time= 0.4 min calculated for 0.193 af (100% of inflow)
Center-of-Mass det. time= 0.4 min (851.0 - 850.6)

Volume	Invert	Avail.Storage	Storage Description
#1	785.00'	11,882 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
785.00	0	0	0
786.00	267	134	134
788.00	2,403	2,670	2,804
790.00	6,675	9,078	11,882

Device	Routing	Invert	Outlet Devices
#1	Primary	785.00'	**20.5" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Secondary	788.00'	**100.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=4.25 cfs @ 11.97 hrs HW=785.39' (Free Discharge)
└**1=Orifice/Grate** (Weir Controls 4.25 cfs @ 2.04 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=785.00' (Free Discharge)
└**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond C1S: Catch Basin

Inflow Area = 3.455 ac, 0.00% Impervious, Inflow Depth = 1.54" for 10 year - 24 hour event
Inflow = 6.70 cfs @ 12.08 hrs, Volume= 0.443 af
Outflow = 6.68 cfs @ 12.09 hrs, Volume= 0.443 af, Atten= 0%, Lag= 0.5 min
Primary = 6.68 cfs @ 12.09 hrs, Volume= 0.443 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 809.53' @ 12.09 hrs Surf.Area= 620 sf Storage= 310 cf
Flood Elev= 812.00' Surf.Area= 12,050 sf Storage= 12,985 cf

Plug-Flow detention time= 1.6 min calculated for 0.443 af (100% of inflow)
Center-of-Mass det. time= 1.6 min (861.4 - 859.8)

Volume	Invert	Avail.Storage	Storage Description
#1	809.00'	30,580 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
809.00	0	0	0
810.00	1,180	590	590
811.00	5,780	3,480	4,070
812.00	12,050	8,915	12,985
813.00	23,140	17,595	30,580

Device	Routing	Invert	Outlet Devices
#1	Primary	809.00'	**20.5" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Secondary	812.00'	**100.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=6.68 cfs @ 12.09 hrs HW=809.53' (Free Discharge)
└**1=Orifice/Grate** (Weir Controls 6.68 cfs @ 2.37 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=809.00' (Free Discharge)
└**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond C1SE: Catch Basin

Inflow Area = 3.373 ac, 0.00% Impervious, Inflow Depth = 1.54" for 10 year - 24 hour event
Inflow = 6.61 cfs @ 12.08 hrs, Volume= 0.433 af
Outflow = 6.58 cfs @ 12.09 hrs, Volume= 0.433 af, Atten= 0%, Lag= 0.7 min
Primary = 6.58 cfs @ 12.09 hrs, Volume= 0.433 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 810.52' @ 12.09 hrs Surf.Area= 614 sf Storage= 307 cf
Flood Elev= 813.00' Surf.Area= 12,050 sf Storage= 12,985 cf

Plug-Flow detention time= 1.6 min calculated for 0.433 af (100% of inflow)
Center-of-Mass det. time= 1.6 min (861.1 - 859.5)

Volume	Invert	Avail.Storage	Storage Description
#1	810.00'	30,580 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
810.00	0	0	0
811.00	1,180	590	590
812.00	5,780	3,480	4,070
813.00	12,050	8,915	12,985
814.00	23,140	17,595	30,580

Device	Routing	Invert	Outlet Devices
#1	Primary	810.00'	**20.5" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Secondary	813.00'	**100.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=6.58 cfs @ 12.09 hrs HW=810.52' (Free Discharge)
└**1=Orifice/Grate** (Weir Controls 6.58 cfs @ 2.36 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=810.00' (Free Discharge)
└**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond C1SW: Catch Basin

Inflow Area = 4.734 ac, 0.00% Impervious, Inflow Depth = 1.54" for 10 year - 24 hour event
Inflow = 9.37 cfs @ 12.08 hrs, Volume= 0.607 af
Outflow = 8.92 cfs @ 12.11 hrs, Volume= 0.607 af, Atten= 5%, Lag= 2.1 min
Primary = 8.92 cfs @ 12.11 hrs, Volume= 0.607 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 811.65' @ 12.11 hrs Surf.Area= 2,958 sf Storage= 1,479 cf
Flood Elev= 815.00' Surf.Area= 44,099 sf Storage= 76,190 cf

Plug-Flow detention time= 5.7 min calculated for 0.607 af (100% of inflow)
Center-of-Mass det. time= 5.7 min (864.9 - 859.2)

Volume	Invert	Avail.Storage	Storage Description
#1	811.00'	120,289 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
811.00	0	0	0
812.00	4,533	2,267	2,267
814.00	25,292	29,825	32,092
816.00	62,905	88,197	120,289

Device	Routing	Invert	Outlet Devices
#1	Primary	811.00'	**20.5" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Secondary	815.00'	**100.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=8.92 cfs @ 12.11 hrs HW=811.65' (Free Discharge)
1=Orifice/Grate (Orifice Controls 8.92 cfs @ 3.89 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=811.00' (Free Discharge)
2=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Summary for Pond C1W: Catch Basin

Inflow Area = 16.760 ac, 0.00% Impervious, Inflow Depth = 1.54" for 10 year - 24 hour event
Inflow = 27.77 cfs @ 12.14 hrs, Volume= 2.150 af
Outflow = 27.53 cfs @ 12.16 hrs, Volume= 2.150 af, Atten= 1%, Lag= 1.3 min
Primary = 27.53 cfs @ 12.16 hrs, Volume= 2.150 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 799.69' @ 12.16 hrs Surf.Area= 2,556 sf Storage= 1,278 cf
Flood Elev= 803.00' Surf.Area= 25,337 sf Storage= 46,529 cf

Plug-Flow detention time= 1.5 min calculated for 2.150 af (100% of inflow)
Center-of-Mass det. time= 1.5 min (865.7 - 864.2)

Volume	Invert	Avail.Storage	Storage Description
#1	799.00'	71,866 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
799.00	0	0	0
800.00	3,697	1,849	1,849
802.00	15,646	19,343	21,192
804.00	35,028	50,674	71,866

Device	Routing	Invert	Outlet Devices
#1	Primary	799.00'	**20.5" Horiz. Orifice/Grate X 3.00** C= 0.600 Limited to weir flow at low heads
#2	Secondary	803.00'	**100.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=27.52 cfs @ 12.16 hrs HW=799.69' (Free Discharge)
1=Orifice/Grate (Orifice Controls 27.52 cfs @ 4.00 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=799.00' (Free Discharge)
2=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Summary for Pond C2N: Catch Basin

Inflow Area = 1.145 ac, 0.00% Impervious, Inflow Depth = 1.54" for 10 year - 24 hour event
Inflow = 3.09 cfs @ 11.98 hrs, Volume= 0.147 af
Outflow = 3.09 cfs @ 11.99 hrs, Volume= 0.147 af, Atten= 0%, Lag= 0.2 min
Primary = 3.09 cfs @ 11.99 hrs, Volume= 0.147 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 782.31' @ 11.99 hrs Surf.Area= 84 sf Storage= 42 cf
Flood Elev= 785.00' Surf.Area= 2,403 sf Storage= 2,804 cf

Plug-Flow detention time= 0.4 min calculated for 0.147 af (100% of inflow)
Center-of-Mass det. time= 0.4 min (852.1 - 851.7)

Volume	Invert	Avail.Storage	Storage Description
#1	782.00'	11,882 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
782.00	0	0	0
783.00	267	134	134
785.00	2,403	2,670	2,804
787.00	6,675	9,078	11,882

Device	Routing	Invert	Outlet Devices
#1	Primary	782.00'	**20.5" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Secondary	785.00'	**100.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=3.07 cfs @ 11.99 hrs HW=782.31' (Free Discharge)
1=Orifice/Grate (Weir Controls 3.07 cfs @ 1.83 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=782.00' (Free Discharge)
2=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Summary for Pond C2NW: Catch Basin

Inflow Area = 2.338 ac, 0.00% Impervious, Inflow Depth = 1.54" for 10 year - 24 hour event
Inflow = 5.13 cfs @ 12.04 hrs, Volume= 0.300 af
Outflow = 5.11 cfs @ 12.05 hrs, Volume= 0.300 af, Atten= 0%, Lag= 0.5 min
Primary = 5.11 cfs @ 12.05 hrs, Volume= 0.300 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 745.44' @ 12.05 hrs Surf.Area= 469 sf Storage= 234 cf
Flood Elev= 748.00' Surf.Area= 4,272 sf Storage= 5,874 cf

Plug-Flow detention time= 1.6 min calculated for 0.300 af (100% of inflow)
Center-of-Mass det. time= 1.6 min (858.2 - 856.6)

Volume	Invert	Avail.Storage	Storage Description
#1	745.00'	16,821 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
745.00	0	0	0
746.00	1,068	534	534
748.00	4,272	5,340	5,874
750.00	6,675	10,947	16,821

Device	Routing	Invert	Outlet Devices
#1	Primary	745.00'	**20.5" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Secondary	748.00'	**100.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=5.10 cfs @ 12.05 hrs HW=745.44' (Free Discharge)
1=Orifice/Grate (Weir Controls 5.10 cfs @ 2.17 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=745.00' (Free Discharge)
2=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Summary for Pond C2S: Catch Basin

Inflow Area = 7.410 ac, 0.00% Impervious, Inflow Depth = 1.54" for 10 year - 24 hour event
Inflow = 9.95 cfs @ 12.23 hrs, Volume= 0.951 af
Outflow = 9.87 cfs @ 12.26 hrs, Volume= 0.951 af, Atten= 1%, Lag= 1.6 min
Primary = 9.87 cfs @ 12.26 hrs, Volume= 0.951 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Peak Elev= 800.80' @ 12.26 hrs Surf.Area= 944 sf Storage= 472 cf
Flood Elev= 803.00' Surf.Area= 12,050 sf Storage= 12,985 cf

Plug-Flow detention time= 1.3 min calculated for 0.951 af (100% of inflow)
Center-of-Mass det. time= 1.3 min (872.7 - 871.4)

Volume	Invert	Avail.Storage	Storage Description
#1	800.00'	30,580 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
800.00	0	0	0
801.00	1,180	590	590
802.00	5,780	3,480	4,070
803.00	12,050	8,915	12,985
804.00	23,140	17,595	30,580

Device	Routing	Invert	Outlet Devices
#1	Primary	800.00'	**20.5" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Secondary	803.00'	**100.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=9.87 cfs @ 12.26 hrs HW=800.80' (Free Discharge)
└**1=Orifice/Grate** (Orifice Controls 9.87 cfs @ 4.31 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=800.00' (Free Discharge)
└**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond C2SE: Catch Basin

Inflow Area = 5.356 ac, 0.00% Impervious, Inflow Depth = 1.54" for 10 year - 24 hour event
Inflow = 7.35 cfs @ 12.21 hrs, Volume= 0.687 af
Outflow = 7.33 cfs @ 12.23 hrs, Volume= 0.687 af, Atten= 0%, Lag= 0.7 min
Primary = 7.33 cfs @ 12.23 hrs, Volume= 0.687 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 804.56' @ 12.23 hrs Surf.Area= 659 sf Storage= 330 cf
Flood Elev= 807.00' Surf.Area= 12,050 sf Storage= 12,985 cf

Plug-Flow detention time= 1.4 min calculated for 0.687 af (100% of inflow)
Center-of-Mass det. time= 1.4 min (872.1 - 870.7)

Volume	Invert	Avail.Storage	Storage Description
#1	804.00'	30,580 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
804.00	0	0	0
805.00	1,180	590	590
806.00	5,780	3,480	4,070
807.00	12,050	8,915	12,985
808.00	23,140	17,595	30,580

Device	Routing	Invert	Outlet Devices
#1	Primary	804.00'	**20.5" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Secondary	807.00'	**100.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=7.33 cfs @ 12.23 hrs HW=804.56' (Free Discharge)
1=Orifice/Grate (Weir Controls 7.33 cfs @ 2.44 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=804.00' (Free Discharge)
2=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Summary for Pond C2SW: Catch Basin

Inflow Area = 2.975 ac, 0.00% Impervious, Inflow Depth = 1.54" for 10 year - 24 hour event
Inflow = 7.93 cfs @ 11.99 hrs, Volume= 0.382 af
Outflow = 7.92 cfs @ 11.99 hrs, Volume= 0.382 af, Atten= 0%, Lag= 0.3 min
Primary = 7.92 cfs @ 11.99 hrs, Volume= 0.382 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 776.59' @ 11.99 hrs Surf.Area= 373 sf Storage= 186 cf
Flood Elev= 779.00' Surf.Area= 2,509 sf Storage= 3,360 cf

Plug-Flow detention time= 0.9 min calculated for 0.382 af (100% of inflow)
Center-of-Mass det. time= 0.9 min (852.9 - 852.0)

Volume	Invert	Avail.Storage	Storage Description
#1	776.00'	7,403 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
776.00	0	0	0
777.00	634	317	317
778.00	1,471	1,053	1,370
779.00	2,509	1,990	3,360
780.00	5,577	4,043	7,403

Device	Routing	Invert	Outlet Devices
#1	Primary	776.00'	**20.5" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Secondary	779.00'	**100.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=7.90 cfs @ 11.99 hrs HW=776.59' (Free Discharge)
1=Orifice/Grate (Weir Controls 7.90 cfs @ 2.51 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=776.00' (Free Discharge)
2=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Summary for Pond C2W: Catch Basin

Inflow Area = 1.924 ac, 0.00% Impervious, Inflow Depth = 1.54" for 10 year - 24 hour event
Inflow = 4.97 cfs @ 12.00 hrs, Volume= 0.247 af
Outflow = 4.96 cfs @ 12.00 hrs, Volume= 0.247 af, Atten= 0%, Lag= 0.1 min
Primary = 4.96 cfs @ 12.00 hrs, Volume= 0.247 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 769.43' @ 12.00 hrs Surf.Area= 100 sf Storage= 50 cf
Flood Elev= 772.00' Surf.Area= 2,097 sf Storage= 2,214 cf

Plug-Flow detention time= 0.4 min calculated for 0.247 af (100% of inflow)
Center-of-Mass det. time= 0.4 min (853.1 - 852.7)

Volume	Invert	Avail.Storage	Storage Description
#1	769.00'	9,903 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
769.00	0	0	0
770.00	233	117	117
771.00	932	583	699
772.00	2,097	1,515	2,214
773.00	3,728	2,913	5,126
774.00	5,825	4,777	9,903

Device	Routing	Invert	Outlet Devices
#1	Primary	769.00'	**20.5" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Secondary	772.00'	**100.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=4.95 cfs @ 12.00 hrs HW=769.43' (Free Discharge)
└**1=Orifice/Grate** (Weir Controls 4.95 cfs @ 2.14 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=769.00' (Free Discharge)
└**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond C3N: Catch Basin

Inflow Area = 1.762 ac, 0.00% Impervious, Inflow Depth = 1.54" for 10 year - 24 hour event
Inflow = 4.50 cfs @ 12.00 hrs, Volume= 0.226 af
Outflow = 4.47 cfs @ 12.01 hrs, Volume= 0.226 af, Atten= 1%, Lag= 0.5 min
Primary = 4.47 cfs @ 12.01 hrs, Volume= 0.226 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 742.40' @ 12.01 hrs Surf.Area= 215 sf Storage= 215 cf
Flood Elev= 745.00' Surf.Area= 2,670 sf Storage= 3,738 cf

Plug-Flow detention time= 1.6 min calculated for 0.226 af (100% of inflow)
Center-of-Mass det. time= 1.6 min (854.6 - 853.0)

Volume	Invert	Avail.Storage	Storage Description
#1	742.00'	11,882 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
742.00	0	0	0
744.00	1,068	1,068	1,068
746.00	4,272	5,340	6,408
747.00	6,675	5,474	11,882

Device	Routing	Invert	Outlet Devices
#1	Primary	742.00'	**20.5" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Secondary	745.00'	**100.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=4.47 cfs @ 12.01 hrs HW=742.40' (Free Discharge)
└**1=Orifice/Grate** (Weir Controls 4.47 cfs @ 2.07 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=742.00' (Free Discharge)
└**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond C3NW: Northwest Ditch

Inflow Area = 9.855 ac, 0.00% Impervious, Inflow Depth = 1.54" for 10 year - 24 hour event
Inflow = 23.08 cfs @ 12.01 hrs, Volume= 1.264 af
Outflow = 20.57 cfs @ 12.05 hrs, Volume= 1.264 af, Atten= 11%, Lag= 2.5 min
Primary = 20.57 cfs @ 12.05 hrs, Volume= 1.264 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 721.85' @ 12.05 hrs Surf.Area= 2,243 sf Storage= 2,603 cf
Flood Elev= 723.00' Surf.Area= 4,539 sf Storage= 7,343 cf

Plug-Flow detention time= 1.2 min calculated for 1.264 af (100% of inflow)
Center-of-Mass det. time= 1.2 min (855.9 - 854.6)

Volume	Invert	Avail.Storage	Storage Description
#1	719.00'	11,882 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
719.00	0	0	0
720.00	267	134	134
722.00	2,403	2,670	2,804
724.00	6,675	9,078	11,882

Device	Routing	Invert	Outlet Devices
#1	Primary	719.00'	**24.0" Round Culvert** L= 100.0' CMP, end-section conforming to fill, Ke= 0.500 Inlet / Outlet Invert= 719.00' / 705.00' S= 0.1400 '/' Cc= 0.900 n= 0.018, Flow Area= 3.14 sf
#2	Secondary	723.00'	**100.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50

Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=20.56 cfs @ 12.05 hrs HW=721.85' (Free Discharge)
└**1=Culvert** (Inlet Controls 20.56 cfs @ 6.55 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=719.00' (Free Discharge)
└**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond C3S: Catch Basin

Inflow Area = 20.973 ac, 0.00% Impervious, Inflow Depth = 1.54" for 10 year - 24 hour event
Inflow = 27.37 cfs @ 12.25 hrs, Volume= 2.691 af
Outflow = 27.18 cfs @ 12.27 hrs, Volume= 2.691 af, Atten= 1%, Lag= 1.7 min
Primary = 18.12 cfs @ 12.27 hrs, Volume= 1.794 af
Secondary = 9.06 cfs @ 12.27 hrs, Volume= 0.897 af
Tertiary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 797.37' @ 12.27 hrs Surf.Area= 2,615 sf Storage= 1,700 cf
Flood Elev= 800.70' Surf.Area= 41,310 sf Storage= 68,694 cf

Plug-Flow detention time= 1.8 min calculated for 2.690 af (100% of inflow)
Center-of-Mass det. time= 1.8 min (874.4 - 872.5)

Volume	Invert	Avail.Storage	Storage Description
#1	796.70'	322,396 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
796.70	0	0	0
798.00	5,040	3,276	3,276
800.00	27,240	32,280	35,556
802.00	67,440	94,680	130,236
804.00	124,720	192,160	322,396

Device	Routing	Invert	Outlet Devices
#1	Primary	796.70'	**20.5" Horiz. Orifice/Grate X 2.00** C= 0.600 Limited to weir flow at low heads
#2	Secondary	796.70'	**20.5" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Tertiary	800.70'	**100.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=18.12 cfs @ 12.27 hrs HW=797.37' (Free Discharge)
└**1=Orifice/Grate** (Orifice Controls 18.12 cfs @ 3.95 fps)

Secondary OutFlow Max=9.06 cfs @ 12.27 hrs HW=797.37' (Free Discharge)
└**2=Orifice/Grate** (Orifice Controls 9.06 cfs @ 3.95 fps)

Tertiary OutFlow Max=0.00 cfs @ 0.00 hrs HW=796.70' (Free Discharge)
└**3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond C3SE: Catch Basin

Inflow Area = 12.185 ac, 0.00% Impervious, Inflow Depth = 1.54" for 10 year - 24 hour event
Inflow = 16.59 cfs @ 12.22 hrs, Volume= 1.563 af
Outflow = 16.58 cfs @ 12.23 hrs, Volume= 1.563 af, Atten= 0%, Lag= 0.1 min
Primary = 16.58 cfs @ 12.23 hrs, Volume= 1.563 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 799.61' @ 12.23 hrs Surf.Area= 350 sf Storage= 175 cf
Flood Elev= 803.00' Surf.Area= 27,802 sf Storage= 41,827 cf

Plug-Flow detention time= 0.3 min calculated for 1.563 af (100% of inflow)
Center-of-Mass det. time= 0.3 min (871.3 - 871.0)

Volume	Invert	Avail.Storage	Storage Description
#1	799.00'	200,239 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
799.00	0	0	0
800.00	577	289	289
802.00	13,160	13,737	14,026
804.00	42,443	55,603	69,629
806.00	88,167	130,610	200,239

Device	Routing	Invert	Outlet Devices
#1	Primary	799.00'	**20.5" Horiz. Orifice/Grate X 2.00** C= 0.600 Limited to weir flow at low heads
#2	Secondary	803.00'	**100.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=16.57 cfs @ 12.23 hrs HW=799.61' (Free Discharge)
↑—**1=Orifice/Grate** (Weir Controls 16.57 cfs @ 2.55 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=799.00' (Free Discharge)
↑—**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond C3SW: Catch Basin

Inflow Area = 2.085 ac, 0.00% Impervious, Inflow Depth = 1.54" for 10 year - 24 hour event
Inflow = 5.43 cfs @ 11.99 hrs, Volume= 0.268 af
Outflow = 5.42 cfs @ 12.00 hrs, Volume= 0.268 af, Atten= 0%, Lag= 0.1 min
Primary = 5.42 cfs @ 12.00 hrs, Volume= 0.268 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 752.96' @ 12.00 hrs Surf.Area= 106 sf Storage= 53 cf
Flood Elev= 755.50' Surf.Area= 2,097 sf Storage= 2,214 cf

Plug-Flow detention time= 0.3 min calculated for 0.267 af (100% of inflow)
Center-of-Mass det. time= 0.3 min (852.9 - 852.5)

Volume	Invert	Avail.Storage	Storage Description
#1	752.50'	9,903 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
752.50	0	0	0
753.50	233	117	117
754.50	932	583	699
755.50	2,097	1,515	2,214
756.50	3,728	2,913	5,126
757.50	5,825	4,777	9,903

Device	Routing	Invert	Outlet Devices
#1	Primary	752.50'	**20.5" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Secondary	755.50'	**100.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=5.41 cfs @ 12.00 hrs HW=752.96' (Free Discharge)
└**1=Orifice/Grate** (Weir Controls 5.41 cfs @ 2.21 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=752.50' (Free Discharge)
└**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond C3W: Catch Basin

Inflow Area = 1.543 ac, 0.00% Impervious, Inflow Depth = 1.54" for 10 year - 24 hour event
Inflow = 3.97 cfs @ 12.00 hrs, Volume= 0.198 af
Outflow = 3.97 cfs @ 12.00 hrs, Volume= 0.198 af, Atten= 0%, Lag= 0.1 min
Primary = 3.97 cfs @ 12.00 hrs, Volume= 0.198 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 742.37' @ 12.00 hrs Surf.Area= 86 sf Storage= 43 cf
Flood Elev= 744.00' Surf.Area= 932 sf Storage= 699 cf

Plug-Flow detention time= 0.4 min calculated for 0.198 af (100% of inflow)
Center-of-Mass det. time= 0.4 min (853.2 - 852.8)

Volume	Invert	Avail.Storage	Storage Description
#1	742.00'	5,126 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
742.00	0	0	0
743.00	233	117	117
744.00	932	583	699
745.00	2,097	1,515	2,214
746.00	3,728	2,913	5,126

Device	Routing	Invert	Outlet Devices
#1	Primary	742.00'	**20.5" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Secondary	744.00'	**100.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00

3.50 4.00 4.50 5.00 5.50
Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73
2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=3.97 cfs @ 12.00 hrs HW=742.37' (Free Discharge)
1=Orifice/Grate (Weir Controls 3.97 cfs @ 1.99 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=742.00' (Free Discharge)
2=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Summary for Pond C4N: Catch Basin

Inflow Area = 1.933 ac, 0.00% Impervious, Inflow Depth = 1.54" for 10 year - 24 hour event
Inflow = 5.09 cfs @ 11.99 hrs, Volume= 0.248 af
Outflow = 5.09 cfs @ 11.99 hrs, Volume= 0.248 af, Atten= 0%, Lag= 0.1 min
Primary = 5.09 cfs @ 11.99 hrs, Volume= 0.248 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 782.44' @ 11.99 hrs Surf.Area= 117 sf Storage= 58 cf
Flood Elev= 785.00' Surf.Area= 2,403 sf Storage= 2,804 cf

Plug-Flow detention time= 0.4 min calculated for 0.248 af (100% of inflow)
Center-of-Mass det. time= 0.4 min (852.6 - 852.2)

Volume	Invert	Avail.Storage	Storage Description
#1	782.00'	11,882 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
782.00	0	0	0
783.00	267	134	134
785.00	2,403	2,670	2,804
787.00	6,675	9,078	11,882

Device	Routing	Invert	Outlet Devices
#1	Primary	782.00'	**20.5" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Secondary	785.00'	**100.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=5.08 cfs @ 11.99 hrs HW=782.44' (Free Discharge)
1=Orifice/Grate (Weir Controls 5.08 cfs @ 2.16 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=782.00' (Free Discharge)
2=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Summary for Pond C4S: Catch Basin

Inflow Area = 0.872 ac, 0.00% Impervious, Inflow Depth = 1.54" for 10 year - 24 hour event
Inflow = 2.34 cfs @ 11.99 hrs, Volume= 0.112 af
Outflow = 2.34 cfs @ 11.99 hrs, Volume= 0.112 af, Atten= 0%, Lag= 0.2 min
Primary = 2.34 cfs @ 11.99 hrs, Volume= 0.112 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 777.76' @ 11.99 hrs Surf.Area= 99 sf Storage= 49 cf
Flood Elev= 780.25' Surf.Area= 1,479 sf Storage= 1,816 cf

Plug-Flow detention time= 0.7 min calculated for 0.112 af (100% of inflow)
Center-of-Mass det. time= 0.7 min (852.5 - 851.8)

Volume	Invert	Avail.Storage	Storage Description
#1	777.50'	2,141 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
777.50	0	0	0
778.50	378	189	189
779.50	932	655	844
780.50	1,661	1,297	2,141

Device	Routing	Invert	Outlet Devices
#1	Primary	777.50'	**20.5" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Secondary	780.25'	**100.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=2.33 cfs @ 11.99 hrs HW=777.76' (Free Discharge)
1=Orifice/Grate (Weir Controls 2.33 cfs @ 1.67 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=777.50' (Free Discharge)
2=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Summary for Pond C4SE: Catch Basin

Inflow Area = 2.200 ac, 0.00% Impervious, Inflow Depth = 1.54" for 10 year - 24 hour event
Inflow = 5.87 cfs @ 11.99 hrs, Volume= 0.282 af
Outflow = 5.85 cfs @ 11.99 hrs, Volume= 0.282 af, Atten= 0%, Lag= 0.3 min
Primary = 5.85 cfs @ 11.99 hrs, Volume= 0.282 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 776.48' @ 11.99 hrs Surf.Area= 305 sf Storage= 152 cf
Flood Elev= 779.00' Surf.Area= 2,509 sf Storage= 3,360 cf

Plug-Flow detention time= 0.9 min calculated for 0.282 af (100% of inflow)
Center-of-Mass det. time= 0.9 min (852.9 - 852.0)

Volume	Invert	Avail.Storage	Storage Description
#1	776.00'	10,959 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
776.00	0	0	0
777.00	634	317	317
778.00	1,471	1,053	1,370
779.00	2,509	1,990	3,360
780.00	3,750	3,130	6,489
781.00	5,190	4,470	10,959

Device	Routing	Invert	Outlet Devices
#1	Primary	776.00'	**20.5" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Secondary	779.00'	**100.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=5.84 cfs @ 11.99 hrs HW=776.48' (Free Discharge)
└**1=Orifice/Grate** (Weir Controls 5.84 cfs @ 2.27 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=776.00' (Free Discharge)
└**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond C4SW: Southwest Ditch 1

Inflow Area = 1.671 ac, 0.00% Impervious, Inflow Depth = 1.54" for 10 year - 24 hour event
Inflow = 4.56 cfs @ 11.98 hrs, Volume= 0.214 af
Outflow = 4.56 cfs @ 11.98 hrs, Volume= 0.214 af, Atten= 0%, Lag= 0.1 min
Primary = 4.56 cfs @ 11.98 hrs, Volume= 0.214 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 744.41' @ 11.98 hrs Surf.Area= 95 sf Storage= 47 cf
Flood Elev= 747.00' Surf.Area= 2,097 sf Storage= 2,214 cf

Plug-Flow detention time= 0.4 min calculated for 0.214 af (100% of inflow)
Center-of-Mass det. time= 0.4 min (851.8 - 851.4)

Volume	Invert	Avail.Storage	Storage Description
#1	744.00'	9,903 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
744.00	0	0	0
745.00	233	117	117
746.00	932	583	699
747.00	2,097	1,515	2,214
748.00	3,728	2,913	5,126
749.00	5,825	4,777	9,903

Device	Routing	Invert	Outlet Devices
#1	Primary	744.00'	**20.5" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Secondary	747.00'	**100.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=4.54 cfs @ 11.98 hrs HW=744.41' (Free Discharge)
1=Orifice/Grate (Weir Controls 4.54 cfs @ 2.08 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=744.00' (Free Discharge)
2=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Summary for Pond C4W: West Ditch

[79] Warning: Submerged Pond MH4W Primary device # 1 INLET by 0.04'

Inflow Area = 18.321 ac, 0.00% Impervious, Inflow Depth = 1.54" for 10 year - 24 hour event
Inflow = 28.45 cfs @ 12.15 hrs, Volume= 2.351 af
Outflow = 25.77 cfs @ 12.22 hrs, Volume= 2.351 af, Atten= 9%, Lag= 4.0 min
Primary = 25.77 cfs @ 12.22 hrs, Volume= 2.351 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 720.04' @ 12.22 hrs Surf.Area= 4,506 sf Storage= 6,504 cf
Flood Elev= 721.50' Surf.Area= 7,097 sf Storage= 15,551 cf

Plug-Flow detention time= 4.0 min calculated for 2.350 af (100% of inflow)
Center-of-Mass det. time= 4.0 min (868.5 - 864.5)

Volume	Invert	Avail.Storage	Storage Description
#1	717.00'	34,968 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
717.00	0	0	0
718.00	1,206	603	603
720.00	4,430	5,636	6,239
722.00	7,986	12,416	18,655
724.00	8,327	16,313	34,968

Device	Routing	Invert	Outlet Devices
#1	Primary	717.00'	**30.0" Round Culvert** L= 90.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 717.00' / 716.00' S= 0.0111 '/' Cc= 0.900 n= 0.024, Flow Area= 4.91 sf
#2	Secondary	722.00'	**400.0' long x 40.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=25.78 cfs @ 12.22 hrs HW=720.04' (Free Discharge)
1=Culvert (Barrel Controls 25.78 cfs @ 5.49 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=717.00' (Free Discharge)
2=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Summary for Pond C5N: Catch Basin

Inflow Area = 3.175 ac, 0.00% Impervious, Inflow Depth = 1.54" for 10 year - 24 hour event
Inflow = 8.04 cfs @ 12.00 hrs, Volume= 0.407 af
Outflow = 8.04 cfs @ 12.00 hrs, Volume= 0.407 af, Atten= 0%, Lag= 0.1 min
Primary = 8.04 cfs @ 12.00 hrs, Volume= 0.407 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 749.37' @ 12.00 hrs Surf.Area= 100 sf Storage= 50 cf
Flood Elev= 752.00' Surf.Area= 2,403 sf Storage= 2,804 cf

Plug-Flow detention time= 0.2 min calculated for 0.407 af (100% of inflow)
Center-of-Mass det. time= 0.2 min (853.4 - 853.2)

Volume	Invert	Avail.Storage	Storage Description
#1	749.00'	11,882 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
749.00	0	0	0
750.00	267	134	134
752.00	2,403	2,670	2,804
754.00	6,675	9,078	11,882

Device	Routing	Invert	Outlet Devices
#1	Primary	749.00'	**20.5" Horiz. Orifice/Grate X 2.00** C= 0.600 Limited to weir flow at low heads
#2	Secondary	752.00'	**100.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=8.01 cfs @ 12.00 hrs HW=749.37' (Free Discharge)
1=Orifice/Grate (Weir Controls 8.01 cfs @ 2.00 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=749.00' (Free Discharge)
2=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Summary for Pond C5S: Catch Basin

Inflow Area = 1.778 ac, 0.00% Impervious, Inflow Depth = 1.54" for 10 year - 24 hour event
Inflow = 4.68 cfs @ 11.99 hrs, Volume= 0.228 af
Outflow = 4.68 cfs @ 11.99 hrs, Volume= 0.228 af, Atten= 0%, Lag= 0.0 min
Primary = 4.68 cfs @ 11.99 hrs, Volume= 0.228 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 732.41' @ 11.99 hrs Surf.Area= 41 sf Storage= 20 cf
Flood Elev= 735.00' Surf.Area= 891 sf Storage= 941 cf

Plug-Flow detention time= 0.2 min calculated for 0.228 af (100% of inflow)
Center-of-Mass det. time= 0.2 min (852.4 - 852.2)

Volume	Invert	Avail.Storage	Storage Description
#1	732.00'	1,986 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
732.00	0	0	0
733.00	99	50	50
734.00	396	248	297
735.00	891	644	941
736.00	1,200	1,046	1,986

Device	Routing	Invert	Outlet Devices
#1	Primary	732.00'	**20.5" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Secondary	735.00'	**100.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=4.67 cfs @ 11.99 hrs HW=732.41' (Free Discharge)
└**1=Orifice/Grate** (Weir Controls 4.67 cfs @ 2.10 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=732.00' (Free Discharge)
└**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond C5SE: Catch Basin

Inflow Area = 2.043 ac, 0.00% Impervious, Inflow Depth = 1.54" for 10 year - 24 hour event
Inflow = 5.34 cfs @ 11.99 hrs, Volume= 0.262 af
Outflow = 5.33 cfs @ 12.00 hrs, Volume= 0.262 af, Atten= 0%, Lag= 0.1 min
Primary = 5.33 cfs @ 12.00 hrs, Volume= 0.262 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 752.95' @ 12.00 hrs Surf.Area= 105 sf Storage= 53 cf
Flood Elev= 755.50' Surf.Area= 2,097 sf Storage= 2,214 cf

Plug-Flow detention time= 0.3 min calculated for 0.262 af (100% of inflow)
Center-of-Mass det. time= 0.3 min (852.8 - 852.4)

Volume	Invert	Avail.Storage	Storage Description
#1	752.50'	9,903 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
752.50	0	0	0
753.50	233	117	117
754.50	932	583	699
755.50	2,097	1,515	2,214
756.50	3,728	2,913	5,126
757.50	5,825	4,777	9,903

Device	Routing	Invert	Outlet Devices
#1	Primary	752.50'	**20.5" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Secondary	755.50'	**100.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=5.32 cfs @ 12.00 hrs HW=752.95' (Free Discharge)
└**1=Orifice/Grate** (Weir Controls 5.32 cfs @ 2.20 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=752.50' (Free Discharge)
└**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond C5SW: Catch Basin

Inflow Area = 4.496 ac, 0.00% Impervious, Inflow Depth = 1.54" for 10 year - 24 hour event
Inflow = 8.96 cfs @ 12.07 hrs, Volume= 0.577 af
Outflow = 8.82 cfs @ 12.09 hrs, Volume= 0.577 af, Atten= 2%, Lag= 1.0 min
Primary = 8.82 cfs @ 12.09 hrs, Volume= 0.577 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 811.64' @ 12.09 hrs Surf.Area= 1,511 sf Storage= 756 cf
Flood Elev= 815.00' Surf.Area= 37,030 sf Storage= 60,372 cf

Plug-Flow detention time= 3.0 min calculated for 0.577 af (100% of inflow)
Center-of-Mass det. time= 3.0 min (862.0 - 859.0)

Volume	Invert	Avail.Storage	Storage Description
#1	811.00'	97,402 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
811.00	0	0	0
812.00	2,344	1,172	1,172
814.00	19,826	22,170	23,342
816.00	54,234	74,060	97,402

Device	Routing	Invert	Outlet Devices
#1	Primary	811.00'	**20.5" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Secondary	815.00'	**100.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=8.86 cfs @ 12.09 hrs HW=811.64' (Free Discharge)
1=Orifice/Grate (Orifice Controls 8.86 cfs @ 3.87 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=811.00' (Free Discharge)
2=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Summary for Pond C6N: North Ditch

[58] Hint: Peaked 0.08' above defined flood level
[79] Warning: Submerged Pond D1N Primary device # 1 OUTLET by 3.08'

Inflow Area = 26.669 ac, 0.00% Impervious, Inflow Depth = 1.54" for 10 year - 24 hour event
Inflow = 28.06 cfs @ 12.04 hrs, Volume= 3.422 af
Outflow = 26.37 cfs @ 12.25 hrs, Volume= 3.422 af, Atten= 6%, Lag= 12.5 min
Primary = 21.19 cfs @ 12.25 hrs, Volume= 3.323 af
Secondary = 5.18 cfs @ 12.25 hrs, Volume= 0.099 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 723.08' @ 12.25 hrs Surf.Area= 4,701 sf Storage= 7,687 cf
Flood Elev= 723.00' Surf.Area= 4,539 sf Storage= 7,343 cf

Plug-Flow detention time= 2.6 min calculated for 3.421 af (100% of inflow)
Center-of-Mass det. time= 2.6 min (872.2 - 869.5)

Volume	Invert	Avail.Storage	Storage Description
#1	719.00'	11,882 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
719.00	0	0	0
720.00	267	134	134
722.00	2,403	2,670	2,804
724.00	6,675	9,078	11,882

Device	Routing	Invert	Outlet Devices
#1	Primary	719.00'	**22.2" Round Culvert** L= 50.0' CMP, end-section conforming to fill, Ke= 0.500 Inlet / Outlet Invert= 719.00' / 718.50' S= 0.0100 '/' Cc= 0.900 n= 0.018, Flow Area= 2.69 sf
#2	Secondary	723.00'	**100.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=21.19 cfs @ 12.25 hrs HW=723.08' (Free Discharge)
└**1=Culvert** (Barrel Controls 21.19 cfs @ 7.88 fps)

Secondary OutFlow Max=4.97 cfs @ 12.25 hrs HW=723.08' (Free Discharge)
└**2=Broad-Crested Rectangular Weir** (Weir Controls 4.97 cfs @ 0.66 fps)

Summary for Pond C6S: Catch Basin

Inflow Area = 1.820 ac, 0.00% Impervious, Inflow Depth = 1.54" for 10 year - 24 hour event
Inflow = 4.91 cfs @ 11.98 hrs, Volume= 0.234 af
Outflow = 4.90 cfs @ 11.99 hrs, Volume= 0.234 af, Atten= 0%, Lag= 0.3 min
Primary = 4.90 cfs @ 11.99 hrs, Volume= 0.234 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 777.43' @ 11.99 hrs Surf.Area= 227 sf Storage= 114 cf
Flood Elev= 780.00' Surf.Area= 1,600 sf Storage= 2,399 cf

Plug-Flow detention time= 0.9 min calculated for 0.234 af (100% of inflow)
Center-of-Mass det. time= 0.9 min (852.6 - 851.7)

Volume	Invert	Avail.Storage	Storage Description
#1	777.00'	2,399 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
777.00	0	0	0
778.00	533	267	267
779.00	1,066	800	1,066
780.00	1,600	1,333	2,399

Device	Routing	Invert	Outlet Devices
#1	Primary	777.00'	**20.5" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Secondary	780.00'	**100.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50

Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=4.89 cfs @ 11.99 hrs HW=777.43' (Free Discharge)
└**1=Orifice/Grate** (Weir Controls 4.89 cfs @ 2.14 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=777.00' (Free Discharge)
└**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond C6SE: Southeast Ditch 1

Inflow Area = 1.487 ac, 0.00% Impervious, Inflow Depth = 1.54" for 10 year - 24 hour event
Inflow = 4.03 cfs @ 11.98 hrs, Volume= 0.191 af
Outflow = 4.02 cfs @ 11.98 hrs, Volume= 0.191 af, Atten= 0%, Lag= 0.1 min
Primary = 4.02 cfs @ 11.98 hrs, Volume= 0.191 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 744.37' @ 11.98 hrs Surf.Area= 87 sf Storage= 44 cf
Flood Elev= 747.00' Surf.Area= 2,097 sf Storage= 2,214 cf

Plug-Flow detention time= 0.4 min calculated for 0.191 af (100% of inflow)
Center-of-Mass det. time= 0.4 min (852.0 - 851.6)

Volume	Invert	Avail.Storage	Storage Description
#1	744.00'	9,903 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
744.00	0	0	0
745.00	233	117	117
746.00	932	583	699
747.00	2,097	1,515	2,214
748.00	3,728	2,913	5,126
749.00	5,825	4,777	9,903

Device	Routing	Invert	Outlet Devices
#1	Primary	744.00'	**20.5" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Secondary	747.00'	**100.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=4.01 cfs @ 11.98 hrs HW=744.37' (Free Discharge)
└**1=Orifice/Grate** (Weir Controls 4.01 cfs @ 2.00 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=744.00' (Free Discharge)
└**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond C6SW: Catch Basin

Inflow Area = 2.314 ac, 0.00% Impervious, Inflow Depth = 1.54" for 10 year - 24 hour event
Inflow = 6.22 cfs @ 11.99 hrs, Volume= 0.297 af
Outflow = 6.21 cfs @ 11.99 hrs, Volume= 0.297 af, Atten= 0%, Lag= 0.3 min
Primary = 6.21 cfs @ 11.99 hrs, Volume= 0.297 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 776.50' @ 11.99 hrs Surf.Area= 317 sf Storage= 159 cf
Flood Elev= 779.00' Surf.Area= 2,509 sf Storage= 3,360 cf

Plug-Flow detention time= 0.9 min calculated for 0.297 af (100% of inflow)
Center-of-Mass det. time= 0.9 min (852.7 - 851.8)

Volume	Invert	Avail.Storage	Storage Description
#1	776.00'	10,959 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
776.00	0	0	0
777.00	634	317	317
778.00	1,471	1,053	1,370
779.00	2,509	1,990	3,360
780.00	3,750	3,130	6,489
781.00	5,190	4,470	10,959

Device	Routing	Invert	Outlet Devices
#1	Primary	776.00'	**20.5" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Secondary	779.00'	**100.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=6.20 cfs @ 11.99 hrs HW=776.50' (Free Discharge)
└**1=Orifice/Grate** (Weir Controls 6.20 cfs @ 2.31 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=776.00' (Free Discharge)
└**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond C7S: Catch Basin

Inflow Area = 2.118 ac, 0.00% Impervious, Inflow Depth = 1.54" for 10 year - 24 hour event
Inflow = 5.60 cfs @ 11.99 hrs, Volume= 0.272 af
Outflow = 5.59 cfs @ 11.99 hrs, Volume= 0.272 af, Atten= 0%, Lag= 0.1 min
Primary = 5.59 cfs @ 11.99 hrs, Volume= 0.272 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 732.97' @ 11.99 hrs Surf.Area= 112 sf Storage= 56 cf
Flood Elev= 735.50' Surf.Area= 2,172 sf Storage= 2,292 cf

Plug-Flow detention time= 0.4 min calculated for 0.272 af (100% of inflow)
Center-of-Mass det. time= 0.4 min (852.5 - 852.2)

Volume	Invert	Avail.Storage	Storage Description
#1	732.50'	3,460 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
732.50	0	0	0
733.50	241	121	121
734.50	965	603	724
735.50	2,172	1,569	2,292
736.00	2,500	1,168	3,460

Device	Routing	Invert	Outlet Devices
#1	Primary	732.50'	**20.5" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Secondary	735.50'	**100.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=5.58 cfs @ 11.99 hrs HW=732.97' (Free Discharge)
└**1=Orifice/Grate** (Weir Controls 5.58 cfs @ 2.23 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=732.50' (Free Discharge)
└**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond C7SE: Catch Basin

Inflow Area = 2.211 ac, 0.00% Impervious, Inflow Depth = 1.54" for 10 year - 24 hour event
Inflow = 5.38 cfs @ 12.01 hrs, Volume= 0.284 af
Outflow = 5.37 cfs @ 12.02 hrs, Volume= 0.284 af, Atten= 0%, Lag= 0.2 min
Primary = 5.37 cfs @ 12.02 hrs, Volume= 0.284 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 775.45' @ 12.02 hrs Surf.Area= 242 sf Storage= 121 cf
Flood Elev= 778.00' Surf.Area= 1,600 sf Storage= 2,399 cf

Plug-Flow detention time= 0.8 min calculated for 0.284 af (100% of inflow)
Center-of-Mass det. time= 0.8 min (854.9 - 854.1)

Volume	Invert	Avail.Storage	Storage Description
#1	775.00'	11,332 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
775.00	0	0	0
776.00	533	267	267
777.00	1,066	800	1,066
778.00	1,600	1,333	2,399
780.00	7,333	8,933	11,332

Device	Routing	Invert	Outlet Devices
#1	Primary	775.00'	**20.5" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Secondary	778.00'	**100.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50

Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=5.36 cfs @ 12.02 hrs HW=775.45' (Free Discharge)
└**1=Orifice/Grate** (Weir Controls 5.36 cfs @ 2.20 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=775.00' (Free Discharge)
└**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond C7SW: Catch Basin

Inflow Area = 3.196 ac, 0.00% Impervious, Inflow Depth = 1.54" for 10 year - 24 hour event
Inflow = 8.03 cfs @ 12.00 hrs, Volume= 0.410 af
Outflow = 8.02 cfs @ 12.01 hrs, Volume= 0.410 af, Atten= 0%, Lag= 0.1 min
Primary = 8.02 cfs @ 12.01 hrs, Volume= 0.410 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 733.09' @ 12.01 hrs Surf.Area= 138 sf Storage= 69 cf
Flood Elev= 735.50' Surf.Area= 2,097 sf Storage= 2,214 cf

Plug-Flow detention time= 0.3 min calculated for 0.410 af (100% of inflow)
Center-of-Mass det. time= 0.3 min (853.7 - 853.4)

Volume	Invert	Avail.Storage	Storage Description
#1	732.50'	9,903 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
732.50	0	0	0
733.50	233	117	117
734.50	932	583	699
735.50	2,097	1,515	2,214
736.50	3,728	2,913	5,126
737.50	5,825	4,777	9,903

Device	Routing	Invert	Outlet Devices
#1	Primary	732.50'	**20.5" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Secondary	735.50'	**100.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=8.00 cfs @ 12.01 hrs HW=733.09' (Free Discharge)
└**1=Orifice/Grate** (Weir Controls 8.00 cfs @ 2.52 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=732.50' (Free Discharge)
└**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond C8SE: Catch Basin

Inflow Area = 1.308 ac, 0.00% Impervious, Inflow Depth = 1.54" for 10 year - 24 hour event
Inflow = 3.76 cfs @ 11.96 hrs, Volume= 0.168 af
Outflow = 3.75 cfs @ 11.97 hrs, Volume= 0.168 af, Atten= 0%, Lag= 0.1 min
Primary = 3.75 cfs @ 11.97 hrs, Volume= 0.168 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 753.36' @ 11.97 hrs Surf.Area= 86 sf Storage= 43 cf
Flood Elev= 756.00' Surf.Area= 2,172 sf Storage= 2,292 cf

Plug-Flow detention time= 0.4 min calculated for 0.168 af (100% of inflow)
Center-of-Mass det. time= 0.4 min (850.6 - 850.2)

Volume	Invert	Avail.Storage	Storage Description
#1	753.00'	2,292 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
753.00	0	0	0
754.00	241	121	121
755.00	965	603	724
756.00	2,172	1,569	2,292

Device	Routing	Invert	Outlet Devices
#1	Primary	753.00'	**20.5" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Secondary	756.00'	**100.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=3.74 cfs @ 11.97 hrs HW=753.36' (Free Discharge)
↑—**1=Orifice/Grate** (Weir Controls 3.74 cfs @ 1.95 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=753.00' (Free Discharge)
↑—**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond C8SW: Southwest Ditch 2

Inflow Area = 0.953 ac, 0.00% Impervious, Inflow Depth = 1.54" for 10 year - 24 hour event
Inflow = 2.64 cfs @ 11.98 hrs, Volume= 0.122 af
Outflow = 2.64 cfs @ 11.98 hrs, Volume= 0.122 af, Atten= 0%, Lag= 0.1 min
Primary = 2.64 cfs @ 11.98 hrs, Volume= 0.122 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 726.28' @ 11.98 hrs Surf.Area= 66 sf Storage= 33 cf
Flood Elev= 729.00' Surf.Area= 2,097 sf Storage= 2,214 cf

Plug-Flow detention time= 0.4 min calculated for 0.122 af (100% of inflow)
Center-of-Mass det. time= 0.4 min (851.4 - 851.0)

Volume	Invert	Avail.Storage	Storage Description
#1	726.00'	9,903 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
726.00	0	0	0
727.00	233	117	117
728.00	932	583	699
729.00	2,097	1,515	2,214
730.00	3,728	2,913	5,126
731.00	5,825	4,777	9,903

Device	Routing	Invert	Outlet Devices
#1	Primary	726.00'	**20.5" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Secondary	729.00'	**100.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=2.63 cfs @ 11.98 hrs HW=726.28' (Free Discharge)
└**1=Orifice/Grate** (Weir Controls 2.63 cfs @ 1.74 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=726.00' (Free Discharge)
└**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond C9SE: Southeast Ditch 2

Inflow Area = 0.641 ac, 0.00% Impervious, Inflow Depth = 1.54" for 10 year - 24 hour event
Inflow = 1.79 cfs @ 11.97 hrs, Volume= 0.082 af
Outflow = 1.79 cfs @ 11.97 hrs, Volume= 0.082 af, Atten= 0%, Lag= 0.1 min
Primary = 1.79 cfs @ 11.97 hrs, Volume= 0.082 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 735.22' @ 11.97 hrs Surf.Area= 26 sf Storage= 13 cf
Flood Elev= 738.00' Surf.Area= 1,100 sf Storage= 1,150 cf

Plug-Flow detention time= 0.3 min calculated for 0.082 af (100% of inflow)
Center-of-Mass det. time= 0.2 min (851.1 - 850.9)

Volume	Invert	Avail.Storage	Storage Description
#1	735.00'	1,150 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
735.00	0	0	0
736.00	120	60	60
737.00	480	300	360
738.00	1,100	790	1,150

Device	Routing	Invert	Outlet Devices
#1	Primary	735.00'	**20.5" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Secondary	738.00'	**100.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=1.78 cfs @ 11.97 hrs HW=735.22' (Free Discharge)
1=Orifice/Grate (Weir Controls 1.78 cfs @ 1.53 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=735.00' (Free Discharge)
2=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Summary for Pond D10SE: 10" Pipe

[58] Hint: Peaked 22.07' above defined flood level
[81] Warning: Exceeded Pond C10SE by 21.47' @ 12.09 hrs

Inflow Area = 3.918 ac, 0.00% Impervious, Inflow Depth = 1.54" for 10 year - 24 hour event
Inflow = 7.62 cfs @ 12.09 hrs, Volume= 0.503 af
Outflow = 7.62 cfs @ 12.09 hrs, Volume= 0.503 af, Atten= 0%, Lag= 0.0 min
Primary = 7.62 cfs @ 12.09 hrs, Volume= 0.503 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 832.07' @ 12.09 hrs
Flood Elev= 810.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	807.00'	**9.9" Round Culvert** L= 350.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 807.00' / 800.00' S= 0.0200 '/' Cc= 0.900 n= 0.010, Flow Area= 0.53 sf

Primary OutFlow Max=7.61 cfs @ 12.09 hrs HW=832.01' (Free Discharge)
1=Culvert (Barrel Controls 7.61 cfs @ 14.24 fps)

Summary for Pond D11SE: 20" Pipe

[79] Warning: Submerged Pond C11SE Primary device # 1 by 0.14'
[79] Warning: Submerged Pond D10SE Primary device # 1 OUTLET by 3.14'

Inflow Area = 9.766 ac, 0.00% Impervious, Inflow Depth = 1.54" for 10 year - 24 hour event
Inflow = 13.83 cfs @ 12.14 hrs, Volume= 1.253 af
Outflow = 13.83 cfs @ 12.14 hrs, Volume= 1.253 af, Atten= 0%, Lag= 0.0 min
Primary = 13.83 cfs @ 12.14 hrs, Volume= 1.253 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 803.14' @ 12.14 hrs
Flood Elev= 809.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	800.00'	**18.5" Round Culvert** L= 265.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 800.00' / 794.50' S= 0.0208 '/' Cc= 0.900 n= 0.010, Flow Area= 1.87 sf

Primary OutFlow Max=13.82 cfs @ 12.14 hrs HW=803.14' (Free Discharge)
1=Culvert (Inlet Controls 13.82 cfs @ 7.40 fps)

Summary for Pond D12SE: 24" Pipe

[58] Hint: Peaked 1.84' above defined flood level
[81] Warning: Exceeded Pond C12SE by 1.35' @ 12.18 hrs
[79] Warning: Submerged Pond D11SE Primary device # 1 OUTLET by 4.84'

Inflow Area = 18.821 ac, 0.00% Impervious, Inflow Depth = 1.54" for 10 year - 24 hour event
Inflow = 25.62 cfs @ 12.18 hrs, Volume= 2.415 af
Outflow = 25.62 cfs @ 12.18 hrs, Volume= 2.415 af, Atten= 0%, Lag= 0.0 min
Primary = 25.62 cfs @ 12.18 hrs, Volume= 2.415 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 799.34' @ 12.18 hrs
Flood Elev= 797.50'

Device	Routing	Invert	Outlet Devices
#1	Primary	794.50'	**22.2" Round Culvert** L= 350.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 794.50' / 720.00' S= 0.2129 '/' Cc= 0.900 n= 0.010, Flow Area= 2.69 sf

Primary OutFlow Max=25.61 cfs @ 12.18 hrs HW=799.34' (Free Discharge)
1=Culvert (Inlet Controls 25.61 cfs @ 9.53 fps)

Summary for Pond D1E: 24" Pipe

[58] Hint: Peaked 0.51' above defined flood level
[79] Warning: Submerged Pond C1E Primary device # 1 by 0.51'

Inflow Area = 17.841 ac, 0.00% Impervious, Inflow Depth = 1.54" for 10 year - 24 hour event
Inflow = 20.81 cfs @ 12.32 hrs, Volume= 2.288 af
Outflow = 20.81 cfs @ 12.32 hrs, Volume= 2.288 af, Atten= 0%, Lag= 0.0 min
Primary = 20.81 cfs @ 12.32 hrs, Volume= 2.288 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 798.01' @ 12.32 hrs
Flood Elev= 797.50'

Device	Routing	Invert	Outlet Devices
#1	Primary	794.50'	**22.2" Round Culvert** L= 330.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 794.50' / 720.00' S= 0.2258 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 2.69 sf

Primary OutFlow Max=20.80 cfs @ 12.32 hrs HW=798.01' (Free Discharge)
1=Culvert (Inlet Controls 20.80 cfs @ 7.74 fps)

Summary for Pond D1N: 24" Pipe

[58] Hint: Peaked 0.64' above defined flood level
[81] Warning: Exceeded Pond C1N by 0.10' @ 12.30 hrs

Inflow Area = 17.691 ac, 0.00% Impervious, Inflow Depth = 1.54" for 10 year - 24 hour event
Inflow = 21.34 cfs @ 12.30 hrs, Volume= 2.270 af
Outflow = 21.34 cfs @ 12.30 hrs, Volume= 2.270 af, Atten= 0%, Lag= 0.0 min
Primary = 21.34 cfs @ 12.30 hrs, Volume= 2.270 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Peak Elev= 801.64' @ 12.30 hrs
Flood Elev= 801.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	798.00'	**22.2" Round Culvert** L= 330.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 798.00' / 720.00' S= 0.2364 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 2.69 sf

Primary OutFlow Max=21.34 cfs @ 12.30 hrs HW=801.64' (Free Discharge)
1=Culvert (Inlet Controls 21.34 cfs @ 7.94 fps)

Summary for Pond D1NW: 24" Pipe

Inflow Area = 1.506 ac, 0.00% Impervious, Inflow Depth = 1.54" for 10 year - 24 hour event
Inflow = 4.26 cfs @ 11.97 hrs, Volume= 0.193 af
Outflow = 4.26 cfs @ 11.97 hrs, Volume= 0.193 af, Atten= 0%, Lag= 0.0 min
Primary = 4.26 cfs @ 11.97 hrs, Volume= 0.193 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 782.91' @ 11.97 hrs
Flood Elev= 785.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	782.00'	**22.2" Round Culvert** L= 200.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 782.00' / 742.00' S= 0.2000 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 2.69 sf

Primary OutFlow Max=4.25 cfs @ 11.97 hrs HW=782.91' (Free Discharge)
1=Culvert (Inlet Controls 4.25 cfs @ 3.24 fps)

Summary for Pond D1S: 10" Pipe

[58] Hint: Peaked 16.92' above defined flood level
[81] Warning: Exceeded Pond C1S by 16.39' @ 12.09 hrs

Inflow Area = 3.455 ac, 0.00% Impervious, Inflow Depth = 1.54" for 10 year - 24 hour event
Inflow = 6.68 cfs @ 12.09 hrs, Volume= 0.443 af
Outflow = 6.68 cfs @ 12.09 hrs, Volume= 0.443 af, Atten= 0%, Lag= 0.0 min
Primary = 6.68 cfs @ 12.09 hrs, Volume= 0.443 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 825.92' @ 12.09 hrs
Flood Elev= 809.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	806.00'	**9.9" Round Culvert** L= 420.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 806.00' / 797.00' S= 0.0214 '/' Cc= 0.900 n= 0.010, Flow Area= 0.53 sf

Primary OutFlow Max=6.68 cfs @ 12.09 hrs HW=825.91' (Free Discharge)
1=Culvert (Barrel Controls 6.68 cfs @ 12.50 fps)

Summary for Pond D1SE: 10" Pipe

[58] Hint: Peaked 15.71' above defined flood level
[81] Warning: Exceeded Pond C1SE by 15.17' @ 12.09 hrs

Inflow Area = 3.373 ac, 0.00% Impervious, Inflow Depth = 1.54" for 10 year - 24 hour event
Inflow = 6.58 cfs @ 12.09 hrs, Volume= 0.433 af
Outflow = 6.58 cfs @ 12.09 hrs, Volume= 0.433 af, Atten= 0%, Lag= 0.0 min
Primary = 6.58 cfs @ 12.09 hrs, Volume= 0.433 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 825.71' @ 12.09 hrs
Flood Elev= 810.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	807.00'	**9.9" Round Culvert** L= 360.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 807.00' / 801.00' S= 0.0167 '/' Cc= 0.900 n= 0.010, Flow Area= 0.53 sf

Primary OutFlow Max=6.58 cfs @ 12.09 hrs HW=825.67' (Free Discharge)
1=Culvert (Barrel Controls 6.58 cfs @ 12.30 fps)

Summary for Pond D1SW: 6" Pipe

[58] Hint: Peaked 172.08' above defined flood level
[81] Warning: Exceeded Pond C1SW by 171.43' @ 12.11 hrs

Inflow Area = 4.734 ac, 0.00% Impervious, Inflow Depth = 1.54" for 10 year - 24 hour event
Inflow = 8.92 cfs @ 12.11 hrs, Volume= 0.607 af
Outflow = 8.92 cfs @ 12.11 hrs, Volume= 0.607 af, Atten= 0%, Lag= 0.0 min
Primary = 8.92 cfs @ 12.11 hrs, Volume= 0.607 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 983.08' @ 12.11 hrs
Flood Elev= 811.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	808.00'	**6.1" Round Culvert** L= 120.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 808.00' / 773.00' S= 0.2917 '/' Cc= 0.900 n= 0.010, Flow Area= 0.20 sf

Primary OutFlow Max=8.91 cfs @ 12.11 hrs HW=983.06' (Free Discharge)
1=Culvert (Barrel Controls 8.91 cfs @ 43.93 fps)

Summary for Pond D1W: 24" Pipe

[58] Hint: Peaked 2.45' above defined flood level
[81] Warning: Exceeded Pond C1W by 1.76' @ 12.16 hrs

Inflow Area = 16.760 ac, 0.00% Impervious, Inflow Depth = 1.54" for 10 year - 24 hour event
Inflow = 27.53 cfs @ 12.16 hrs, Volume= 2.150 af
Outflow = 27.53 cfs @ 12.16 hrs, Volume= 2.150 af, Atten= 0%, Lag= 0.0 min
Primary = 27.53 cfs @ 12.16 hrs, Volume= 2.150 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Peak Elev= 801.45' @ 12.16 hrs
Flood Elev= 799.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	796.00'	**22.2" Round Culvert** L= 280.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 796.00' / 724.00' S= 0.2571 '/' Cc= 0.900 n= 0.010, Flow Area= 2.69 sf

Primary OutFlow Max=27.52 cfs @ 12.16 hrs HW=801.44' (Free Discharge)
1=Culvert (Inlet Controls 27.52 cfs @ 10.24 fps)

Summary for Pond D2N: 24" Pipe

Inflow Area = 1.145 ac, 0.00% Impervious, Inflow Depth = 1.54" for 10 year - 24 hour event
Inflow = 3.09 cfs @ 11.99 hrs, Volume= 0.147 af
Outflow = 3.09 cfs @ 11.99 hrs, Volume= 0.147 af, Atten= 0%, Lag= 0.0 min
Primary = 3.09 cfs @ 11.99 hrs, Volume= 0.147 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 779.76' @ 11.99 hrs
Flood Elev= 782.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	779.00'	**22.2" Round Culvert** L= 170.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 779.00' / 739.00' S= 0.2353 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 2.69 sf

Primary OutFlow Max=3.08 cfs @ 11.99 hrs HW=779.76' (Free Discharge)
1=Culvert (Inlet Controls 3.08 cfs @ 2.97 fps)

Summary for Pond D2NW: 24" Pipe

[79] Warning: Submerged Pond D1NW Primary device # 1 OUTLET by 1.35'

Inflow Area = 3.844 ac, 0.00% Impervious, Inflow Depth = 1.54" for 10 year - 24 hour event
Inflow = 8.35 cfs @ 12.00 hrs, Volume= 0.493 af
Outflow = 8.35 cfs @ 12.00 hrs, Volume= 0.493 af, Atten= 0%, Lag= 0.0 min
Primary = 8.35 cfs @ 12.00 hrs, Volume= 0.493 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 743.35' @ 12.00 hrs
Flood Elev= 745.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	742.00'	**22.2" Round Culvert** L= 60.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 742.00' / 726.00' S= 0.2667 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 2.69 sf

Primary OutFlow Max=8.35 cfs @ 12.00 hrs HW=743.35' (Free Discharge)
1=Culvert (Inlet Controls 8.35 cfs @ 3.96 fps)

Summary for Pond D2S: 20" Pipe

[58] Hint: Peaked 22.93' above defined flood level
[79] Warning: Submerged Pond C2S Primary device # 1 by 0.43'
[79] Warning: Submerged Pond D1S Primary device # 1 OUTLET by 3.43'

Inflow Area = 10.865 ac, 0.00% Impervious, Inflow Depth = 1.54" for 10 year - 24 hour event
Inflow = 14.65 cfs @ 12.15 hrs, Volume= 1.394 af
Outflow = 14.65 cfs @ 12.15 hrs, Volume= 1.394 af, Atten= 0%, Lag= 0.0 min
Primary = 14.65 cfs @ 12.15 hrs, Volume= 1.394 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 800.43' @ 12.15 hrs
Flood Elev= 777.50'

Device	Routing	Invert	Outlet Devices
#1	Primary	797.00'	**18.5" Round Culvert** L= 195.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 797.00' / 793.70' S= 0.0169 '/' Cc= 0.900 n= 0.010, Flow Area= 1.87 sf

Primary OutFlow Max=14.64 cfs @ 12.15 hrs HW=800.42' (Free Discharge)
1=Culvert (Inlet Controls 14.64 cfs @ 7.84 fps)

Summary for Pond D2SE: 20" Pipe

[79] Warning: Submerged Pond D1SE Primary device # 1 OUTLET by 2.66'

Inflow Area = 8.729 ac, 0.00% Impervious, Inflow Depth = 1.54" for 10 year - 24 hour event
Inflow = 12.34 cfs @ 12.14 hrs, Volume= 1.120 af
Outflow = 12.34 cfs @ 12.14 hrs, Volume= 1.120 af, Atten= 0%, Lag= 0.0 min
Primary = 12.34 cfs @ 12.14 hrs, Volume= 1.120 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 803.66' @ 12.14 hrs
Flood Elev= 809.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	801.00'	**18.5" Round Culvert** L= 120.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 801.00' / 796.00' S= 0.0417 '/' Cc= 0.900 n= 0.010, Flow Area= 1.87 sf

Primary OutFlow Max=12.34 cfs @ 12.14 hrs HW=803.66' (Free Discharge)
1=Culvert (Inlet Controls 12.34 cfs @ 6.61 fps)

Summary for Pond D2SW: 12" Pipe

[58] Hint: Peaked 12.59' above defined flood level
[81] Warning: Exceeded Pond C2SW by 12.04' @ 12.03 hrs
[79] Warning: Submerged Pond D1SW Primary device # 1 OUTLET by 15.58'

Inflow Area = 7.709 ac, 0.00% Impervious, Inflow Depth = 1.54" for 10 year - 24 hour event
Inflow = 14.21 cfs @ 12.03 hrs, Volume= 0.989 af
Outflow = 14.21 cfs @ 12.03 hrs, Volume= 0.989 af, Atten= 0%, Lag= 0.0 min
Primary = 14.21 cfs @ 12.03 hrs, Volume= 0.989 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2

Peak Elev= 788.59' @ 12.03 hrs
Flood Elev= 776.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	773.00'	**11.8" Round Culvert** L= 75.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 773.00' / 749.50' S= 0.3133 '/' Cc= 0.900 n= 0.010, Flow Area= 0.76 sf

Primary OutFlow Max=14.20 cfs @ 12.03 hrs HW=788.56' (Free Discharge)
1=Culvert (Inlet Controls 14.20 cfs @ 18.69 fps)

Summary for Pond D2W: 14" Pipe

Inflow Area = 1.924 ac, 0.00% Impervious, Inflow Depth = 1.54" for 10 year - 24 hour event
Inflow = 4.96 cfs @ 12.00 hrs, Volume= 0.247 af
Outflow = 4.96 cfs @ 12.00 hrs, Volume= 0.247 af, Atten= 0%, Lag= 0.0 min
Primary = 4.96 cfs @ 12.00 hrs, Volume= 0.247 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 767.83' @ 12.00 hrs
Flood Elev= 769.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	766.00'	**12.9" Round Culvert** L= 200.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 766.00' / 720.00' S= 0.2300 '/' Cc= 0.900 n= 0.010, Flow Area= 0.91 sf

Primary OutFlow Max=4.96 cfs @ 12.00 hrs HW=767.83' (Free Discharge)
1=Culvert (Inlet Controls 4.96 cfs @ 5.46 fps)

Summary for Pond D3N: 24" Pipe

[79] Warning: Submerged Pond D2N Primary device # 1 OUTLET by 1.26'

Inflow Area = 2.907 ac, 0.00% Impervious, Inflow Depth = 1.54" for 10 year - 24 hour event
Inflow = 7.48 cfs @ 12.00 hrs, Volume= 0.373 af
Outflow = 7.48 cfs @ 12.00 hrs, Volume= 0.373 af, Atten= 0%, Lag= 0.0 min
Primary = 7.48 cfs @ 12.00 hrs, Volume= 0.373 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 740.26' @ 12.00 hrs
Flood Elev= 742.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	739.00'	**22.2" Round Culvert** L= 60.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 739.00' / 726.00' S= 0.2167 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 2.69 sf

Primary OutFlow Max=7.47 cfs @ 12.00 hrs HW=740.26' (Free Discharge)
1=Culvert (Inlet Controls 7.47 cfs @ 3.82 fps)

Summary for Pond D3S1: 22" Pipe 1

[58] Hint: Peaked 0.65' above defined flood level
[79] Warning: Submerged Pond C3S Primary device # 1 by 0.65'

Inflow Area = 20.973 ac, 0.00% Impervious, Inflow Depth = 1.03" for 10 year - 24 hour event
Inflow = 18.12 cfs @ 12.27 hrs, Volume= 1.794 af
Outflow = 18.12 cfs @ 12.27 hrs, Volume= 1.794 af, Atten= 0%, Lag= 0.0 min
Primary = 18.12 cfs @ 12.27 hrs, Volume= 1.794 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 797.35' @ 12.27 hrs
Flood Elev= 796.70'

Device	Routing	Invert	Outlet Devices
#1	Primary	793.70'	**20.3" Round Culvert** L= 475.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 793.70' / 716.50' S= 0.1625 '/' Cc= 0.900 n= 0.010, Flow Area= 2.25 sf

Primary OutFlow Max=18.12 cfs @ 12.27 hrs HW=797.35' (Free Discharge)
1=Culvert (Inlet Controls 18.12 cfs @ 8.06 fps)

Summary for Pond D3S2: 22" Pipe 2

[58] Hint: Peaked 2.28' above defined flood level
[81] Warning: Exceeded Pond C3S by 1.64' @ 12.20 hrs
[79] Warning: Submerged Pond D2S Primary device # 1 INLET by 1.98'

Inflow Area = 10.865 ac, 0.00% Impervious, Inflow Depth = 2.53" for 10 year - 24 hour event
Inflow = 22.79 cfs @ 12.21 hrs, Volume= 2.291 af
Outflow = 22.79 cfs @ 12.21 hrs, Volume= 2.291 af, Atten= 0%, Lag= 0.0 min
Primary = 22.79 cfs @ 12.21 hrs, Volume= 2.291 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 798.98' @ 12.21 hrs
Flood Elev= 796.70'

Device	Routing	Invert	Outlet Devices
#1	Primary	793.70'	**20.3" Round Culvert** L= 475.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 793.70' / 716.50' S= 0.1625 '/' Cc= 0.900 n= 0.010, Flow Area= 2.25 sf

Primary OutFlow Max=22.79 cfs @ 12.21 hrs HW=798.98' (Free Discharge)
1=Culvert (Inlet Controls 22.79 cfs @ 10.14 fps)

Summary for Pond D3SE: 24" Pipe

[58] Hint: Peaked 2.62' above defined flood level
[81] Warning: Exceeded Pond C3SE by 2.02' @ 12.19 hrs
[79] Warning: Submerged Pond D2SE Primary device # 1 INLET by 0.62'

Inflow Area = 20.914 ac, 0.00% Impervious, Inflow Depth = 1.54" for 10 year - 24 hour event
Inflow = 28.05 cfs @ 12.19 hrs, Volume= 2.683 af
Outflow = 28.05 cfs @ 12.19 hrs, Volume= 2.683 af, Atten= 0%, Lag= 0.0 min
Primary = 28.05 cfs @ 12.19 hrs, Volume= 2.683 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 4
Peak Elev= 801.62' @ 12.19 hrs
Flood Elev= 799.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	796.00'	**22.2" Round Culvert** L= 190.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 796.00' / 740.00' S= 0.2947 '/' Cc= 0.900 n= 0.010, Flow Area= 2.69 sf

Primary OutFlow Max=28.04 cfs @ 12.19 hrs HW=801.62' (Free Discharge)
└**1=Culvert** (Inlet Controls 28.04 cfs @ 10.43 fps)

Summary for Pond D3SW: 24" Pipe

[58] Hint: Peaked 0.17' above defined flood level
[79] Warning: Submerged Pond C3SW Primary device # 1 by 0.16'
[79] Warning: Submerged Pond D2SW Primary device # 1 OUTLET by 3.16'

Inflow Area = 9.794 ac, 0.00% Impervious, Inflow Depth = 1.54" for 10 year - 24 hour event
Inflow = 19.38 cfs @ 12.01 hrs, Volume= 1.257 af
Outflow = 19.38 cfs @ 12.01 hrs, Volume= 1.257 af, Atten= 0%, Lag= 0.0 min
Primary = 19.38 cfs @ 12.01 hrs, Volume= 1.257 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 4
Peak Elev= 752.67' @ 12.01 hrs
Flood Elev= 752.50'

Device	Routing	Invert	Outlet Devices
#1	Primary	749.50'	**22.2" Round Culvert** L= 25.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 749.50' / 740.00' S= 0.3800 '/' Cc= 0.900 n= 0.010, Flow Area= 2.69 sf

Primary OutFlow Max=19.36 cfs @ 12.01 hrs HW=752.66' (Free Discharge)
└**1=Culvert** (Inlet Controls 19.36 cfs @ 7.20 fps)

Summary for Pond D3W: 18" Pipe

Inflow Area = 1.543 ac, 0.00% Impervious, Inflow Depth = 1.54" for 10 year - 24 hour event
Inflow = 3.97 cfs @ 12.00 hrs, Volume= 0.198 af
Outflow = 3.97 cfs @ 12.00 hrs, Volume= 0.198 af, Atten= 0%, Lag= 0.0 min
Primary = 3.97 cfs @ 12.00 hrs, Volume= 0.198 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 740.00' @ 12.00 hrs
Flood Elev= 742.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	739.00'	**16.6" Round Culvert** L= 88.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 739.00' / 720.00' S= 0.2159 '/' Cc= 0.900 n= 0.010, Flow Area= 1.50 sf

Primary OutFlow Max=3.97 cfs @ 12.00 hrs HW=740.00' (Free Discharge)
└**1=Culvert** (Inlet Controls 3.97 cfs @ 3.41 fps)

Summary for Pond D4N: 24" Pipe

Inflow Area = 1.933 ac, 0.00% Impervious, Inflow Depth = 1.54" for 10 year - 24 hour event
Inflow = 5.09 cfs @ 11.99 hrs, Volume= 0.248 af
Outflow = 5.09 cfs @ 11.99 hrs, Volume= 0.248 af, Atten= 0%, Lag= 0.0 min
Primary = 5.09 cfs @ 11.99 hrs, Volume= 0.248 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 780.00' @ 11.99 hrs
Flood Elev= 782.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	779.00'	**22.2" Round Culvert** L= 118.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 779.00' / 746.00' S= 0.2797 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 2.69 sf

Primary OutFlow Max=5.08 cfs @ 11.99 hrs HW=780.00' (Free Discharge)
1=Culvert (Inlet Controls 5.08 cfs @ 3.41 fps)

Summary for Pond D4S: 10" Pipe

[58] Hint: Peaked 1.24' above defined flood level
[81] Warning: Exceeded Pond C4S by 0.98' @ 11.99 hrs

Inflow Area = 0.872 ac, 0.00% Impervious, Inflow Depth = 1.54" for 10 year - 24 hour event
Inflow = 2.34 cfs @ 11.99 hrs, Volume= 0.112 af
Outflow = 2.34 cfs @ 11.99 hrs, Volume= 0.112 af, Atten= 0%, Lag= 0.0 min
Primary = 2.34 cfs @ 11.99 hrs, Volume= 0.112 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 778.74' @ 11.99 hrs
Flood Elev= 777.50'

Device	Routing	Invert	Outlet Devices
#1	Primary	777.50'	**9.9" Round Culvert** L= 160.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 777.50' / 728.00' S= 0.3094 '/' Cc= 0.900 n= 0.010, Flow Area= 0.53 sf

Primary OutFlow Max=2.34 cfs @ 11.99 hrs HW=778.74' (Free Discharge)
1=Culvert (Inlet Controls 2.34 cfs @ 4.37 fps)

Summary for Pond D4SE: 12" Pipe

[58] Hint: Peaked 0.05' above defined flood level
[79] Warning: Submerged Pond C4SE Primary device # 1 by 0.05'

Inflow Area = 2.200 ac, 0.00% Impervious, Inflow Depth = 1.54" for 10 year - 24 hour event
Inflow = 5.85 cfs @ 11.99 hrs, Volume= 0.282 af
Outflow = 5.85 cfs @ 11.99 hrs, Volume= 0.282 af, Atten= 0%, Lag= 0.0 min
Primary = 5.85 cfs @ 11.99 hrs, Volume= 0.282 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 776.05' @ 11.99 hrs
Flood Elev= 776.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	773.00'	**11.8" Round Culvert** L= 65.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 773.00' / 749.50' S= 0.3615 '/' Cc= 0.900 n= 0.010, Flow Area= 0.76 sf

Primary OutFlow Max=5.84 cfs @ 11.99 hrs HW=776.05' (Free Discharge)
└**1=Culvert** (Inlet Controls 5.84 cfs @ 7.70 fps)

Summary for Pond D4W: 18" Pipe

[79] Warning: Submerged Pond D2W Primary device # 1 OUTLET by 2.22'
[79] Warning: Submerged Pond D3W Primary device # 1 OUTLET by 2.22'

Inflow Area = 3.467 ac, 0.00% Impervious, Inflow Depth = 1.54" for 10 year - 24 hour event
Inflow = 8.93 cfs @ 12.00 hrs, Volume= 0.445 af
Outflow = 8.93 cfs @ 12.00 hrs, Volume= 0.445 af, Atten= 0%, Lag= 0.0 min
Primary = 8.93 cfs @ 12.00 hrs, Volume= 0.445 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 722.22' @ 12.00 hrs
Flood Elev= 742.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	720.00'	**16.6" Round Culvert** L= 95.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 720.00' / 716.00' S= 0.0421 '/' Cc= 0.900 n= 0.010, Flow Area= 1.50 sf

Primary OutFlow Max=8.93 cfs @ 12.00 hrs HW=722.21' (Free Discharge)
└**1=Culvert** (Inlet Controls 8.93 cfs @ 5.94 fps)

Summary for Pond D5N: 24" Pipe

[79] Warning: Submerged Pond D4N Primary device # 1 OUTLET by 1.95'

Inflow Area = 5.108 ac, 0.00% Impervious, Inflow Depth = 1.54" for 10 year - 24 hour event
Inflow = 13.10 cfs @ 12.00 hrs, Volume= 0.655 af
Outflow = 13.10 cfs @ 12.00 hrs, Volume= 0.655 af, Atten= 0%, Lag= 0.0 min
Primary = 13.10 cfs @ 12.00 hrs, Volume= 0.655 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 747.95' @ 12.00 hrs
Flood Elev= 749.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	746.00'	**22.2" Round Culvert** L= 84.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 746.00' / 726.00' S= 0.2381 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 2.69 sf

Primary OutFlow Max=13.10 cfs @ 12.00 hrs HW=747.95' (Free Discharge)
└**1=Culvert** (Inlet Controls 13.10 cfs @ 4.87 fps)

Summary for Pond D5S: 16" Pipe

[79] Warning: Submerged Pond D4S Primary device # 1 OUTLET by 3.10'

Inflow Area = 2.650 ac, 0.00% Impervious, Inflow Depth = 1.54" for 10 year - 24 hour event
Inflow = 7.01 cfs @ 11.99 hrs, Volume= 0.340 af
Outflow = 7.01 cfs @ 11.99 hrs, Volume= 0.340 af, Atten= 0%, Lag= 0.0 min
Primary = 7.01 cfs @ 11.99 hrs, Volume= 0.340 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 731.10' @ 11.99 hrs
Flood Elev= 732.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	729.00'	**14.8" Round Culvert** L= 142.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 729.00' / 714.00' S= 0.1056 '/' Cc= 0.900 n= 0.010, Flow Area= 1.19 sf

Primary OutFlow Max=7.01 cfs @ 11.99 hrs HW=731.10' (Free Discharge)
1=Culvert (Inlet Controls 7.01 cfs @ 5.87 fps)

Summary for Pond D5SE: 20" Pipe

[79] Warning: Submerged Pond D4SE Primary device # 1 OUTLET by 2.32'

Inflow Area = 4.243 ac, 0.00% Impervious, Inflow Depth = 1.54" for 10 year - 24 hour event
Inflow = 11.18 cfs @ 11.99 hrs, Volume= 0.544 af
Outflow = 11.18 cfs @ 11.99 hrs, Volume= 0.544 af, Atten= 0%, Lag= 0.0 min
Primary = 11.18 cfs @ 11.99 hrs, Volume= 0.544 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 751.82' @ 11.99 hrs
Flood Elev= 752.50'

Device	Routing	Invert	Outlet Devices
#1	Primary	749.50'	**18.5" Round Culvert** L= 30.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 749.50' / 740.00' S= 0.3167 '/' Cc= 0.900 n= 0.010, Flow Area= 1.87 sf

Primary OutFlow Max=11.16 cfs @ 11.99 hrs HW=751.81' (Free Discharge)
1=Culvert (Inlet Controls 11.16 cfs @ 5.98 fps)

Summary for Pond D5SW: 6" Pipe

[58] Hint: Peaked 174.29' above defined flood level
[81] Warning: Exceeded Pond C5SW by 173.59' @ 12.09 hrs

Inflow Area = 4.496 ac, 0.00% Impervious, Inflow Depth = 1.54" for 10 year - 24 hour event
Inflow = 8.82 cfs @ 12.09 hrs, Volume= 0.577 af
Outflow = 8.82 cfs @ 12.09 hrs, Volume= 0.577 af, Atten= 0%, Lag= 0.0 min
Primary = 8.82 cfs @ 12.09 hrs, Volume= 0.577 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 985.29' @ 12.09 hrs
Flood Elev= 811.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	808.00'	**6.1" Round Culvert** L= 125.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 808.00' / 773.00' S= 0.2800 '/' Cc= 0.900 n= 0.010, Flow Area= 0.20 sf

Primary OutFlow Max=8.81 cfs @ 12.09 hrs HW=985.05' (Free Discharge)
└**1=Culvert** (Barrel Controls 8.81 cfs @ 43.43 fps)

Summary for Pond D6S: 14" Pipe

Inflow Area = 1.820 ac, 0.00% Impervious, Inflow Depth = 1.54" for 10 year - 24 hour event
Inflow = 4.90 cfs @ 11.99 hrs, Volume= 0.234 af
Outflow = 4.90 cfs @ 11.99 hrs, Volume= 0.234 af, Atten= 0%, Lag= 0.0 min
Primary = 4.90 cfs @ 11.99 hrs, Volume= 0.234 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 775.79' @ 11.99 hrs
Flood Elev= 777.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	774.00'	**12.9" Round Culvert** L= 185.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 774.00' / 728.50' S= 0.2459 '/' Cc= 0.900 n= 0.010, Flow Area= 0.91 sf

Primary OutFlow Max=4.89 cfs @ 11.99 hrs HW=775.79' (Free Discharge)
└**1=Culvert** (Inlet Controls 4.89 cfs @ 5.39 fps)

Summary for Pond D6SW: 16" Pipe

[58] Hint: Peaked 2.78' above defined flood level
[81] Warning: Exceeded Pond C6SW by 2.32' @ 12.03 hrs
[79] Warning: Submerged Pond D5SW Primary device # 1 OUTLET by 5.78'

Inflow Area = 6.810 ac, 0.00% Impervious, Inflow Depth = 1.54" for 10 year - 24 hour event
Inflow = 13.07 cfs @ 12.03 hrs, Volume= 0.874 af
Outflow = 13.07 cfs @ 12.03 hrs, Volume= 0.874 af, Atten= 0%, Lag= 0.0 min
Primary = 13.07 cfs @ 12.03 hrs, Volume= 0.874 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 778.78' @ 12.03 hrs
Flood Elev= 776.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	773.00'	**14.8" Round Culvert** L= 165.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 773.00' / 729.50' S= 0.2636 '/' Cc= 0.900 n= 0.010, Flow Area= 1.19 sf

Primary OutFlow Max=13.07 cfs @ 12.03 hrs HW=778.78' (Free Discharge)
└**1=Culvert** (Inlet Controls 13.07 cfs @ 10.94 fps)

Summary for Pond D7S: 20" Pipe

[79] Warning: Submerged Pond D6S Primary device # 1 OUTLET by 3.13'

Inflow Area = 3.938 ac, 0.00% Impervious, Inflow Depth = 1.54" for 10 year - 24 hour event
Inflow = 10.49 cfs @ 11.99 hrs, Volume= 0.505 af
Outflow = 10.49 cfs @ 11.99 hrs, Volume= 0.505 af, Atten= 0%, Lag= 0.0 min
Primary = 10.49 cfs @ 11.99 hrs, Volume= 0.505 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 731.63' @ 11.99 hrs
Flood Elev= 732.50'

Device	Routing	Invert	Outlet Devices
#1	Primary	729.50'	**18.5" Round Culvert** L= 70.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 729.50' / 716.50' S= 0.1857 '/' Cc= 0.900 n= 0.010, Flow Area= 1.87 sf

Primary OutFlow Max=10.49 cfs @ 11.99 hrs HW=731.63' (Free Discharge)
1=Culvert (Inlet Controls 10.49 cfs @ 5.62 fps)

Summary for Pond D7SE: 12" Pipe

Inflow Area = 2.211 ac, 0.00% Impervious, Inflow Depth = 1.54" for 10 year - 24 hour event
Inflow = 5.37 cfs @ 12.02 hrs, Volume= 0.284 af
Outflow = 5.37 cfs @ 12.02 hrs, Volume= 0.284 af, Atten= 0%, Lag= 0.0 min
Primary = 5.37 cfs @ 12.02 hrs, Volume= 0.284 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 774.65' @ 12.02 hrs
Flood Elev= 775.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	772.00'	**11.8" Round Culvert** L= 90.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 772.00' / 750.00' S= 0.2444 '/' Cc= 0.900 n= 0.010, Flow Area= 0.76 sf

Primary OutFlow Max=5.37 cfs @ 12.02 hrs HW=774.64' (Free Discharge)
1=Culvert (Inlet Controls 5.37 cfs @ 7.07 fps)

Summary for Pond D7SW: 26" Pipe

[79] Warning: Submerged Pond D6SW Primary device # 1 OUTLET by 2.91'

Inflow Area = 10.006 ac, 0.00% Impervious, Inflow Depth = 1.54" for 10 year - 24 hour event
Inflow = 20.94 cfs @ 12.02 hrs, Volume= 1.284 af
Outflow = 20.94 cfs @ 12.02 hrs, Volume= 1.284 af, Atten= 0%, Lag= 0.0 min
Primary = 20.94 cfs @ 12.02 hrs, Volume= 1.284 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 732.42' @ 12.02 hrs
Flood Elev= 732.50'

Device	Routing	Invert	Outlet Devices
#1	Primary	729.50'	**24.0" Round Culvert** L= 30.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 729.50' / 722.00' S= 0.2500 '/' Cc= 0.900

n= 0.010, Flow Area= 3.14 sf

Primary OutFlow Max=20.91 cfs @ 12.02 hrs HW=732.41' (Free Discharge)
1=Culvert (Inlet Controls 20.91 cfs @ 6.66 fps)

Summary for Pond D8SE: 18" Pipe

[79] Warning: Submerged Pond D7SE Primary device # 1 OUTLET by 2.12'

Inflow Area = 3.519 ac, 0.00% Impervious, Inflow Depth = 1.54" for 10 year - 24 hour event
Inflow = 8.64 cfs @ 11.99 hrs, Volume= 0.452 af
Outflow = 8.64 cfs @ 11.99 hrs, Volume= 0.452 af, Atten= 0%, Lag= 0.0 min
Primary = 8.64 cfs @ 11.99 hrs, Volume= 0.452 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 752.12' @ 11.99 hrs
Flood Elev= 753.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	750.00'	**16.6" Round Culvert** L= 36.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 750.00' / 740.00' S= 0.2778 '/' Cc= 0.900 n= 0.010, Flow Area= 1.50 sf

Primary OutFlow Max=8.63 cfs @ 11.99 hrs HW=752.11' (Free Discharge)
1=Culvert (Inlet Controls 8.63 cfs @ 5.74 fps)

Summary for Pond DP6N: 24" Pipe

[79] Warning: Submerged Pond C6N Primary device # 1 INLET by 3.10'

Inflow Area = 26.669 ac, 0.00% Impervious, Inflow Depth = 1.50" for 10 year - 24 hour event
Inflow = 21.19 cfs @ 12.25 hrs, Volume= 3.323 af
Outflow = 21.19 cfs @ 12.25 hrs, Volume= 3.323 af, Atten= 0%, Lag= 0.0 min
Primary = 21.19 cfs @ 12.25 hrs, Volume= 3.323 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 722.10' @ 12.25 hrs
Flood Elev= 724.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	718.50'	**22.2" Round Culvert** L= 780.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 718.50' / 700.00' S= 0.0237 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 2.69 sf

Primary OutFlow Max=21.19 cfs @ 12.25 hrs HW=722.10' (Free Discharge)
1=Culvert (Inlet Controls 21.19 cfs @ 7.88 fps)

Summary for Pond MH1S: 4' Dia. Manhole

[79] Warning: Submerged Pond D7S Primary device # 1 OUTLET by 1.58'

Inflow Area = 3.938 ac, 0.00% Impervious, Inflow Depth = 1.54" for 10 year - 24 hour event
Inflow = 10.49 cfs @ 11.99 hrs, Volume= 0.505 af
Outflow = 10.49 cfs @ 11.99 hrs, Volume= 0.505 af, Atten= 0%, Lag= 0.0 min
Primary = 10.49 cfs @ 11.99 hrs, Volume= 0.505 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 718.08' @ 11.99 hrs
Flood Elev= 720.50'

Device	Routing	Invert	Outlet Devices
#1	Primary	716.50'	**22.2" Round Culvert** L= 830.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 716.50' / 712.50' S= 0.0048 '/' Cc= 0.900 n= 0.010, Flow Area= 2.69 sf

Primary OutFlow Max=10.49 cfs @ 11.99 hrs HW=718.08' (Free Discharge)
└**1=Culvert** (Inlet Controls 10.49 cfs @ 4.28 fps)

Summary for Pond MH1SE: 8' Dia. Manhole

[58] Hint: Peaked 2.76' above defined flood level
[81] Warning: Exceeded Pond C6SE by 0.63' @ 12.16 hrs
[79] Warning: Submerged Pond D3SE Primary device # 1 OUTLET by 4.76'
[79] Warning: Submerged Pond D5SE Primary device # 1 OUTLET by 4.76'

Inflow Area = 26.644 ac, 0.00% Impervious, Inflow Depth = 1.54" for 10 year - 24 hour event
Inflow = 31.26 cfs @ 12.16 hrs, Volume= 3.419 af
Outflow = 31.26 cfs @ 12.16 hrs, Volume= 3.419 af, Atten= 0%, Lag= 0.0 min
Primary = 31.26 cfs @ 12.16 hrs, Volume= 3.419 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 744.76' @ 12.16 hrs
Flood Elev= 742.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	738.00'	**22.2" Round Culvert** L= 590.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 738.00' / 718.00' S= 0.0339 '/' Cc= 0.900 n= 0.010, Flow Area= 2.69 sf

Primary OutFlow Max=31.25 cfs @ 12.16 hrs HW=744.76' (Free Discharge)
└**1=Culvert** (Inlet Controls 31.25 cfs @ 11.63 fps)

Summary for Pond MH1SW: 4' Dia. Manhole

[57] Hint: Peaked at 743.61' (Flood elevation advised)
[79] Warning: Submerged Pond D3SW Primary device # 1 OUTLET by 3.60'

Inflow Area = 11.465 ac, 0.00% Impervious, Inflow Depth = 1.54" for 10 year - 24 hour event
Inflow = 23.63 cfs @ 12.01 hrs, Volume= 1.471 af
Outflow = 23.63 cfs @ 12.01 hrs, Volume= 1.471 af, Atten= 0%, Lag= 0.0 min
Primary = 23.63 cfs @ 12.01 hrs, Volume= 1.471 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 743.61' @ 12.01 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	738.00'	**20.3" Round Culvert** L= 550.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 738.00' / 717.00' S= 0.0382 '/' Cc= 0.900 n= 0.010, Flow Area= 2.25 sf

Primary OutFlow Max=23.60 cfs @ 12.01 hrs HW=743.60' (Free Discharge)
└**1=Culvert** (Inlet Controls 23.60 cfs @ 10.50 fps)

Summary for Pond MH1W: 6' Manhole

[58] Hint: Peaked 2.83' above defined flood level
[79] Warning: Submerged Pond D3S1 Primary device # 1 OUTLET by 6.33'
[79] Warning: Submerged Pond D3S2 Primary device # 1 OUTLET by 6.33'
[81] Warning: Exceeded Pond D4W by 2.21' @ 12.22 hrs

Inflow Area = 35.305 ac, 0.00% Impervious, Inflow Depth = 1.54" for 10 year - 24 hour event
Inflow = 42.32 cfs @ 12.22 hrs, Volume= 4.530 af
Outflow = 42.32 cfs @ 12.22 hrs, Volume= 4.530 af, Atten= 0%, Lag= 0.0 min
Primary = 42.32 cfs @ 12.22 hrs, Volume= 4.530 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 722.83' @ 12.22 hrs
Flood Elev= 720.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	714.00'	**24.0" Round Culvert** L= 5.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 714.00' / 713.00' S= 0.2000 '/' Cc= 0.900 n= 0.024, Flow Area= 3.14 sf

Primary OutFlow Max=42.31 cfs @ 12.22 hrs HW=722.82' (Free Discharge)
1=Culvert (Inlet Controls 42.31 cfs @ 13.47 fps)

Summary for Pond MH2SE: 4' Dia. Manhole

[79] Warning: Submerged Pond MH1SE Primary device # 1 OUTLET by 1.00'

Inflow Area = 26.644 ac, 0.00% Impervious, Inflow Depth = 1.54" for 10 year - 24 hour event
Inflow = 31.26 cfs @ 12.16 hrs, Volume= 3.419 af
Outflow = 31.26 cfs @ 12.16 hrs, Volume= 3.419 af, Atten= 0%, Lag= 0.0 min
Primary = 31.26 cfs @ 12.16 hrs, Volume= 3.419 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 719.00' @ 12.16 hrs
Flood Elev= 722.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	716.00'	**30.0" Round Culvert** L= 10.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 716.00' / 715.00' S= 0.1000 '/' Cc= 0.900 n= 0.024, Flow Area= 4.91 sf

Primary OutFlow Max=31.25 cfs @ 12.16 hrs HW=719.00' (Free Discharge)
1=Culvert (Inlet Controls 31.25 cfs @ 6.37 fps)

Summary for Pond MH2SW: 6' Dia. Manhole

[58] Hint: Peaked 0.87' above defined flood level
[81] Warning: Exceeded Pond C8SW by 0.60' @ 12.01 hrs
[79] Warning: Submerged Pond D7SW Primary device # 1 OUTLET by 4.87'

Inflow Area = 10.959 ac, 0.00% Impervious, Inflow Depth = 1.54" for 10 year - 24 hour event
Inflow = 23.26 cfs @ 12.01 hrs, Volume= 1.406 af
Outflow = 23.26 cfs @ 12.01 hrs, Volume= 1.406 af, Atten= 0%, Lag= 0.0 min
Primary = 23.26 cfs @ 12.01 hrs, Volume= 1.406 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 726.87' @ 12.01 hrs
Flood Elev= 726.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	722.00'	**24.0" Round Culvert** L= 1,050.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 722.00' / 717.00' S= 0.0048 '/' Cc= 0.900 n= 0.010, Flow Area= 3.14 sf

Primary OutFlow Max=23.25 cfs @ 12.01 hrs HW=726.86' (Free Discharge)
1=Culvert (Barrel Controls 23.25 cfs @ 7.40 fps)

Summary for Pond MH3S: 6' Dia. Manhole

[79] Warning: Submerged Pond D5S Primary device # 1 OUTLET by 4.75'
[81] Warning: Exceeded Pond MH1S by 0.67' @ 11.99 hrs

Inflow Area = 6.588 ac, 0.00% Impervious, Inflow Depth = 1.54" for 10 year - 24 hour event
Inflow = 17.50 cfs @ 11.99 hrs, Volume= 0.845 af
Outflow = 17.50 cfs @ 11.99 hrs, Volume= 0.845 af, Atten= 0%, Lag= 0.0 min
Primary = 17.50 cfs @ 11.99 hrs, Volume= 0.845 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 718.75' @ 11.99 hrs
Flood Elev= 720.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	716.00'	**22.2" Round Culvert** L= 10.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 716.00' / 712.00' S= 0.4000 '/' Cc= 0.900 n= 0.010, Flow Area= 2.69 sf

Primary OutFlow Max=17.49 cfs @ 11.99 hrs HW=718.75' (Free Discharge)
1=Culvert (Inlet Controls 17.49 cfs @ 6.51 fps)

Summary for Pond MH3SE: 8' Dia. Manhole

[58] Hint: Peaked 2.62' above defined flood level
[81] Warning: Exceeded Pond C13SE by 6.43' @ 12.17 hrs
[79] Warning: Submerged Pond D12SE Primary device # 1 OUTLET by 10.62'

Inflow Area = 21.294 ac, 0.00% Impervious, Inflow Depth = 1.54" for 10 year - 24 hour event
Inflow = 27.06 cfs @ 12.17 hrs, Volume= 2.732 af
Outflow = 27.06 cfs @ 12.17 hrs, Volume= 2.732 af, Atten= 0%, Lag= 0.0 min
Primary = 27.06 cfs @ 12.17 hrs, Volume= 2.732 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 730.62' @ 12.17 hrs
Flood Elev= 728.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	720.00'	**24.0" Round Culvert** L= 1,400.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 720.00' / 715.00' S= 0.0036 '/' Cc= 0.900 n= 0.010, Flow Area= 3.14 sf

Primary OutFlow Max=27.06 cfs @ 12.17 hrs HW=730.62' (Free Discharge)
1=Culvert (Barrel Controls 27.06 cfs @ 8.61 fps)

Summary for Pond MH3SW: 6' Dia. Manhole

[58] Hint: Peaked 6.60' above defined flood level
[79] Warning: Submerged Pond MH1SW Primary device # 1 OUTLET by 10.60'
[81] Warning: Exceeded Pond MH2SW by 0.77' @ 12.00 hrs

Inflow Area = 22.424 ac, 0.00% Impervious, Inflow Depth = 1.54" for 10 year - 24 hour event
Inflow = 46.87 cfs @ 12.01 hrs, Volume= 2.877 af
Outflow = 46.87 cfs @ 12.01 hrs, Volume= 2.877 af, Atten= 0%, Lag= 0.0 min
Primary = 46.87 cfs @ 12.01 hrs, Volume= 2.877 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 727.60' @ 12.01 hrs
Flood Elev= 721.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	717.00'	**24.0" Round Culvert** L= 5.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 717.00' / 717.00' S= 0.0000 '/' Cc= 0.900 n= 0.024, Flow Area= 3.14 sf

Primary OutFlow Max=46.83 cfs @ 12.01 hrs HW=727.59' (Free Discharge)
1=Culvert (Inlet Controls 46.83 cfs @ 14.91 fps)

Summary for Pond MH4SE: 4' Dia. Manhole

[81] Warning: Exceeded Pond MH3SE by 4.40' @ 11.98 hrs

Inflow Area = 25.454 ac, 0.00% Impervious, Inflow Depth = 1.54" for 10 year - 24 hour event
Inflow = 31.55 cfs @ 12.04 hrs, Volume= 3.266 af
Outflow = 31.55 cfs @ 12.04 hrs, Volume= 3.266 af, Atten= 0%, Lag= 0.0 min
Primary = 31.55 cfs @ 12.04 hrs, Volume= 3.266 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 728.71' @ 12.04 hrs
Flood Elev= 735.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	720.30'	**24.0" Round Culvert** L= 620.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 720.30' / 717.20' S= 0.0050 '/' Cc= 0.900 n= 0.010, Flow Area= 3.14 sf

Primary OutFlow Max=31.55 cfs @ 12.04 hrs HW=728.71' (Free Discharge)
1=Culvert (Barrel Controls 31.55 cfs @ 10.04 fps)

Summary for Pond MH4W: Manhole

[57] Hint: Peaked at 724.31' (Flood elevation advised)
[79] Warning: Submerged Pond D1W Primary device # 1 OUTLET by 0.31'

Inflow Area = 16.760 ac, 0.00% Impervious, Inflow Depth = 1.54" for 10 year - 24 hour event
Inflow = 27.53 cfs @ 12.16 hrs, Volume= 2.150 af
Outflow = 27.53 cfs @ 12.16 hrs, Volume= 2.150 af, Atten= 0%, Lag= 0.0 min
Primary = 27.53 cfs @ 12.16 hrs, Volume= 2.150 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2

Peak Elev= 724.31' @ 12.16 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	720.00'	**24.0" Round Culvert** L= 5.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 720.00' / 719.00' S= 0.2000 '/' Cc= 0.900 n= 0.024, Flow Area= 3.14 sf

Primary OutFlow Max=27.52 cfs @ 12.16 hrs HW=724.31' (Free Discharge)
1=Culvert (Inlet Controls 27.52 cfs @ 8.76 fps)

Summary for Pond MH5SE: 4' Dia. Manhole

[79] Warning: Submerged Pond MH4SE Primary device # 1 OUTLET by 1.83'

Inflow Area = 25.454 ac, 0.00% Impervious, Inflow Depth = 1.54" for 10 year - 24 hour event
Inflow = 31.55 cfs @ 12.04 hrs, Volume= 3.266 af
Outflow = 31.55 cfs @ 12.04 hrs, Volume= 3.266 af, Atten= 0%, Lag= 0.0 min
Primary = 31.55 cfs @ 12.04 hrs, Volume= 3.266 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 719.03' @ 12.04 hrs
Flood Elev= 722.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	716.00'	**30.0" Round Culvert** L= 10.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 716.00' / 715.00' S= 0.1000 '/' Cc= 0.900 n= 0.024, Flow Area= 4.91 sf

Primary OutFlow Max=31.55 cfs @ 12.04 hrs HW=719.03' (Free Discharge)
1=Culvert (Inlet Controls 31.55 cfs @ 6.43 fps)

Summary for Pond NP: North Pond

Inflow Area = 38.256 ac, 2.57% Impervious, Inflow Depth = 1.57" for 10 year - 24 hour event
Inflow = 40.80 cfs @ 12.06 hrs, Volume= 5.009 af
Outflow = 24.13 cfs @ 12.51 hrs, Volume= 4.995 af, Atten= 41%, Lag= 26.6 min
Primary = 24.13 cfs @ 12.51 hrs, Volume= 4.995 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Tertiary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Starting Elev= 696.00' Surf.Area= 20,300 sf Storage= 34,300 cf
Peak Elev= 698.00' @ 12.51 hrs Surf.Area= 26,005 sf Storage= 80,641 cf (46,341 cf above start)
Flood Elev= 702.00' Surf.Area= 39,000 sf Storage= 210,400 cf (176,100 cf above start)

Plug-Flow detention time= 179.3 min calculated for 4.206 af (84% of inflow)
Center-of-Mass det. time= 67.2 min (929.0 - 861.8)

Volume	Invert	Avail.Storage	Storage Description
#1	694.00'	230,713 cf	**Custom Stage Data (Prismatic)**Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
694.00	14,000	0	0
696.00	20,300	34,300	34,300
698.00	26,000	46,300	80,600
700.00	32,400	58,400	139,000
702.00	39,000	71,400	210,400
702.50	42,250	20,313	230,713

Device	Routing	Invert	Outlet Devices
#1	Primary	696.00'	**36.0" Round Culvert** L= 60.0' CMP, end-section conforming to fill, Ke= 0.500 Inlet / Outlet Invert= 696.00' / 694.00' S= 0.0333 '/' Cc= 0.900 n= 0.018, Flow Area= 7.07 sf
#2	Secondary	701.50'	**40.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88
#3	Tertiary	702.00'	**600.0' long x 2.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32

Primary OutFlow Max=24.13 cfs @ 12.51 hrs HW=698.00' (Free Discharge)
└**1=Culvert** (Inlet Controls 24.13 cfs @ 4.82 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=696.00' (Free Discharge)
└**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Tertiary OutFlow Max=0.00 cfs @ 0.00 hrs HW=696.00' (Free Discharge)
└**3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond NWP: Northwest Pond

Inflow Area = 65.182 ac, 1.44% Impervious, Inflow Depth = 1.57" for 10 year - 24 hour event
Inflow = 74.73 cfs @ 12.19 hrs, Volume= 8.554 af
Outflow = 40.51 cfs @ 12.50 hrs, Volume= 8.547 af, Atten= 46%, Lag= 18.2 min
Primary = 40.51 cfs @ 12.50 hrs, Volume= 8.547 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Tertiary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Starting Elev= 707.00' Surf.Area= 18,591 sf Storage= 71,995 cf
Peak Elev= 711.19' @ 12.50 hrs Surf.Area= 26,299 sf Storage= 165,750 cf (93,755 cf above start)
Flood Elev= 716.00' Surf.Area= 35,795 sf Storage= 314,850 cf (242,856 cf above start)

Plug-Flow detention time= 180.5 min calculated for 6.895 af (81% of inflow)
Center-of-Mass det. time= 51.3 min (913.9 - 862.6)

Volume	Invert	Avail.Storage	Storage Description
#1	702.00'	333,326 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
702.00	10,381	0	0
704.00	13,520	23,901	23,901
706.00	16,852	30,372	54,273
708.00	20,330	37,182	91,455
710.00	24,050	44,380	135,835
712.00	27,835	51,885	187,720
714.00	31,750	59,585	247,305
716.00	35,795	67,545	314,850
716.50	38,110	18,476	333,326

Device	Routing	Invert	Outlet Devices
#1	Primary	707.00'	**30.0" Round Culvert** L= 40.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 707.00' / 706.00' S= 0.0250 '/' Cc= 0.900 n= 0.012, Flow Area= 4.91 sf
#2	Secondary	715.50'	**40.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88
#3	Tertiary	716.00'	**530.0' long x 2.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32

Primary OutFlow Max=40.51 cfs @ 12.50 hrs HW=711.19' (Free Discharge)
└**1=Culvert** (Inlet Controls 40.51 cfs @ 8.25 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=707.00' (Free Discharge)
└**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Tertiary OutFlow Max=0.00 cfs @ 0.00 hrs HW=707.00' (Free Discharge)
└**3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond SEP: Southeast Pond

[79] Warning: Submerged Pond MH2SE Primary device # 1 OUTLET by 0.48'
[79] Warning: Submerged Pond MH5SE Primary device # 1 OUTLET by 0.48'

Inflow Area = 54.264 ac, 1.25% Impervious, Inflow Depth = 1.57" for 10 year - 24 hour event
Inflow = 65.42 cfs @ 12.03 hrs, Volume= 7.100 af
Outflow = 47.93 cfs @ 12.34 hrs, Volume= 7.099 af, Atten= 27%, Lag= 19.0 min
Primary = 47.93 cfs @ 12.34 hrs, Volume= 7.099 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Starting Elev= 712.00' Surf.Area= 11,817 sf Storage= 33,961 cf
Peak Elev= 715.48' @ 12.34 hrs Surf.Area= 17,858 sf Storage= 86,354 cf (52,393 cf above start)
Flood Elev= 718.00' Surf.Area= 22,487 sf Storage= 136,385 cf (102,424 cf above start)

Plug-Flow detention time= 111.4 min calculated for 6.319 af (89% of inflow)
Center-of-Mass det. time= 33.7 min (895.2 - 861.5)

Volume	Invert	Avail.Storage	Storage Description
#1	708.00'	187,373 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
708.00	5,158	0	0
710.00	8,493	13,651	13,651
712.00	11,817	20,310	33,961
714.00	15,317	27,134	61,095
716.00	18,743	34,060	95,155
718.00	22,487	41,230	136,385
720.00	28,501	50,988	187,373

Device	Routing	Invert	Outlet Devices
#1	Primary	712.00'	**36.0" Round Culvert** L= 73.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 712.00' / 710.90' S= 0.0151 '/' Cc= 0.900 n= 0.015 Concrete sewer w/manholes & inlets, Flow Area= 7.07 sf
#2	Secondary	718.00'	**600.0' long x 60.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=47.93 cfs @ 12.34 hrs HW=715.48' (Free Discharge)
↑—**1=Culvert** (Inlet Controls 47.93 cfs @ 6.78 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=712.00' (Free Discharge)
↑—**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond SP: South Pond

Inflow Area = 5.541 ac, 25.00% Impervious, Inflow Depth = 2.10" for 10 year - 24 hour event
Inflow = 18.52 cfs @ 11.96 hrs, Volume= 0.969 af
Outflow = 0.20 cfs @ 23.99 hrs, Volume= 0.249 af, Atten= 99%, Lag= 721.7 min
Discarded = 0.08 cfs @ 23.99 hrs, Volume= 0.243 af
Secondary = 0.12 cfs @ 23.99 hrs, Volume= 0.006 af
Tertiary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 720.00' @ 23.99 hrs Surf.Area= 22,030 sf Storage= 38,251 cf
Flood Elev= 720.00' Surf.Area= 22,003 sf Storage= 38,164 cf

Plug-Flow detention time= 1,084.3 min calculated for 0.249 af (26% of inflow)
Center-of-Mass det. time= 933.0 min (1,753.2 - 820.1)

Volume	Invert	Avail.Storage	Storage Description
#1	716.50'	95,942 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
716.50	0	0	0
718.00	9,235	6,926	6,926
720.00	22,003	31,238	38,164
722.00	35,775	57,778	95,942

Device	Routing	Invert	Outlet Devices
#1	Discarded	716.50'	**0.150 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 700.00'
#2	Secondary	720.00'	**80.0' long x 30.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63
#3	Tertiary	720.50'	**100.0' long x 30.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Discarded OutFlow Max=0.08 cfs @ 23.99 hrs HW=720.00' (Free Discharge)
└**1=Exfiltration** (Controls 0.08 cfs)

Secondary OutFlow Max=0.05 cfs @ 23.99 hrs HW=720.00' (Free Discharge)
└**2=Broad-Crested Rectangular Weir** (Weir Controls 0.05 cfs @ 0.17 fps)

Tertiary OutFlow Max=0.00 cfs @ 0.00 hrs HW=716.50' (Free Discharge)
└**3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond SWP: Southwest Pond

[81] Warning: Exceeded Pond MH3SW by 3.02' @ 25.19 hrs

Inflow Area = 25.347 ac, 3.30% Impervious, Inflow Depth = 1.62" for 10 year - 24 hour event
Inflow = 52.71 cfs @ 11.99 hrs, Volume= 3.422 af
Outflow = 9.85 cfs @ 12.42 hrs, Volume= 2.121 af, Atten= 81%, Lag= 25.9 min
Primary = 9.85 cfs @ 12.42 hrs, Volume= 2.121 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 720.39' @ 12.42 hrs Surf.Area= 24,929 sf Storage= 67,108 cf
Flood Elev= 723.00' Surf.Area= 40,614 sf Storage= 151,443 cf

Plug-Flow detention time= 238.7 min calculated for 2.121 af (62% of inflow)
Center-of-Mass det. time= 114.7 min (962.0 - 847.2)

Volume	Invert	Avail.Storage	Storage Description
#1	715.00'	192,056 cf	**Custom Stage Data (Prismatic)** Listed below

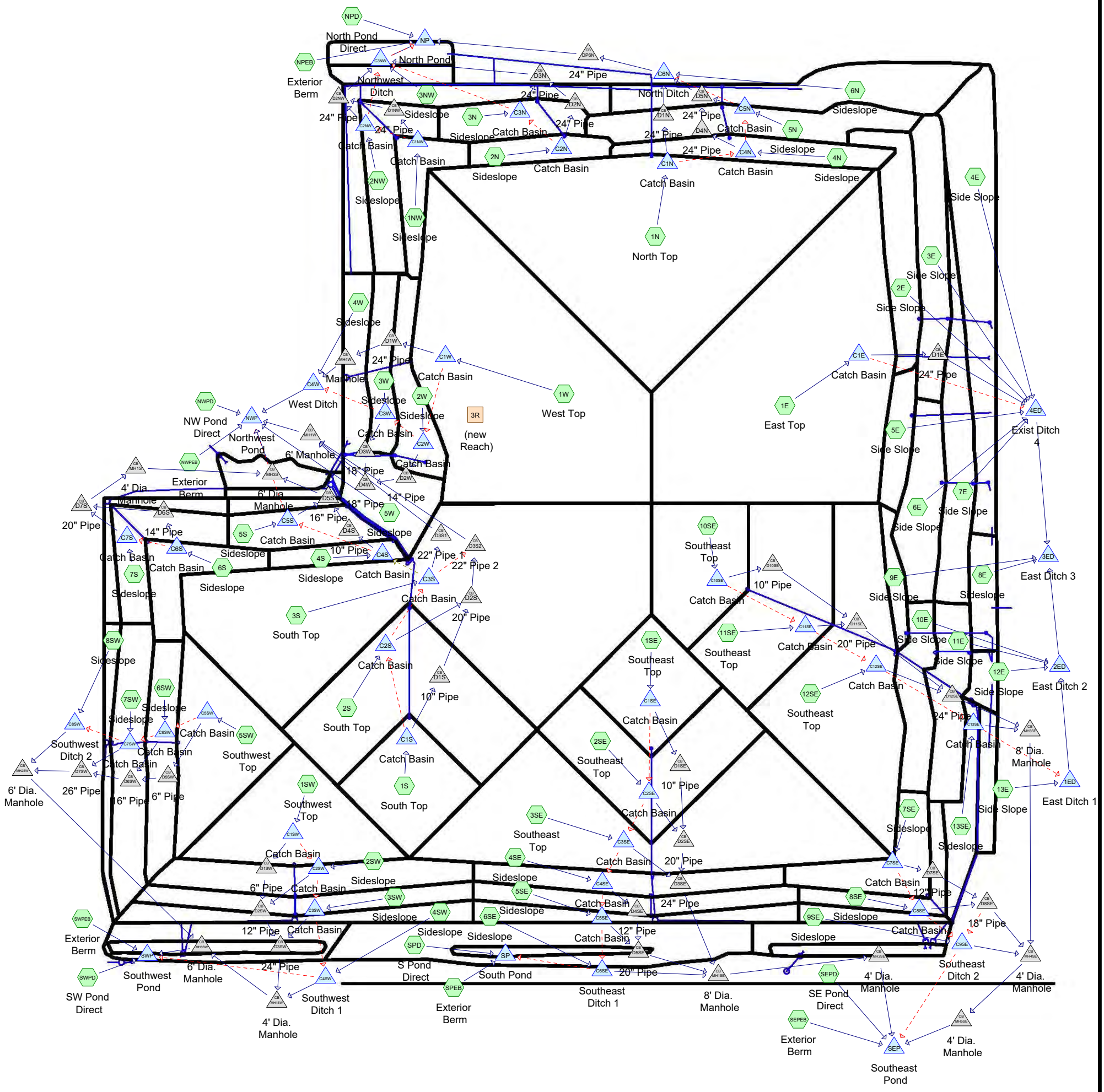
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
715.00	0	0	0
716.00	950	475	475
718.00	15,835	16,785	17,260
720.00	23,586	39,421	56,681
722.00	30,562	54,148	110,829
724.00	50,665	81,227	192,056

Device	Routing	Invert	Outlet Devices
#1	Primary	715.05'	**18.0" Round Culvert** L= 134.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 715.05' / 714.37' S= 0.0051 '/' Cc= 0.900 n= 0.015 Concrete sewer w/manholes & inlets, Flow Area= 1.77 sf
#2	Device 1	720.00'	**48.0" Horiz. Orifice/Grate** C= 0.600 in 48.0" Grate (100% open area) Limited to weir flow at low heads
#3	Secondary	723.00'	**300.0' long x 60.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=9.82 cfs @ 12.42 hrs HW=720.39' (Free Discharge)
└─**1=Culvert** (Passes 9.82 cfs of 13.81 cfs potential flow)
└─**2=Orifice/Grate** (Weir Controls 9.82 cfs @ 2.03 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=715.00' (Free Discharge)
└─**3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pre-Expansion 500-Year Storm HydroCAD Analysis



Routing Diagram for BSLI WDA&NDA Combined Existing Model

Prepared by Carlson McCain, Inc., Printed 12/18/2019

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Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
223.437	71	Meadow, non-grazed, HSG C (1E, 1N, 1NW, 1S, 1SE, 1SW, 1W, 2E, 2N, 2NW, 2S, 2SE, 2SW, 2W, 3E, 3N, 3NW, 3S, 3SE, 3SW, 3W, 4E, 4N, 4S, 4SE, 4SW, 4W, 5E, 5N, 5S, 5SE, 5SW, 5W, 6E, 6N, 6S, 6SE, 6SW, 7E, 7S, 7SE, 7SW, 8E, 8SE, 8SW, 9E, 9SE, 10E, 10SE, 11E, 11SE, 12E, 12SE, 13E, 13SE, NPEB, NWPEB, SEPEB, SPEB, SWPEB)
1.192	91	Urban industrial, 72% imp, HSG C (SPEB)
3.962	98	Water Surface, HSG C (NPD, NWPD, SEPD, SPD, SWPD)
228.591	**72**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
228.591	HSG C	1E, 1N, 1NW, 1S, 1SE, 1SW, 1W, 2E, 2N, 2NW, 2S, 2SE, 2SW, 2W, 3E, 3N, 3NW, 3S, 3SE, 3SW, 3W, 4E, 4N, 4S, 4SE, 4SW, 4W, 5E, 5N, 5S, 5SE, 5SW, 5W, 6E, 6N, 6S, 6SE, 6SW, 7E, 7S, 7SE, 7SW, 8E, 8SE, 8SW, 9E, 9SE, 10E, 10SE, 11E, 11SE, 12E, 12SE, 13E, 13SE, NPD, NPEB, NWPD, NWPEB, SEPD, SEPEB, SPD, SPEB, SWPD, SWPEB
0.000	HSG D	
0.000	Other	
228.591		**TOTAL AREA**

Pipe Listing (all nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Diam/Width (inches)	Height (inches)	Inside-Fill (inches)
1	2E	0.00	0.00	280.0	0.3300	0.010	18.0	0.0	0.0
2	3E	0.00	0.00	170.0	0.3300	0.010	18.0	0.0	0.0
3	5E	0.00	0.00	315.0	0.3300	0.010	18.0	0.0	0.0
4	6E	0.00	0.00	185.0	0.3300	0.010	18.0	0.0	0.0
5	7E	0.00	0.00	60.0	0.3300	0.010	18.0	0.0	0.0
6	9E	0.00	0.00	300.0	0.3333	0.010	18.0	0.0	0.0
7	10E	0.00	0.00	210.0	0.3333	0.010	18.0	0.0	0.0
8	11E	0.00	0.00	210.0	0.3333	0.010	18.0	0.0	0.0
9	13E	0.00	0.00	266.0	0.0050	0.010	18.0	0.0	0.0
10	1ED	711.50	709.00	230.0	0.0109	0.010	16.0	0.0	0.0
11	2ED	709.50	708.50	90.0	0.0111	0.011	16.0	0.0	0.0
12	3ED	708.19	707.50	75.0	0.0092	0.011	16.0	0.0	0.0
13	4ED	709.72	709.24	65.0	0.0074	0.010	16.0	0.0	0.0
14	C3NW	719.00	705.00	100.0	0.1400	0.018	24.0	0.0	0.0
15	C4W	717.00	716.00	90.0	0.0111	0.024	30.0	0.0	0.0
16	C6N	719.00	718.50	50.0	0.0100	0.018	22.2	0.0	0.0
17	D10SE	807.00	800.00	350.0	0.0200	0.010	9.9	0.0	0.0
18	D11SE	800.00	794.50	265.0	0.0208	0.010	18.5	0.0	0.0
19	D12SE	794.50	720.00	350.0	0.2129	0.010	22.2	0.0	0.0
20	D1E	794.50	720.00	330.0	0.2258	0.010	22.2	0.0	0.0
21	D1N	798.00	720.00	330.0	0.2364	0.010	22.2	0.0	0.0
22	D1NW	782.00	742.00	200.0	0.2000	0.010	22.2	0.0	0.0
23	D1S	806.00	797.00	420.0	0.0214	0.010	9.9	0.0	0.0
24	D1SE	807.00	801.00	360.0	0.0167	0.010	9.9	0.0	0.0
25	D1SW	808.00	773.00	120.0	0.2917	0.010	6.1	0.0	0.0
26	D1W	796.00	724.00	280.0	0.2571	0.010	22.2	0.0	0.0
27	D2N	779.00	739.00	170.0	0.2353	0.010	22.2	0.0	0.0
28	D2NW	742.00	726.00	60.0	0.2667	0.010	22.2	0.0	0.0
29	D2S	797.00	793.70	195.0	0.0169	0.010	18.5	0.0	0.0
30	D2SE	801.00	796.00	120.0	0.0417	0.010	18.5	0.0	0.0
31	D2SW	773.00	749.50	75.0	0.3133	0.010	11.8	0.0	0.0
32	D2W	766.00	720.00	200.0	0.2300	0.010	12.9	0.0	0.0
33	D3N	739.00	726.00	60.0	0.2167	0.010	22.2	0.0	0.0
34	D3S1	793.70	716.50	475.0	0.1625	0.010	20.3	0.0	0.0
35	D3S2	793.70	716.50	475.0	0.1625	0.010	20.3	0.0	0.0
36	D3SE	796.00	740.00	190.0	0.2947	0.010	22.2	0.0	0.0
37	D3SW	749.50	740.00	25.0	0.3800	0.010	22.2	0.0	0.0
38	D3W	739.00	720.00	88.0	0.2159	0.010	16.6	0.0	0.0
39	D4N	779.00	746.00	118.0	0.2797	0.010	22.2	0.0	0.0
40	D4S	777.50	728.00	160.0	0.3094	0.010	9.9	0.0	0.0
41	D4SE	773.00	749.50	65.0	0.3615	0.010	11.8	0.0	0.0
42	D4W	720.00	716.00	95.0	0.0421	0.010	16.6	0.0	0.0
43	D5N	746.00	726.00	84.0	0.2381	0.010	22.2	0.0	0.0
44	D5S	729.00	714.00	142.0	0.1056	0.010	14.8	0.0	0.0
45	D5SE	749.50	740.00	30.0	0.3167	0.010	18.5	0.0	0.0
46	D5SW	808.00	773.00	125.0	0.2800	0.010	6.1	0.0	0.0

Pipe Listing (all nodes) (continued)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Diam/Width (inches)	Height (inches)	Inside-Fill (inches)
47	D6S	774.00	728.50	185.0	0.2459	0.010	12.9	0.0	0.0
48	D6SW	773.00	729.50	165.0	0.2636	0.010	14.8	0.0	0.0
49	D7S	729.50	716.50	70.0	0.1857	0.010	18.5	0.0	0.0
50	D7SE	772.00	750.00	90.0	0.2444	0.010	11.8	0.0	0.0
51	D7SW	729.50	722.00	30.0	0.2500	0.010	24.0	0.0	0.0
52	D8SE	750.00	740.00	36.0	0.2778	0.010	16.6	0.0	0.0
53	DP6N	718.50	700.00	780.0	0.0237	0.010	22.2	0.0	0.0
54	MH1S	716.50	712.50	830.0	0.0048	0.010	22.2	0.0	0.0
55	MH1SE	738.00	718.00	590.0	0.0339	0.010	22.2	0.0	0.0
56	MH1SW	738.00	717.00	550.0	0.0382	0.010	20.3	0.0	0.0
57	MH1W	714.00	713.00	5.0	0.2000	0.024	24.0	0.0	0.0
58	MH2SE	716.00	715.00	10.0	0.1000	0.024	30.0	0.0	0.0
59	MH2SW	722.00	717.00	1,050.0	0.0048	0.010	24.0	0.0	0.0
60	MH3S	716.00	712.00	10.0	0.4000	0.010	22.2	0.0	0.0
61	MH3SE	720.00	715.00	1,400.0	0.0036	0.010	24.0	0.0	0.0
62	MH3SW	717.00	717.00	5.0	0.0000	0.024	24.0	0.0	0.0
63	MH4SE	720.30	717.20	620.0	0.0050	0.010	24.0	0.0	0.0
64	MH4W	720.00	719.00	5.0	0.2000	0.024	24.0	0.0	0.0
65	MH5SE	716.00	715.00	10.0	0.1000	0.024	30.0	0.0	0.0
66	NP	696.00	694.00	60.0	0.0333	0.018	36.0	0.0	0.0
67	NWP	707.00	706.00	40.0	0.0250	0.012	30.0	0.0	0.0
68	SEP	712.00	710.90	73.0	0.0151	0.015	36.0	0.0	0.0
69	SWP	715.05	714.37	134.0	0.0051	0.015	18.0	0.0	0.0

Time span=0.00-48.00 hrs, dt=0.01 hrs, 4801 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1E: East Top Runoff Area=17.841 ac 0.00% Impervious Runoff Depth=6.81"
Flow Length=970' Tc=34.1 min CN=71 Runoff=96.72 cfs 10.125 af

Subcatchment 1N: North Top Runoff Area=17.691 ac 0.00% Impervious Runoff Depth=6.81"
Flow Length=770' Tc=32.5 min CN=71 Runoff=99.03 cfs 10.040 af

Subcatchment 1NW: Sideslope Runoff Area=1.506 ac 0.00% Impervious Runoff Depth=6.81"
Flow Length=535' Tc=5.3 min CN=71 Runoff=18.27 cfs 0.855 af

Subcatchment 1S: South Top Runoff Area=3.455 ac 0.00% Impervious Runoff Depth=6.81"
Flow Length=550' Slope=0.0200 '/' Tc=15.2 min CN=71 Runoff=30.03 cfs 1.961 af

Subcatchment 1SE: Southeast Top Runoff Area=3.373 ac 0.00% Impervious Runoff Depth=6.81"
Flow Length=510' Slope=0.0200 '/' Tc=14.9 min CN=71 Runoff=29.62 cfs 1.914 af

Subcatchment 1SW: Southwest Top Runoff Area=4.734 ac 0.00% Impervious Runoff Depth=6.81"
Flow Length=470' Slope=0.0200 '/' Tc=14.6 min CN=71 Runoff=41.89 cfs 2.687 af

Subcatchment 1W: West Top Runoff Area=16.760 ac 0.00% Impervious Runoff Depth=6.81"
Flow Length=970' Tc=20.0 min CN=71 Runoff=126.27 cfs 9.512 af

Subcatchment 2E: Side Slope Runoff Area=2.590 ac 0.00% Impervious Runoff Depth=6.81"
Flow Length=980' Tc=10.4 min CN=71 Runoff=26.33 cfs 1.470 af

Subcatchment 2N: Sideslope Runoff Area=1.145 ac 0.00% Impervious Runoff Depth=6.81"
Flow Length=424' Tc=6.5 min CN=71 Runoff=13.33 cfs 0.650 af

Subcatchment 2NW: Sideslope Runoff Area=2.338 ac 0.00% Impervious Runoff Depth=6.81"
Flow Length=1,113' Tc=11.8 min CN=71 Runoff=22.67 cfs 1.327 af

Subcatchment 2S: South Top Runoff Area=7.410 ac 0.00% Impervious Runoff Depth=6.81"
Flow Length=800' Tc=27.8 min CN=71 Runoff=46.02 cfs 4.205 af

Subcatchment 2SE: Southeast Top Runoff Area=5.356 ac 0.00% Impervious Runoff Depth=6.81"
Flow Length=700' Tc=27.0 min CN=71 Runoff=33.88 cfs 3.040 af

Subcatchment 2SW: Sideslope Runoff Area=2.975 ac 0.00% Impervious Runoff Depth=6.81"
Flow Length=725' Tc=6.8 min CN=71 Runoff=34.26 cfs 1.688 af

Subcatchment 2W: Sideslope Runoff Area=1.924 ac 0.00% Impervious Runoff Depth=6.81"
Flow Length=770' Tc=7.6 min CN=71 Runoff=21.54 cfs 1.092 af

Subcatchment 3E: Side Slope Runoff Area=2.825 ac 0.00% Impervious Runoff Depth=6.81"
Flow Length=1,010' Tc=11.5 min CN=71 Runoff=27.68 cfs 1.603 af

Subcatchment 3N: Sideslope Runoff Area=1.762 ac 0.00% Impervious Runoff Depth=6.81"
Flow Length=398' Tc=7.9 min CN=71 Runoff=19.53 cfs 1.000 af

Subcatchment 3NW: Sideslope Runoff Area=3.104 ac 0.00% Impervious Runoff Depth=6.81"
Flow Length=1,190' Tc=9.7 min CN=71 Runoff=32.33 cfs 1.762 af

Subcatchment 3S: South Top Runoff Area=20.973 ac 0.00% Impervious Runoff Depth=6.81"
Flow Length=950' Tc=29.0 min CN=71 Runoff=126.65 cfs 11.903 af

Subcatchment 3SE: Southeast Top Runoff Area=12.185 ac 0.00% Impervious Runoff Depth=6.81"
Flow Length=730' Tc=27.3 min CN=71 Runoff=76.25 cfs 6.915 af

Subcatchment 3SW: Sideslope Runoff Area=2.085 ac 0.00% Impervious Runoff Depth=6.81"
Flow Length=756' Tc=7.4 min CN=71 Runoff=23.51 cfs 1.183 af

Subcatchment 3W: Sideslope Runoff Area=1.543 ac 0.00% Impervious Runoff Depth=6.81"
Flow Length=740' Tc=7.7 min CN=71 Runoff=17.23 cfs 0.876 af

Subcatchment 4E: Side Slope Runoff Area=5.342 ac 0.00% Impervious Runoff Depth=6.81"
Flow Length=820' Tc=11.2 min CN=71 Runoff=52.90 cfs 3.032 af

Subcatchment 4N: Sideslope Runoff Area=1.933 ac 0.00% Impervious Runoff Depth=6.81"
Flow Length=632' Tc=7.1 min CN=71 Runoff=22.03 cfs 1.097 af

Subcatchment 4S: Sideslope Runoff Area=0.872 ac 0.00% Impervious Runoff Depth=6.81"
Flow Length=530' Tc=6.6 min CN=71 Runoff=10.11 cfs 0.495 af

Subcatchment 4SE: Sideslope Runoff Area=2.200 ac 0.00% Impervious Runoff Depth=6.81"
Flow Length=730' Tc=6.8 min CN=71 Runoff=25.34 cfs 1.249 af

Subcatchment 4SW: Sideslope Runoff Area=1.671 ac 0.00% Impervious Runoff Depth=6.81"
Flow Length=730' Tc=6.2 min CN=71 Runoff=19.65 cfs 0.948 af

Subcatchment 4W: Sideslope Runoff Area=1.561 ac 0.00% Impervious Runoff Depth=6.81"
Flow Length=350' Tc=6.6 min CN=71 Runoff=18.10 cfs 0.886 af

Subcatchment 5E: Side Slope Runoff Area=1.195 ac 0.00% Impervious Runoff Depth=6.81"
Flow Length=730' Tc=7.0 min CN=71 Runoff=13.66 cfs 0.678 af

Subcatchment 5N: Sideslope Runoff Area=3.175 ac 0.00% Impervious Runoff Depth=6.81"
Flow Length=766' Tc=8.1 min CN=71 Runoff=34.95 cfs 1.802 af

Subcatchment 5S: Sideslope Runoff Area=1.778 ac 0.00% Impervious Runoff Depth=6.81"
Flow Length=565' Tc=7.1 min CN=71 Runoff=20.27 cfs 1.009 af

Subcatchment 5SE: Sideslope Runoff Area=2.043 ac 0.00% Impervious Runoff Depth=6.81"
Flow Length=750' Tc=7.3 min CN=71 Runoff=23.12 cfs 1.159 af

Subcatchment 5SW: Southwest Top Runoff Area=4.496 ac 0.00% Impervious Runoff Depth=6.81"
Flow Length=440' Slope=0.0200 '/' Tc=14.4 min CN=71 Runoff=40.03 cfs 2.552 af

Subcatchment 5W: Sideslope Runoff Area=2.191 ac 0.00% Impervious Runoff Depth=6.81"
Flow Length=385' Tc=6.1 min CN=71 Runoff=25.84 cfs 1.243 af

Subcatchment 6E: Side Slope Runoff Area=2.437 ac 0.00% Impervious Runoff Depth=6.81"
Flow Length=735' Tc=9.2 min CN=71 Runoff=25.84 cfs 1.383 af

Subcatchment 6N: Sideslope Runoff Area=3.870 ac 0.00% Impervious Runoff Depth=6.81"
Flow Length=1,070' Tc=13.5 min CN=71 Runoff=35.50 cfs 2.196 af

Subcatchment 6S: Sideslope Runoff Area=1.820 ac 0.00% Impervious Runoff Depth=6.81"
Flow Length=490' Tc=6.5 min CN=71 Runoff=21.19 cfs 1.033 af

Subcatchment 6SE: Sideslope Runoff Area=1.487 ac 0.00% Impervious Runoff Depth=6.81"
Flow Length=725' Tc=6.4 min CN=71 Runoff=17.37 cfs 0.844 af

Subcatchment 6SW: Sideslope Runoff Area=2.314 ac 0.00% Impervious Runoff Depth=6.81"
Flow Length=530' Tc=6.6 min CN=71 Runoff=26.83 cfs 1.313 af

Subcatchment 7E: Side Slope Runoff Area=3.018 ac 0.00% Impervious Runoff Depth=6.81"
Flow Length=1,050' Tc=8.9 min CN=71 Runoff=32.32 cfs 1.713 af

Subcatchment 7S: Sideslope Runoff Area=2.118 ac 0.00% Impervious Runoff Depth=6.81"
Flow Length=560' Tc=7.0 min CN=71 Runoff=24.22 cfs 1.202 af

Subcatchment 7SE: Sideslope Runoff Area=2.211 ac 0.00% Impervious Runoff Depth=6.81"
Flow Length=930' Tc=9.1 min CN=71 Runoff=23.52 cfs 1.255 af

Subcatchment 7SW: Sideslope Runoff Area=3.196 ac 0.00% Impervious Runoff Depth=6.81"
Flow Length=696' Tc=8.3 min CN=71 Runoff=34.95 cfs 1.814 af

Subcatchment 8E: Sideslope Runoff Area=1.052 ac 0.00% Impervious Runoff Depth=6.81"
Flow Length=70' Slope=0.3333 '/' Tc=3.7 min CN=71 Runoff=13.48 cfs 0.597 af

Subcatchment 8SE: Sideslope Runoff Area=1.308 ac 0.00% Impervious Runoff Depth=6.81"
Flow Length=580' Tc=4.9 min CN=71 Runoff=16.09 cfs 0.742 af

Subcatchment 8SW: Sideslope Runoff Area=0.953 ac 0.00% Impervious Runoff Depth=6.81"
Flow Length=710' Tc=5.8 min CN=71 Runoff=11.36 cfs 0.541 af

Subcatchment 9E: Side Slope Runoff Area=0.680 ac 0.00% Impervious Runoff Depth=6.81"
Flow Length=870' Tc=7.7 min CN=71 Runoff=7.59 cfs 0.386 af

Subcatchment 9SE: Sideslope Runoff Area=0.641 ac 0.00% Impervious Runoff Depth=6.81"
Flow Length=640' Tc=5.6 min CN=71 Runoff=7.70 cfs 0.364 af

Subcatchment 10E: Side Slope Runoff Area=0.614 ac 0.00% Impervious Runoff Depth=6.81"
Flow Length=850' Tc=8.9 min CN=71 Runoff=6.58 cfs 0.348 af

Subcatchment 10SE: Southeast Top Runoff Area=3.918 ac 0.00% Impervious Runoff Depth=6.81"
Flow Length=490' Slope=0.0200 '/' Tc=14.8 min CN=71 Runoff=34.45 cfs 2.224 af

Subcatchment 11E: Side Slope Runoff Area=1.017 ac 0.00% Impervious Runoff Depth=6.81"
Flow Length=890' Tc=10.2 min CN=71 Runoff=10.42 cfs 0.577 af

Subcatchment 11SE: Southeast Top Runoff Area=5.848 ac 0.00% Impervious Runoff Depth=6.81"
Flow Length=675' Tc=26.8 min CN=71 Runoff=37.03 cfs 3.319 af

Subcatchment 12E: Side Slope Runoff Area=0.535 ac 0.00% Impervious Runoff Depth=6.81"
Flow Length=100' Slope=0.3333 '/' Tc=4.9 min CN=71 Runoff=6.58 cfs 0.304 af

Subcatchment 12SE: Southeast Top Runoff Area=9.055 ac 0.00% Impervious Runoff Depth=6.81"
Flow Length=700' Tc=27.0 min CN=71 Runoff=57.27 cfs 5.139 af

Subcatchment 13E: Side Slope Runoff Area=0.855 ac 0.00% Impervious Runoff Depth=6.81"
Flow Length=686' Tc=5.3 min CN=71 Runoff=10.37 cfs 0.485 af

Subcatchment 13SE: Sideslope Runoff Area=2.473 ac 0.00% Impervious Runoff Depth=6.81"
Flow Length=665' Tc=7.3 min CN=71 Runoff=27.99 cfs 1.404 af

Subcatchment NPD: North Pond Direct Runoff Area=0.982 ac 100.00% Impervious Runoff Depth=10.26"
Tc=0.0 min CN=98 Runoff=17.52 cfs 0.840 af

Subcatchment NPEB: Exterior Berm Runoff Area=0.750 ac 0.00% Impervious Runoff Depth=6.81"
Flow Length=40' Slope=0.3333 '/' Tc=2.4 min CN=71 Runoff=10.05 cfs 0.426 af

Subcatchment NWPD: NW Pond Direct Runoff Area=0.938 ac 100.00% Impervious Runoff Depth=10.26"
Tc=0.0 min CN=98 Runoff=16.74 cfs 0.802 af

Subcatchment NWPEB: Exterior Berm Runoff Area=1.839 ac 0.00% Impervious Runoff Depth=6.81"
Flow Length=1,030' Tc=14.1 min CN=71 Runoff=16.54 cfs 1.044 af

Subcatchment SEPD: SE Pond Direct Runoff Area=0.678 ac 100.00% Impervious Runoff Depth=10.26"
Tc=0.0 min CN=98 Runoff=12.10 cfs 0.580 af

Subcatchment SEPEB: Exterior Berm Runoff Area=1.488 ac 0.00% Impervious Runoff Depth=6.81"
Flow Length=80' Slope=0.3333 '/' Tc=4.1 min CN=71 Runoff=18.81 cfs 0.844 af

Subcatchment SPD: S Pond Direct Runoff Area=0.527 ac 100.00% Impervious Runoff Depth=10.26"
Tc=0.0 min CN=98 Runoff=9.40 cfs 0.451 af

Subcatchment SPEB: Exterior Berm Runoff Area=5.014 ac 17.12% Impervious Runoff Depth=7.48"
Flow Length=440' Tc=6.0 min CN=76 Runoff=63.94 cfs 3.124 af

Subcatchment SWPD: SW Pond Direct Runoff Area=0.837 ac 100.00% Impervious Runoff Depth=10.26"
Tc=0.0 min CN=98 Runoff=14.93 cfs 0.716 af

Subcatchment SWPEB: Exterior Berm Runoff Area=2.086 ac 0.00% Impervious Runoff Depth=6.81"
Flow Length=80' Slope=0.2500 '/' Tc=4.6 min CN=71 Runoff=25.93 cfs 1.184 af

Reach 3R: (new Reach)

Pond 1ED: East Ditch 1 Peak Elev=713.77' Storage=4,897 cf Inflow=17.64 cfs 0.527 af
Primary=8.51 cfs 0.521 af Secondary=0.00 cfs 0.000 af Outflow=8.51 cfs 0.521 af

Pond 2ED: East Ditch 2 Peak Elev=713.90' Storage=14,623 cf Inflow=30.02 cfs 1.750 af
Primary=12.98 cfs 1.689 af Secondary=9.31 cfs 0.056 af Outflow=22.30 cfs 1.745 af

Pond 3ED: East Ditch 3 Peak Elev=713.86' Storage=41,964 cf Inflow=43.80 cfs 12.900 af
Primary=15.04 cfs 12.330 af Secondary=13.15 cfs 0.569 af Outflow=28.19 cfs 12.899 af

Pond 4ED: Exist Ditch 4 Peak Elev=714.07' Storage=53,478 cf Inflow=211.67 cfs 20.004 af
Primary=12.91 cfs 10.228 af Secondary=197.73 cfs 9.767 af Outflow=210.64 cfs 19.995 af

Pond C10SE: Catch Basin Peak Elev=812.65' Storage=14,513 cf Inflow=34.45 cfs 2.224 af
Primary=17.98 cfs 2.223 af Secondary=0.00 cfs 0.000 af Outflow=17.98 cfs 2.223 af

Pond C11SE: Catch Basin Peak Elev=806.13' Storage=18,295 cf Inflow=37.03 cfs 3.319 af
Primary=19.52 cfs 3.175 af Secondary=10.79 cfs 0.144 af Outflow=30.30 cfs 3.319 af

Pond C12SE: Catch Basin Peak Elev=801.37' Storage=22,537 cf Inflow=60.31 cfs 5.283 af
Primary=43.39 cfs 5.285 af Secondary=0.00 cfs 0.000 af Outflow=43.39 cfs 5.285 af

Pond C13SE: Catch Basin Peak Elev=727.10' Storage=2,518 cf Inflow=27.99 cfs 1.404 af
Primary=19.45 cfs 1.361 af Secondary=8.17 cfs 0.042 af Outflow=27.62 cfs 1.403 af

Pond C1E: Catch Basin Peak Elev=801.72' Storage=27,572 cf Inflow=96.72 cfs 10.125 af
Primary=67.98 cfs 9.819 af Secondary=24.09 cfs 0.306 af Outflow=92.07 cfs 10.125 af

Pond C1N: Catch Basin Peak Elev=804.26' Storage=31,160 cf Inflow=99.03 cfs 10.040 af
Primary=59.81 cfs 9.380 af Secondary=32.96 cfs 0.660 af Outflow=92.77 cfs 10.040 af

Pond C1NW: Catch Basin Peak Elev=786.96' Storage=1,411 cf Inflow=18.27 cfs 0.855 af
Primary=15.44 cfs 0.855 af Secondary=0.00 cfs 0.000 af Outflow=15.44 cfs 0.855 af

Pond C1S: Catch Basin Peak Elev=811.67' Storage=10,010 cf Inflow=30.03 cfs 1.961 af
Primary=18.02 cfs 1.961 af Secondary=0.00 cfs 0.000 af Outflow=18.02 cfs 1.961 af

Pond C1SE: Catch Basin Peak Elev=812.62' Storage=9,617 cf Inflow=29.62 cfs 1.914 af
Primary=17.87 cfs 1.914 af Secondary=0.00 cfs 0.000 af Outflow=17.87 cfs 1.914 af

Pond C1SW: Catch Basin Peak Elev=813.47' Storage=24,165 cf Inflow=41.89 cfs 2.687 af
Primary=17.34 cfs 2.687 af Secondary=0.00 cfs 0.000 af Outflow=17.34 cfs 2.687 af

Pond C1W: Catch Basin Peak Elev=803.24' Storage=52,644 cf Inflow=126.27 cfs 9.512 af
Primary=68.19 cfs 9.228 af Secondary=28.70 cfs 0.283 af Outflow=96.89 cfs 9.512 af

Pond C2N: Catch Basin Peak Elev=783.23' Storage=437 cf Inflow=13.33 cfs 0.650 af
Primary=12.23 cfs 0.650 af Secondary=0.00 cfs 0.000 af Outflow=12.23 cfs 0.650 af

Pond C2NW: Catch Basin Peak Elev=747.40' Storage=4,261 cf Inflow=22.67 cfs 1.327 af
Primary=17.08 cfs 1.327 af Secondary=0.00 cfs 0.000 af Outflow=17.08 cfs 1.327 af

Pond C2S: Catch Basin Peak Elev=803.22' Storage=16,800 cf Inflow=46.02 cfs 4.205 af
Primary=19.79 cfs 3.711 af Secondary=24.26 cfs 0.494 af Outflow=44.06 cfs 4.205 af

Pond C2SE: Catch Basin Peak Elev=807.10' Storage=14,771 cf Inflow=33.88 cfs 3.040 af
Primary=19.44 cfs 2.945 af Secondary=7.81 cfs 0.095 af Outflow=27.25 cfs 3.040 af

Pond C2SW: Catch Basin Peak Elev=779.15' Storage=3,982 cf Inflow=34.26 cfs 1.688 af
Primary=19.60 cfs 1.588 af Secondary=14.42 cfs 0.100 af Outflow=34.02 cfs 1.688 af

Pond C2W: Catch Basin Peak Elev=772.12' Storage=2,574 cf Inflow=32.09 cfs 1.375 af
Primary=19.51 cfs 1.337 af Secondary=10.50 cfs 0.038 af Outflow=30.01 cfs 1.375 af

Pond C3N: Catch Basin Peak Elev=744.27' Storage=1,776 cf Inflow=19.53 cfs 1.000 af
Primary=16.61 cfs 1.000 af Secondary=0.00 cfs 0.000 af Outflow=16.61 cfs 1.000 af

Pond C3NW: Northwest Ditch Peak Elev=723.40' Storage=9,137 cf Inflow=91.09 cfs 5.593 af
Primary=27.87 cfs 4.470 af Secondary=63.12 cfs 1.123 af Outflow=90.99 cfs 5.593 af

Pond C3S: Catch Basin Peak Elev=801.00' Storage=82,839 cf Inflow=149.27 cfs 12.397 af
Primary=45.76 cfs 7.844 af Secondary=22.88 cfs 3.922 af Tertiary=40.29 cfs 0.631 af Outflow=108.94 cfs 12.397 af

Pond C3SE: Catch Basin Peak Elev=803.07' Storage=43,820 cf Inflow=76.25 cfs 7.010 af
Primary=44.54 cfs 6.974 af Secondary=4.78 cfs 0.036 af Outflow=49.31 cfs 7.010 af

Pond C3SW: Catch Basin Peak Elev=755.68' Storage=2,726 cf Inflow=37.92 cfs 1.284 af
Primary=19.67 cfs 1.196 af Secondary=17.71 cfs 0.088 af Outflow=37.38 cfs 1.284 af

Pond C3W: Catch Basin Peak Elev=744.02' Storage=735 cf Inflow=17.23 cfs 0.913 af
Primary=15.70 cfs 0.911 af Secondary=1.13 cfs 0.003 af Outflow=16.83 cfs 0.913 af

Pond C4N: Catch Basin Peak Elev=785.16' Storage=3,542 cf Inflow=35.51 cfs 1.757 af
Primary=19.63 cfs 1.595 af Secondary=15.72 cfs 0.162 af Outflow=35.34 cfs 1.757 af

Pond C4S: Catch Basin Peak Elev=780.46' Storage=2,083 cf Inflow=41.34 cfs 1.126 af
Primary=18.97 cfs 0.917 af Secondary=22.32 cfs 0.208 af Outflow=41.29 cfs 1.125 af

Pond C4SE: Catch Basin Peak Elev=779.03' Storage=3,460 cf Inflow=25.34 cfs 1.285 af
Primary=19.22 cfs 1.281 af Secondary=1.71 cfs 0.003 af Outflow=20.93 cfs 1.285 af

Pond C4SW: Southwest Ditch 1 Peak Elev=747.14' Storage=2,633 cf Inflow=36.30 cfs 1.037 af
Primary=19.57 cfs 0.997 af Secondary=13.09 cfs 0.039 af Outflow=32.66 cfs 1.035 af

Pond C4W: West Ditch Peak Elev=722.10' Storage=19,473 cf Inflow=70.76 cfs 10.117 af
Primary=35.88 cfs 8.295 af Secondary=34.87 cfs 1.822 af Outflow=70.75 cfs 10.117 af

Pond C5N: Catch Basin Peak Elev=751.16' Storage=1,686 cf Inflow=34.95 cfs 1.963 af
Primary=32.46 cfs 1.963 af Secondary=0.00 cfs 0.000 af Outflow=32.46 cfs 1.963 af

Pond C5S: Catch Basin Peak Elev=735.07' Storage=1,015 cf Inflow=24.47 cfs 1.217 af
Primary=19.34 cfs 1.203 af Secondary=4.62 cfs 0.013 af Outflow=23.96 cfs 1.215 af

Pond C5SE: Catch Basin Peak Elev=755.52' Storage=2,276 cf Inflow=23.12 cfs 1.163 af
Primary=19.18 cfs 1.161 af Secondary=1.14 cfs 0.002 af Outflow=20.33 cfs 1.162 af

Pond C5SW: Catch Basin Peak Elev=813.74' Storage=20,433 cf Inflow=40.03 cfs 2.552 af
Primary=18.26 cfs 2.552 af Secondary=0.00 cfs 0.000 af Outflow=18.26 cfs 2.552 af

Pond C6N: North Ditch Peak Elev=723.52' Storage=9,717 cf Inflow=122.68 cfs 15.135 af
Primary=22.86 cfs 9.358 af Secondary=99.76 cfs 5.778 af Outflow=122.62 cfs 15.135 af

Pond C6S: Catch Basin Peak Elev=779.65' Storage=1,929 cf Inflow=21.19 cfs 1.033 af
Primary=17.96 cfs 1.033 af Secondary=0.00 cfs 0.000 af Outflow=17.96 cfs 1.033 af

Pond C6SE: Southeast Ditch 1 Peak Elev=746.07' Storage=812 cf Inflow=17.37 cfs 0.846 af
Primary=15.90 cfs 0.845 af Secondary=0.00 cfs 0.000 af Outflow=15.90 cfs 0.845 af

Pond C6SW: Catch Basin Peak Elev=779.08' Storage=3,599 cf Inflow=26.83 cfs 1.313 af
Primary=19.36 cfs 1.297 af Secondary=5.25 cfs 0.016 af Outflow=24.60 cfs 1.313 af

Pond C7S: Catch Basin Peak Elev=735.55' Storage=2,401 cf Inflow=24.22 cfs 1.202 af
Primary=19.26 cfs 1.196 af Secondary=2.42 cfs 0.006 af Outflow=21.69 cfs 1.202 af

Pond C7SE: Catch Basin Peak Elev=778.03' Storage=2,542 cf Inflow=23.52 cfs 1.255 af
Primary=19.22 cfs 1.250 af Secondary=1.70 cfs 0.005 af Outflow=20.92 cfs 1.255 af

Pond C7SW: Catch Basin Peak Elev=735.69' Storage=2,758 cf Inflow=39.65 cfs 1.830 af
Primary=19.70 cfs 1.680 af Secondary=19.35 cfs 0.150 af Outflow=39.05 cfs 1.830 af

Pond C8SE: Catch Basin Peak Elev=754.84' Storage=628 cf Inflow=16.09 cfs 0.747 af
Primary=14.98 cfs 0.747 af Secondary=0.00 cfs 0.000 af Outflow=14.98 cfs 0.747 af

Pond C8SW: Southwest Ditch 2 Peak Elev=729.09' Storage=2,466 cf Inflow=28.85 cfs 0.690 af
Primary=19.39 cfs 0.678 af Secondary=6.23 cfs 0.013 af Outflow=25.62 cfs 0.690 af

Pond C9SE: Southeast Ditch 2 Peak Elev=735.58' Storage=35 cf Inflow=7.70 cfs 0.364 af
Primary=7.69 cfs 0.364 af Secondary=0.00 cfs 0.000 af Outflow=7.69 cfs 0.364 af

Pond D10SE: 10" Pipe Peak Elev=974.70' Inflow=17.98 cfs 2.223 af
9.9" Round Culvert n=0.010 L=350.0' S=0.0200 '/' Outflow=17.98 cfs 2.223 af

Pond D11SE: 20" Pipe Peak Elev=822.36' Inflow=37.21 cfs 5.399 af
18.5" Round Culvert n=0.010 L=265.0' S=0.0208 '/' Outflow=37.21 cfs 5.399 af

Pond D12SE: 24" Pipe Peak Elev=833.43' Inflow=79.79 cfs 10.684 af
22.2" Round Culvert n=0.010 L=350.0' S=0.2129 '/' Outflow=79.79 cfs 10.684 af

Pond D1E: 24" Pipe Peak Elev=823.01' Inflow=67.98 cfs 9.819 af
22.2" Round Culvert n=0.010 L=330.0' S=0.2258 '/' Outflow=67.98 cfs 9.819 af

Pond D1N: 24" Pipe Peak Elev=820.28' Inflow=59.81 cfs 9.380 af
22.2" Round Culvert n=0.010 L=330.0' S=0.2364 '/' Outflow=59.81 cfs 9.380 af

Pond D1NW: 24" Pipe Peak Elev=784.35' Inflow=15.44 cfs 0.855 af
22.2" Round Culvert n=0.010 L=200.0' S=0.2000 '/' Outflow=15.44 cfs 0.855 af

Pond D1S: 10" Pipe Peak Elev=1,002.25' Inflow=18.02 cfs 1.961 af
9.9" Round Culvert n=0.010 L=420.0' S=0.0214 '/' Outflow=18.02 cfs 1.961 af

Pond D1SE: 10" Pipe Peak Elev=977.87' Inflow=17.87 cfs 1.914 af
9.9" Round Culvert n=0.010 L=360.0' S=0.0167 '/' Outflow=17.87 cfs 1.914 af

Pond D1SW: 6" Pipe Peak Elev=1,566.28' Inflow=17.34 cfs 2.687 af
6.1" Round Culvert n=0.010 L=120.0' S=0.2917 '/' Outflow=17.34 cfs 2.687 af

Pond D1W: 24" Pipe Peak Elev=824.68' Inflow=68.19 cfs 9.228 af
22.2" Round Culvert n=0.010 L=280.0' S=0.2571 '/' Outflow=68.19 cfs 9.228 af

Pond D2N: 24" Pipe Peak Elev=780.81' Inflow=12.23 cfs 0.650 af
22.2" Round Culvert n=0.010 L=170.0' S=0.2353 '/' Outflow=12.23 cfs 0.650 af

Pond D2NW: 24" Pipe Peak Elev=748.41' Inflow=30.31 cfs 2.182 af
22.2" Round Culvert n=0.010 L=60.0' S=0.2667 '/' Outflow=30.31 cfs 2.182 af

Pond D2S: 20" Pipe Peak Elev=817.65' Inflow=37.72 cfs 5.672 af
18.5" Round Culvert n=0.010 L=195.0' S=0.0169 '/' Outflow=37.72 cfs 5.672 af

Pond D2SE: 20" Pipe Peak Elev=818.51' Inflow=36.77 cfs 4.859 af
18.5" Round Culvert n=0.010 L=120.0' S=0.0417 '/' Outflow=36.77 cfs 4.859 af

Pond D2SW: 12" Pipe Peak Elev=862.46' Inflow=34.49 cfs 4.275 af
11.8" Round Culvert n=0.010 L=75.0' S=0.3133 '/' Outflow=34.49 cfs 4.275 af

Pond D2W: 14" Pipe Peak Elev=786.46' Inflow=19.51 cfs 1.337 af
12.9" Round Culvert n=0.010 L=200.0' S=0.2300 '/' Outflow=19.51 cfs 1.337 af

Pond D3N: 24" Pipe Peak Elev=744.84' Inflow=28.68 cfs 1.650 af
22.2" Round Culvert n=0.010 L=60.0' S=0.2167 '/' Outflow=28.68 cfs 1.650 af

Pond D3S1: 22" Pipe 1 Peak Elev=812.43' Inflow=45.76 cfs 7.844 af
20.3" Round Culvert n=0.010 L=475.0' S=0.1625 '/' Outflow=45.76 cfs 7.844 af

Pond D3S2: 22" Pipe 2 Peak Elev=824.77' Inflow=59.49 cfs 9.594 af
20.3" Round Culvert n=0.010 L=475.0' S=0.1625 '/' Outflow=59.49 cfs 9.594 af

Pond D3SE: 24" Pipe Peak Elev=835.02' Inflow=79.89 cfs 11.833 af
22.2" Round Culvert n=0.010 L=190.0' S=0.2947 '/' Outflow=79.89 cfs 11.833 af

Pond D3SW: 24" Pipe Peak Elev=767.49' Inflow=53.47 cfs 5.470 af
22.2" Round Culvert n=0.010 L=25.0' S=0.3800 '/' Outflow=53.47 cfs 5.470 af

Pond D3W: 18" Pipe Peak Elev=744.40' Inflow=15.70 cfs 0.911 af
16.6" Round Culvert n=0.010 L=88.0' S=0.2159 '/' Outflow=15.70 cfs 0.911 af

Pond D4N: 24" Pipe Peak Elev=782.22' Inflow=19.63 cfs 1.595 af
22.2" Round Culvert n=0.010 L=118.0' S=0.2797 '/' Outflow=19.63 cfs 1.595 af

Pond D4S: 10" Pipe Peak Elev=833.32' Inflow=18.97 cfs 0.917 af
9.9" Round Culvert n=0.010 L=160.0' S=0.3094 '/' Outflow=18.97 cfs 0.917 af

Pond D4SE: 12" Pipe Peak Elev=801.11' Inflow=19.22 cfs 1.281 af
11.8" Round Culvert n=0.010 L=65.0' S=0.3615 '/' Outflow=19.22 cfs 1.281 af

Pond D4W: 18" Pipe Peak Elev=742.56' Inflow=33.84 cfs 2.248 af
16.6" Round Culvert n=0.010 L=95.0' S=0.0421 '/' Outflow=33.84 cfs 2.248 af

Pond D5N: 24" Pipe Peak Elev=762.20' Inflow=50.58 cfs 3.559 af
22.2" Round Culvert n=0.010 L=84.0' S=0.2381 '/' Outflow=50.58 cfs 3.559 af

Pond D5S: 16" Pipe Peak Elev=773.95' Inflow=38.30 cfs 2.119 af
14.8" Round Culvert n=0.010 L=142.0' S=0.1056 '/' Outflow=38.30 cfs 2.119 af

Pond D5SE: 20" Pipe Peak Elev=768.52' Inflow=38.40 cfs 2.442 af
18.5" Round Culvert n=0.010 L=30.0' S=0.3167 '/' Outflow=38.40 cfs 2.442 af

Pond D5SW: 6" Pipe Peak Elev=1,681.48' Inflow=18.26 cfs 2.552 af
6.1" Round Culvert n=0.010 L=125.0' S=0.2800 '/' Outflow=18.26 cfs 2.552 af

Pond D6S: 14" Pipe Peak Elev=791.42' Inflow=17.96 cfs 1.033 af
12.9" Round Culvert n=0.010 L=185.0' S=0.2459 '/' Outflow=17.96 cfs 1.033 af

Pond D6SW: 16" Pipe Peak Elev=809.93' Inflow=34.66 cfs 3.849 af
14.8" Round Culvert n=0.010 L=165.0' S=0.2636 '/' Outflow=34.66 cfs 3.849 af

Pond D7S: 20" Pipe Peak Elev=747.42' Inflow=37.22 cfs 2.229 af
18.5" Round Culvert n=0.010 L=70.0' S=0.1857 '/' Outflow=37.22 cfs 2.229 af

Pond D7SE: 12" Pipe Peak Elev=800.11' Inflow=19.22 cfs 1.250 af
11.8" Round Culvert n=0.010 L=90.0' S=0.2444 '/' Outflow=19.22 cfs 1.250 af

Pond D7SW: 26" Pipe Peak Elev=743.28' Inflow=54.09 cfs 5.529 af
24.0" Round Culvert n=0.010 L=30.0' S=0.2500 '/' Outflow=54.09 cfs 5.529 af

Pond D8SE: 18" Pipe Peak Elev=771.36' Inflow=32.90 cfs 1.997 af
16.6" Round Culvert n=0.010 L=36.0' S=0.2778 '/' Outflow=32.90 cfs 1.997 af

Pond DP6N: 24" Pipe Peak Elev=722.54' Inflow=22.86 cfs 9.358 af
22.2" Round Culvert n=0.010 L=780.0' S=0.0237 '/' Outflow=22.86 cfs 9.358 af

Pond MH1S: 4' Dia. Manhole Peak Elev=739.04' Inflow=37.22 cfs 2.229 af
22.2" Round Culvert n=0.010 L=830.0' S=0.0048 '/' Outflow=37.22 cfs 2.229 af

Pond MH1SE: 8' Dia. Manhole Peak Elev=893.44' Inflow=112.98 cfs 15.120 af
22.2" Round Culvert n=0.010 L=590.0' S=0.0339 '/' Outflow=112.98 cfs 15.120 af

Pond MH1SW: 4' Dia. Manhole Peak Elev=825.11' Inflow=72.59 cfs 6.467 af
20.3" Round Culvert n=0.010 L=550.0' S=0.0382 '/' Outflow=72.59 cfs 6.467 af

Pond MH1W: 6' Manhole Peak Elev=793.54' Inflow=134.06 cfs 19.685 af
24.0" Round Culvert n=0.024 L=5.0' S=0.2000 '/' Outflow=134.06 cfs 19.685 af

Pond MH2SE: 4' Dia. Manhole Peak Elev=740.10' Inflow=112.98 cfs 15.120 af
30.0" Round Culvert n=0.024 L=10.0' S=0.1000 '/' Outflow=112.98 cfs 15.120 af

Pond MH2SW: 6' Dia. Manhole Peak Elev=796.99' Inflow=73.23 cfs 6.207 af
24.0" Round Culvert n=0.010 L=1,050.0' S=0.0048 '/' Outflow=73.23 cfs 6.207 af

Pond MH3S: 6' Dia. Manhole Peak Elev=742.47' Inflow=65.41 cfs 4.348 af
22.2" Round Culvert n=0.010 L=10.0' S=0.4000 '/' Outflow=65.41 cfs 4.348 af

Pond MH3SE: 8' Dia. Manhole Peak Elev=853.93' Inflow=85.79 cfs 12.045 af
24.0" Round Culvert n=0.010 L=1,400.0' S=0.0036 '/' Outflow=85.79 cfs 12.045 af

Pond MH3SW: 6' Dia. Manhole Peak Elev=810.94' Inflow=145.83 cfs 12.674 af
24.0" Round Culvert n=0.024 L=5.0' S=0.0000 '/' Outflow=145.83 cfs 12.674 af

Pond MH4SE: 4' Dia. Manhole Peak Elev=840.60' Inflow=112.73 cfs 14.407 af
24.0" Round Culvert n=0.010 L=620.0' S=0.0050 '/' Outflow=112.73 cfs 14.407 af

Pond MH4W: Manhole Peak Elev=741.32' Inflow=68.19 cfs 9.228 af
24.0" Round Culvert n=0.024 L=5.0' S=0.2000 '/' Outflow=68.19 cfs 9.228 af

Pond MH5SE: 4' Dia. Manhole Peak Elev=740.00' Inflow=112.73 cfs 14.407 af
30.0" Round Culvert n=0.024 L=10.0' S=0.1000 '/' Outflow=112.73 cfs 14.407 af

Pond NP: North Pond Peak Elev=700.40' Storage=153,358 cf Inflow=120.29 cfs 16.216 af
Primary=57.98 cfs 16.200 af Secondary=0.00 cfs 0.000 af Tertiary=0.00 cfs 0.000 af Outflow=57.98 cfs 16.200 af

Pond NWP: Northwest Pond Peak Elev=716.14' Storage=319,940 cf Inflow=245.11 cfs 35.430 af
Primary=66.39 cfs 27.781 af Secondary=55.26 cfs 4.332 af Tertiary=78.55 cfs 3.311 af Outflow=200.21 cfs 35.423 af

Pond SEP: Southeast Pond Peak Elev=718.21' Storage=141,806 cf Inflow=233.43 cfs 30.951 af
Primary=73.88 cfs 23.229 af Secondary=159.49 cfs 7.721 af Outflow=233.37 cfs 30.950 af

Pond SP: South Pond Peak Elev=720.44' Storage=48,612 cf Inflow=67.87 cfs 3.574 af
Discarded=0.10 cfs 0.263 af Secondary=63.97 cfs 2.590 af Tertiary=0.00 cfs 0.000 af Outflow=64.07 cfs 2.853 af

Pond SWP: Southwest Pond Peak Elev=723.33' Storage=164,811 cf Inflow=178.07 cfs 14.612 af
Primary=17.75 cfs 8.997 af Secondary=153.68 cfs 4.314 af Outflow=171.43 cfs 13.311 af

Total Runoff Area = 228.591 ac Runoff Volume = 131.149 af Average Runoff Depth = 6.88"
97.89% Pervious = 223.771 ac 2.11% Impervious = 4.820 ac

Summary for Subcatchment 1E: East Top

Runoff = 96.72 cfs @ 12.28 hrs, Volume= 10.125 af, Depth= 6.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 500 year - 24 hour Rainfall=10.50"

Area (ac)	CN	Description
17.841	71	Meadow, non-grazed, HSG C
17.841		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
28.6	270	0.0300	0.16		**Sheet Flow, 3% Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
5.5	700	0.0200	2.12		**Shallow Concentrated Flow, 2% Channel Flow** Grassed Waterway Kv= 15.0 fps
34.1	970	Total			

Summary for Subcatchment 1N: North Top

Runoff = 99.03 cfs @ 12.27 hrs, Volume= 10.040 af, Depth= 6.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 500 year - 24 hour Rainfall=10.50"

Area (ac)	CN	Description
17.691	71	Meadow, non-grazed, HSG C
17.691		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
28.6	270	0.0300	0.16		**Sheet Flow, 3% Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
3.9	500	0.0200	2.12		**Shallow Concentrated Flow, 2% Shallow Flow** Grassed Waterway Kv= 15.0 fps
32.5	770	Total			

Summary for Subcatchment 1NW: Sideslope

Runoff = 18.27 cfs @ 11.96 hrs, Volume= 0.855 af, Depth= 6.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 500 year - 24 hour Rainfall=10.50"

Area (ac)	CN	Description
1.506	71	Meadow, non-grazed, HSG C
1.506		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.1	35	0.3333	0.27		**Sheet Flow, 3:1 Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
3.2	500	0.0300	2.60		**Shallow Concentrated Flow, 3% Shallow Flow** Grassed Waterway Kv= 15.0 fps
5.3	535	Total			

Summary for Subcatchment 1S: South Top

Runoff = 30.03 cfs @ 12.07 hrs, Volume= 1.961 af, Depth= 6.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 500 year - 24 hour Rainfall=10.50"

Area (ac)	CN	Description
3.455	71	Meadow, non-grazed, HSG C
3.455		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.7	100	0.0200	0.14		**Sheet Flow, 2% Sheet Flow** Grass: Dense n= 0.240 P2= 4.80"
3.5	450	0.0200	2.12		**Shallow Concentrated Flow, 2% Shallow Flow** Grassed Waterway Kv= 15.0 fps
15.2	550	Total			

Summary for Subcatchment 1SE: Southeast Top

Runoff = 29.62 cfs @ 12.07 hrs, Volume= 1.914 af, Depth= 6.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 500 year - 24 hour Rainfall=10.50"

Area (ac)	CN	Description
3.373	71	Meadow, non-grazed, HSG C
3.373		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.7	100	0.0200	0.14		**Sheet Flow, 2% Sheet Flow** Grass: Dense n= 0.240 P2= 4.80"
3.2	410	0.0200	2.12		**Shallow Concentrated Flow, 2% Shallow Flow** Grassed Waterway Kv= 15.0 fps
14.9	510	Total			

Summary for Subcatchment 1SW: Southwest Top

Runoff = 41.89 cfs @ 12.06 hrs, Volume= 2.687 af, Depth= 6.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 500 year - 24 hour Rainfall=10.50"

Area (ac)	CN	Description
4.734	71	Meadow, non-grazed, HSG C
4.734		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.7	100	0.0200	0.14		**Sheet Flow, 2% Sheet Flow** Grass: Dense n= 0.240 P2= 4.80"
2.9	370	0.0200	2.12		**Shallow Concentrated Flow, 2% ShallowFlow** Grassed Waterway Kv= 15.0 fps
14.6	470	Total			

Summary for Subcatchment 1W: West Top

Runoff = 126.27 cfs @ 12.12 hrs, Volume= 9.512 af, Depth= 6.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 500 year - 24 hour Rainfall=10.50"

Area (ac)	CN	Description
16.760	71	Meadow, non-grazed, HSG C
16.760		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.7	150	0.0300	0.18		**Sheet Flow, 3% Sheet Flow** Grass: Dense n= 0.240 P2= 4.80"
1.0	150	0.0300	2.60		**Shallow Concentrated Flow, 3% Shallow Flow** Grassed Waterway Kv= 15.0 fps
5.3	670	0.0200	2.12		**Shallow Concentrated Flow, 2% Concentrated Flow** Grassed Waterway Kv= 15.0 fps
20.0	970	Total			

Summary for Subcatchment 2E: Side Slope

Runoff = 26.33 cfs @ 12.02 hrs, Volume= 1.470 af, Depth= 6.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 500 year - 24 hour Rainfall=10.50"

Area (ac)	CN	Description
2.590	71	Meadow, non-grazed, HSG C
2.590		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	120	0.3333	0.35		**Sheet Flow, 3:1 Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
4.6	580	0.0200	2.12		**Shallow Concentrated Flow, 2% Shallow Flow** Grassed Waterway Kv= 15.0 fps
0.1	280	0.3300	44.39	78.45	**Pipe Channel, Drop Pipe** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.010 PVC, smooth interior
10.4	980	Total			

Summary for Subcatchment 2N: Sideslope

Runoff = 13.33 cfs @ 11.98 hrs, Volume= 0.650 af, Depth= 6.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 500 year - 24 hour Rainfall=10.50"

Area (ac)	CN	Description
1.145	71	Meadow, non-grazed, HSG C
1.145		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.3	84	0.3333	0.33		**Sheet Flow, 3:1 Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
2.2	340	0.0300	2.60		**Shallow Concentrated Flow, 3% Concentrated Flow** Grassed Waterway Kv= 15.0 fps
6.5	424	Total			

Summary for Subcatchment 2NW: Sideslope

Runoff = 22.67 cfs @ 12.03 hrs, Volume= 1.327 af, Depth= 6.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 500 year - 24 hour Rainfall=10.50"

Area (ac)	CN	Description
2.338	71	Meadow, non-grazed, HSG C
2.338		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.4	113	0.3333	0.35		**Sheet Flow, 3:1 Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
6.4	1,000	0.0300	2.60		**Shallow Concentrated Flow, 3% Shallow Flow** Grassed Waterway Kv= 15.0 fps
11.8	1,113	Total			

Summary for Subcatchment 2S: South Top

Runoff = 46.02 cfs @ 12.20 hrs, Volume= 4.205 af, Depth= 6.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 500 year - 24 hour Rainfall=10.50"

Area (ac)	CN	Description
7.410	71	Meadow, non-grazed, HSG C
7.410		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
23.9	300	0.0300	0.21		**Sheet Flow, 3% Sheet Flow** Grass: Dense n= 0.240 P2= 4.80"
3.9	500	0.0200	2.12		**Shallow Concentrated Flow, 2% Shallow Flow** Grassed Waterway Kv= 15.0 fps
27.8	800	Total			

Summary for Subcatchment 2SE: Southeast Top

Runoff = 33.88 cfs @ 12.21 hrs, Volume= 3.040 af, Depth= 6.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 500 year - 24 hour Rainfall=10.50"

Area (ac)	CN	Description
5.356	71	Meadow, non-grazed, HSG C
5.356		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
23.9	300	0.0300	0.21		**Sheet Flow, 3% Sheet Flow** Grass: Dense n= 0.240 P2= 4.80"
3.1	400	0.0200	2.12		**Shallow Concentrated Flow, 2% Shallow Flow** Grassed Waterway Kv= 15.0 fps
27.0	700	Total			

Summary for Subcatchment 2SW: Sideslope

Runoff = 34.26 cfs @ 11.98 hrs, Volume= 1.688 af, Depth= 6.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 500 year - 24 hour Rainfall=10.50"

Area (ac)	CN	Description
2.975	71	Meadow, non-grazed, HSG C
2.975		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.5	60	0.3300	0.40		**Sheet Flow, 3:1 Sheet Flow** Grass: Dense n= 0.240 P2= 4.80"
4.3	665	0.0300	2.60		**Shallow Concentrated Flow, 3% Shallow Flow** Grassed Waterway Kv= 15.0 fps
6.8	725	Total			

Summary for Subcatchment 2W: Sideslope

Runoff = 21.54 cfs @ 11.99 hrs, Volume= 1.092 af, Depth= 6.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 500 year - 24 hour Rainfall=10.50"

Area (ac)	CN	Description
1.924	71	Meadow, non-grazed, HSG C
1.924		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.2	80	0.3300	0.42		**Sheet Flow, 3:1 Sheet Flow** Grass: Dense n= 0.240 P2= 4.80"
4.4	690	0.0300	2.60		**Shallow Concentrated Flow, 3% Shallow Flow** Grassed Waterway Kv= 15.0 fps
7.6	770	Total			

Summary for Subcatchment 3E: Side Slope

Runoff = 27.68 cfs @ 12.03 hrs, Volume= 1.603 af, Depth= 6.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 500 year - 24 hour Rainfall=10.50"

Area (ac)	CN	Description
2.825	71	Meadow, non-grazed, HSG C
2.825		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	120	0.3333	0.35		**Sheet Flow, 3:1 Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
5.7	720	0.0200	2.12		**Shallow Concentrated Flow, 2% Shallow Flow** Grassed Waterway Kv= 15.0 fps
0.1	170	0.3300	44.39	78.45	**Pipe Channel, Drop Pipe** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.010 PVC, smooth interior
11.5	1,010	Total			

Summary for Subcatchment 3N: Sideslope

Runoff = 19.53 cfs @ 11.99 hrs, Volume= 1.000 af, Depth= 6.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 500 year - 24 hour Rainfall=10.50"

Area (ac)	CN	Description
1.762	71	Meadow, non-grazed, HSG C
1.762		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.2	133	0.3333	0.36		**Sheet Flow, 3:1 Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
1.7	265	0.0300	2.60		**Shallow Concentrated Flow, 3% Shallow Flow** Grassed Waterway Kv= 15.0 fps
7.9	398	Total			

Summary for Subcatchment 3NW: Sideslope

Runoff = 32.33 cfs @ 12.01 hrs, Volume= 1.762 af, Depth= 6.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 500 year - 24 hour Rainfall=10.50"

Area (ac)	CN	Description
3.104	71	Meadow, non-grazed, HSG C
3.104		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.5	90	0.3333	0.33		**Sheet Flow, 3:1 Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
5.2	1,100	0.0300	3.52		**Shallow Concentrated Flow, 3% Concentrated Channel** Paved Kv= 20.3 fps
9.7	1,190	Total			

Summary for Subcatchment 3S: South Top

Runoff = 126.65 cfs @ 12.22 hrs, Volume= 11.903 af, Depth= 6.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 500 year - 24 hour Rainfall=10.50"

Area (ac)	CN	Description
20.973	71	Meadow, non-grazed, HSG C
20.973		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
23.9	300	0.0300	0.21		**Sheet Flow, 3% Sheet Flow** Grass: Dense n= 0.240 P2= 4.80"
5.1	650	0.0200	2.12		**Shallow Concentrated Flow, 2% Shallow Flow** Grassed Waterway Kv= 15.0 fps
29.0	950	Total			

Summary for Subcatchment 3SE: Southeast Top

Runoff = 76.25 cfs @ 12.22 hrs, Volume= 6.915 af, Depth= 6.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 500 year - 24 hour Rainfall=10.50"

Area (ac)	CN	Description
12.185	71	Meadow, non-grazed, HSG C
12.185		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
23.9	300	0.0300	0.21		**Sheet Flow, 3% Sheet Flow** Grass: Dense n= 0.240 P2= 4.80"
3.4	430	0.0200	2.12		**Shallow Concentrated Flow, 2% Shallow Flow** Grassed Waterway Kv= 15.0 fps
27.3	730	Total			

Summary for Subcatchment 3SW: Sideslope

Runoff = 23.51 cfs @ 11.99 hrs, Volume= 1.183 af, Depth= 6.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 500 year - 24 hour Rainfall=10.50"

Area (ac)	CN	Description
2.085	71	Meadow, non-grazed, HSG C
2.085		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.0	76	0.3300	0.42		**Sheet Flow, 3:1 Sheet Flow** Grass: Dense n= 0.240 P2= 4.80"
4.4	680	0.0300	2.60		**Shallow Concentrated Flow, 3% Shallow Flow** Grassed Waterway Kv= 15.0 fps
7.4	756	Total			

Summary for Subcatchment 3W: Sideslope

Runoff = 17.23 cfs @ 11.99 hrs, Volume= 0.876 af, Depth= 6.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 500 year - 24 hour Rainfall=10.50"

Area (ac)	CN	Description
1.543	71	Meadow, non-grazed, HSG C
1.543		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.5	90	0.3300	0.43		**Sheet Flow, 3:1 Sheet Flow** Grass: Dense n= 0.240 P2= 4.80"
4.2	650	0.0300	2.60		**Shallow Concentrated Flow, 3% Shallow Flow** Grassed Waterway Kv= 15.0 fps
7.7	740	Total			

Summary for Subcatchment 4E: Side Slope

Runoff = 52.90 cfs @ 12.03 hrs, Volume= 3.032 af, Depth= 6.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 500 year - 24 hour Rainfall=10.50"

Area (ac)	CN	Description
5.342	71	Meadow, non-grazed, HSG C
5.342		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	120	0.3333	0.35		**Sheet Flow, 3:1 Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
5.5	700	0.0200	2.12		**Shallow Concentrated Flow, 2% Shallow Flow** Grassed Waterway Kv= 15.0 fps
11.2	820	Total			

Summary for Subcatchment 4N: Sideslope

Runoff = 22.03 cfs @ 11.98 hrs, Volume= 1.097 af, Depth= 6.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 500 year - 24 hour Rainfall=10.50"

Area (ac)	CN	Description
1.933	71	Meadow, non-grazed, HSG C
1.933		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.4	63	0.3333	0.31		**Sheet Flow, 3:1 Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
3.7	569	0.0300	2.60		**Shallow Concentrated Flow, 3% Shallow Flow** Grassed Waterway Kv= 15.0 fps
7.1	632	Total			

Summary for Subcatchment 4S: Sideslope

Runoff = 10.11 cfs @ 11.98 hrs, Volume= 0.495 af, Depth= 6.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 500 year - 24 hour Rainfall=10.50"

Area (ac)	CN	Description
0.872	71	Meadow, non-grazed, HSG C
0.872		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.8	100	0.3300	0.44		**Sheet Flow, 3:1 Sheet Flow** Grass: Dense n= 0.240 P2= 4.80"
2.8	430	0.0300	2.60		**Shallow Concentrated Flow, 3% Shallow Flow** Grassed Waterway Kv= 15.0 fps
6.6	530	Total			

Summary for Subcatchment 4SE: Sideslope

Runoff = 25.34 cfs @ 11.98 hrs, Volume= 1.249 af, Depth= 6.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 500 year - 24 hour Rainfall=10.50"

Area (ac)	CN	Description
2.200	71	Meadow, non-grazed, HSG C
2.200		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.5	60	0.3300	0.40		**Sheet Flow, 3:1 Sheet Flow** Grass: Dense n= 0.240 P2= 4.80"
4.3	670	0.0300	2.60		**Shallow Concentrated Flow, 3% Shallow Flow** Grassed Waterway Kv= 15.0 fps
6.8	730	Total			

Summary for Subcatchment 4SW: Sideslope

Runoff = 19.65 cfs @ 11.97 hrs, Volume= 0.948 af, Depth= 6.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 500 year - 24 hour Rainfall=10.50"

Area (ac)	CN	Description
1.671	71	Meadow, non-grazed, HSG C
1.671		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.8	40	0.3300	0.37		**Sheet Flow, 3:1 Sheet Flow** Grass: Dense n= 0.240 P2= 4.80"
4.4	690	0.0300	2.60		**Shallow Concentrated Flow, 3% Shallow Flow** Grassed Waterway Kv= 15.0 fps
6.2	730	Total			

Summary for Subcatchment 4W: Sideslope

Runoff = 18.10 cfs @ 11.98 hrs, Volume= 0.886 af, Depth= 6.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 500 year - 24 hour Rainfall=10.50"

Area (ac)	CN	Description
1.561	71	Meadow, non-grazed, HSG C
1.561		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.3	150	0.3300	0.48		**Sheet Flow, 3:1 Sheet Flow** Grass: Dense n= 0.240 P2= 4.80"
1.3	200	0.0300	2.60		**Shallow Concentrated Flow, 3% Shallow Flow** Grassed Waterway Kv= 15.0 fps
6.6	350	Total			

Summary for Subcatchment 5E: Side Slope

Runoff = 13.66 cfs @ 11.98 hrs, Volume= 0.678 af, Depth= 6.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 500 year - 24 hour Rainfall=10.50"

Area (ac)	CN	Description
1.195	71	Meadow, non-grazed, HSG C
1.195		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.3	85	0.3333	0.33		**Sheet Flow, 3:1 Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
2.6	330	0.0200	2.12		**Shallow Concentrated Flow, 2% Shallow Flow** Grassed Waterway Kv= 15.0 fps
0.1	315	0.3300	44.39	78.45	**Pipe Channel, Drop Pipe** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.010 PVC, smooth interior
7.0	730	Total			

Summary for Subcatchment 5N: Sideslope

Runoff = 34.95 cfs @ 11.99 hrs, Volume= 1.802 af, Depth= 6.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 500 year - 24 hour Rainfall=10.50"

Area (ac)	CN	Description
3.175	71	Meadow, non-grazed, HSG C
3.175		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.5	56	0.2500	0.27		**Sheet Flow, 4:1 Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
4.6	710	0.0300	2.60		**Shallow Concentrated Flow, 3% Concentrated Flow** Grassed Waterway Kv= 15.0 fps
8.1	766	Total			

Summary for Subcatchment 5S: Sideslope

Runoff = 20.27 cfs @ 11.98 hrs, Volume= 1.009 af, Depth= 6.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 500 year - 24 hour Rainfall=10.50"

Area (ac)	CN	Description
1.778	71	Meadow, non-grazed, HSG C
1.778		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.2	115	0.3300	0.45		**Sheet Flow, 3:1 Sheet Flow** Grass: Dense n= 0.240 P2= 4.80"
2.9	450	0.0300	2.60		**Shallow Concentrated Flow, 3% Shallow Flow** Grassed Waterway Kv= 15.0 fps
7.1	565	Total			

Summary for Subcatchment 5SE: Sideslope

Runoff = 23.12 cfs @ 11.99 hrs, Volume= 1.159 af, Depth= 6.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 500 year - 24 hour Rainfall=10.50"

Area (ac)	CN	Description
2.043	71	Meadow, non-grazed, HSG C
2.043		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.9	70	0.3300	0.41		**Sheet Flow, 3:1 Sheet Flow** Grass: Dense n= 0.240 P2= 4.80"
4.4	680	0.0300	2.60		**Shallow Concentrated Flow, 3% Shallow Flow** Grassed Waterway Kv= 15.0 fps
7.3	750	Total			

Summary for Subcatchment 5SW: Southwest Top

Runoff = 40.03 cfs @ 12.06 hrs, Volume= 2.552 af, Depth= 6.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 500 year - 24 hour Rainfall=10.50"

Area (ac)	CN	Description
4.496	71	Meadow, non-grazed, HSG C
4.496		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.7	100	0.0200	0.14		**Sheet Flow, 2% Sheet Flow** Grass: Dense n= 0.240 P2= 4.80"
2.7	340	0.0200	2.12		**Shallow Concentrated Flow, 2% Shallow Flow** Grassed Waterway Kv= 15.0 fps
14.4	440	Total			

Summary for Subcatchment 5W: Sideslope

Runoff = 25.84 cfs @ 11.97 hrs, Volume= 1.243 af, Depth= 6.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 500 year - 24 hour Rainfall=10.50"

Area (ac)	CN	Description
2.191	71	Meadow, non-grazed, HSG C
2.191		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.3	150	0.3300	0.48		**Sheet Flow, 3:1 Sheet Flow** Grass: Dense n= 0.240 P2= 4.80"
0.4	200	0.3300	8.62		**Shallow Concentrated Flow, 3:1 Shallow Flow** Grassed Waterway Kv= 15.0 fps
0.4	35	0.0200	1.37		**Sheet Flow, 2% Concentrated Flow** Smooth surfaces n= 0.011 P2= 4.80"
6.1	385	Total			

Summary for Subcatchment 6E: Side Slope

Runoff = 25.84 cfs @ 12.01 hrs, Volume= 1.383 af, Depth= 6.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 500 year - 24 hour Rainfall=10.50"

Area (ac)	CN	Description
2.437	71	Meadow, non-grazed, HSG C
2.437		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	120	0.3333	0.35		**Sheet Flow, 3:1 Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
3.4	430	0.0200	2.12		**Shallow Concentrated Flow, 2% Shallow Flow** Grassed Waterway Kv= 15.0 fps
0.1	185	0.3300	44.39	78.45	**Pipe Channel, Drop Pipe** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.010 PVC, smooth interior
9.2	735	Total			

Summary for Subcatchment 6N: Sideslope

Runoff = 35.50 cfs @ 12.05 hrs, Volume= 2.196 af, Depth= 6.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 500 year - 24 hour Rainfall=10.50"

Area (ac)	CN	Description
3.870	71	Meadow, non-grazed, HSG C
3.870		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	120	0.3333	0.35		**Sheet Flow, 3:1 Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
7.8	950	0.0100	2.03		**Shallow Concentrated Flow, 1% Channel** Paved Kv= 20.3 fps
13.5	1,070	Total			

Summary for Subcatchment 6S: Sideslope

Runoff = 21.19 cfs @ 11.98 hrs, Volume= 1.033 af, Depth= 6.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 500 year - 24 hour Rainfall=10.50"

Area (ac)	CN	Description
1.820	71	Meadow, non-grazed, HSG C
1.820		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.1	110	0.3300	0.45		**Sheet Flow, 3:1 Sheet Flow** Grass: Dense n= 0.240 P2= 4.80"
2.4	380	0.0300	2.60		**Shallow Concentrated Flow, 3% Shallow Flow** Grassed Waterway Kv= 15.0 fps
6.5	490	Total			

Summary for Subcatchment 6SE: Sideslope

Runoff = 17.37 cfs @ 11.98 hrs, Volume= 0.844 af, Depth= 6.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 500 year - 24 hour Rainfall=10.50"

Area (ac)	CN	Description
1.487	71	Meadow, non-grazed, HSG C
1.487		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.0	45	0.3300	0.37		**Sheet Flow, 3:1 Sheet Flow** Grass: Dense n= 0.240 P2= 4.80"
4.4	680	0.0300	2.60		**Shallow Concentrated Flow, 3% Shallow Flow** Grassed Waterway Kv= 15.0 fps
6.4	725	Total			

Summary for Subcatchment 6SW: Sideslope

Runoff = 26.83 cfs @ 11.98 hrs, Volume= 1.313 af, Depth= 6.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 500 year - 24 hour Rainfall=10.50"

Area (ac)	CN	Description
2.314	71	Meadow, non-grazed, HSG C
2.314		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.8	100	0.3300	0.44		**Sheet Flow, 3:1 Sheet Flow** Grass: Dense n= 0.240 P2= 4.80"
2.8	430	0.0300	2.60		**Shallow Concentrated Flow, 3% Shallow Flow** Grassed Waterway Kv= 15.0 fps
6.6	530	Total			

Summary for Subcatchment 7E: Side Slope

Runoff = 32.32 cfs @ 12.00 hrs, Volume= 1.713 af, Depth= 6.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 500 year - 24 hour Rainfall=10.50"

Area (ac)	CN	Description
3.018	71	Meadow, non-grazed, HSG C
3.018		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.4	40	0.3333	0.28		**Sheet Flow, 3:1 Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
4.5	700	0.0300	2.60		**Shallow Concentrated Flow, 3% Shallow Flow** Grassed Waterway Kv= 15.0 fps
2.0	250	0.0200	2.12		**Shallow Concentrated Flow, 2% Concentrated Flow** Grassed Waterway Kv= 15.0 fps
0.0	60	0.3300	44.39	78.45	**Pipe Channel, Drop Pipe** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.010 PVC, smooth interior
8.9	1,050	Total			

Summary for Subcatchment 7S: Sideslope

Runoff = 24.22 cfs @ 11.98 hrs, Volume= 1.202 af, Depth= 6.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 500 year - 24 hour Rainfall=10.50"

Area (ac)	CN	Description
2.118	71	Meadow, non-grazed, HSG C
2.118		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.1	110	0.3300	0.45		**Sheet Flow, 3:1 Sheet Flow** Grass: Dense n= 0.240 P2= 4.80"
2.9	450	0.0300	2.60		**Shallow Concentrated Flow, 3% Shallow Flow** Grassed Waterway Kv= 15.0 fps
7.0	560	Total			

Summary for Subcatchment 7SE: Sideslope

Runoff = 23.52 cfs @ 12.00 hrs, Volume= 1.255 af, Depth= 6.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 500 year - 24 hour Rainfall=10.50"

Area (ac)	CN	Description
2.211	71	Meadow, non-grazed, HSG C
2.211		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.8	100	0.3300	0.44		**Sheet Flow, 3:1 Sheet Flow** Grass: Dense n= 0.240 P2= 4.80"
5.3	830	0.0300	2.60		**Shallow Concentrated Flow, 3% Shallow Flow** Grassed Waterway Kv= 15.0 fps
9.1	930	Total			

Summary for Subcatchment 7SW: Sideslope

Runoff = 34.95 cfs @ 12.00 hrs, Volume= 1.814 af, Depth= 6.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 500 year - 24 hour Rainfall=10.50"

Area (ac)	CN	Description
3.196	71	Meadow, non-grazed, HSG C
3.196		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.6	126	0.3300	0.46		**Sheet Flow, 3:1 Sheet Flow** Grass: Dense n= 0.240 P2= 4.80"
3.7	570	0.0300	2.60		**Shallow Concentrated Flow, 3% Shallow Flow** Grassed Waterway Kv= 15.0 fps
8.3	696	Total			

Summary for Subcatchment 8E: Sideslope

Runoff = 13.48 cfs @ 11.94 hrs, Volume= 0.597 af, Depth= 6.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 500 year - 24 hour Rainfall=10.50"

Area (ac)	CN	Description
1.052	71	Meadow, non-grazed, HSG C
1.052		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.7	70	0.3333	0.32		**Sheet Flow, 3:1 Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"

Summary for Subcatchment 8SE: Sideslope

Runoff = 16.09 cfs @ 11.96 hrs, Volume= 0.742 af, Depth= 6.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 500 year - 24 hour Rainfall=10.50"

Area (ac)	CN	Description
1.308	71	Meadow, non-grazed, HSG C
1.308		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.4	30	0.3300	0.35		**Sheet Flow, 3:1 Sheet Flow** Grass: Dense n= 0.240 P2= 4.80"
3.5	550	0.0300	2.60		**Shallow Concentrated Flow, 3% Shallow Flow** Grassed Waterway Kv= 15.0 fps
4.9	580	Total			

Summary for Subcatchment 8SW: Sideslope

Runoff = 11.36 cfs @ 11.97 hrs, Volume= 0.541 af, Depth= 6.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 500 year - 24 hour Rainfall=10.50"

Area (ac)	CN	Description
0.953	71	Meadow, non-grazed, HSG C
0.953		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.4	30	0.3300	0.35		**Sheet Flow, 3:1 Sheet Flow** Grass: Dense n= 0.240 P2= 4.80"
4.4	680	0.0300	2.60		**Shallow Concentrated Flow, 3% Shallow Flow** Grassed Waterway Kv= 15.0 fps
5.8	710	Total			

Summary for Subcatchment 9E: Side Slope

Runoff = 7.59 cfs @ 11.99 hrs, Volume= 0.386 af, Depth= 6.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 500 year - 24 hour Rainfall=10.50"

Area (ac)	CN	Description
0.680	71	Meadow, non-grazed, HSG C
0.680		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.7	70	0.3333	0.32		**Sheet Flow, 3:1 Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
3.9	500	0.0200	2.12		**Shallow Concentrated Flow, 2% Shallow Flow** Grassed Waterway Kv= 15.0 fps
0.1	300	0.3333	44.61	78.84	**Pipe Channel, Drop Pipe** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.010 PVC, smooth interior
7.7	870	Total			

Summary for Subcatchment 9SE: Sideslope

Runoff = 7.70 cfs @ 11.97 hrs, Volume= 0.364 af, Depth= 6.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 500 year - 24 hour Rainfall=10.50"

Area (ac)	CN	Description
0.641	71	Meadow, non-grazed, HSG C
0.641		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.8	40	0.3300	0.37		**Sheet Flow, 3:1 Sheet Flow** Grass: Dense n= 0.240 P2= 4.80"
3.8	600	0.0300	2.60		**Shallow Concentrated Flow, 3% Shallow Flow** Grassed Waterway Kv= 15.0 fps
5.6	640	Total			

Summary for Subcatchment 10E: Side Slope

Runoff = 6.58 cfs @ 12.00 hrs, Volume= 0.348 af, Depth= 6.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 500 year - 24 hour Rainfall=10.50"

Area (ac)	CN	Description
0.614	71	Meadow, non-grazed, HSG C
0.614		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.5	90	0.3333	0.33		**Sheet Flow, 3:1 Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
4.3	550	0.0200	2.12		**Shallow Concentrated Flow, 2% Shallow Flow** Grassed Waterway Kv= 15.0 fps
0.1	210	0.3333	44.61	78.84	**Pipe Channel, Drop Pipe** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.010 PVC, smooth interior
8.9	850	Total			

Summary for Subcatchment 10SE: Southeast Top

Runoff = 34.45 cfs @ 12.07 hrs, Volume= 2.224 af, Depth= 6.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 500 year - 24 hour Rainfall=10.50"

Area (ac)	CN	Description
3.918	71	Meadow, non-grazed, HSG C
3.918		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.7	100	0.0200	0.14		**Sheet Flow, 2% Sheet Flow** Grass: Dense n= 0.240 P2= 4.80"
3.1	390	0.0200	2.12		**Shallow Concentrated Flow, 2% Shallow Flow** Grassed Waterway Kv= 15.0 fps
14.8	490	Total			

Summary for Subcatchment 11E: Side Slope

Runoff = 10.42 cfs @ 12.02 hrs, Volume= 0.577 af, Depth= 6.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 500 year - 24 hour Rainfall=10.50"

Area (ac)	CN	Description
1.017	71	Meadow, non-grazed, HSG C
1.017		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	120	0.3333	0.35		**Sheet Flow, 3:1 Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
4.4	560	0.0200	2.12		**Shallow Concentrated Flow, 2% Shallow Flow** Grassed Waterway Kv= 15.0 fps
0.1	210	0.3333	44.61	78.84	**Pipe Channel, Drop Pipe** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.010 PVC, smooth interior
10.2	890	Total			

Summary for Subcatchment 11SE: Southeast Top

Runoff = 37.03 cfs @ 12.20 hrs, Volume= 3.319 af, Depth= 6.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 500 year - 24 hour Rainfall=10.50"

Area (ac)	CN	Description
5.848	71	Meadow, non-grazed, HSG C
5.848		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
23.9	300	0.0300	0.21		**Sheet Flow, 3% Sheet Flow** Grass: Dense n= 0.240 P2= 4.80"
2.9	375	0.0200	2.12		**Shallow Concentrated Flow, 2% Shallow Flow** Grassed Waterway Kv= 15.0 fps
26.8	675	Total			

Summary for Subcatchment 12E: Side Slope

Runoff = 6.58 cfs @ 11.96 hrs, Volume= 0.304 af, Depth= 6.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 500 year - 24 hour Rainfall=10.50"

Area (ac)	CN	Description
0.535	71	Meadow, non-grazed, HSG C
0.535		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.9	100	0.3333	0.34		**Sheet Flow, 3:1 Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"

Summary for Subcatchment 12SE: Southeast Top

Runoff = 57.27 cfs @ 12.21 hrs, Volume= 5.139 af, Depth= 6.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 500 year - 24 hour Rainfall=10.50"

Area (ac)	CN	Description
9.055	71	Meadow, non-grazed, HSG C
9.055		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
23.9	300	0.0300	0.21		**Sheet Flow, 3% Sheet Flow** Grass: Dense n= 0.240 P2= 4.80"
3.1	400	0.0200	2.12		**Shallow Concentrated Flow, 2% Shallow Flow** Grassed Waterway Kv= 15.0 fps
27.0	700	Total			

Summary for Subcatchment 13E: Side Slope

Runoff = 10.37 cfs @ 11.96 hrs, Volume= 0.485 af, Depth= 6.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 500 year - 24 hour Rainfall=10.50"

Area (ac)	CN	Description
0.855	71	Meadow, non-grazed, HSG C
0.855		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.4	20	0.3333	0.25		**Sheet Flow, 3:1 Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
3.1	400	0.0200	2.12		**Shallow Concentrated Flow, 2% Shallow Flow** Grassed Waterway Kv= 15.0 fps
0.8	266	0.0050	5.46	9.66	**Pipe Channel, Culvert** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.010 PVC, smooth interior
5.3	686	Total			

Summary for Subcatchment 13SE: Sideslope

Runoff = 27.99 cfs @ 11.99 hrs, Volume= 1.404 af, Depth= 6.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 500 year - 24 hour Rainfall=10.50"

Area (ac)	CN	Description
2.473	71	Meadow, non-grazed, HSG C
2.473		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.6	95	0.3300	0.43		**Sheet Flow, 3:1 Sheet Flow** Grass: Dense n= 0.240 P2= 4.80"
3.7	570	0.0300	2.60		**Shallow Concentrated Flow, 3% Shallow Flow** Grassed Waterway Kv= 15.0 fps
7.3	665	Total			

Summary for Subcatchment NPD: North Pond Direct

[46] Hint: Tc=0 (Instant runoff peak depends on dt)

Runoff = 17.52 cfs @ 11.90 hrs, Volume= 0.840 af, Depth=10.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 500 year - 24 hour Rainfall=10.50"

Area (ac)	CN	Description
0.982	98	Water Surface, HSG C
0.982		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0					**Direct Entry, Direct Entry**

Summary for Subcatchment NPEB: Exterior Berm

Runoff = 10.05 cfs @ 11.93 hrs, Volume= 0.426 af, Depth= 6.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 500 year - 24 hour Rainfall=10.50"

Area (ac)	CN	Description
0.750	71	Meadow, non-grazed, HSG C
0.750		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.4	40	0.3333	0.28		**Sheet Flow, 2% Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"

Summary for Subcatchment NWPD: NW Pond Direct

[46] Hint: Tc=0 (Instant runoff peak depends on dt)

Runoff = 16.74 cfs @ 11.90 hrs, Volume= 0.802 af, Depth=10.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 500 year - 24 hour Rainfall=10.50"

Area (ac)	CN	Description
0.938	98	Water Surface, HSG C
0.938		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0					**Direct Entry, Direct Entry**

Summary for Subcatchment NWPEB: Exterior Berm

Runoff = 16.54 cfs @ 12.06 hrs, Volume= 1.044 af, Depth= 6.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 500 year - 24 hour Rainfall=10.50"

Area (ac)	CN	Description
1.839	71	Meadow, non-grazed, HSG C
1.839		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.3	60	0.3333	0.31		**Sheet Flow, 3:1 Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
10.8	970	0.0100	1.50		**Shallow Concentrated Flow, 1% Shallow Flow** Grassed Waterway Kv= 15.0 fps
14.1	1,030	Total			

Summary for Subcatchment SEPD: SE Pond Direct

[46] Hint: Tc=0 (Instant runoff peak depends on dt)

Runoff = 12.10 cfs @ 11.90 hrs, Volume= 0.580 af, Depth=10.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 500 year - 24 hour Rainfall=10.50"

Area (ac)	CN	Description
0.678	98	Water Surface, HSG C
0.678		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0					**Direct Entry, Direct Entry**

Summary for Subcatchment SEPEB: Exterior Berm

Runoff = 18.81 cfs @ 11.95 hrs, Volume= 0.844 af, Depth= 6.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 500 year - 24 hour Rainfall=10.50"

Area (ac)	CN	Description
1.488	71	Meadow, non-grazed, HSG C
1.488		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.1	80	0.3333	0.32		**Sheet Flow, 3:1 Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"

Summary for Subcatchment SPD: S Pond Direct

[46] Hint: Tc=0 (Instant runoff peak depends on dt)

Runoff = 9.40 cfs @ 11.90 hrs, Volume= 0.451 af, Depth=10.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 500 year - 24 hour Rainfall=10.50"

Area (ac)	CN	Description
0.527	98	Water Surface, HSG C
0.527		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0					**Direct Entry, Direct Entry**

Summary for Subcatchment SPEB: Exterior Berm

Runoff = 63.94 cfs @ 11.97 hrs, Volume= 3.124 af, Depth= 7.48"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 500 year - 24 hour Rainfall=10.50"

Area (ac)	CN	Description
3.822	71	Meadow, non-grazed, HSG C
1.192	91	Urban industrial, 72% imp, HSG C
5.014	76	Weighted Average
4.156		82.88% Pervious Area
0.858		17.12% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.8	50	0.3333	0.29		**Sheet Flow, 3:1 Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
3.2	390	0.0100	2.03		**Shallow Concentrated Flow, 1% Shallow Flow** Paved Kv= 20.3 fps
6.0	440	Total			

Summary for Subcatchment SWPD: SW Pond Direct

[46] Hint: Tc=0 (Instant runoff peak depends on dt)

Runoff = 14.93 cfs @ 11.90 hrs, Volume= 0.716 af, Depth=10.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 500 year - 24 hour Rainfall=10.50"

Area (ac)	CN	Description
0.837	98	Water Surface, HSG C
0.837		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0					**Direct Entry, Direct Entry**

Summary for Subcatchment SWPEB: Exterior Berm

Runoff = 25.93 cfs @ 11.96 hrs, Volume= 1.184 af, Depth= 6.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 500 year - 24 hour Rainfall=10.50"

Area (ac)	CN	Description
2.086	71	Meadow, non-grazed, HSG C
2.086		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.6	80	0.2500	0.29		**Sheet Flow, 4:1 Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"

Summary for Reach 3R: (new Reach)

[40] Hint: Not Described (Outflow=Inflow)

Summary for Pond 1ED: East Ditch 1

Inflow Area = 0.855 ac, 0.00% Impervious, Inflow Depth = 7.40" for 500 year - 24 hour event
Inflow = 17.64 cfs @ 11.99 hrs, Volume= 0.527 af
Outflow = 8.51 cfs @ 12.05 hrs, Volume= 0.521 af, Atten= 52%, Lag= 3.2 min
Primary = 8.51 cfs @ 12.05 hrs, Volume= 0.521 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 713.77' @ 12.05 hrs Surf.Area= 3,011 sf Storage= 4,897 cf
Flood Elev= 715.00' Surf.Area= 4,659 sf Storage= 9,544 cf

Plug-Flow detention time= 23.5 min calculated for 0.521 af (99% of inflow)
Center-of-Mass det. time= 15.6 min (816.3 - 800.7)

Volume	Invert	Avail.Storage	Storage Description
#1	711.00'	14,929 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
711.00	254	0	0
712.00	1,520	887	887
714.00	3,205	4,725	5,612
716.00	6,112	9,317	14,929

Device	Routing	Invert	Outlet Devices
#1	Primary	711.50'	**16.0" Round Culvert** L= 230.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 711.50' / 709.00' S= 0.0109 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 1.40 sf

#2	Secondary	715.00'	**115.0' long x 30.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=8.50 cfs @ 12.05 hrs HW=713.77' (Free Discharge)
└**1=Culvert** (Inlet Controls 8.50 cfs @ 6.09 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=711.00' (Free Discharge)
└**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond 2ED: East Ditch 2

[58] Hint: Peaked 0.10' above defined flood level
[81] Warning: Exceeded Pond 1ED by 1.22' @ 12.29 hrs

Inflow Area = 3.021 ac, 0.00% Impervious, Inflow Depth = 6.95" for 500 year - 24 hour event
Inflow = 30.02 cfs @ 12.00 hrs, Volume= 1.750 af
Outflow = 22.30 cfs @ 12.08 hrs, Volume= 1.745 af, Atten= 26%, Lag= 4.9 min
Primary = 12.98 cfs @ 12.08 hrs, Volume= 1.689 af
Secondary = 9.31 cfs @ 12.08 hrs, Volume= 0.056 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 713.90' @ 12.08 hrs Surf.Area= 6,291 sf Storage= 14,623 cf
Flood Elev= 713.80' Surf.Area= 6,136 sf Storage= 14,023 cf

Plug-Flow detention time= 14.2 min calculated for 1.745 af (100% of inflow)
Center-of-Mass det. time= 12.4 min (824.7 - 812.3)

Volume	Invert	Avail.Storage	Storage Description
#1	709.00'	15,282 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
709.00	0	0	0
710.00	1,558	779	779
712.00	3,244	4,802	5,581
714.00	6,457	9,701	15,282

Device	Routing	Invert	Outlet Devices
#1	Primary	709.50'	**16.0" Round Culvert** L= 90.0' RCP, end-section conforming to fill, Ke= 0.500 Inlet / Outlet Invert= 709.50' / 708.50' S= 0.0111 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 1.40 sf
#2	Secondary	713.80'	**115.0' long x 30.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=12.98 cfs @ 12.08 hrs HW=713.90' (Free Discharge)
└**1=Culvert** (Inlet Controls 12.98 cfs @ 9.30 fps)

Secondary OutFlow Max=9.03 cfs @ 12.08 hrs HW=713.90' (Free Discharge)
└**2=Broad-Crested Rectangular Weir** (Weir Controls 9.03 cfs @ 0.83 fps)

Summary for Pond 3ED: East Ditch 3

[58] Hint: Peaked 0.06' above defined flood level
[81] Warning: Exceeded Pond 2ED by 3.75' @ 14.09 hrs
[81] Warning: Exceeded Pond 4ED by 0.44' @ 18.31 hrs

Inflow Area = 40.001 ac, 0.00% Impervious, Inflow Depth = 3.87" for 500 year - 24 hour event
Inflow = 43.80 cfs @ 11.96 hrs, Volume= 12.900 af
Outflow = 28.19 cfs @ 12.23 hrs, Volume= 12.899 af, Atten= 36%, Lag= 16.3 min
Primary = 15.04 cfs @ 12.23 hrs, Volume= 12.330 af
Secondary = 13.15 cfs @ 12.23 hrs, Volume= 0.569 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 713.86' @ 12.23 hrs Surf.Area= 20,661 sf Storage= 41,964 cf
Flood Elev= 713.80' Surf.Area= 20,308 sf Storage= 40,715 cf

Plug-Flow detention time= 25.4 min calculated for 12.899 af (100% of inflow)
Center-of-Mass det. time= 25.2 min (937.7 - 912.5)

Volume	Invert	Avail.Storage	Storage Description
#1	708.00'	44,892 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
708.00	0	0	0
710.00	1,805	1,805	1,805
712.00	9,909	11,714	13,519
714.00	21,464	31,373	44,892

Device	Routing	Invert	Outlet Devices
#1	Primary	708.19'	**16.0" Round Culvert** L= 75.0' RCP, end-section conforming to fill, Ke= 0.500 Inlet / Outlet Invert= 708.19' / 707.50' S= 0.0092 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 1.40 sf
#2	Secondary	713.80'	**300.0' long x 30.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=15.04 cfs @ 12.23 hrs HW=713.86' (Free Discharge)
↑—**1=Culvert** (Inlet Controls 15.04 cfs @ 10.77 fps)

Secondary OutFlow Max=12.11 cfs @ 12.23 hrs HW=713.86' (Free Discharge)
↑—**2=Broad-Crested Rectangular Weir** (Weir Controls 12.11 cfs @ 0.66 fps)

Summary for Pond 4ED: Exist Ditch 4

[58] Hint: Peaked 0.27' above defined flood level

Inflow Area = 35.248 ac, 0.00% Impervious, Inflow Depth = 6.81" for 500 year - 24 hour event
Inflow = 211.67 cfs @ 12.02 hrs, Volume= 20.004 af
Outflow = 210.64 cfs @ 12.03 hrs, Volume= 19.995 af, Atten= 0%, Lag= 0.6 min
Primary = 12.91 cfs @ 12.03 hrs, Volume= 10.228 af
Secondary = 197.73 cfs @ 12.03 hrs, Volume= 9.767 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 714.07' @ 12.03 hrs Surf.Area= 41,785 sf Storage= 53,478 cf
Flood Elev= 713.80' Surf.Area= 35,801 sf Storage= 42,961 cf

Plug-Flow detention time= 17.9 min calculated for 19.995 af (100% of inflow)
Center-of-Mass det. time= 17.5 min (841.9 - 824.4)

Volume	Invert	Avail.Storage	Storage Description
#1	709.00'	106,611 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
709.00	0	0	0
712.00	4,475	6,713	6,713
714.00	39,282	43,757	50,470
715.00	73,000	56,141	106,611

Device	Routing	Invert	Outlet Devices
#1	Primary	709.72'	**16.0" Round Culvert** L= 65.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 709.72' / 709.24' S= 0.0074 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 1.40 sf
#2	Secondary	713.80'	**510.0' long x 30.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=12.91 cfs @ 12.03 hrs HW=714.07' (Free Discharge)
↑—**1=Culvert** (Inlet Controls 12.91 cfs @ 9.25 fps)

Secondary OutFlow Max=196.64 cfs @ 12.03 hrs HW=714.07' (Free Discharge)
↑—**2=Broad-Crested Rectangular Weir** (Weir Controls 196.64 cfs @ 1.41 fps)

Summary for Pond C10SE: Catch Basin

Inflow Area = 3.918 ac, 0.00% Impervious, Inflow Depth = 6.81" for 500 year - 24 hour event
Inflow = 34.45 cfs @ 12.07 hrs, Volume= 2.224 af
Outflow = 17.98 cfs @ 12.22 hrs, Volume= 2.223 af, Atten= 48%, Lag= 9.2 min
Primary = 17.98 cfs @ 12.22 hrs, Volume= 2.223 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 812.65' @ 12.22 hrs Surf.Area= 14,908 sf Storage= 14,513 cf
Flood Elev= 813.00' Surf.Area= 18,960 sf Storage= 19,070 cf

Plug-Flow detention time= 5.6 min calculated for 2.223 af (100% of inflow)
Center-of-Mass det. time= 5.6 min (822.0 - 816.5)

Volume	Invert	Avail.Storage	Storage Description
#1	810.00'	46,175 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
810.00	0	0	0
811.00	2,300	1,150	1,150
812.00	7,290	4,795	5,945
813.00	18,960	13,125	19,070
814.00	35,250	27,105	46,175

Device	Routing	Invert	Outlet Devices
#1	Primary	810.00'	**20.5" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Secondary	813.00'	**100.0' long x 4.0' breadth Broad-Crested Rectangular Weir**

Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50
Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=17.97 cfs @ 12.22 hrs HW=812.65' (Free Discharge)
1=Orifice/Grate (Orifice Controls 17.97 cfs @ 7.84 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=810.00' (Free Discharge)
2=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Summary for Pond C11SE: Catch Basin

[58] Hint: Peaked 0.13' above defined flood level

Inflow Area = 5.848 ac, 0.00% Impervious, Inflow Depth = 6.81" for 500 year - 24 hour event
Inflow = 37.03 cfs @ 12.20 hrs, Volume= 3.319 af
Outflow = 30.30 cfs @ 12.33 hrs, Volume= 3.319 af, Atten= 18%, Lag= 7.9 min
Primary = 19.52 cfs @ 12.33 hrs, Volume= 3.175 af
Secondary = 10.79 cfs @ 12.33 hrs, Volume= 0.144 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 806.13' @ 12.33 hrs Surf.Area= 14,499 sf Storage= 18,295 cf
Flood Elev= 806.00' Surf.Area= 13,540 sf Storage= 16,100 cf

Plug-Flow detention time= 6.4 min calculated for 3.318 af (100% of inflow)
Center-of-Mass det. time= 6.4 min (834.0 - 827.6)

Volume	Invert	Avail.Storage	Storage Description
#1	803.00'	33,425 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
803.00	0	0	0
804.00	2,690	1,345	1,345
805.00	6,640	4,665	6,010
806.00	13,540	10,090	16,100
807.00	21,110	17,325	33,425

Device	Routing	Invert	Outlet Devices
#1	Primary	803.00'	**20.5" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Secondary	806.00'	**100.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=19.52 cfs @ 12.33 hrs HW=806.13' (Free Discharge)
1=Orifice/Grate (Orifice Controls 19.52 cfs @ 8.51 fps)

Secondary OutFlow Max=10.73 cfs @ 12.33 hrs HW=806.13' (Free Discharge)
2=Broad-Crested Rectangular Weir (Weir Controls 10.73 cfs @ 0.85 fps)

Summary for Pond C12SE: Catch Basin

Inflow Area = 9.055 ac, 0.00% Impervious, Inflow Depth = 7.00" for 500 year - 24 hour event
Inflow = 60.31 cfs @ 12.30 hrs, Volume= 5.283 af
Outflow = 43.39 cfs @ 12.41 hrs, Volume= 5.285 af, Atten= 28%, Lag= 7.0 min
Primary = 43.39 cfs @ 12.41 hrs, Volume= 5.285 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 801.37' @ 12.41 hrs Surf.Area= 14,971 sf Storage= 22,537 cf
Flood Elev= 801.50' Surf.Area= 15,910 sf Storage= 24,215 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 2.6 min (828.1 - 825.4)

Volume	Invert	Avail.Storage	Storage Description
#1	797.50'	92,310 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
797.50	0	0	0
798.00	80	20	20
800.00	5,470	5,550	5,570
802.00	19,390	24,860	30,430
804.00	42,490	61,880	92,310

Device	Routing	Invert	Outlet Devices
#1	Primary	797.50'	**20.5" Horiz. Orifice/Grate X 2.00** C= 0.600 Limited to weir flow at low heads
#2	Secondary	801.50'	**100.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=43.39 cfs @ 12.41 hrs HW=801.36' (Free Discharge)
↑—**1=Orifice/Grate** (Orifice Controls 43.39 cfs @ 9.47 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=797.50' (Free Discharge)
↑—**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond C13SE: Catch Basin

[58] Hint: Peaked 0.10' above defined flood level

Inflow Area = 2.473 ac, 0.00% Impervious, Inflow Depth = 6.81" for 500 year - 24 hour event
Inflow = 27.99 cfs @ 11.99 hrs, Volume= 1.404 af
Outflow = 27.62 cfs @ 12.00 hrs, Volume= 1.403 af, Atten= 1%, Lag= 0.9 min
Primary = 19.45 cfs @ 12.00 hrs, Volume= 1.361 af
Secondary = 8.17 cfs @ 12.00 hrs, Volume= 0.042 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 727.10' @ 12.00 hrs Surf.Area= 2,268 sf Storage= 2,518 cf
Flood Elev= 727.00' Surf.Area= 2,097 sf Storage= 2,214 cf

Plug-Flow detention time= 0.7 min calculated for 1.403 af (100% of inflow)
Center-of-Mass det. time= 0.7 min (810.2 - 809.5)

Volume	Invert	Avail.Storage	Storage Description
#1	724.00'	5,126 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
724.00	0	0	0
725.00	233	117	117
726.00	932	583	699
727.00	2,097	1,515	2,214
728.00	3,728	2,913	5,126

Device	Routing	Invert	Outlet Devices
#1	Primary	724.00'	**20.5" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Secondary	727.00'	**100.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=19.45 cfs @ 12.00 hrs HW=727.10' (Free Discharge)
↑—**1=Orifice/Grate** (Orifice Controls 19.45 cfs @ 8.48 fps)

Secondary OutFlow Max=8.05 cfs @ 12.00 hrs HW=727.10' (Free Discharge)
↑—**2=Broad-Crested Rectangular Weir** (Weir Controls 8.05 cfs @ 0.77 fps)

Summary for Pond C1E: Catch Basin

[58] Hint: Peaked 0.22' above defined flood level

Inflow Area = 17.841 ac, 0.00% Impervious, Inflow Depth = 6.81" for 500 year - 24 hour event
Inflow = 96.72 cfs @ 12.28 hrs, Volume= 10.125 af
Outflow = 92.07 cfs @ 12.36 hrs, Volume= 10.125 af, Atten= 5%, Lag= 4.8 min
Primary = 67.98 cfs @ 12.36 hrs, Volume= 9.819 af
Secondary = 24.09 cfs @ 12.36 hrs, Volume= 0.306 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 801.72' @ 12.36 hrs Surf.Area= 17,815 sf Storage= 27,572 cf
Flood Elev= 801.50' Surf.Area= 16,283 sf Storage= 24,828 cf

Plug-Flow detention time= 2.1 min calculated for 10.123 af (100% of inflow)
Center-of-Mass det. time= 2.1 min (836.4 - 834.3)

Volume	Invert	Avail.Storage	Storage Description
#1	797.50'	31,194 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
797.50	0	0	0
798.00	82	21	21
800.00	5,628	5,710	5,731
802.00	19,835	25,463	31,194

Device	Routing	Invert	Outlet Devices
#1	Primary	797.50'	**20.5" Horiz. Orifice/Grate X 3.00** C= 0.600 Limited to weir flow at low heads
#2	Secondary	801.50'	**100.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00

3.50 4.00 4.50 5.00 5.50
Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73
2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=67.98 cfs @ 12.36 hrs HW=801.72' (Free Discharge)
1=Orifice/Grate (Orifice Controls 67.98 cfs @ 9.89 fps)

Secondary OutFlow Max=23.87 cfs @ 12.36 hrs HW=801.72' (Free Discharge)
2=Broad-Crested Rectangular Weir (Weir Controls 23.87 cfs @ 1.11 fps)

Summary for Pond C1N: Catch Basin

[58] Hint: Peaked 0.26' above defined flood level

Inflow Area = 17.691 ac, 0.00% Impervious, Inflow Depth = 6.81" for 500 year - 24 hour event
Inflow = 99.03 cfs @ 12.27 hrs, Volume= 10.040 af
Outflow = 92.77 cfs @ 12.35 hrs, Volume= 10.040 af, Atten= 6%, Lag= 5.1 min
Primary = 59.81 cfs @ 12.35 hrs, Volume= 9.380 af
Secondary = 32.96 cfs @ 12.35 hrs, Volume= 0.660 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 804.26' @ 12.35 hrs Surf.Area= 22,617 sf Storage= 31,160 cf
Flood Elev= 804.00' Surf.Area= 18,200 sf Storage= 21,950 cf

Plug-Flow detention time= 3.0 min calculated for 10.038 af (100% of inflow)
Center-of-Mass det. time= 3.0 min (835.8 - 832.9)

Volume	Invert	Avail.Storage	Storage Description
#1	801.00'	91,900 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
801.00	0	0	0
802.00	2,500	1,250	1,250
804.00	18,200	20,700	21,950
806.00	51,750	69,950	91,900

Device	Routing	Invert	Outlet Devices
#1	Primary	801.00'	**20.5" Horiz. Orifice/Grate X 3.00** C= 0.600 Limited to weir flow at low heads
#2	Secondary	804.00'	**100.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=59.81 cfs @ 12.35 hrs HW=804.26' (Free Discharge)
1=Orifice/Grate (Orifice Controls 59.81 cfs @ 8.70 fps)

Secondary OutFlow Max=32.82 cfs @ 12.35 hrs HW=804.26' (Free Discharge)
2=Broad-Crested Rectangular Weir (Weir Controls 32.82 cfs @ 1.25 fps)

Summary for Pond C1NW: Catch Basin

Inflow Area = 1.506 ac, 0.00% Impervious, Inflow Depth = 6.81" for 500 year - 24 hour event
Inflow = 18.27 cfs @ 11.96 hrs, Volume= 0.855 af
Outflow = 15.44 cfs @ 12.00 hrs, Volume= 0.855 af, Atten= 16%, Lag= 2.5 min
Primary = 15.44 cfs @ 12.00 hrs, Volume= 0.855 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 786.96' @ 12.00 hrs Surf.Area= 1,289 sf Storage= 1,411 cf
Flood Elev= 788.00' Surf.Area= 2,403 sf Storage= 2,804 cf

Plug-Flow detention time= 0.6 min calculated for 0.855 af (100% of inflow)
Center-of-Mass det. time= 0.6 min (808.2 - 807.6)

Volume	Invert	Avail.Storage	Storage Description
#1	785.00'	11,882 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
785.00	0	0	0
786.00	267	134	134
788.00	2,403	2,670	2,804
790.00	6,675	9,078	11,882

Device	Routing	Invert	Outlet Devices
#1	Primary	785.00'	**20.5" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Secondary	788.00'	**100.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=15.42 cfs @ 12.00 hrs HW=786.95' (Free Discharge)
└**1=Orifice/Grate** (Orifice Controls 15.42 cfs @ 6.73 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=785.00' (Free Discharge)
└**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond C1S: Catch Basin

Inflow Area = 3.455 ac, 0.00% Impervious, Inflow Depth = 6.81" for 500 year - 24 hour event
Inflow = 30.03 cfs @ 12.07 hrs, Volume= 1.961 af
Outflow = 18.02 cfs @ 12.20 hrs, Volume= 1.961 af, Atten= 40%, Lag= 8.0 min
Primary = 18.02 cfs @ 12.20 hrs, Volume= 1.961 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 811.67' @ 12.20 hrs Surf.Area= 9,958 sf Storage= 10,010 cf
Flood Elev= 812.00' Surf.Area= 12,050 sf Storage= 12,985 cf

Plug-Flow detention time= 3.4 min calculated for 1.961 af (100% of inflow)
Center-of-Mass det. time= 3.4 min (820.3 - 816.8)

Volume	Invert	Avail.Storage	Storage Description
#1	809.00'	30,580 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
809.00	0	0	0
810.00	1,180	590	590
811.00	5,780	3,480	4,070
812.00	12,050	8,915	12,985
813.00	23,140	17,595	30,580

Device	Routing	Invert	Outlet Devices
#1	Primary	809.00'	**20.5" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Secondary	812.00'	**100.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=18.02 cfs @ 12.20 hrs HW=811.67' (Free Discharge)
└**1=Orifice/Grate** (Orifice Controls 18.02 cfs @ 7.86 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=809.00' (Free Discharge)
└**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond C1SE: Catch Basin

Inflow Area = 3.373 ac, 0.00% Impervious, Inflow Depth = 6.81" for 500 year - 24 hour event
Inflow = 29.62 cfs @ 12.07 hrs, Volume= 1.914 af
Outflow = 17.87 cfs @ 12.20 hrs, Volume= 1.914 af, Atten= 40%, Lag= 7.7 min
Primary = 17.87 cfs @ 12.20 hrs, Volume= 1.914 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 812.62' @ 12.20 hrs Surf.Area= 9,681 sf Storage= 9,617 cf
Flood Elev= 813.00' Surf.Area= 12,050 sf Storage= 12,985 cf

Plug-Flow detention time= 3.3 min calculated for 1.914 af (100% of inflow)
Center-of-Mass det. time= 3.3 min (819.9 - 816.5)

Volume	Invert	Avail.Storage	Storage Description
#1	810.00'	30,580 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
810.00	0	0	0
811.00	1,180	590	590
812.00	5,780	3,480	4,070
813.00	12,050	8,915	12,985
814.00	23,140	17,595	30,580

Device	Routing	Invert	Outlet Devices
#1	Primary	810.00'	**20.5" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Secondary	813.00'	**100.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50

Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=17.87 cfs @ 12.20 hrs HW=812.62' (Free Discharge)
└**1=Orifice/Grate** (Orifice Controls 17.87 cfs @ 7.80 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=810.00' (Free Discharge)
└**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond C1SW: Catch Basin

Inflow Area = 4.734 ac, 0.00% Impervious, Inflow Depth = 6.81" for 500 year - 24 hour event
Inflow = 41.89 cfs @ 12.06 hrs, Volume= 2.687 af
Outflow = 17.34 cfs @ 12.25 hrs, Volume= 2.687 af, Atten= 59%, Lag= 11.3 min
Primary = 17.34 cfs @ 12.25 hrs, Volume= 2.687 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 813.47' @ 12.25 hrs Surf.Area= 19,775 sf Storage= 24,165 cf
Flood Elev= 815.00' Surf.Area= 44,099 sf Storage= 76,190 cf

Plug-Flow detention time= 10.7 min calculated for 2.687 af (100% of inflow)
Center-of-Mass det. time= 10.6 min (826.9 - 816.3)

Volume	Invert	Avail.Storage	Storage Description
#1	811.00'	120,289 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
811.00	0	0	0
812.00	4,533	2,267	2,267
814.00	25,292	29,825	32,092
816.00	62,905	88,197	120,289

Device	Routing	Invert	Outlet Devices
#1	Primary	811.00'	**20.5" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Secondary	815.00'	**100.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=17.34 cfs @ 12.25 hrs HW=813.47' (Free Discharge)
└**1=Orifice/Grate** (Orifice Controls 17.34 cfs @ 7.56 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=811.00' (Free Discharge)
└**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond C1W: Catch Basin

[58] Hint: Peaked 0.24' above defined flood level

Inflow Area = 16.760 ac, 0.00% Impervious, Inflow Depth = 6.81" for 500 year - 24 hour event
Inflow = 126.27 cfs @ 12.12 hrs, Volume= 9.512 af
Outflow = 96.89 cfs @ 12.24 hrs, Volume= 9.512 af, Atten= 23%, Lag= 7.1 min
Primary = 68.19 cfs @ 12.24 hrs, Volume= 9.228 af
Secondary = 28.70 cfs @ 12.24 hrs, Volume= 0.283 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 803.24' @ 12.24 hrs Surf.Area= 27,676 sf Storage= 52,644 cf
Flood Elev= 803.00' Surf.Area= 25,337 sf Storage= 46,529 cf

Plug-Flow detention time= 4.6 min calculated for 9.510 af (100% of inflow)
Center-of-Mass det. time= 4.6 min (825.9 - 821.3)

Volume	Invert	Avail.Storage	Storage Description
#1	799.00'	71,866 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
799.00	0	0	0
800.00	3,697	1,849	1,849
802.00	15,646	19,343	21,192
804.00	35,028	50,674	71,866

Device	Routing	Invert	Outlet Devices
#1	Primary	799.00'	**20.5" Horiz. Orifice/Grate X 3.00** C= 0.600 Limited to weir flow at low heads
#2	Secondary	803.00'	**100.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=68.19 cfs @ 12.24 hrs HW=803.24' (Free Discharge)
↑—**1=Orifice/Grate** (Orifice Controls 68.19 cfs @ 9.92 fps)

Secondary OutFlow Max=28.56 cfs @ 12.24 hrs HW=803.24' (Free Discharge)
↑—**2=Broad-Crested Rectangular Weir** (Weir Controls 28.56 cfs @ 1.18 fps)

Summary for Pond C2N: Catch Basin

Inflow Area = 1.145 ac, 0.00% Impervious, Inflow Depth = 6.81" for 500 year - 24 hour event
Inflow = 13.33 cfs @ 11.98 hrs, Volume= 0.650 af
Outflow = 12.23 cfs @ 12.01 hrs, Volume= 0.650 af, Atten= 8%, Lag= 1.9 min
Primary = 12.23 cfs @ 12.01 hrs, Volume= 0.650 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 783.23' @ 12.01 hrs Surf.Area= 510 sf Storage= 437 cf
Flood Elev= 785.00' Surf.Area= 2,403 sf Storage= 2,804 cf

Plug-Flow detention time= 0.4 min calculated for 0.650 af (100% of inflow)
Center-of-Mass det. time= 0.4 min (809.1 - 808.8)

Volume	Invert	Avail.Storage	Storage Description
#1	782.00'	11,882 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
782.00	0	0	0
783.00	267	134	134
785.00	2,403	2,670	2,804
787.00	6,675	9,078	11,882

Device	Routing	Invert	Outlet Devices
#1	Primary	782.00'	**20.5" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Secondary	785.00'	**100.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=12.22 cfs @ 12.01 hrs HW=783.23' (Free Discharge)
1=Orifice/Grate (Orifice Controls 12.22 cfs @ 5.33 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=782.00' (Free Discharge)
2=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Summary for Pond C2NW: Catch Basin

Inflow Area = 2.338 ac, 0.00% Impervious, Inflow Depth = 6.81" for 500 year - 24 hour event
Inflow = 22.67 cfs @ 12.03 hrs, Volume= 1.327 af
Outflow = 17.08 cfs @ 12.11 hrs, Volume= 1.327 af, Atten= 25%, Lag= 4.7 min
Primary = 17.08 cfs @ 12.11 hrs, Volume= 1.327 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 747.40' @ 12.11 hrs Surf.Area= 3,304 sf Storage= 4,261 cf
Flood Elev= 748.00' Surf.Area= 4,272 sf Storage= 5,874 cf

Plug-Flow detention time= 1.9 min calculated for 1.327 af (100% of inflow)
Center-of-Mass det. time= 1.9 min (815.6 - 813.7)

Volume	Invert	Avail.Storage	Storage Description
#1	745.00'	16,821 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
745.00	0	0	0
746.00	1,068	534	534
748.00	4,272	5,340	5,874
750.00	6,675	10,947	16,821

Device	Routing	Invert	Outlet Devices
#1	Primary	745.00'	**20.5" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Secondary	748.00'	**100.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=17.08 cfs @ 12.11 hrs HW=747.39' (Free Discharge)
1=Orifice/Grate (Orifice Controls 17.08 cfs @ 7.45 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=745.00' (Free Discharge)
2=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Summary for Pond C2S: Catch Basin

[58] Hint: Peaked 0.22' above defined flood level

Inflow Area = 7.410 ac, 0.00% Impervious, Inflow Depth = 6.81" for 500 year - 24 hour event
Inflow = 46.02 cfs @ 12.20 hrs, Volume= 4.205 af
Outflow = 44.06 cfs @ 12.27 hrs, Volume= 4.205 af, Atten= 4%, Lag= 4.0 min
Primary = 19.79 cfs @ 12.27 hrs, Volume= 3.711 af
Secondary = 24.26 cfs @ 12.27 hrs, Volume= 0.494 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 803.22' @ 12.27 hrs Surf.Area= 14,455 sf Storage= 16,800 cf
Flood Elev= 803.00' Surf.Area= 12,050 sf Storage= 12,985 cf

Plug-Flow detention time= 4.5 min calculated for 4.205 af (100% of inflow)
Center-of-Mass det. time= 4.5 min (833.0 - 828.5)

Volume	Invert	Avail.Storage	Storage Description
#1	800.00'	30,580 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
800.00	0	0	0
801.00	1,180	590	590
802.00	5,780	3,480	4,070
803.00	12,050	8,915	12,985
804.00	23,140	17,595	30,580

Device	Routing	Invert	Outlet Devices
#1	Primary	800.00'	**20.5" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Secondary	803.00'	**100.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=19.79 cfs @ 12.27 hrs HW=803.22' (Free Discharge)
1=Orifice/Grate (Orifice Controls 19.79 cfs @ 8.64 fps)

Secondary OutFlow Max=24.16 cfs @ 12.27 hrs HW=803.22' (Free Discharge)
2=Broad-Crested Rectangular Weir (Weir Controls 24.16 cfs @ 1.11 fps)

Summary for Pond C2SE: Catch Basin

[58] Hint: Peaked 0.10' above defined flood level

Inflow Area = 5.356 ac, 0.00% Impervious, Inflow Depth = 6.81" for 500 year - 24 hour event
Inflow = 33.88 cfs @ 12.21 hrs, Volume= 3.040 af
Outflow = 27.25 cfs @ 12.34 hrs, Volume= 3.040 af, Atten= 20%, Lag= 7.9 min
Primary = 19.44 cfs @ 12.34 hrs, Volume= 2.945 af
Secondary = 7.81 cfs @ 12.34 hrs, Volume= 0.095 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 807.10' @ 12.34 hrs Surf.Area= 13,176 sf Storage= 14,771 cf
Flood Elev= 807.00' Surf.Area= 12,050 sf Storage= 12,985 cf

Plug-Flow detention time= 4.6 min calculated for 3.039 af (100% of inflow)
Center-of-Mass det. time= 4.6 min (832.3 - 827.8)

Volume	Invert	Avail.Storage	Storage Description
#1	804.00'	30,580 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
804.00	0	0	0
805.00	1,180	590	590
806.00	5,780	3,480	4,070
807.00	12,050	8,915	12,985
808.00	23,140	17,595	30,580

Device	Routing	Invert	Outlet Devices
#1	Primary	804.00'	**20.5" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Secondary	807.00'	**100.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=19.44 cfs @ 12.34 hrs HW=807.10' (Free Discharge)
1=Orifice/Grate (Orifice Controls 19.44 cfs @ 8.48 fps)

Secondary OutFlow Max=7.69 cfs @ 12.34 hrs HW=807.10' (Free Discharge)
2=Broad-Crested Rectangular Weir (Weir Controls 7.69 cfs @ 0.76 fps)

Summary for Pond C2SW: Catch Basin

[58] Hint: Peaked 0.15' above defined flood level

Inflow Area = 2.975 ac, 0.00% Impervious, Inflow Depth = 6.81" for 500 year - 24 hour event
Inflow = 34.26 cfs @ 11.98 hrs, Volume= 1.688 af
Outflow = 34.02 cfs @ 11.99 hrs, Volume= 1.688 af, Atten= 1%, Lag= 0.6 min
Primary = 19.60 cfs @ 11.99 hrs, Volume= 1.588 af
Secondary = 14.42 cfs @ 11.99 hrs, Volume= 0.100 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 779.15' @ 11.99 hrs Surf.Area= 2,981 sf Storage= 3,982 cf
Flood Elev= 779.00' Surf.Area= 2,509 sf Storage= 3,360 cf

Plug-Flow detention time= 1.2 min calculated for 1.688 af (100% of inflow)
Center-of-Mass det. time= 1.2 min (810.3 - 809.0)

Volume	Invert	Avail.Storage	Storage Description
#1	776.00'	7,403 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
776.00	0	0	0
777.00	634	317	317
778.00	1,471	1,053	1,370
779.00	2,509	1,990	3,360
780.00	5,577	4,043	7,403

Device	Routing	Invert	Outlet Devices
#1	Primary	776.00'	**20.5" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Secondary	779.00'	**100.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=19.60 cfs @ 11.99 hrs HW=779.15' (Free Discharge)
↑—**1=Orifice/Grate** (Orifice Controls 19.60 cfs @ 8.55 fps)

Secondary OutFlow Max=14.37 cfs @ 11.99 hrs HW=779.15' (Free Discharge)
↑—**2=Broad-Crested Rectangular Weir** (Weir Controls 14.37 cfs @ 0.93 fps)

Summary for Pond C2W: Catch Basin

[58] Hint: Peaked 0.12' above defined flood level

Inflow Area = 1.924 ac, 0.00% Impervious, Inflow Depth = 8.58" for 500 year - 24 hour event
Inflow = 32.09 cfs @ 12.24 hrs, Volume= 1.375 af
Outflow = 30.01 cfs @ 12.26 hrs, Volume= 1.375 af, Atten= 6%, Lag= 1.5 min
Primary = 19.51 cfs @ 12.26 hrs, Volume= 1.337 af
Secondary = 10.50 cfs @ 12.26 hrs, Volume= 0.038 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 772.12' @ 12.26 hrs Surf.Area= 2,299 sf Storage= 2,574 cf
Flood Elev= 772.00' Surf.Area= 2,097 sf Storage= 2,214 cf

Plug-Flow detention time= 1.1 min calculated for 1.374 af (100% of inflow)
Center-of-Mass det. time= 0.8 min (795.3 - 794.5)

Volume	Invert	Avail.Storage	Storage Description
#1	769.00'	9,903 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
769.00	0	0	0
770.00	233	117	117
771.00	932	583	699
772.00	2,097	1,515	2,214
773.00	3,728	2,913	5,126
774.00	5,825	4,777	9,903

Device	Routing	Invert	Outlet Devices
#1	Primary	769.00'	**20.5" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Secondary	772.00'	**100.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=19.50 cfs @ 12.26 hrs HW=772.12' (Free Discharge)
1=Orifice/Grate (Orifice Controls 19.50 cfs @ 8.51 fps)

Secondary OutFlow Max=10.07 cfs @ 12.26 hrs HW=772.12' (Free Discharge)
2=Broad-Crested Rectangular Weir (Weir Controls 10.07 cfs @ 0.83 fps)

Summary for Pond C3N: Catch Basin

Inflow Area = 1.762 ac, 0.00% Impervious, Inflow Depth = 6.81" for 500 year - 24 hour event
Inflow = 19.53 cfs @ 11.99 hrs, Volume= 1.000 af
Outflow = 16.61 cfs @ 12.04 hrs, Volume= 1.000 af, Atten= 15%, Lag= 2.8 min
Primary = 16.61 cfs @ 12.04 hrs, Volume= 1.000 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 744.27' @ 12.04 hrs Surf.Area= 1,493 sf Storage= 1,776 cf
Flood Elev= 745.00' Surf.Area= 2,670 sf Storage= 3,738 cf

Plug-Flow detention time= 1.4 min calculated for 1.000 af (100% of inflow)
Center-of-Mass det. time= 1.4 min (811.5 - 810.1)

Volume	Invert	Avail.Storage	Storage Description
#1	742.00'	11,882 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
742.00	0	0	0
744.00	1,068	1,068	1,068
746.00	4,272	5,340	6,408
747.00	6,675	5,474	11,882

Device	Routing	Invert	Outlet Devices
#1	Primary	742.00'	**20.5" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Secondary	745.00'	**100.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=16.61 cfs @ 12.04 hrs HW=744.26' (Free Discharge)
1=Orifice/Grate (Orifice Controls 16.61 cfs @ 7.25 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=742.00' (Free Discharge)
2=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Summary for Pond C3NW: Northwest Ditch

[58] Hint: Peaked 0.40' above defined flood level

Inflow Area = 9.855 ac, 0.00% Impervious, Inflow Depth = 6.81" for 500 year - 24 hour event
Inflow = 91.09 cfs @ 12.02 hrs, Volume= 5.593 af
Outflow = 90.99 cfs @ 12.02 hrs, Volume= 5.593 af, Atten= 0%, Lag= 0.3 min
Primary = 27.87 cfs @ 12.02 hrs, Volume= 4.470 af
Secondary = 63.12 cfs @ 12.02 hrs, Volume= 1.123 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 723.40' @ 12.02 hrs Surf.Area= 5,384 sf Storage= 9,137 cf
Flood Elev= 723.00' Surf.Area= 4,539 sf Storage= 7,343 cf

Plug-Flow detention time= 1.6 min calculated for 5.592 af (100% of inflow)
Center-of-Mass det. time= 1.6 min (813.4 - 811.8)

Volume	Invert	Avail.Storage	Storage Description
#1	719.00'	11,882 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
719.00	0	0	0
720.00	267	134	134
722.00	2,403	2,670	2,804
724.00	6,675	9,078	11,882

Device	Routing	Invert	Outlet Devices
#1	Primary	719.00'	**24.0" Round Culvert** L= 100.0' CMP, end-section conforming to fill, Ke= 0.500 Inlet / Outlet Invert= 719.00' / 705.00' S= 0.1400 '/' Cc= 0.900 n= 0.018, Flow Area= 3.14 sf
#2	Secondary	723.00'	**100.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=27.87 cfs @ 12.02 hrs HW=723.40' (Free Discharge)
↑—**1=Culvert** (Inlet Controls 27.87 cfs @ 8.87 fps)

Secondary OutFlow Max=63.00 cfs @ 12.02 hrs HW=723.40' (Free Discharge)
↑—**2=Broad-Crested Rectangular Weir** (Weir Controls 63.00 cfs @ 1.59 fps)

Summary for Pond C3S: Catch Basin

[58] Hint: Peaked 0.30' above defined flood level

Inflow Area = 20.973 ac, 0.00% Impervious, Inflow Depth = 7.09" for 500 year - 24 hour event
Inflow = 149.27 cfs @ 12.25 hrs, Volume= 12.397 af
Outflow = 108.94 cfs @ 12.40 hrs, Volume= 12.397 af, Atten= 27%, Lag= 9.3 min
Primary = 45.76 cfs @ 12.40 hrs, Volume= 7.844 af
Secondary = 22.88 cfs @ 12.40 hrs, Volume= 3.922 af
Tertiary = 40.29 cfs @ 12.40 hrs, Volume= 0.631 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Peak Elev= 801.00' @ 12.40 hrs Surf.Area= 47,316 sf Storage= 82,839 cf
Flood Elev= 800.70' Surf.Area= 41,310 sf Storage= 68,694 cf

Plug-Flow detention time= 7.2 min calculated for 12.397 af (100% of inflow)
Center-of-Mass det. time= 7.2 min (833.3 - 826.0)

Volume	Invert	Avail.Storage	Storage Description
#1	796.70'	322,396 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
796.70	0	0	0
798.00	5,040	3,276	3,276
800.00	27,240	32,280	35,556
802.00	67,440	94,680	130,236
804.00	124,720	192,160	322,396

Device	Routing	Invert	Outlet Devices
#1	Primary	796.70'	**20.5" Horiz. Orifice/Grate X 2.00** C= 0.600 Limited to weir flow at low heads
#2	Secondary	796.70'	**20.5" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Tertiary	800.70'	**100.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=45.76 cfs @ 12.40 hrs HW=801.00' (Free Discharge)
1=Orifice/Grate (Orifice Controls 45.76 cfs @ 9.98 fps)

Secondary OutFlow Max=22.88 cfs @ 12.40 hrs HW=801.00' (Free Discharge)
2=Orifice/Grate (Orifice Controls 22.88 cfs @ 9.98 fps)

Tertiary OutFlow Max=40.10 cfs @ 12.40 hrs HW=801.00' (Free Discharge)
3=Broad-Crested Rectangular Weir (Weir Controls 40.10 cfs @ 1.34 fps)

Summary for Pond C3SE: Catch Basin

[58] Hint: Peaked 0.07' above defined flood level

Inflow Area = 12.185 ac, 0.00% Impervious, Inflow Depth = 6.90" for 500 year - 24 hour event
Inflow = 76.25 cfs @ 12.22 hrs, Volume= 7.010 af
Outflow = 49.31 cfs @ 12.44 hrs, Volume= 7.010 af, Atten= 35%, Lag= 13.0 min
Primary = 44.54 cfs @ 12.44 hrs, Volume= 6.974 af
Secondary = 4.78 cfs @ 12.44 hrs, Volume= 0.036 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 803.07' @ 12.44 hrs Surf.Area= 28,851 sf Storage= 43,820 cf
Flood Elev= 803.00' Surf.Area= 27,802 sf Storage= 41,827 cf

Plug-Flow detention time= 5.5 min calculated for 7.010 af (100% of inflow)
Center-of-Mass det. time= 5.5 min (832.4 - 826.9)

Volume	Invert	Avail.Storage	Storage Description
#1	799.00'	200,239 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
799.00	0	0	0
800.00	577	289	289
802.00	13,160	13,737	14,026
804.00	42,443	55,603	69,629
806.00	88,167	130,610	200,239

Device	Routing	Invert	Outlet Devices
#1	Primary	799.00'	**20.5" Horiz. Orifice/Grate X 2.00** C= 0.600 Limited to weir flow at low heads
#2	Secondary	803.00'	**100.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=44.54 cfs @ 12.44 hrs HW=803.07' (Free Discharge)
└**1=Orifice/Grate** (Orifice Controls 44.54 cfs @ 9.72 fps)

Secondary OutFlow Max=4.54 cfs @ 12.44 hrs HW=803.07' (Free Discharge)
└**2=Broad-Crested Rectangular Weir** (Weir Controls 4.54 cfs @ 0.64 fps)

Summary for Pond C3SW: Catch Basin

[58] Hint: Peaked 0.18' above defined flood level

Inflow Area = 2.085 ac, 0.00% Impervious, Inflow Depth = 7.39" for 500 year - 24 hour event
Inflow = 37.92 cfs @ 11.99 hrs, Volume= 1.284 af
Outflow = 37.38 cfs @ 12.00 hrs, Volume= 1.284 af, Atten= 1%, Lag= 0.7 min
Primary = 19.67 cfs @ 12.00 hrs, Volume= 1.196 af
Secondary = 17.71 cfs @ 12.00 hrs, Volume= 0.088 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 755.68' @ 12.00 hrs Surf.Area= 2,384 sf Storage= 2,726 cf
Flood Elev= 755.50' Surf.Area= 2,097 sf Storage= 2,214 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 0.6 min (803.2 - 802.6)

Volume	Invert	Avail.Storage	Storage Description
#1	752.50'	9,903 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
752.50	0	0	0
753.50	233	117	117
754.50	932	583	699
755.50	2,097	1,515	2,214
756.50	3,728	2,913	5,126
757.50	5,825	4,777	9,903

Device	Routing	Invert	Outlet Devices
#1	Primary	752.50'	**20.5" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Secondary	755.50'	**100.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73

2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=19.67 cfs @ 12.00 hrs HW=755.68' (Free Discharge)
└**1=Orifice/Grate** (Orifice Controls 19.67 cfs @ 8.58 fps)

Secondary OutFlow Max=17.53 cfs @ 12.00 hrs HW=755.68' (Free Discharge)
└**2=Broad-Crested Rectangular Weir** (Weir Controls 17.53 cfs @ 1.00 fps)

Summary for Pond C3W: Catch Basin

[58] Hint: Peaked 0.02' above defined flood level

Inflow Area = 1.543 ac, 0.00% Impervious, Inflow Depth = 7.10" for 500 year - 24 hour event
Inflow = 17.23 cfs @ 11.99 hrs, Volume= 0.913 af
Outflow = 16.83 cfs @ 12.01 hrs, Volume= 0.913 af, Atten= 2%, Lag= 1.2 min
Primary = 15.70 cfs @ 12.01 hrs, Volume= 0.911 af
Secondary = 1.13 cfs @ 12.01 hrs, Volume= 0.003 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 744.02' @ 12.01 hrs Surf.Area= 960 sf Storage= 735 cf
Flood Elev= 744.00' Surf.Area= 932 sf Storage= 699 cf

Plug-Flow detention time= 0.4 min calculated for 0.913 af (100% of inflow)
Center-of-Mass det. time= 0.4 min (807.2 - 806.8)

Volume	Invert	Avail.Storage	Storage Description
#1	742.00'	5,126 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
742.00	0	0	0
743.00	233	117	117
744.00	932	583	699
745.00	2,097	1,515	2,214
746.00	3,728	2,913	5,126

Device	Routing	Invert	Outlet Devices
#1	Primary	742.00'	**20.5" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Secondary	744.00'	**100.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=15.70 cfs @ 12.01 hrs HW=744.02' (Free Discharge)
└**1=Orifice/Grate** (Orifice Controls 15.70 cfs @ 6.85 fps)

Secondary OutFlow Max=0.86 cfs @ 12.01 hrs HW=744.02' (Free Discharge)
└**2=Broad-Crested Rectangular Weir** (Weir Controls 0.86 cfs @ 0.36 fps)

Summary for Pond C4N: Catch Basin

[58] Hint: Peaked 0.16' above defined flood level

Inflow Area = 1.933 ac, 0.00% Impervious, Inflow Depth = 10.91" for 500 year - 24 hour event
Inflow = 35.51 cfs @ 12.35 hrs, Volume= 1.757 af
Outflow = 35.34 cfs @ 12.36 hrs, Volume= 1.757 af, Atten= 0%, Lag= 0.7 min
Primary = 19.63 cfs @ 12.36 hrs, Volume= 1.595 af
Secondary = 15.72 cfs @ 12.36 hrs, Volume= 0.162 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 785.16' @ 12.36 hrs Surf.Area= 2,750 sf Storage= 3,542 cf
Flood Elev= 785.00' Surf.Area= 2,403 sf Storage= 2,804 cf

Plug-Flow detention time= 1.2 min calculated for 1.757 af (100% of inflow)
Center-of-Mass det. time= 1.2 min (785.8 - 784.6)

Volume	Invert	Avail.Storage	Storage Description
#1	782.00'	11,882 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
782.00	0	0	0
783.00	267	134	134
785.00	2,403	2,670	2,804
787.00	6,675	9,078	11,882

Device	Routing	Invert	Outlet Devices
#1	Primary	782.00'	**20.5" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Secondary	785.00'	**100.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=19.63 cfs @ 12.36 hrs HW=785.16' (Free Discharge)
└**1=Orifice/Grate** (Orifice Controls 19.63 cfs @ 8.56 fps)

Secondary OutFlow Max=15.56 cfs @ 12.36 hrs HW=785.16' (Free Discharge)
└**2=Broad-Crested Rectangular Weir** (Weir Controls 15.56 cfs @ 0.96 fps)

Summary for Pond C4S: Catch Basin

[58] Hint: Peaked 0.21' above defined flood level

Inflow Area = 0.872 ac, 0.00% Impervious, Inflow Depth = 15.50" for 500 year - 24 hour event
Inflow = 41.34 cfs @ 12.40 hrs, Volume= 1.126 af
Outflow = 41.29 cfs @ 12.40 hrs, Volume= 1.125 af, Atten= 0%, Lag= 0.1 min
Primary = 18.97 cfs @ 12.40 hrs, Volume= 0.917 af
Secondary = 22.32 cfs @ 12.40 hrs, Volume= 0.208 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 780.46' @ 12.40 hrs Surf.Area= 1,629 sf Storage= 2,083 cf
Flood Elev= 780.25' Surf.Area= 1,479 sf Storage= 1,816 cf

Plug-Flow detention time= 1.8 min calculated for 1.125 af (100% of inflow)
Center-of-Mass det. time= 0.8 min (774.5 - 773.7)

Volume	Invert	Avail.Storage	Storage Description
#1	777.50'	2,141 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
777.50	0	0	0
778.50	378	189	189
779.50	932	655	844
780.50	1,661	1,297	2,141

Device	Routing	Invert	Outlet Devices
#1	Primary	777.50'	**20.5" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Secondary	780.25'	**100.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=18.97 cfs @ 12.40 hrs HW=780.46' (Free Discharge)
1=Orifice/Grate (Orifice Controls 18.97 cfs @ 8.28 fps)

Secondary OutFlow Max=22.15 cfs @ 12.40 hrs HW=780.46' (Free Discharge)
2=Broad-Crested Rectangular Weir (Weir Controls 22.15 cfs @ 1.08 fps)

Summary for Pond C4SE: Catch Basin

[58] Hint: Peaked 0.03' above defined flood level

Inflow Area = 2.200 ac, 0.00% Impervious, Inflow Depth = 7.01" for 500 year - 24 hour event
Inflow = 25.34 cfs @ 11.98 hrs, Volume= 1.285 af
Outflow = 20.93 cfs @ 12.03 hrs, Volume= 1.285 af, Atten= 17%, Lag= 3.0 min
Primary = 19.22 cfs @ 12.03 hrs, Volume= 1.281 af
Secondary = 1.71 cfs @ 12.03 hrs, Volume= 0.003 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 779.03' @ 12.03 hrs Surf.Area= 2,549 sf Storage= 3,460 cf
Flood Elev= 779.00' Surf.Area= 2,509 sf Storage= 3,360 cf

Plug-Flow detention time= 1.2 min calculated for 1.285 af (100% of inflow)
Center-of-Mass det. time= 1.2 min (808.5 - 807.3)

Volume	Invert	Avail.Storage	Storage Description
#1	776.00'	10,959 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
776.00	0	0	0
777.00	634	317	317
778.00	1,471	1,053	1,370
779.00	2,509	1,990	3,360
780.00	3,750	3,130	6,489
781.00	5,190	4,470	10,959

Device	Routing	Invert	Outlet Devices
#1	Primary	776.00'	**20.5" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Secondary	779.00'	**100.0' long x 4.0' breadth Broad-Crested Rectangular Weir**

Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50
Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=19.22 cfs @ 12.03 hrs HW=779.03' (Free Discharge)
└**1=Orifice/Grate** (Orifice Controls 19.22 cfs @ 8.38 fps)

Secondary OutFlow Max=1.33 cfs @ 12.03 hrs HW=779.03' (Free Discharge)
└**2=Broad-Crested Rectangular Weir** (Weir Controls 1.33 cfs @ 0.42 fps)

Summary for Pond C4SW: Southwest Ditch 1

[58] Hint: Peaked 0.14' above defined flood level

Inflow Area = 1.671 ac, 0.00% Impervious, Inflow Depth = 7.44" for 500 year - 24 hour event
Inflow = 36.30 cfs @ 12.00 hrs, Volume= 1.037 af
Outflow = 32.66 cfs @ 12.02 hrs, Volume= 1.035 af, Atten= 10%, Lag= 1.2 min
Primary = 19.57 cfs @ 12.02 hrs, Volume= 0.997 af
Secondary = 13.09 cfs @ 12.02 hrs, Volume= 0.039 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 747.14' @ 12.02 hrs Surf.Area= 2,332 sf Storage= 2,633 cf
Flood Elev= 747.00' Surf.Area= 2,097 sf Storage= 2,214 cf

Plug-Flow detention time= 1.6 min calculated for 1.035 af (100% of inflow)
Center-of-Mass det. time= 0.7 min (801.7 - 801.0)

Volume	Invert	Avail.Storage	Storage Description
#1	744.00'	9,903 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
744.00	0	0	0
745.00	233	117	117
746.00	932	583	699
747.00	2,097	1,515	2,214
748.00	3,728	2,913	5,126
749.00	5,825	4,777	9,903

Device	Routing	Invert	Outlet Devices
#1	Primary	744.00'	**20.5" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Secondary	747.00'	**100.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=19.56 cfs @ 12.02 hrs HW=747.14' (Free Discharge)
└**1=Orifice/Grate** (Orifice Controls 19.56 cfs @ 8.53 fps)

Secondary OutFlow Max=12.63 cfs @ 12.02 hrs HW=747.14' (Free Discharge)
└**2=Broad-Crested Rectangular Weir** (Weir Controls 12.63 cfs @ 0.89 fps)

Summary for Pond C4W: West Ditch

[58] Hint: Peaked 0.60' above defined flood level
[79] Warning: Submerged Pond MH4W Primary device # 1 INLET by 2.10'

Inflow Area = 18.321 ac, 0.00% Impervious, Inflow Depth = 6.63" for 500 year - 24 hour event
Inflow = 70.76 cfs @ 12.22 hrs, Volume= 10.117 af
Outflow = 70.75 cfs @ 12.23 hrs, Volume= 10.117 af, Atten= 0%, Lag= 0.3 min
Primary = 35.88 cfs @ 12.23 hrs, Volume= 8.295 af
Secondary = 34.87 cfs @ 12.23 hrs, Volume= 1.822 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 722.10' @ 12.23 hrs Surf.Area= 8,003 sf Storage= 19,473 cf
Flood Elev= 721.50' Surf.Area= 7,097 sf Storage= 15,551 cf

Plug-Flow detention time= 4.4 min calculated for 10.115 af (100% of inflow)
Center-of-Mass det. time= 4.4 min (831.3 - 826.9)

Volume	Invert	Avail.Storage	Storage Description
#1	717.00'	34,968 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
717.00	0	0	0
718.00	1,206	603	603
720.00	4,430	5,636	6,239
722.00	7,986	12,416	18,655
724.00	8,327	16,313	34,968

Device	Routing	Invert	Outlet Devices
#1	Primary	717.00'	**30.0" Round Culvert** L= 90.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 717.00' / 716.00' S= 0.0111 '/' Cc= 0.900 n= 0.024, Flow Area= 4.91 sf
#2	Secondary	722.00'	**400.0' long x 40.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=35.88 cfs @ 12.23 hrs HW=722.10' (Free Discharge)
└**1=Culvert** (Barrel Controls 35.88 cfs @ 7.31 fps)

Secondary OutFlow Max=34.04 cfs @ 12.23 hrs HW=722.10' (Free Discharge)
└**2=Broad-Crested Rectangular Weir** (Weir Controls 34.04 cfs @ 0.85 fps)

Summary for Pond C5N: Catch Basin

Inflow Area = 3.175 ac, 0.00% Impervious, Inflow Depth = 7.42" for 500 year - 24 hour event
Inflow = 34.95 cfs @ 11.99 hrs, Volume= 1.963 af
Outflow = 32.46 cfs @ 12.03 hrs, Volume= 1.963 af, Atten= 7%, Lag= 1.9 min
Primary = 32.46 cfs @ 12.03 hrs, Volume= 1.963 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 751.16' @ 12.03 hrs Surf.Area= 1,509 sf Storage= 1,686 cf
Flood Elev= 752.00' Surf.Area= 2,403 sf Storage= 2,804 cf

Plug-Flow detention time= 0.3 min calculated for 1.963 af (100% of inflow)
Center-of-Mass det. time= 0.3 min (805.0 - 804.8)

Volume	Invert	Avail.Storage	Storage Description
#1	749.00'	11,882 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
749.00	0	0	0
750.00	267	134	134
752.00	2,403	2,670	2,804
754.00	6,675	9,078	11,882

Device	Routing	Invert	Outlet Devices
#1	Primary	749.00'	**20.5" Horiz. Orifice/Grate X 2.00** C= 0.600 Limited to weir flow at low heads
#2	Secondary	752.00'	**100.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=32.43 cfs @ 12.03 hrs HW=751.16' (Free Discharge)
↑—**1=Orifice/Grate** (Orifice Controls 32.43 cfs @ 7.07 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=749.00' (Free Discharge)
↑—**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond C5S: Catch Basin

[58] Hint: Peaked 0.07' above defined flood level

Inflow Area = 1.778 ac, 0.00% Impervious, Inflow Depth = 8.22" for 500 year - 24 hour event
Inflow = 24.47 cfs @ 12.40 hrs, Volume= 1.217 af
Outflow = 23.96 cfs @ 12.42 hrs, Volume= 1.215 af, Atten= 2%, Lag= 1.0 min
Primary = 19.34 cfs @ 12.42 hrs, Volume= 1.203 af
Secondary = 4.62 cfs @ 12.42 hrs, Volume= 0.013 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 735.07' @ 12.42 hrs Surf.Area= 913 sf Storage= 1,015 cf
Flood Elev= 735.00' Surf.Area= 891 sf Storage= 941 cf

Plug-Flow detention time= 1.5 min calculated for 1.215 af (100% of inflow)
Center-of-Mass det. time= 0.4 min (798.8 - 798.4)

Volume	Invert	Avail.Storage	Storage Description
#1	732.00'	1,986 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
732.00	0	0	0
733.00	99	50	50
734.00	396	248	297
735.00	891	644	941
736.00	1,200	1,046	1,986

Device	Routing	Invert	Outlet Devices
#1	Primary	732.00'	**20.5" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Secondary	735.00'	**100.0' long x 4.0' breadth Broad-Crested Rectangular Weir**

Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50
Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=19.34 cfs @ 12.42 hrs HW=735.07' (Free Discharge)
1=Orifice/Grate (Orifice Controls 19.34 cfs @ 8.44 fps)

Secondary OutFlow Max=4.37 cfs @ 12.42 hrs HW=735.07' (Free Discharge)
2=Broad-Crested Rectangular Weir (Weir Controls 4.37 cfs @ 0.63 fps)

Summary for Pond C5SE: Catch Basin

[58] Hint: Peaked 0.02' above defined flood level

Inflow Area = 2.043 ac, 0.00% Impervious, Inflow Depth = 6.83" for 500 year - 24 hour event
Inflow = 23.12 cfs @ 11.99 hrs, Volume= 1.163 af
Outflow = 20.33 cfs @ 12.04 hrs, Volume= 1.162 af, Atten= 12%, Lag= 3.1 min
Primary = 19.18 cfs @ 12.04 hrs, Volume= 1.161 af
Secondary = 1.14 cfs @ 12.04 hrs, Volume= 0.002 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 755.52' @ 12.04 hrs Surf.Area= 2,132 sf Storage= 2,276 cf
Flood Elev= 755.50' Surf.Area= 2,097 sf Storage= 2,214 cf

Plug-Flow detention time= 0.9 min calculated for 1.162 af (100% of inflow)
Center-of-Mass det. time= 0.6 min (809.9 - 809.2)

Volume	Invert	Avail.Storage	Storage Description
#1	752.50'	9,903 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
752.50	0	0	0
753.50	233	117	117
754.50	932	583	699
755.50	2,097	1,515	2,214
756.50	3,728	2,913	5,126
757.50	5,825	4,777	9,903

Device	Routing	Invert	Outlet Devices
#1	Primary	752.50'	**20.5" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Secondary	755.50'	**100.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=19.18 cfs @ 12.04 hrs HW=755.52' (Free Discharge)
1=Orifice/Grate (Orifice Controls 19.18 cfs @ 8.37 fps)

Secondary OutFlow Max=0.61 cfs @ 12.04 hrs HW=755.52' (Free Discharge)
2=Broad-Crested Rectangular Weir (Weir Controls 0.61 cfs @ 0.33 fps)

Summary for Pond C5SW: Catch Basin

Inflow Area = 4.496 ac, 0.00% Impervious, Inflow Depth = 6.81" for 500 year - 24 hour event
Inflow = 40.03 cfs @ 12.06 hrs, Volume= 2.552 af
Outflow = 18.26 cfs @ 12.23 hrs, Volume= 2.552 af, Atten= 54%, Lag= 10.3 min
Primary = 18.26 cfs @ 12.23 hrs, Volume= 2.552 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 813.74' @ 12.23 hrs Surf.Area= 17,532 sf Storage= 20,433 cf
Flood Elev= 815.00' Surf.Area= 37,030 sf Storage= 60,372 cf

Plug-Flow detention time= 7.6 min calculated for 2.552 af (100% of inflow)
Center-of-Mass det. time= 7.6 min (823.7 - 816.1)

Volume	Invert	Avail.Storage	Storage Description
#1	811.00'	97,402 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
811.00	0	0	0
812.00	2,344	1,172	1,172
814.00	19,826	22,170	23,342
816.00	54,234	74,060	97,402

Device	Routing	Invert	Outlet Devices
#1	Primary	811.00'	**20.5" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Secondary	815.00'	**100.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=18.26 cfs @ 12.23 hrs HW=813.74' (Free Discharge)
└**1=Orifice/Grate** (Orifice Controls 18.26 cfs @ 7.97 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=811.00' (Free Discharge)
└**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond C6N: North Ditch

[58] Hint: Peaked 0.52' above defined flood level
[79] Warning: Submerged Pond D1N Primary device # 1 OUTLET by 3.52'

Inflow Area = 26.669 ac, 0.00% Impervious, Inflow Depth = 6.81" for 500 year - 24 hour event
Inflow = 122.68 cfs @ 12.05 hrs, Volume= 15.135 af
Outflow = 122.62 cfs @ 12.05 hrs, Volume= 15.135 af, Atten= 0%, Lag= 0.2 min
Primary = 22.86 cfs @ 12.05 hrs, Volume= 9.358 af
Secondary = 99.76 cfs @ 12.05 hrs, Volume= 5.778 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 723.52' @ 12.05 hrs Surf.Area= 5,657 sf Storage= 9,717 cf
Flood Elev= 723.00' Surf.Area= 4,539 sf Storage= 7,343 cf

Plug-Flow detention time= 1.9 min calculated for 15.132 af (100% of inflow)
Center-of-Mass det. time= 1.9 min (829.9 - 828.0)

Volume	Invert	Avail.Storage	Storage Description
#1	719.00'	11,882 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
719.00	0	0	0
720.00	267	134	134
722.00	2,403	2,670	2,804
724.00	6,675	9,078	11,882

Device	Routing	Invert	Outlet Devices
#1	Primary	719.00'	**22.2" Round Culvert** L= 50.0' CMP, end-section conforming to fill, Ke= 0.500 Inlet / Outlet Invert= 719.00' / 718.50' S= 0.0100 '/' Cc= 0.900 n= 0.018, Flow Area= 2.69 sf
#2	Secondary	723.00'	**100.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=22.86 cfs @ 12.05 hrs HW=723.52' (Free Discharge)
1=Culvert (Barrel Controls 22.86 cfs @ 8.50 fps)

Secondary OutFlow Max=99.55 cfs @ 12.05 hrs HW=723.52' (Free Discharge)
2=Broad-Crested Rectangular Weir (Weir Controls 99.55 cfs @ 1.90 fps)

Summary for Pond C6S: Catch Basin

Inflow Area = 1.820 ac, 0.00% Impervious, Inflow Depth = 6.81" for 500 year - 24 hour event
Inflow = 21.19 cfs @ 11.98 hrs, Volume= 1.033 af
Outflow = 17.96 cfs @ 12.02 hrs, Volume= 1.033 af, Atten= 15%, Lag= 2.6 min
Primary = 17.96 cfs @ 12.02 hrs, Volume= 1.033 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 779.65' @ 12.02 hrs Surf.Area= 1,412 sf Storage= 1,929 cf
Flood Elev= 780.00' Surf.Area= 1,600 sf Storage= 2,399 cf

Plug-Flow detention time= 1.0 min calculated for 1.033 af (100% of inflow)
Center-of-Mass det. time= 0.9 min (809.7 - 808.8)

Volume	Invert	Avail.Storage	Storage Description
#1	777.00'	2,399 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
777.00	0	0	0
778.00	533	267	267
779.00	1,066	800	1,066
780.00	1,600	1,333	2,399

Device	Routing	Invert	Outlet Devices
#1	Primary	777.00'	**20.5" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Secondary	780.00'	**100.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50

Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=17.96 cfs @ 12.02 hrs HW=779.65' (Free Discharge)
└**1=Orifice/Grate** (Orifice Controls 17.96 cfs @ 7.83 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=777.00' (Free Discharge)
└**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond C6SE: Southeast Ditch 1

Inflow Area = 1.487 ac, 0.00% Impervious, Inflow Depth = 6.82" for 500 year - 24 hour event
Inflow = 17.37 cfs @ 11.98 hrs, Volume= 0.846 af
Outflow = 15.90 cfs @ 12.01 hrs, Volume= 0.845 af, Atten= 8%, Lag= 1.9 min
Primary = 15.90 cfs @ 12.01 hrs, Volume= 0.845 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 746.07' @ 12.01 hrs Surf.Area= 1,019 sf Storage= 812 cf
Flood Elev= 747.00' Surf.Area= 2,097 sf Storage= 2,214 cf

Plug-Flow detention time= 0.5 min calculated for 0.845 af (100% of inflow)
Center-of-Mass det. time= 0.4 min (808.9 - 808.5)

Volume	Invert	Avail.Storage	Storage Description
#1	744.00'	9,903 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
744.00	0	0	0
745.00	233	117	117
746.00	932	583	699
747.00	2,097	1,515	2,214
748.00	3,728	2,913	5,126
749.00	5,825	4,777	9,903

Device	Routing	Invert	Outlet Devices
#1	Primary	744.00'	**20.5" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Secondary	747.00'	**100.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=15.89 cfs @ 12.01 hrs HW=746.07' (Free Discharge)
└**1=Orifice/Grate** (Orifice Controls 15.89 cfs @ 6.93 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=744.00' (Free Discharge)
└**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond C6SW: Catch Basin

[58] Hint: Peaked 0.08' above defined flood level

Inflow Area = 2.314 ac, 0.00% Impervious, Inflow Depth = 6.81" for 500 year - 24 hour event
Inflow = 26.83 cfs @ 11.98 hrs, Volume= 1.313 af
Outflow = 24.60 cfs @ 12.01 hrs, Volume= 1.313 af, Atten= 8%, Lag= 2.1 min
Primary = 19.36 cfs @ 12.01 hrs, Volume= 1.297 af
Secondary = 5.25 cfs @ 12.01 hrs, Volume= 0.016 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 779.08' @ 12.01 hrs Surf.Area= 2,604 sf Storage= 3,599 cf
Flood Elev= 779.00' Surf.Area= 2,509 sf Storage= 3,360 cf

Plug-Flow detention time= 1.2 min calculated for 1.313 af (100% of inflow)
Center-of-Mass det. time= 1.2 min (810.1 - 808.8)

Volume	Invert	Avail.Storage	Storage Description
#1	776.00'	10,959 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
776.00	0	0	0
777.00	634	317	317
778.00	1,471	1,053	1,370
779.00	2,509	1,990	3,360
780.00	3,750	3,130	6,489
781.00	5,190	4,470	10,959

Device	Routing	Invert	Outlet Devices
#1	Primary	776.00'	**20.5" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Secondary	779.00'	**100.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=19.35 cfs @ 12.01 hrs HW=779.07' (Free Discharge)
└**1=Orifice/Grate** (Orifice Controls 19.35 cfs @ 8.44 fps)

Secondary OutFlow Max=4.81 cfs @ 12.01 hrs HW=779.07' (Free Discharge)
└**2=Broad-Crested Rectangular Weir** (Weir Controls 4.81 cfs @ 0.65 fps)

Summary for Pond C7S: Catch Basin

[58] Hint: Peaked 0.05' above defined flood level

Inflow Area = 2.118 ac, 0.00% Impervious, Inflow Depth = 6.81" for 500 year - 24 hour event
Inflow = 24.22 cfs @ 11.98 hrs, Volume= 1.202 af
Outflow = 21.69 cfs @ 12.02 hrs, Volume= 1.202 af, Atten= 10%, Lag= 2.3 min
Primary = 19.26 cfs @ 12.02 hrs, Volume= 1.196 af
Secondary = 2.42 cfs @ 12.02 hrs, Volume= 0.006 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 735.55' @ 12.02 hrs Surf.Area= 2,203 sf Storage= 2,401 cf
Flood Elev= 735.50' Surf.Area= 2,172 sf Storage= 2,292 cf

Plug-Flow detention time= 0.9 min calculated for 1.202 af (100% of inflow)
Center-of-Mass det. time= 0.7 min (809.9 - 809.2)

Volume	Invert	Avail.Storage	Storage Description
#1	732.50'	3,460 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
732.50	0	0	0
733.50	241	121	121
734.50	965	603	724
735.50	2,172	1,569	2,292
736.00	2,500	1,168	3,460

Device	Routing	Invert	Outlet Devices
#1	Primary	732.50'	**20.5" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Secondary	735.50'	**100.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=19.26 cfs @ 12.02 hrs HW=735.55' (Free Discharge)
↑—**1=Orifice/Grate** (Orifice Controls 19.26 cfs @ 8.40 fps)

Secondary OutFlow Max=2.34 cfs @ 12.02 hrs HW=735.55' (Free Discharge)
↑—**2=Broad-Crested Rectangular Weir** (Weir Controls 2.34 cfs @ 0.51 fps)

Summary for Pond C7SE: Catch Basin

[58] Hint: Peaked 0.03' above defined flood level

Inflow Area = 2.211 ac, 0.00% Impervious, Inflow Depth = 6.81" for 500 year - 24 hour event
Inflow = 23.52 cfs @ 12.00 hrs, Volume= 1.255 af
Outflow = 20.92 cfs @ 12.05 hrs, Volume= 1.255 af, Atten= 11%, Lag= 2.6 min
Primary = 19.22 cfs @ 12.05 hrs, Volume= 1.250 af
Secondary = 1.70 cfs @ 12.05 hrs, Volume= 0.005 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 778.03' @ 12.05 hrs Surf.Area= 1,692 sf Storage= 2,542 cf
Flood Elev= 778.00' Surf.Area= 1,600 sf Storage= 2,399 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 1.0 min (812.1 - 811.2)

Volume	Invert	Avail.Storage	Storage Description
#1	775.00'	11,332 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
775.00	0	0	0
776.00	533	267	267
777.00	1,066	800	1,066
778.00	1,600	1,333	2,399
780.00	7,333	8,933	11,332

Device	Routing	Invert	Outlet Devices
#1	Primary	775.00'	**20.5" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Secondary	778.00'	**100.0' long x 4.0' breadth Broad-Crested Rectangular Weir**

Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50
Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=19.22 cfs @ 12.05 hrs HW=778.03' (Free Discharge)
└**1=Orifice/Grate** (Orifice Controls 19.22 cfs @ 8.38 fps)

Secondary OutFlow Max=1.32 cfs @ 12.05 hrs HW=778.03' (Free Discharge)
└**2=Broad-Crested Rectangular Weir** (Weir Controls 1.32 cfs @ 0.42 fps)

Summary for Pond C7SW: Catch Basin

[58] Hint: Peaked 0.19' above defined flood level

Inflow Area = 3.196 ac, 0.00% Impervious, Inflow Depth = 6.87" for 500 year - 24 hour event
Inflow = 39.65 cfs @ 12.01 hrs, Volume= 1.830 af
Outflow = 39.05 cfs @ 12.02 hrs, Volume= 1.830 af, Atten= 2%, Lag= 0.3 min
Primary = 19.70 cfs @ 12.02 hrs, Volume= 1.680 af
Secondary = 19.35 cfs @ 12.02 hrs, Volume= 0.150 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 735.69' @ 12.02 hrs Surf.Area= 2,402 sf Storage= 2,758 cf
Flood Elev= 735.50' Surf.Area= 2,097 sf Storage= 2,214 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 0.7 min (810.3 - 809.6)

Volume	Invert	Avail.Storage	Storage Description
#1	732.50'	9,903 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
732.50	0	0	0
733.50	233	117	117
734.50	932	583	699
735.50	2,097	1,515	2,214
736.50	3,728	2,913	5,126
737.50	5,825	4,777	9,903

Device	Routing	Invert	Outlet Devices
#1	Primary	732.50'	**20.5" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Secondary	735.50'	**100.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=19.70 cfs @ 12.02 hrs HW=735.69' (Free Discharge)
└**1=Orifice/Grate** (Orifice Controls 19.70 cfs @ 8.59 fps)

Secondary OutFlow Max=19.01 cfs @ 12.02 hrs HW=735.69' (Free Discharge)
└**2=Broad-Crested Rectangular Weir** (Weir Controls 19.01 cfs @ 1.03 fps)

Summary for Pond C8SE: Catch Basin

Inflow Area = 1.308 ac, 0.00% Impervious, Inflow Depth = 6.86" for 500 year - 24 hour event
Inflow = 16.09 cfs @ 11.96 hrs, Volume= 0.747 af
Outflow = 14.98 cfs @ 11.98 hrs, Volume= 0.747 af, Atten= 7%, Lag= 1.6 min
Primary = 14.98 cfs @ 11.98 hrs, Volume= 0.747 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 754.84' @ 11.98 hrs Surf.Area= 850 sf Storage= 628 cf
Flood Elev= 756.00' Surf.Area= 2,172 sf Storage= 2,292 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 0.4 min (807.1 - 806.7)

Volume	Invert	Avail.Storage	Storage Description
#1	753.00'	2,292 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
753.00	0	0	0
754.00	241	121	121
755.00	965	603	724
756.00	2,172	1,569	2,292

Device	Routing	Invert	Outlet Devices
#1	Primary	753.00'	**20.5" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Secondary	756.00'	**100.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=14.96 cfs @ 11.98 hrs HW=754.84' (Free Discharge)
└**1=Orifice/Grate** (Orifice Controls 14.96 cfs @ 6.52 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=753.00' (Free Discharge)
└**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond C8SW: Southwest Ditch 2

[58] Hint: Peaked 0.09' above defined flood level

Inflow Area = 0.953 ac, 0.00% Impervious, Inflow Depth = 8.69" for 500 year - 24 hour event
Inflow = 28.85 cfs @ 12.01 hrs, Volume= 0.690 af
Outflow = 25.62 cfs @ 12.03 hrs, Volume= 0.690 af, Atten= 11%, Lag= 1.2 min
Primary = 19.39 cfs @ 12.03 hrs, Volume= 0.678 af
Secondary = 6.23 cfs @ 12.03 hrs, Volume= 0.013 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 729.09' @ 12.03 hrs Surf.Area= 2,238 sf Storage= 2,466 cf
Flood Elev= 729.00' Surf.Area= 2,097 sf Storage= 2,214 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 0.7 min (789.9 - 789.2)

Volume	Invert	Avail.Storage	Storage Description
#1	726.00'	9,903 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
726.00	0	0	0
727.00	233	117	117
728.00	932	583	699
729.00	2,097	1,515	2,214
730.00	3,728	2,913	5,126
731.00	5,825	4,777	9,903

Device	Routing	Invert	Outlet Devices
#1	Primary	726.00'	**20.5" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Secondary	729.00'	**100.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=19.38 cfs @ 12.03 hrs HW=729.08' (Free Discharge)
1=Orifice/Grate (Orifice Controls 19.38 cfs @ 8.45 fps)

Secondary OutFlow Max=5.63 cfs @ 12.03 hrs HW=729.08' (Free Discharge)
2=Broad-Crested Rectangular Weir (Weir Controls 5.63 cfs @ 0.68 fps)

Summary for Pond C9SE: Southeast Ditch 2

Inflow Area = 0.641 ac, 0.00% Impervious, Inflow Depth = 6.81" for 500 year - 24 hour event
Inflow = 7.70 cfs @ 11.97 hrs, Volume= 0.364 af
Outflow = 7.69 cfs @ 11.97 hrs, Volume= 0.364 af, Atten= 0%, Lag= 0.0 min
Primary = 7.69 cfs @ 11.97 hrs, Volume= 0.364 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 735.58' @ 11.97 hrs Surf.Area= 69 sf Storage= 35 cf
Flood Elev= 738.00' Surf.Area= 1,100 sf Storage= 1,150 cf

Plug-Flow detention time= 0.2 min calculated for 0.364 af (100% of inflow)
Center-of-Mass det. time= 0.2 min (808.1 - 807.9)

Volume	Invert	Avail.Storage	Storage Description
#1	735.00'	1,150 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
735.00	0	0	0
736.00	120	60	60
737.00	480	300	360
738.00	1,100	790	1,150

Device	Routing	Invert	Outlet Devices
#1	Primary	735.00'	**20.5" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Secondary	738.00'	**100.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50

Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73
2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=7.67 cfs @ 11.97 hrs HW=735.58' (Free Discharge)
└**1=Orifice/Grate** (Weir Controls 7.67 cfs @ 2.48 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=735.00' (Free Discharge)
└**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond D10SE: 10" Pipe

[58] Hint: Peaked 164.70' above defined flood level
[81] Warning: Exceeded Pond C10SE by 162.05' @ 12.22 hrs

Inflow Area = 3.918 ac, 0.00% Impervious, Inflow Depth = 6.81" for 500 year - 24 hour event
Inflow = 17.98 cfs @ 12.22 hrs, Volume= 2.223 af
Outflow = 17.98 cfs @ 12.22 hrs, Volume= 2.223 af, Atten= 0%, Lag= 0.0 min
Primary = 17.98 cfs @ 12.22 hrs, Volume= 2.223 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 974.70' @ 12.22 hrs
Flood Elev= 810.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	807.00'	**9.9" Round Culvert** L= 350.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 807.00' / 800.00' S= 0.0200 '/' Cc= 0.900 n= 0.010, Flow Area= 0.53 sf

Primary OutFlow Max=17.97 cfs @ 12.22 hrs HW=974.69' (Free Discharge)
└**1=Culvert** (Barrel Controls 17.97 cfs @ 33.62 fps)

Summary for Pond D11SE: 20" Pipe

[58] Hint: Peaked 13.36' above defined flood level
[81] Warning: Exceeded Pond C11SE by 16.27' @ 12.28 hrs
[79] Warning: Submerged Pond D10SE Primary device # 1 INLET by 15.36'

Inflow Area = 9.766 ac, 0.00% Impervious, Inflow Depth = 6.63" for 500 year - 24 hour event
Inflow = 37.21 cfs @ 12.28 hrs, Volume= 5.399 af
Outflow = 37.21 cfs @ 12.28 hrs, Volume= 5.399 af, Atten= 0%, Lag= 0.0 min
Primary = 37.21 cfs @ 12.28 hrs, Volume= 5.399 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 822.36' @ 12.28 hrs
Flood Elev= 809.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	800.00'	**18.5" Round Culvert** L= 265.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 800.00' / 794.50' S= 0.0208 '/' Cc= 0.900 n= 0.010, Flow Area= 1.87 sf

Primary OutFlow Max=37.21 cfs @ 12.28 hrs HW=822.36' (Free Discharge)
└**1=Culvert** (Barrel Controls 37.21 cfs @ 19.93 fps)

Summary for Pond D12SE: 24" Pipe

[58] Hint: Peaked 35.93' above defined flood level
[81] Warning: Exceeded Pond C12SE by 32.09' @ 12.37 hrs
[81] Warning: Exceeded Pond D11SE by 12.33' @ 12.43 hrs

Inflow Area = 18.821 ac, 0.00% Impervious, Inflow Depth = 6.81" for 500 year - 24 hour event
Inflow = 79.79 cfs @ 12.38 hrs, Volume= 10.684 af
Outflow = 79.79 cfs @ 12.38 hrs, Volume= 10.684 af, Atten= 0%, Lag= 0.0 min
Primary = 79.79 cfs @ 12.38 hrs, Volume= 10.684 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 833.43' @ 12.38 hrs
Flood Elev= 797.50'

Device	Routing	Invert	Outlet Devices
#1	Primary	794.50'	**22.2" Round Culvert** L= 350.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 794.50' / 720.00' S= 0.2129 '/' Cc= 0.900 n= 0.010, Flow Area= 2.69 sf

Primary OutFlow Max=79.79 cfs @ 12.38 hrs HW=833.43' (Free Discharge)
1=Culvert (Inlet Controls 79.79 cfs @ 29.68 fps)

Summary for Pond D1E: 24" Pipe

[58] Hint: Peaked 25.51' above defined flood level
[81] Warning: Exceeded Pond C1E by 21.29' @ 12.36 hrs

Inflow Area = 17.841 ac, 0.00% Impervious, Inflow Depth = 6.60" for 500 year - 24 hour event
Inflow = 67.98 cfs @ 12.36 hrs, Volume= 9.819 af
Outflow = 67.98 cfs @ 12.36 hrs, Volume= 9.819 af, Atten= 0%, Lag= 0.0 min
Primary = 67.98 cfs @ 12.36 hrs, Volume= 9.819 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 823.01' @ 12.36 hrs
Flood Elev= 797.50'

Device	Routing	Invert	Outlet Devices
#1	Primary	794.50'	**22.2" Round Culvert** L= 330.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 794.50' / 720.00' S= 0.2258 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 2.69 sf

Primary OutFlow Max=67.98 cfs @ 12.36 hrs HW=823.01' (Free Discharge)
1=Culvert (Inlet Controls 67.98 cfs @ 25.29 fps)

Summary for Pond D1N: 24" Pipe

[58] Hint: Peaked 19.28' above defined flood level
[81] Warning: Exceeded Pond C1N by 16.02' @ 12.35 hrs

Inflow Area = 17.691 ac, 0.00% Impervious, Inflow Depth = 6.36" for 500 year - 24 hour event
Inflow = 59.81 cfs @ 12.35 hrs, Volume= 9.380 af
Outflow = 59.81 cfs @ 12.35 hrs, Volume= 9.380 af, Atten= 0%, Lag= 0.0 min
Primary = 59.81 cfs @ 12.35 hrs, Volume= 9.380 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Peak Elev= 820.28' @ 12.35 hrs
Flood Elev= 801.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	798.00'	**22.2" Round Culvert** L= 330.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 798.00' / 720.00' S= 0.2364 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 2.69 sf

Primary OutFlow Max=59.81 cfs @ 12.35 hrs HW=820.28' (Free Discharge)
1=Culvert (Inlet Controls 59.81 cfs @ 22.25 fps)

Summary for Pond D1NW: 24" Pipe

Inflow Area = 1.506 ac, 0.00% Impervious, Inflow Depth = 6.81" for 500 year - 24 hour event
Inflow = 15.44 cfs @ 12.00 hrs, Volume= 0.855 af
Outflow = 15.44 cfs @ 12.00 hrs, Volume= 0.855 af, Atten= 0%, Lag= 0.0 min
Primary = 15.44 cfs @ 12.00 hrs, Volume= 0.855 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 784.35' @ 12.00 hrs
Flood Elev= 785.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	782.00'	**22.2" Round Culvert** L= 200.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 782.00' / 742.00' S= 0.2000 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 2.69 sf

Primary OutFlow Max=15.42 cfs @ 12.00 hrs HW=784.34' (Free Discharge)
1=Culvert (Inlet Controls 15.42 cfs @ 5.74 fps)

Summary for Pond D1S: 10" Pipe

[58] Hint: Peaked 193.25' above defined flood level
[81] Warning: Exceeded Pond C1S by 190.57' @ 12.20 hrs

Inflow Area = 3.455 ac, 0.00% Impervious, Inflow Depth = 6.81" for 500 year - 24 hour event
Inflow = 18.02 cfs @ 12.20 hrs, Volume= 1.961 af
Outflow = 18.02 cfs @ 12.20 hrs, Volume= 1.961 af, Atten= 0%, Lag= 0.0 min
Primary = 18.02 cfs @ 12.20 hrs, Volume= 1.961 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 1,002.25' @ 12.20 hrs
Flood Elev= 809.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	806.00'	**9.9" Round Culvert** L= 420.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 806.00' / 797.00' S= 0.0214 '/' Cc= 0.900 n= 0.010, Flow Area= 0.53 sf

Primary OutFlow Max=18.02 cfs @ 12.20 hrs HW=1,002.21' (Free Discharge)
1=Culvert (Barrel Controls 18.02 cfs @ 33.71 fps)

Summary for Pond D1SE: 10" Pipe

[58] Hint: Peaked 167.87' above defined flood level
[81] Warning: Exceeded Pond C1SE by 165.23' @ 12.20 hrs

Inflow Area = 3.373 ac, 0.00% Impervious, Inflow Depth = 6.81" for 500 year - 24 hour event
Inflow = 17.87 cfs @ 12.20 hrs, Volume= 1.914 af
Outflow = 17.87 cfs @ 12.20 hrs, Volume= 1.914 af, Atten= 0%, Lag= 0.0 min
Primary = 17.87 cfs @ 12.20 hrs, Volume= 1.914 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 977.87' @ 12.20 hrs
Flood Elev= 810.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	807.00'	**9.9" Round Culvert** L= 360.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 807.00' / 801.00' S= 0.0167 '/' Cc= 0.900 n= 0.010, Flow Area= 0.53 sf

Primary OutFlow Max=17.87 cfs @ 12.20 hrs HW=977.84' (Free Discharge)
1=Culvert (Barrel Controls 17.87 cfs @ 33.43 fps)

Summary for Pond D1SW: 6" Pipe

[58] Hint: Peaked 755.28' above defined flood level
[81] Warning: Exceeded Pond C1SW by 752.81' @ 12.25 hrs

Inflow Area = 4.734 ac, 0.00% Impervious, Inflow Depth = 6.81" for 500 year - 24 hour event
Inflow = 17.34 cfs @ 12.25 hrs, Volume= 2.687 af
Outflow = 17.34 cfs @ 12.25 hrs, Volume= 2.687 af, Atten= 0%, Lag= 0.0 min
Primary = 17.34 cfs @ 12.25 hrs, Volume= 2.687 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 1,566.28' @ 12.25 hrs
Flood Elev= 811.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	808.00'	**6.1" Round Culvert** L= 120.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 808.00' / 773.00' S= 0.2917 '/' Cc= 0.900 n= 0.010, Flow Area= 0.20 sf

Primary OutFlow Max=17.34 cfs @ 12.25 hrs HW=1,566.23' (Free Discharge)
1=Culvert (Barrel Controls 17.34 cfs @ 85.44 fps)

Summary for Pond D1W: 24" Pipe

[58] Hint: Peaked 25.68' above defined flood level
[81] Warning: Exceeded Pond C1W by 21.44' @ 12.24 hrs

Inflow Area = 16.760 ac, 0.00% Impervious, Inflow Depth = 6.61" for 500 year - 24 hour event
Inflow = 68.19 cfs @ 12.24 hrs, Volume= 9.228 af
Outflow = 68.19 cfs @ 12.24 hrs, Volume= 9.228 af, Atten= 0%, Lag= 0.0 min
Primary = 68.19 cfs @ 12.24 hrs, Volume= 9.228 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Peak Elev= 824.68' @ 12.24 hrs
Flood Elev= 799.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	796.00'	**22.2" Round Culvert** L= 280.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 796.00' / 724.00' S= 0.2571 '/' Cc= 0.900 n= 0.010, Flow Area= 2.69 sf

Primary OutFlow Max=68.19 cfs @ 12.24 hrs HW=824.68' (Free Discharge)
↑—**1=Culvert** (Inlet Controls 68.19 cfs @ 25.37 fps)

Summary for Pond D2N: 24" Pipe

Inflow Area = 1.145 ac, 0.00% Impervious, Inflow Depth = 6.81" for 500 year - 24 hour event
Inflow = 12.23 cfs @ 12.01 hrs, Volume= 0.650 af
Outflow = 12.23 cfs @ 12.01 hrs, Volume= 0.650 af, Atten= 0%, Lag= 0.0 min
Primary = 12.23 cfs @ 12.01 hrs, Volume= 0.650 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 780.81' @ 12.01 hrs
Flood Elev= 782.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	779.00'	**22.2" Round Culvert** L= 170.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 779.00' / 739.00' S= 0.2353 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 2.69 sf

Primary OutFlow Max=12.22 cfs @ 12.01 hrs HW=780.81' (Free Discharge)
↑—**1=Culvert** (Inlet Controls 12.22 cfs @ 4.58 fps)

Summary for Pond D2NW: 24" Pipe

[58] Hint: Peaked 3.41' above defined flood level
[81] Warning: Exceeded Pond C2NW by 1.54' @ 12.01 hrs
[79] Warning: Submerged Pond D1NW Primary device # 1 OUTLET by 6.41'

Inflow Area = 3.844 ac, 0.00% Impervious, Inflow Depth = 6.81" for 500 year - 24 hour event
Inflow = 30.31 cfs @ 12.03 hrs, Volume= 2.182 af
Outflow = 30.31 cfs @ 12.03 hrs, Volume= 2.182 af, Atten= 0%, Lag= 0.0 min
Primary = 30.31 cfs @ 12.03 hrs, Volume= 2.182 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 748.41' @ 12.03 hrs
Flood Elev= 745.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	742.00'	**22.2" Round Culvert** L= 60.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 742.00' / 726.00' S= 0.2667 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 2.69 sf

Primary OutFlow Max=30.30 cfs @ 12.03 hrs HW=748.40' (Free Discharge)
↑—**1=Culvert** (Inlet Controls 30.30 cfs @ 11.27 fps)

Summary for Pond D2S: 20" Pipe

[58] Hint: Peaked 40.15' above defined flood level
[81] Warning: Exceeded Pond C2S by 14.46' @ 12.22 hrs
[79] Warning: Submerged Pond D1S Primary device # 1 INLET by 11.65'

Inflow Area = 10.865 ac, 0.00% Impervious, Inflow Depth = 6.26" for 500 year - 24 hour event
Inflow = 37.72 cfs @ 12.23 hrs, Volume= 5.672 af
Outflow = 37.72 cfs @ 12.23 hrs, Volume= 5.672 af, Atten= 0%, Lag= 0.0 min
Primary = 37.72 cfs @ 12.23 hrs, Volume= 5.672 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 817.65' @ 12.23 hrs
Flood Elev= 777.50'

Device	Routing	Invert	Outlet Devices
#1	Primary	797.00'	**18.5" Round Culvert** L= 195.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 797.00' / 793.70' S= 0.0169 '/' Cc= 0.900 n= 0.010, Flow Area= 1.87 sf

Primary OutFlow Max=37.72 cfs @ 12.23 hrs HW=817.65' (Free Discharge)
1=Culvert (Barrel Controls 37.72 cfs @ 20.21 fps)

Summary for Pond D2SE: 20" Pipe

[58] Hint: Peaked 9.51' above defined flood level
[81] Warning: Exceeded Pond C2SE by 11.49' @ 12.26 hrs
[79] Warning: Submerged Pond D1SE Primary device # 1 INLET by 11.51'

Inflow Area = 8.729 ac, 0.00% Impervious, Inflow Depth = 6.68" for 500 year - 24 hour event
Inflow = 36.77 cfs @ 12.26 hrs, Volume= 4.859 af
Outflow = 36.77 cfs @ 12.26 hrs, Volume= 4.859 af, Atten= 0%, Lag= 0.0 min
Primary = 36.77 cfs @ 12.26 hrs, Volume= 4.859 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 818.51' @ 12.26 hrs
Flood Elev= 809.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	801.00'	**18.5" Round Culvert** L= 120.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 801.00' / 796.00' S= 0.0417 '/' Cc= 0.900 n= 0.010, Flow Area= 1.87 sf

Primary OutFlow Max=36.77 cfs @ 12.26 hrs HW=818.50' (Free Discharge)
1=Culvert (Inlet Controls 36.77 cfs @ 19.70 fps)

Summary for Pond D2SW: 12" Pipe

[58] Hint: Peaked 86.46' above defined flood level
[81] Warning: Exceeded Pond C2SW by 83.47' @ 12.09 hrs
[79] Warning: Submerged Pond D1SW Primary device # 1 INLET by 54.40'

Inflow Area = 7.709 ac, 0.00% Impervious, Inflow Depth = 6.65" for 500 year - 24 hour event
Inflow = 34.49 cfs @ 12.09 hrs, Volume= 4.275 af
Outflow = 34.49 cfs @ 12.09 hrs, Volume= 4.275 af, Atten= 0%, Lag= 0.0 min
Primary = 34.49 cfs @ 12.09 hrs, Volume= 4.275 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 862.46' @ 12.09 hrs
Flood Elev= 776.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	773.00'	**11.8" Round Culvert** L= 75.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 773.00' / 749.50' S= 0.3133 '/' Cc= 0.900 n= 0.010, Flow Area= 0.76 sf

Primary OutFlow Max=34.48 cfs @ 12.09 hrs HW=862.38' (Free Discharge)
1=Culvert (Inlet Controls 34.48 cfs @ 45.40 fps)

Summary for Pond D2W: 14" Pipe

[58] Hint: Peaked 17.46' above defined flood level
[81] Warning: Exceeded Pond C2W by 14.33' @ 12.26 hrs

Inflow Area = 1.924 ac, 0.00% Impervious, Inflow Depth = 8.34" for 500 year - 24 hour event
Inflow = 19.51 cfs @ 12.26 hrs, Volume= 1.337 af
Outflow = 19.51 cfs @ 12.26 hrs, Volume= 1.337 af, Atten= 0%, Lag= 0.0 min
Primary = 19.51 cfs @ 12.26 hrs, Volume= 1.337 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 786.46' @ 12.26 hrs
Flood Elev= 769.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	766.00'	**12.9" Round Culvert** L= 200.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 766.00' / 720.00' S= 0.2300 '/' Cc= 0.900 n= 0.010, Flow Area= 0.91 sf

Primary OutFlow Max=19.50 cfs @ 12.26 hrs HW=786.44' (Free Discharge)
1=Culvert (Inlet Controls 19.50 cfs @ 21.48 fps)

Summary for Pond D3N: 24" Pipe

[58] Hint: Peaked 2.84' above defined flood level
[81] Warning: Exceeded Pond C3N by 0.61' @ 12.01 hrs
[79] Warning: Submerged Pond D2N Primary device # 1 OUTLET by 5.83'

Inflow Area = 2.907 ac, 0.00% Impervious, Inflow Depth = 6.81" for 500 year - 24 hour event
Inflow = 28.68 cfs @ 12.02 hrs, Volume= 1.650 af
Outflow = 28.68 cfs @ 12.02 hrs, Volume= 1.650 af, Atten= 0%, Lag= 0.0 min
Primary = 28.68 cfs @ 12.02 hrs, Volume= 1.650 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 744.84' @ 12.02 hrs
Flood Elev= 742.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	739.00'	**22.2" Round Culvert** L= 60.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 739.00' / 726.00' S= 0.2167 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 2.69 sf

Primary OutFlow Max=28.67 cfs @ 12.02 hrs HW=744.83' (Free Discharge)
└**1=Culvert** (Inlet Controls 28.67 cfs @ 10.67 fps)

Summary for Pond D3S1: 22" Pipe 1

[58] Hint: Peaked 15.73' above defined flood level
[81] Warning: Exceeded Pond C3S by 11.43' @ 12.40 hrs

Inflow Area = 20.973 ac, 0.00% Impervious, Inflow Depth = 4.49" for 500 year - 24 hour event
Inflow = 45.76 cfs @ 12.40 hrs, Volume= 7.844 af
Outflow = 45.76 cfs @ 12.40 hrs, Volume= 7.844 af, Atten= 0%, Lag= 0.0 min
Primary = 45.76 cfs @ 12.40 hrs, Volume= 7.844 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 812.43' @ 12.40 hrs
Flood Elev= 796.70'

Device	Routing	Invert	Outlet Devices
#1	Primary	793.70'	**20.3" Round Culvert** L= 475.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 793.70' / 716.50' S= 0.1625 '/' Cc= 0.900 n= 0.010, Flow Area= 2.25 sf

Primary OutFlow Max=45.76 cfs @ 12.40 hrs HW=812.43' (Free Discharge)
└**1=Culvert** (Inlet Controls 45.76 cfs @ 20.36 fps)

Summary for Pond D3S2: 22" Pipe 2

[58] Hint: Peaked 28.07' above defined flood level
[81] Warning: Exceeded Pond C3S by 23.99' @ 12.29 hrs
[81] Warning: Exceeded Pond D2S by 8.64' @ 12.57 hrs

Inflow Area = 10.865 ac, 0.00% Impervious, Inflow Depth = 10.60" for 500 year - 24 hour event
Inflow = 59.49 cfs @ 12.32 hrs, Volume= 9.594 af
Outflow = 59.49 cfs @ 12.32 hrs, Volume= 9.594 af, Atten= 0%, Lag= 0.0 min
Primary = 59.49 cfs @ 12.32 hrs, Volume= 9.594 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 824.77' @ 12.32 hrs
Flood Elev= 796.70'

Device	Routing	Invert	Outlet Devices
#1	Primary	793.70'	**20.3" Round Culvert** L= 475.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 793.70' / 716.50' S= 0.1625 '/' Cc= 0.900 n= 0.010, Flow Area= 2.25 sf

Primary OutFlow Max=59.49 cfs @ 12.32 hrs HW=824.77' (Free Discharge)
└**1=Culvert** (Inlet Controls 59.49 cfs @ 26.47 fps)

Summary for Pond D3SE: 24" Pipe

[58] Hint: Peaked 36.02' above defined flood level
[81] Warning: Exceeded Pond C3SE by 32.06' @ 12.35 hrs
[81] Warning: Exceeded Pond D2SE by 17.74' @ 12.42 hrs

Inflow Area = 20.914 ac, 0.00% Impervious, Inflow Depth = 6.79" for 500 year - 24 hour event
Inflow = 79.89 cfs @ 12.37 hrs, Volume= 11.833 af
Outflow = 79.89 cfs @ 12.37 hrs, Volume= 11.833 af, Atten= 0%, Lag= 0.0 min
Primary = 79.89 cfs @ 12.37 hrs, Volume= 11.833 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 4
Peak Elev= 835.02' @ 12.37 hrs
Flood Elev= 799.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	796.00'	**22.2" Round Culvert** L= 190.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 796.00' / 740.00' S= 0.2947 '/' Cc= 0.900 n= 0.010, Flow Area= 2.69 sf

Primary OutFlow Max=79.89 cfs @ 12.37 hrs HW=835.02' (Free Discharge)
1=Culvert (Inlet Controls 79.89 cfs @ 29.72 fps)

Summary for Pond D3SW: 24" Pipe

[58] Hint: Peaked 14.99' above defined flood level
[81] Warning: Exceeded Pond C3SW by 11.97' @ 12.07 hrs
[79] Warning: Submerged Pond D2SW Primary device # 1 OUTLET by 17.98'

Inflow Area = 9.794 ac, 0.00% Impervious, Inflow Depth = 6.70" for 500 year - 24 hour event
Inflow = 53.47 cfs @ 12.07 hrs, Volume= 5.470 af
Outflow = 53.47 cfs @ 12.07 hrs, Volume= 5.470 af, Atten= 0%, Lag= 0.0 min
Primary = 53.47 cfs @ 12.07 hrs, Volume= 5.470 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 4
Peak Elev= 767.49' @ 12.07 hrs
Flood Elev= 752.50'

Device	Routing	Invert	Outlet Devices
#1	Primary	749.50'	**22.2" Round Culvert** L= 25.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 749.50' / 740.00' S= 0.3800 '/' Cc= 0.900 n= 0.010, Flow Area= 2.69 sf

Primary OutFlow Max=53.44 cfs @ 12.07 hrs HW=767.47' (Free Discharge)
1=Culvert (Inlet Controls 53.44 cfs @ 19.88 fps)

Summary for Pond D3W: 18" Pipe

[58] Hint: Peaked 2.40' above defined flood level
[81] Warning: Exceeded Pond C3W by 0.37' @ 12.01 hrs

Inflow Area = 1.543 ac, 0.00% Impervious, Inflow Depth = 7.08" for 500 year - 24 hour event
Inflow = 15.70 cfs @ 12.01 hrs, Volume= 0.911 af
Outflow = 15.70 cfs @ 12.01 hrs, Volume= 0.911 af, Atten= 0%, Lag= 0.0 min
Primary = 15.70 cfs @ 12.01 hrs, Volume= 0.911 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 744.40' @ 12.01 hrs
Flood Elev= 742.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	739.00'	**16.6" Round Culvert** L= 88.0' RCP, square edge headwall, Ke= 0.500

Inlet / Outlet Invert= 739.00' / 720.00' S= 0.2159 '/' Cc= 0.900
n= 0.010, Flow Area= 1.50 sf

Primary OutFlow Max=15.70 cfs @ 12.01 hrs HW=744.40' (Free Discharge)
1=Culvert (Inlet Controls 15.70 cfs @ 10.45 fps)

Summary for Pond D4N: 24" Pipe

[58] Hint: Peaked 0.22' above defined flood level
[79] Warning: Submerged Pond C4N Primary device # 1 by 0.22'

Inflow Area = 1.933 ac, 0.00% Impervious, Inflow Depth = 9.90" for 500 year - 24 hour event
Inflow = 19.63 cfs @ 12.36 hrs, Volume= 1.595 af
Outflow = 19.63 cfs @ 12.36 hrs, Volume= 1.595 af, Atten= 0%, Lag= 0.0 min
Primary = 19.63 cfs @ 12.36 hrs, Volume= 1.595 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 782.22' @ 12.36 hrs
Flood Elev= 782.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	779.00'	**22.2" Round Culvert** L= 118.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 779.00' / 746.00' S= 0.2797 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 2.69 sf

Primary OutFlow Max=19.63 cfs @ 12.36 hrs HW=782.22' (Free Discharge)
1=Culvert (Inlet Controls 19.63 cfs @ 7.30 fps)

Summary for Pond D4S: 10" Pipe

[58] Hint: Peaked 55.82' above defined flood level
[81] Warning: Exceeded Pond C4S by 52.85' @ 12.40 hrs

Inflow Area = 0.872 ac, 0.00% Impervious, Inflow Depth = 12.61" for 500 year - 24 hour event
Inflow = 18.97 cfs @ 12.40 hrs, Volume= 0.917 af
Outflow = 18.97 cfs @ 12.40 hrs, Volume= 0.917 af, Atten= 0%, Lag= 0.0 min
Primary = 18.97 cfs @ 12.40 hrs, Volume= 0.917 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 833.32' @ 12.40 hrs
Flood Elev= 777.50'

Device	Routing	Invert	Outlet Devices
#1	Primary	777.50'	**9.9" Round Culvert** L= 160.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 777.50' / 728.00' S= 0.3094 '/' Cc= 0.900 n= 0.010, Flow Area= 0.53 sf

Primary OutFlow Max=18.97 cfs @ 12.40 hrs HW=833.30' (Free Discharge)
1=Culvert (Barrel Controls 18.97 cfs @ 35.49 fps)

Summary for Pond D4SE: 12" Pipe

[58] Hint: Peaked 25.11' above defined flood level
[81] Warning: Exceeded Pond C4SE by 22.08' @ 12.03 hrs

Inflow Area = 2.200 ac, 0.00% Impervious, Inflow Depth = 6.99" for 500 year - 24 hour event
Inflow = 19.22 cfs @ 12.03 hrs, Volume= 1.281 af
Outflow = 19.22 cfs @ 12.03 hrs, Volume= 1.281 af, Atten= 0%, Lag= 0.0 min
Primary = 19.22 cfs @ 12.03 hrs, Volume= 1.281 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 801.11' @ 12.03 hrs
Flood Elev= 776.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	773.00'	**11.8" Round Culvert** L= 65.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 773.00' / 749.50' S= 0.3615 '/' Cc= 0.900 n= 0.010, Flow Area= 0.76 sf

Primary OutFlow Max=19.22 cfs @ 12.03 hrs HW=801.11' (Free Discharge)
1=Culvert (Inlet Controls 19.22 cfs @ 25.30 fps)

Summary for Pond D4W: 18" Pipe

[58] Hint: Peaked 0.56' above defined flood level
[79] Warning: Submerged Pond D2W Primary device # 1 OUTLET by 22.55'
[79] Warning: Submerged Pond D3W Primary device # 1 INLET by 3.55'

Inflow Area = 3.467 ac, 0.00% Impervious, Inflow Depth = 7.78" for 500 year - 24 hour event
Inflow = 33.84 cfs @ 12.03 hrs, Volume= 2.248 af
Outflow = 33.84 cfs @ 12.03 hrs, Volume= 2.248 af, Atten= 0%, Lag= 0.0 min
Primary = 33.84 cfs @ 12.03 hrs, Volume= 2.248 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 742.56' @ 12.03 hrs
Flood Elev= 742.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	720.00'	**16.6" Round Culvert** L= 95.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 720.00' / 716.00' S= 0.0421 '/' Cc= 0.900 n= 0.010, Flow Area= 1.50 sf

Primary OutFlow Max=33.82 cfs @ 12.03 hrs HW=742.53' (Free Discharge)
1=Culvert (Inlet Controls 33.82 cfs @ 22.50 fps)

Summary for Pond D5N: 24" Pipe

[58] Hint: Peaked 13.20' above defined flood level
[81] Warning: Exceeded Pond C5N by 11.03' @ 12.03 hrs
[79] Warning: Submerged Pond D4N Primary device # 1 OUTLET by 16.19'

Inflow Area = 5.108 ac, 0.00% Impervious, Inflow Depth = 8.36" for 500 year - 24 hour event
Inflow = 50.58 cfs @ 12.03 hrs, Volume= 3.559 af
Outflow = 50.58 cfs @ 12.03 hrs, Volume= 3.559 af, Atten= 0%, Lag= 0.0 min
Primary = 50.58 cfs @ 12.03 hrs, Volume= 3.559 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 762.20' @ 12.03 hrs
Flood Elev= 749.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	746.00'	**22.2" Round Culvert** L= 84.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 746.00' / 726.00' S= 0.2381 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 2.69 sf

Primary OutFlow Max=50.55 cfs @ 12.03 hrs HW=762.18' (Free Discharge)
1=Culvert (Inlet Controls 50.55 cfs @ 18.81 fps)

Summary for Pond D5S: 16" Pipe

[58] Hint: Peaked 41.95' above defined flood level
[81] Warning: Exceeded Pond C5S by 38.88' @ 12.42 hrs
[79] Warning: Submerged Pond D4S Primary device # 1 OUTLET by 45.95'

Inflow Area = 2.650 ac, 0.00% Impervious, Inflow Depth = 9.60" for 500 year - 24 hour event
Inflow = 38.30 cfs @ 12.42 hrs, Volume= 2.119 af
Outflow = 38.30 cfs @ 12.42 hrs, Volume= 2.119 af, Atten= 0%, Lag= 0.0 min
Primary = 38.30 cfs @ 12.42 hrs, Volume= 2.119 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 773.95' @ 12.42 hrs
Flood Elev= 732.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	729.00'	**14.8" Round Culvert** L= 142.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 729.00' / 714.00' S= 0.1056 '/' Cc= 0.900 n= 0.010, Flow Area= 1.19 sf

Primary OutFlow Max=38.30 cfs @ 12.42 hrs HW=773.95' (Free Discharge)
1=Culvert (Inlet Controls 38.30 cfs @ 32.06 fps)

Summary for Pond D5SE: 20" Pipe

[58] Hint: Peaked 16.02' above defined flood level
[81] Warning: Exceeded Pond C5SE by 12.99' @ 12.03 hrs
[79] Warning: Submerged Pond D4SE Primary device # 1 OUTLET by 19.01'

Inflow Area = 4.243 ac, 0.00% Impervious, Inflow Depth = 6.91" for 500 year - 24 hour event
Inflow = 38.40 cfs @ 12.03 hrs, Volume= 2.442 af
Outflow = 38.40 cfs @ 12.03 hrs, Volume= 2.442 af, Atten= 0%, Lag= 0.0 min
Primary = 38.40 cfs @ 12.03 hrs, Volume= 2.442 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 768.52' @ 12.03 hrs
Flood Elev= 752.50'

Device	Routing	Invert	Outlet Devices
#1	Primary	749.50'	**18.5" Round Culvert** L= 30.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 749.50' / 740.00' S= 0.3167 '/' Cc= 0.900 n= 0.010, Flow Area= 1.87 sf

Primary OutFlow Max=38.38 cfs @ 12.03 hrs HW=768.50' (Free Discharge)
1=Culvert (Inlet Controls 38.38 cfs @ 20.56 fps)

Summary for Pond D5SW: 6" Pipe

[58] Hint: Peaked 870.48' above defined flood level
[81] Warning: Exceeded Pond C5SW by 867.73' @ 12.23 hrs

Inflow Area = 4.496 ac, 0.00% Impervious, Inflow Depth = 6.81" for 500 year - 24 hour event
Inflow = 18.26 cfs @ 12.23 hrs, Volume= 2.552 af
Outflow = 18.26 cfs @ 12.23 hrs, Volume= 2.552 af, Atten= 0%, Lag= 0.0 min
Primary = 18.26 cfs @ 12.23 hrs, Volume= 2.552 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 1,681.48' @ 12.23 hrs
Flood Elev= 811.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	808.00'	**6.1" Round Culvert** L= 125.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 808.00' / 773.00' S= 0.2800 '/' Cc= 0.900 n= 0.010, Flow Area= 0.20 sf

Primary OutFlow Max=18.26 cfs @ 12.23 hrs HW=1,681.41' (Free Discharge)
1=Culvert (Barrel Controls 18.26 cfs @ 89.97 fps)

Summary for Pond D6S: 14" Pipe

[58] Hint: Peaked 14.42' above defined flood level
[81] Warning: Exceeded Pond C6S by 11.77' @ 12.02 hrs

Inflow Area = 1.820 ac, 0.00% Impervious, Inflow Depth = 6.81" for 500 year - 24 hour event
Inflow = 17.96 cfs @ 12.02 hrs, Volume= 1.033 af
Outflow = 17.96 cfs @ 12.02 hrs, Volume= 1.033 af, Atten= 0%, Lag= 0.0 min
Primary = 17.96 cfs @ 12.02 hrs, Volume= 1.033 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 791.42' @ 12.02 hrs
Flood Elev= 777.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	774.00'	**12.9" Round Culvert** L= 185.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 774.00' / 728.50' S= 0.2459 '/' Cc= 0.900 n= 0.010, Flow Area= 0.91 sf

Primary OutFlow Max=17.96 cfs @ 12.02 hrs HW=791.42' (Free Discharge)
1=Culvert (Inlet Controls 17.96 cfs @ 19.78 fps)

Summary for Pond D6SW: 16" Pipe

[58] Hint: Peaked 33.93' above defined flood level
[81] Warning: Exceeded Pond C6SW by 31.04' @ 12.07 hrs
[79] Warning: Submerged Pond D5SW Primary device # 1 INLET by 1.92'

Inflow Area = 6.810 ac, 0.00% Impervious, Inflow Depth = 6.78" for 500 year - 24 hour event
Inflow = 34.66 cfs @ 12.07 hrs, Volume= 3.849 af
Outflow = 34.66 cfs @ 12.07 hrs, Volume= 3.849 af, Atten= 0%, Lag= 0.0 min
Primary = 34.66 cfs @ 12.07 hrs, Volume= 3.849 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2

Peak Elev= 809.93' @ 12.07 hrs
Flood Elev= 776.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	773.00'	**14.8" Round Culvert** L= 165.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 773.00' / 729.50' S= 0.2636 '/' Cc= 0.900 n= 0.010, Flow Area= 1.19 sf

Primary OutFlow Max=34.66 cfs @ 12.07 hrs HW=809.92' (Free Discharge)
1=Culvert (Inlet Controls 34.66 cfs @ 29.01 fps)

Summary for Pond D7S: 20" Pipe

[58] Hint: Peaked 14.92' above defined flood level
[81] Warning: Exceeded Pond C7S by 11.87' @ 12.02 hrs
[79] Warning: Submerged Pond D6S Primary device # 1 OUTLET by 18.92'

Inflow Area = 3.938 ac, 0.00% Impervious, Inflow Depth = 6.79" for 500 year - 24 hour event
Inflow = 37.22 cfs @ 12.02 hrs, Volume= 2.229 af
Outflow = 37.22 cfs @ 12.02 hrs, Volume= 2.229 af, Atten= 0%, Lag= 0.0 min
Primary = 37.22 cfs @ 12.02 hrs, Volume= 2.229 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 747.42' @ 12.02 hrs
Flood Elev= 732.50'

Device	Routing	Invert	Outlet Devices
#1	Primary	729.50'	**18.5" Round Culvert** L= 70.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 729.50' / 716.50' S= 0.1857 '/' Cc= 0.900 n= 0.010, Flow Area= 1.87 sf

Primary OutFlow Max=37.22 cfs @ 12.02 hrs HW=747.42' (Free Discharge)
1=Culvert (Inlet Controls 37.22 cfs @ 19.94 fps)

Summary for Pond D7SE: 12" Pipe

[58] Hint: Peaked 25.11' above defined flood level
[81] Warning: Exceeded Pond C7SE by 22.08' @ 12.05 hrs

Inflow Area = 2.211 ac, 0.00% Impervious, Inflow Depth = 6.78" for 500 year - 24 hour event
Inflow = 19.22 cfs @ 12.05 hrs, Volume= 1.250 af
Outflow = 19.22 cfs @ 12.05 hrs, Volume= 1.250 af, Atten= 0%, Lag= 0.0 min
Primary = 19.22 cfs @ 12.05 hrs, Volume= 1.250 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 800.11' @ 12.05 hrs
Flood Elev= 775.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	772.00'	**11.8" Round Culvert** L= 90.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 772.00' / 750.00' S= 0.2444 '/' Cc= 0.900 n= 0.010, Flow Area= 0.76 sf

Primary OutFlow Max=19.22 cfs @ 12.05 hrs HW=800.10' (Free Discharge)
1=Culvert (Inlet Controls 19.22 cfs @ 25.30 fps)

Summary for Pond D7SW: 26" Pipe

[58] Hint: Peaked 10.78' above defined flood level
[81] Warning: Exceeded Pond C7SW by 7.68' @ 12.07 hrs
[79] Warning: Submerged Pond D6SW Primary device # 1 OUTLET by 13.78'

Inflow Area = 10.006 ac, 0.00% Impervious, Inflow Depth = 6.63" for 500 year - 24 hour event
Inflow = 54.09 cfs @ 12.06 hrs, Volume= 5.529 af
Outflow = 54.09 cfs @ 12.06 hrs, Volume= 5.529 af, Atten= 0%, Lag= 0.0 min
Primary = 54.09 cfs @ 12.06 hrs, Volume= 5.529 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 743.28' @ 12.06 hrs
Flood Elev= 732.50'

Device	Routing	Invert	Outlet Devices
#1	Primary	729.50'	**24.0" Round Culvert** L= 30.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 729.50' / 722.00' S= 0.2500 '/' Cc= 0.900 n= 0.010, Flow Area= 3.14 sf

Primary OutFlow Max=54.08 cfs @ 12.06 hrs HW=743.28' (Free Discharge)
1=Culvert (Inlet Controls 54.08 cfs @ 17.21 fps)

Summary for Pond D8SE: 18" Pipe

[58] Hint: Peaked 18.36' above defined flood level
[81] Warning: Exceeded Pond C8SE by 16.66' @ 12.01 hrs
[79] Warning: Submerged Pond D7SE Primary device # 1 OUTLET by 21.34'

Inflow Area = 3.519 ac, 0.00% Impervious, Inflow Depth = 6.81" for 500 year - 24 hour event
Inflow = 32.90 cfs @ 12.01 hrs, Volume= 1.997 af
Outflow = 32.90 cfs @ 12.01 hrs, Volume= 1.997 af, Atten= 0%, Lag= 0.0 min
Primary = 32.90 cfs @ 12.01 hrs, Volume= 1.997 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 771.36' @ 12.01 hrs
Flood Elev= 753.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	750.00'	**16.6" Round Culvert** L= 36.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 750.00' / 740.00' S= 0.2778 '/' Cc= 0.900 n= 0.010, Flow Area= 1.50 sf

Primary OutFlow Max=32.87 cfs @ 12.01 hrs HW=771.32' (Free Discharge)
1=Culvert (Inlet Controls 32.87 cfs @ 21.87 fps)

Summary for Pond DP6N: 24" Pipe

[79] Warning: Submerged Pond C6N Primary device # 1 INLET by 3.54'

Inflow Area = 26.669 ac, 0.00% Impervious, Inflow Depth = 4.21" for 500 year - 24 hour event
Inflow = 22.86 cfs @ 12.05 hrs, Volume= 9.358 af
Outflow = 22.86 cfs @ 12.05 hrs, Volume= 9.358 af, Atten= 0%, Lag= 0.0 min
Primary = 22.86 cfs @ 12.05 hrs, Volume= 9.358 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Peak Elev= 722.54' @ 12.05 hrs
Flood Elev= 724.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	718.50'	**22.2" Round Culvert** L= 780.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 718.50' / 700.00' S= 0.0237 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 2.69 sf

Primary OutFlow Max=22.86 cfs @ 12.05 hrs HW=722.54' (Free Discharge)
1=Culvert (Inlet Controls 22.86 cfs @ 8.50 fps)

Summary for Pond MH1S: 4' Dia. Manhole

[58] Hint: Peaked 18.54' above defined flood level
[79] Warning: Submerged Pond D7S Primary device # 1 INLET by 9.54'

Inflow Area = 3.938 ac, 0.00% Impervious, Inflow Depth = 6.79" for 500 year - 24 hour event
Inflow = 37.22 cfs @ 12.02 hrs, Volume= 2.229 af
Outflow = 37.22 cfs @ 12.02 hrs, Volume= 2.229 af, Atten= 0%, Lag= 0.0 min
Primary = 37.22 cfs @ 12.02 hrs, Volume= 2.229 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 739.04' @ 12.02 hrs
Flood Elev= 720.50'

Device	Routing	Invert	Outlet Devices
#1	Primary	716.50'	**22.2" Round Culvert** L= 830.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 716.50' / 712.50' S= 0.0048 '/' Cc= 0.900 n= 0.010, Flow Area= 2.69 sf

Primary OutFlow Max=37.22 cfs @ 12.02 hrs HW=739.03' (Free Discharge)
1=Culvert (Barrel Controls 37.22 cfs @ 13.85 fps)

Summary for Pond MH1SE: 8' Dia. Manhole

[58] Hint: Peaked 151.44' above defined flood level
[81] Warning: Exceeded Pond C6SE by 147.92' @ 12.06 hrs
[81] Warning: Exceeded Pond D3SE by 74.67' @ 12.05 hrs
[81] Warning: Exceeded Pond D5SE by 125.51' @ 12.07 hrs

Inflow Area = 26.644 ac, 0.00% Impervious, Inflow Depth = 6.81" for 500 year - 24 hour event
Inflow = 112.98 cfs @ 12.06 hrs, Volume= 15.120 af
Outflow = 112.98 cfs @ 12.06 hrs, Volume= 15.120 af, Atten= 0%, Lag= 0.0 min
Primary = 112.98 cfs @ 12.06 hrs, Volume= 15.120 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 893.44' @ 12.06 hrs
Flood Elev= 742.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	738.00'	**22.2" Round Culvert** L= 590.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 738.00' / 718.00' S= 0.0339 '/' Cc= 0.900 n= 0.010, Flow Area= 2.69 sf

Primary OutFlow Max=112.97 cfs @ 12.06 hrs HW=893.40' (Free Discharge)
1=Culvert (Barrel Controls 112.97 cfs @ 42.03 fps)

Summary for Pond MH1SW: 4' Dia. Manhole

[57] Hint: Peaked at 825.11' (Flood elevation advised)
[81] Warning: Exceeded Pond C4SW by 78.04' @ 12.05 hrs
[81] Warning: Exceeded Pond D3SW by 57.79' @ 12.04 hrs

Inflow Area = 11.465 ac, 0.00% Impervious, Inflow Depth = 6.77" for 500 year - 24 hour event
Inflow = 72.59 cfs @ 12.04 hrs, Volume= 6.467 af
Outflow = 72.59 cfs @ 12.04 hrs, Volume= 6.467 af, Atten= 0%, Lag= 0.0 min
Primary = 72.59 cfs @ 12.04 hrs, Volume= 6.467 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 825.11' @ 12.04 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	738.00'	**20.3" Round Culvert** L= 550.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 738.00' / 717.00' S= 0.0382 '/' Cc= 0.900 n= 0.010, Flow Area= 2.25 sf

Primary OutFlow Max=72.59 cfs @ 12.04 hrs HW=825.10' (Free Discharge)
1=Culvert (Barrel Controls 72.59 cfs @ 32.29 fps)

Summary for Pond MH1W: 6' Manhole

[58] Hint: Peaked 73.54' above defined flood level
[79] Warning: Submerged Pond D3S1 Primary device # 1 OUTLET by 76.94'
[79] Warning: Submerged Pond D3S2 Primary device # 1 OUTLET by 76.94'
[81] Warning: Exceeded Pond D4W by 55.02' @ 12.29 hrs

Inflow Area = 35.305 ac, 0.00% Impervious, Inflow Depth = 6.69" for 500 year - 24 hour event
Inflow = 134.06 cfs @ 12.28 hrs, Volume= 19.685 af
Outflow = 134.06 cfs @ 12.28 hrs, Volume= 19.685 af, Atten= 0%, Lag= 0.0 min
Primary = 134.06 cfs @ 12.28 hrs, Volume= 19.685 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 793.54' @ 12.28 hrs
Flood Elev= 720.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	714.00'	**24.0" Round Culvert** L= 5.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 714.00' / 713.00' S= 0.2000 '/' Cc= 0.900 n= 0.024, Flow Area= 3.14 sf

Primary OutFlow Max=133.90 cfs @ 12.28 hrs HW=793.35' (Free Discharge)
1=Culvert (Inlet Controls 133.90 cfs @ 42.62 fps)

Summary for Pond MH2SE: 4' Dia. Manhole

[58] Hint: Peaked 18.10' above defined flood level
[79] Warning: Submerged Pond MH1SE Primary device # 1 INLET by 2.10'

Inflow Area = 26.644 ac, 0.00% Impervious, Inflow Depth = 6.81" for 500 year - 24 hour event
Inflow = 112.98 cfs @ 12.06 hrs, Volume= 15.120 af
Outflow = 112.98 cfs @ 12.06 hrs, Volume= 15.120 af, Atten= 0%, Lag= 0.0 min
Primary = 112.98 cfs @ 12.06 hrs, Volume= 15.120 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 740.10' @ 12.06 hrs
Flood Elev= 722.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	716.00'	**30.0" Round Culvert** L= 10.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 716.00' / 715.00' S= 0.1000 '/' Cc= 0.900 n= 0.024, Flow Area= 4.91 sf

Primary OutFlow Max=112.97 cfs @ 12.06 hrs HW=740.10' (Free Discharge)
└**1=Culvert** (Inlet Controls 112.97 cfs @ 23.01 fps)

Summary for Pond MH2SW: 6' Dia. Manhole

[58] Hint: Peaked 70.99' above defined flood level
[81] Warning: Exceeded Pond C8SW by 67.95' @ 12.05 hrs
[81] Warning: Exceeded Pond D7SW by 53.74' @ 12.05 hrs

Inflow Area = 10.959 ac, 0.00% Impervious, Inflow Depth = 6.80" for 500 year - 24 hour event
Inflow = 73.23 cfs @ 12.05 hrs, Volume= 6.207 af
Outflow = 73.23 cfs @ 12.05 hrs, Volume= 6.207 af, Atten= 0%, Lag= 0.0 min
Primary = 73.23 cfs @ 12.05 hrs, Volume= 6.207 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 796.99' @ 12.05 hrs
Flood Elev= 726.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	722.00'	**24.0" Round Culvert** L= 1,050.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 722.00' / 717.00' S= 0.0048 '/' Cc= 0.900 n= 0.010, Flow Area= 3.14 sf

Primary OutFlow Max=73.22 cfs @ 12.05 hrs HW=796.97' (Free Discharge)
└**1=Culvert** (Barrel Controls 73.22 cfs @ 23.31 fps)

Summary for Pond MH3S: 6' Dia. Manhole

[58] Hint: Peaked 22.47' above defined flood level
[79] Warning: Submerged Pond D5S Primary device # 1 INLET by 13.47'
[81] Warning: Exceeded Pond MH1S by 10.49' @ 12.41 hrs

Inflow Area = 6.588 ac, 0.00% Impervious, Inflow Depth = 7.92" for 500 year - 24 hour event
Inflow = 65.41 cfs @ 12.01 hrs, Volume= 4.348 af
Outflow = 65.41 cfs @ 12.01 hrs, Volume= 4.348 af, Atten= 0%, Lag= 0.0 min
Primary = 65.41 cfs @ 12.01 hrs, Volume= 4.348 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 742.47' @ 12.01 hrs
Flood Elev= 720.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	716.00'	**22.2" Round Culvert** L= 10.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 716.00' / 712.00' S= 0.4000 '/' Cc= 0.900 n= 0.010, Flow Area= 2.69 sf

Primary OutFlow Max=65.38 cfs @ 12.01 hrs HW=742.45' (Free Discharge)
1=Culvert (Inlet Controls 65.38 cfs @ 24.32 fps)

Summary for Pond MH3SE: 8' Dia. Manhole

[58] Hint: Peaked 125.93' above defined flood level
[81] Warning: Exceeded Pond C13SE by 127.78' @ 12.13 hrs
[81] Warning: Exceeded Pond D12SE by 30.47' @ 12.11 hrs

Inflow Area = 21.294 ac, 0.00% Impervious, Inflow Depth = 6.79" for 500 year - 24 hour event
Inflow = 85.79 cfs @ 12.12 hrs, Volume= 12.045 af
Outflow = 85.79 cfs @ 12.12 hrs, Volume= 12.045 af, Atten= 0%, Lag= 0.0 min
Primary = 85.79 cfs @ 12.12 hrs, Volume= 12.045 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 853.93' @ 12.12 hrs
Flood Elev= 728.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	720.00'	**24.0" Round Culvert** L= 1,400.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 720.00' / 715.00' S= 0.0036 '/' Cc= 0.900 n= 0.010, Flow Area= 3.14 sf

Primary OutFlow Max=85.79 cfs @ 12.12 hrs HW=853.92' (Free Discharge)
1=Culvert (Barrel Controls 85.79 cfs @ 27.31 fps)

Summary for Pond MH3SW: 6' Dia. Manhole

[58] Hint: Peaked 89.94' above defined flood level
[79] Warning: Submerged Pond MH1SW Primary device # 1 INLET by 72.92'
[81] Warning: Exceeded Pond MH2SW by 14.95' @ 12.00 hrs

Inflow Area = 22.424 ac, 0.00% Impervious, Inflow Depth = 6.78" for 500 year - 24 hour event
Inflow = 145.83 cfs @ 12.05 hrs, Volume= 12.674 af
Outflow = 145.83 cfs @ 12.05 hrs, Volume= 12.674 af, Atten= 0%, Lag= 0.0 min
Primary = 145.83 cfs @ 12.05 hrs, Volume= 12.674 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 810.94' @ 12.05 hrs
Flood Elev= 721.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	717.00'	**24.0" Round Culvert** L= 5.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 717.00' / 717.00' S= 0.0000 '/' Cc= 0.900 n= 0.024, Flow Area= 3.14 sf

Primary OutFlow Max=145.79 cfs @ 12.05 hrs HW=810.90' (Free Discharge)
1=Culvert (Inlet Controls 145.79 cfs @ 46.41 fps)

Summary for Pond MH4SE: 4' Dia. Manhole

[58] Hint: Peaked 105.60' above defined flood level
[81] Warning: Exceeded Pond C9SE by 104.96' @ 12.05 hrs
[81] Warning: Exceeded Pond D8SE by 73.64' @ 12.10 hrs
[81] Warning: Exceeded Pond MH3SE by 27.77' @ 11.98 hrs

Inflow Area = 25.454 ac, 0.00% Impervious, Inflow Depth = 6.79" for 500 year - 24 hour event
Inflow = 112.73 cfs @ 12.05 hrs, Volume= 14.407 af
Outflow = 112.73 cfs @ 12.05 hrs, Volume= 14.407 af, Atten= 0%, Lag= 0.0 min
Primary = 112.73 cfs @ 12.05 hrs, Volume= 14.407 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 840.60' @ 12.05 hrs
Flood Elev= 735.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	720.30'	**24.0" Round Culvert** L= 620.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 720.30' / 717.20' S= 0.0050 '/' Cc= 0.900 n= 0.010, Flow Area= 3.14 sf

Primary OutFlow Max=112.50 cfs @ 12.05 hrs HW=840.12' (Free Discharge)
1=Culvert (Barrel Controls 112.50 cfs @ 35.81 fps)

Summary for Pond MH4W: Manhole

[57] Hint: Peaked at 741.32' (Flood elevation advised)
[79] Warning: Submerged Pond D1W Primary device # 1 OUTLET by 17.32'

Inflow Area = 16.760 ac, 0.00% Impervious, Inflow Depth = 6.61" for 500 year - 24 hour event
Inflow = 68.19 cfs @ 12.24 hrs, Volume= 9.228 af
Outflow = 68.19 cfs @ 12.24 hrs, Volume= 9.228 af, Atten= 0%, Lag= 0.0 min
Primary = 68.19 cfs @ 12.24 hrs, Volume= 9.228 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 741.32' @ 12.24 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	720.00'	**24.0" Round Culvert** L= 5.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 720.00' / 719.00' S= 0.2000 '/' Cc= 0.900 n= 0.024, Flow Area= 3.14 sf

Primary OutFlow Max=68.18 cfs @ 12.24 hrs HW=741.32' (Free Discharge)
1=Culvert (Inlet Controls 68.18 cfs @ 21.70 fps)

Summary for Pond MH5SE: 4' Dia. Manhole

[58] Hint: Peaked 18.00' above defined flood level
[79] Warning: Submerged Pond MH4SE Primary device # 1 INLET by 19.65'

Inflow Area = 25.454 ac, 0.00% Impervious, Inflow Depth = 6.79" for 500 year - 24 hour event
Inflow = 112.73 cfs @ 12.05 hrs, Volume= 14.407 af
Outflow = 112.73 cfs @ 12.05 hrs, Volume= 14.407 af, Atten= 0%, Lag= 0.0 min
Primary = 112.73 cfs @ 12.05 hrs, Volume= 14.407 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 740.00' @ 12.05 hrs
Flood Elev= 722.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	716.00'	**30.0" Round Culvert** L= 10.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 716.00' / 715.00' S= 0.1000 '/' Cc= 0.900

n= 0.024, Flow Area= 4.91 sf

Primary OutFlow Max=112.50 cfs @ 12.05 hrs HW=739.91' (Free Discharge)
1=Culvert (Inlet Controls 112.50 cfs @ 22.92 fps)

Summary for Pond NP: North Pond

[79] Warning: Submerged Pond DP6N Primary device # 1 OUTLET by 0.40'

Inflow Area = 38.256 ac, 2.57% Impervious, Inflow Depth = 5.09" for 500 year - 24 hour event
Inflow = 120.29 cfs @ 11.98 hrs, Volume= 16.216 af
Outflow = 57.98 cfs @ 12.21 hrs, Volume= 16.200 af, Atten= 52%, Lag= 13.9 min
Primary = 57.98 cfs @ 12.21 hrs, Volume= 16.200 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Tertiary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Starting Elev= 696.00' Surf.Area= 20,300 sf Storage= 34,300 cf
Peak Elev= 700.40' @ 12.21 hrs Surf.Area= 33,727 sf Storage= 153,358 cf (119,058 cf above start)
Flood Elev= 702.00' Surf.Area= 39,000 sf Storage= 210,400 cf (176,100 cf above start)

Plug-Flow detention time= 88.8 min calculated for 15.410 af (95% of inflow)
Center-of-Mass det. time= 45.5 min (895.9 - 850.4)

Volume	Invert	Avail.Storage	Storage Description
#1	694.00'	230,713 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
694.00	14,000	0	0
696.00	20,300	34,300	34,300
698.00	26,000	46,300	80,600
700.00	32,400	58,400	139,000
702.00	39,000	71,400	210,400
702.50	42,250	20,313	230,713

Device	Routing	Invert	Outlet Devices
#1	Primary	696.00'	**36.0" Round Culvert** L= 60.0' CMP, end-section conforming to fill, Ke= 0.500 Inlet / Outlet Invert= 696.00' / 694.00' S= 0.0333 '/' Cc= 0.900 n= 0.018, Flow Area= 7.07 sf
#2	Secondary	701.50'	**40.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88
#3	Tertiary	702.00'	**600.0' long x 2.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32

Primary OutFlow Max=57.98 cfs @ 12.21 hrs HW=700.40' (Free Discharge)
└**1=Culvert** (Inlet Controls 57.98 cfs @ 8.20 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=696.00' (Free Discharge)
└**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Tertiary OutFlow Max=0.00 cfs @ 0.00 hrs HW=696.00' (Free Discharge)
└**3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond NWP: Northwest Pond

[58] Hint: Peaked 0.14' above defined flood level
[79] Warning: Submerged Pond C4W Primary device # 1 OUTLET by 0.14'
[79] Warning: Submerged Pond MH1W Primary device # 1 INLET by 2.14'
[79] Warning: Submerged Pond MH3S Primary device # 1 INLET by 0.14'

Inflow Area = 65.182 ac, 1.44% Impervious, Inflow Depth = 6.52" for 500 year - 24 hour event
Inflow = 245.11 cfs @ 12.02 hrs, Volume= 35.430 af
Outflow = 200.21 cfs @ 12.39 hrs, Volume= 35.423 af, Atten= 18%, Lag= 22.0 min
Primary = 66.39 cfs @ 12.39 hrs, Volume= 27.781 af
Secondary = 55.26 cfs @ 12.39 hrs, Volume= 4.332 af
Tertiary = 78.55 cfs @ 12.39 hrs, Volume= 3.311 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Starting Elev= 707.00' Surf.Area= 18,591 sf Storage= 71,995 cf
Peak Elev= 716.14' @ 12.39 hrs Surf.Area= 36,447 sf Storage= 319,940 cf (247,946 cf above start)
Flood Elev= 716.00' Surf.Area= 35,795 sf Storage= 314,850 cf (242,856 cf above start)

Plug-Flow detention time= 78.7 min calculated for 33.764 af (95% of inflow)
Center-of-Mass det. time= 39.0 min (868.8 - 829.8)

Volume	Invert	Avail.Storage	Storage Description
#1	702.00'	333,326 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
702.00	10,381	0	0
704.00	13,520	23,901	23,901
706.00	16,852	30,372	54,273
708.00	20,330	37,182	91,455
710.00	24,050	44,380	135,835
712.00	27,835	51,885	187,720
714.00	31,750	59,585	247,305
716.00	35,795	67,545	314,850
716.50	38,110	18,476	333,326

Device	Routing	Invert	Outlet Devices
#1	Primary	707.00'	**30.0" Round Culvert** L= 40.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 707.00' / 706.00' S= 0.0250 '/' Cc= 0.900 n= 0.012, Flow Area= 4.91 sf
#2	Secondary	715.50'	**40.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88
#3	Tertiary	716.00'	**530.0' long x 2.0' breadth Broad-Crested Rectangular Weir**

Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50
Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32

Primary OutFlow Max=66.39 cfs @ 12.39 hrs HW=716.14' (Free Discharge)
└**1=Culvert** (Inlet Controls 66.39 cfs @ 13.53 fps)

Secondary OutFlow Max=55.28 cfs @ 12.39 hrs HW=716.14' (Free Discharge)
└**2=Broad-Crested Rectangular Weir** (Weir Controls 55.28 cfs @ 2.16 fps)

Tertiary OutFlow Max=70.92 cfs @ 12.39 hrs HW=716.14' (Free Discharge)
└**3=Broad-Crested Rectangular Weir** (Weir Controls 70.92 cfs @ 0.95 fps)

Summary for Pond SEP: Southeast Pond

[58] Hint: Peaked 0.21' above defined flood level
[79] Warning: Submerged Pond MH2SE Primary device # 1 INLET by 2.21'
[79] Warning: Submerged Pond MH5SE Primary device # 1 INLET by 2.21'

Inflow Area = 54.264 ac, 1.25% Impervious, Inflow Depth = 6.84" for 500 year - 24 hour event
Inflow = 233.43 cfs @ 12.03 hrs, Volume= 30.951 af
Outflow = 233.37 cfs @ 12.04 hrs, Volume= 30.950 af, Atten= 0%, Lag= 0.4 min
Primary = 73.88 cfs @ 12.04 hrs, Volume= 23.229 af
Secondary = 159.49 cfs @ 12.04 hrs, Volume= 7.721 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Starting Elev= 712.00' Surf.Area= 11,817 sf Storage= 33,961 cf
Peak Elev= 718.21' @ 12.04 hrs Surf.Area= 23,126 sf Storage= 141,806 cf (107,845 cf above start)
Flood Elev= 718.00' Surf.Area= 22,487 sf Storage= 136,385 cf (102,424 cf above start)

Plug-Flow detention time= 41.9 min calculated for 30.164 af (97% of inflow)
Center-of-Mass det. time= 19.4 min (842.9 - 823.4)

Volume	Invert	Avail.Storage	Storage Description
#1	708.00'	187,373 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
708.00	5,158	0	0
710.00	8,493	13,651	13,651
712.00	11,817	20,310	33,961
714.00	15,317	27,134	61,095
716.00	18,743	34,060	95,155
718.00	22,487	41,230	136,385
720.00	28,501	50,988	187,373

Device	Routing	Invert	Outlet Devices
#1	Primary	712.00'	**36.0" Round Culvert** L= 73.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 712.00' / 710.90' S= 0.0151 '/' Cc= 0.900 n= 0.015 Concrete sewer w/manholes & inlets, Flow Area= 7.07 sf
#2	Secondary	718.00'	**600.0' long x 60.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=73.89 cfs @ 12.04 hrs HW=718.21' (Free Discharge)
└**1=Culvert** (Inlet Controls 73.89 cfs @ 10.45 fps)

Secondary OutFlow Max=157.76 cfs @ 12.04 hrs HW=718.21' (Free Discharge)
└**2=Broad-Crested Rectangular Weir** (Weir Controls 157.76 cfs @ 1.24 fps)

Summary for Pond SP: South Pond

[58] Hint: Peaked 0.44' above defined flood level

Inflow Area = 5.541 ac, 25.00% Impervious, Inflow Depth = 7.74" for 500 year - 24 hour event
Inflow = 67.87 cfs @ 11.96 hrs, Volume= 3.574 af
Outflow = 64.07 cfs @ 11.99 hrs, Volume= 2.853 af, Atten= 6%, Lag= 1.6 min
Discarded = 0.10 cfs @ 11.99 hrs, Volume= 0.263 af
Secondary = 63.97 cfs @ 11.99 hrs, Volume= 2.590 af
Tertiary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 720.44' @ 11.99 hrs Surf.Area= 25,060 sf Storage= 48,612 cf
Flood Elev= 720.00' Surf.Area= 22,003 sf Storage= 38,164 cf

Plug-Flow detention time= 209.2 min calculated for 2.853 af (80% of inflow)
Center-of-Mass det. time= 127.5 min (917.0 - 789.5)

Volume	Invert	Avail.Storage	Storage Description
#1	716.50'	95,942 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
716.50	0	0	0
718.00	9,235	6,926	6,926
720.00	22,003	31,238	38,164
722.00	35,775	57,778	95,942

Device	Routing	Invert	Outlet Devices
#1	Discarded	716.50'	**0.150 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 700.00'
#2	Secondary	720.00'	**80.0' long x 30.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63
#3	Tertiary	720.50'	**100.0' long x 30.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Discarded OutFlow Max=0.10 cfs @ 11.99 hrs HW=720.44' (Free Discharge)
└**1=Exfiltration** (Controls 0.10 cfs)

Secondary OutFlow Max=63.84 cfs @ 11.99 hrs HW=720.44' (Free Discharge)
└**2=Broad-Crested Rectangular Weir** (Weir Controls 63.84 cfs @ 1.80 fps)

Tertiary OutFlow Max=0.00 cfs @ 0.00 hrs HW=716.50' (Free Discharge)
└**3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond SWP: Southwest Pond

[58] Hint: Peaked 0.33' above defined flood level
[81] Warning: Exceeded Pond MH3SW by 3.94' @ 13.71 hrs

Inflow Area = 25.347 ac, 3.30% Impervious, Inflow Depth = 6.92" for 500 year - 24 hour event
Inflow = 178.07 cfs @ 12.01 hrs, Volume= 14.612 af
Outflow = 171.43 cfs @ 12.03 hrs, Volume= 13.311 af, Atten= 4%, Lag= 1.0 min
Primary = 17.75 cfs @ 12.03 hrs, Volume= 8.997 af
Secondary = 153.68 cfs @ 12.03 hrs, Volume= 4.314 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 723.33' @ 12.03 hrs Surf.Area= 43,922 sf Storage= 164,811 cf
Flood Elev= 723.00' Surf.Area= 40,614 sf Storage= 151,443 cf

Plug-Flow detention time= 105.5 min calculated for 13.311 af (91% of inflow)
Center-of-Mass det. time= 58.8 min (870.2 - 811.4)

Volume	Invert	Avail.Storage	Storage Description
#1	715.00'	192,056 cf	**Custom Stage Data (Prismatic)** Listed below

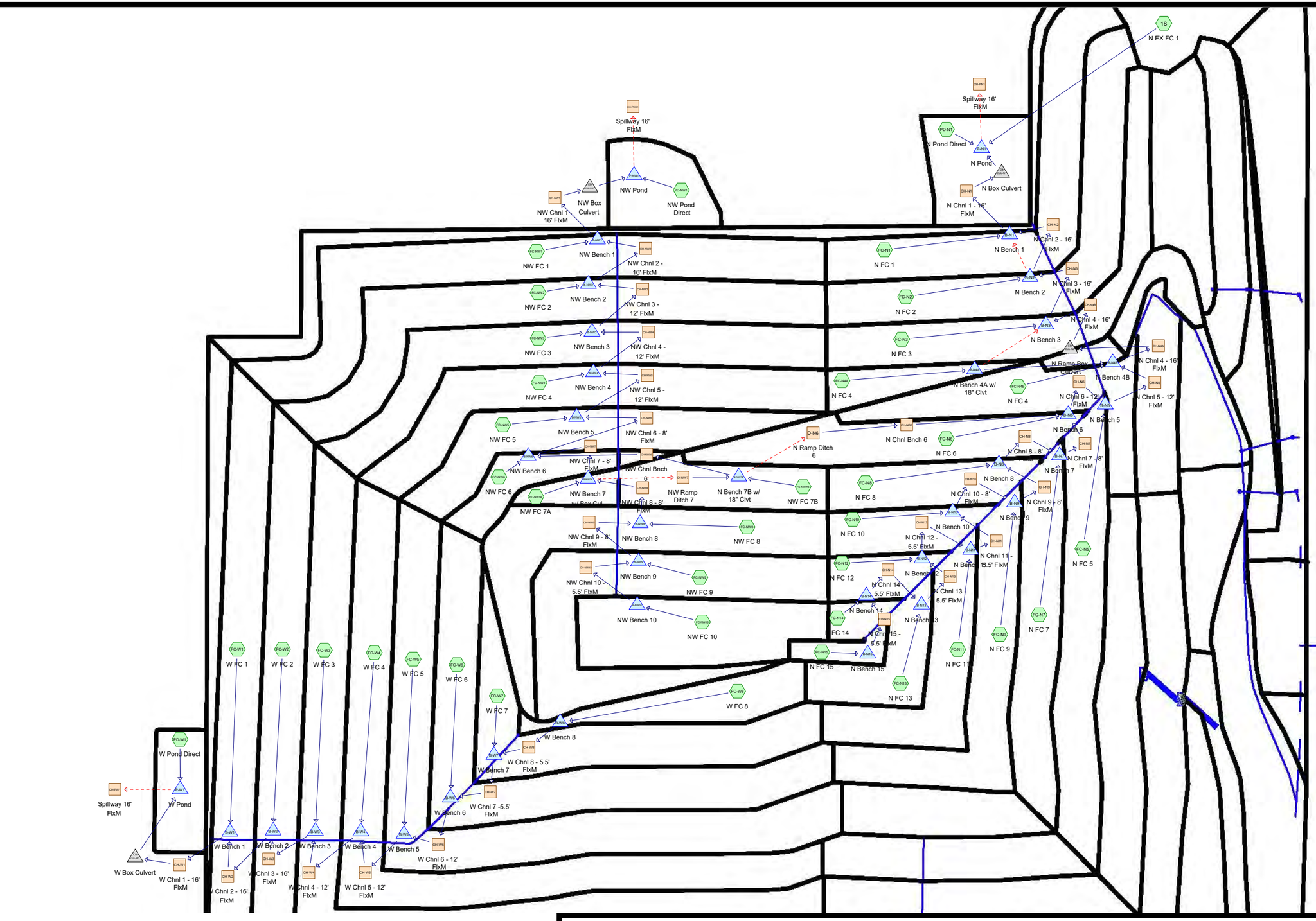
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
715.00	0	0	0
716.00	950	475	475
718.00	15,835	16,785	17,260
720.00	23,586	39,421	56,681
722.00	30,562	54,148	110,829
724.00	50,665	81,227	192,056

Device	Routing	Invert	Outlet Devices
#1	Primary	715.05'	**18.0" Round Culvert** L= 134.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 715.05' / 714.37' S= 0.0051 '/' Cc= 0.900 n= 0.015 Concrete sewer w/manholes & inlets, Flow Area= 1.77 sf
#2	Device 1	720.00'	**48.0" Horiz. Orifice/Grate** C= 0.600 in 48.0" Grate (100% open area) Limited to weir flow at low heads
#3	Secondary	723.00'	**300.0' long x 60.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=17.75 cfs @ 12.03 hrs HW=723.33' (Free Discharge)
└**1=Culvert** (Barrel Controls 17.75 cfs @ 10.04 fps)
└**2=Orifice/Grate** (Passes 17.75 cfs of 110.40 cfs potential flow)

Secondary OutFlow Max=152.35 cfs @ 12.03 hrs HW=723.33' (Free Discharge)
└**3=Broad-Crested Rectangular Weir** (Weir Controls 152.35 cfs @ 1.54 fps)

Post-Project 2-Year Storm HydroCAD Analysis



Routing Diagram for BSLI Permit Expansion 2019 N & W

Prepared by Carlson McCain, Inc., Printed 12/18/2019

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Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
135.354	71	Meadow, non-grazed, HSG C (1S, FC-N1, FC-N10, FC-N11, FC-N12, FC-N13, FC-N14, FC-N15, FC-N2, FC-N3, FC-N4A, FC-N4B, FC-N5, FC-N6, FC-N7, FC-N8, FC-N9, FC-NW1, FC-NW10, FC-NW2, FC-NW3, FC-NW4, FC-NW5, FC-NW6, FC-NW7A, FC-NW7B, FC-NW8, FC-NW9, FC-W1, FC-W2, FC-W3, FC-W4, FC-W5, FC-W6, FC-W7, FC-W8)
1.497	98	Paved parking, HSG B (FC-N4B, FC-N6, FC-NW7A, FC-NW7B, FC-NW8, FC-NW9)
5.877	98	Water Surface, 0% imp, HSG B (PD-N1, PD-NW1, PD-W1)
142.727	**72**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
7.374	HSG B	FC-N4B, FC-N6, FC-NW7A, FC-NW7B, FC-NW8, FC-NW9, PD-N1, PD-NW1, PD-W1
135.354	HSG C	1S, FC-N1, FC-N10, FC-N11, FC-N12, FC-N13, FC-N14, FC-N15, FC-N2, FC-N3, FC-N4A, FC-N4B, FC-N5, FC-N6, FC-N7, FC-N8, FC-N9, FC-NW1, FC-NW10, FC-NW2, FC-NW3, FC-NW4, FC-NW5, FC-NW6, FC-NW7A, FC-NW7B, FC-NW8, FC-NW9, FC-W1, FC-W2, FC-W3, FC-W4, FC-W5, FC-W6, FC-W7, FC-W8
0.000	HSG D	
0.000	Other	
142.727		**TOTAL AREA**

Pipe Listing (all nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Diam/Width (inches)	Height (inches)	Inside-Fill (inches)
1	B-N4A	842.30	842.00	50.0	0.0060	0.010	15.8	0.0	0.0
2	B-NW7A	931.00	930.83	35.0	0.0049	0.012	96.0	48.0	0.0
3	B-NW7B	920.50	920.00	50.0	0.0100	0.010	15.8	0.0	0.0
4	CUL-N1	717.00	716.50	50.0	0.0100	0.012	120.0	48.0	0.0
5	CUL-N2	830.00	829.83	35.0	0.0049	0.010	96.0	48.0	0.0
6	CUL-NW1	717.00	716.60	40.0	0.0100	0.012	120.0	48.0	0.0
7	CUL-W1	717.00	716.60	40.0	0.0100	0.012	120.0	48.0	0.0
8	P-N1	701.00	700.50	50.0	0.0100	0.013	9.4	0.0	0.0
9	P-NW1	699.00	698.50	50.0	0.0100	0.013	10.0	0.0	0.0
10	P-W1	713.00	712.50	50.0	0.0100	0.013	10.0	0.0	0.0

Time span=0.00-60.00 hrs, dt=0.01 hrs, 6001 points x 2
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: N EX FC 1 Runoff Area=189,400 sf 0.00% Impervious Runoff Depth=0.66"
Flow Length=1,060' Tc=14.1 min CN=71 Runoff=3.46 cfs 0.241 af

Subcatchment FC-N1: N FC 1 Runoff Area=206,346 sf 0.00% Impervious Runoff Depth=0.66"
Flow Length=963' Tc=14.3 min CN=71 Runoff=3.74 cfs 0.262 af

Subcatchment FC-N10: N FC 10 Runoff Area=63,734 sf 0.00% Impervious Runoff Depth=0.66"
Flow Length=628' Tc=10.9 min CN=71 Runoff=1.33 cfs 0.081 af

Subcatchment FC-N11: N FC 11 Runoff Area=122,568 sf 0.00% Impervious Runoff Depth=0.66"
Flow Length=1,222' Tc=16.3 min CN=71 Runoff=2.06 cfs 0.156 af

Subcatchment FC-N12: N FC 12 Runoff Area=43,115 sf 0.00% Impervious Runoff Depth=0.66"
Flow Length=481' Tc=9.4 min CN=71 Runoff=0.96 cfs 0.055 af

Subcatchment FC-N13: N FC 13 Runoff Area=77,429 sf 0.00% Impervious Runoff Depth=0.66"
Flow Length=863' Tc=12.8 min CN=71 Runoff=1.49 cfs 0.098 af

Subcatchment FC-N14: N FC 14 Runoff Area=20,870 sf 0.00% Impervious Runoff Depth=0.66"
Flow Length=321' Tc=7.5 min CN=71 Runoff=0.51 cfs 0.027 af

Subcatchment FC-N15: N FC 15 Runoff Area=23,198 sf 0.00% Impervious Runoff Depth=0.66"
Flow Length=453' Tc=6.5 min CN=71 Runoff=0.59 cfs 0.029 af

Subcatchment FC-N2: N FC 2 Runoff Area=215,322 sf 0.00% Impervious Runoff Depth=0.66"
Flow Length=985' Tc=14.3 min CN=71 Runoff=3.90 cfs 0.274 af

Subcatchment FC-N3: N FC 3 Runoff Area=177,256 sf 0.00% Impervious Runoff Depth=0.66"
Flow Length=870' Tc=14.6 min CN=71 Runoff=3.17 cfs 0.225 af

Subcatchment FC-N4A: N FC 4 Runoff Area=45,986 sf 0.00% Impervious Runoff Depth=0.66"
Flow Length=706' Tc=11.6 min CN=71 Runoff=0.93 cfs 0.058 af

Subcatchment FC-N4B: N FC 4 Runoff Area=89,094 sf 15.79% Impervious Runoff Depth=0.85"
Flow Length=752' Tc=4.9 min CN=75 Runoff=3.21 cfs 0.145 af

Subcatchment FC-N5: N FC 5 Runoff Area=183,015 sf 0.00% Impervious Runoff Depth=0.66"
Flow Length=1,591' Tc=20.3 min CN=71 Runoff=2.68 cfs 0.233 af

Subcatchment FC-N6: N FC 6 Runoff Area=144,191 sf 6.48% Impervious Runoff Depth=0.75"
Flow Length=875' Tc=13.2 min CN=73 Runoff=3.21 cfs 0.208 af

Subcatchment FC-N7: N FC 7 Runoff Area=146,829 sf 0.00% Impervious Runoff Depth=0.66"
Flow Length=1,209' Tc=16.3 min CN=71 Runoff=2.46 cfs 0.187 af

Subcatchment FC-N8: N FC 8 Runoff Area=84,345 sf 0.00% Impervious Runoff Depth=0.66"
Flow Length=775' Tc=12.3 min CN=71 Runoff=1.66 cfs 0.107 af

Subcatchment FC-N9: N FC 9 Runoff Area=171,400 sf 0.00% Impervious Runoff Depth=0.66"
Flow Length=1,580' Tc=19.8 min CN=71 Runoff=2.54 cfs 0.218 af

Subcatchment FC-NW1: NW FC 1 Runoff Area=278,073 sf 0.00% Impervious Runoff Depth=0.66"
Flow Length=1,327' Tc=17.7 min CN=71 Runoff=4.44 cfs 0.354 af

Subcatchment FC-NW10: NW FC 10 Runoff Area=152,624 sf 0.00% Impervious Runoff Depth=0.66"
Flow Length=772' Tc=12.3 min CN=71 Runoff=3.00 cfs 0.194 af

Subcatchment FC-NW2: NW FC 2 Runoff Area=253,669 sf 0.00% Impervious Runoff Depth=0.66"
Flow Length=1,445' Tc=19.2 min CN=71 Runoff=3.85 cfs 0.323 af

Subcatchment FC-NW3: NW FC 3 Runoff Area=220,927 sf 0.00% Impervious Runoff Depth=0.66"
Flow Length=1,265' Tc=16.8 min CN=71 Runoff=3.64 cfs 0.281 af

Subcatchment FC-NW4: NW FC 4 Runoff Area=206,398 sf 0.00% Impervious Runoff Depth=0.66"
Flow Length=1,089' Tc=14.4 min CN=71 Runoff=3.73 cfs 0.262 af

Subcatchment FC-NW5: NW FC 5 Runoff Area=156,508 sf 0.00% Impervious Runoff Depth=0.66"
Flow Length=924' Tc=12.5 min CN=71 Runoff=3.05 cfs 0.199 af

Subcatchment FC-NW6: NW FC 6 Runoff Area=61,906 sf 0.00% Impervious Runoff Depth=0.66"
Flow Length=763' Tc=12.2 min CN=71 Runoff=1.22 cfs 0.079 af

Subcatchment FC-NW7A: NW FC 7A Runoff Area=26,678 sf 34.64% Impervious Runoff Depth=1.12"
Flow Length=294' Tc=2.2 min CN=80 Runoff=1.43 cfs 0.057 af

Subcatchment FC-NW7B: NW FC 7B Runoff Area=92,091 sf 4.67% Impervious Runoff Depth=0.71"
Flow Length=765' Tc=12.2 min CN=72 Runoff=1.97 cfs 0.125 af

Subcatchment FC-NW8: NW FC 8 Runoff Area=198,885 sf 6.07% Impervious Runoff Depth=0.75"
Flow Length=765' Tc=12.2 min CN=73 Runoff=4.60 cfs 0.287 af

Subcatchment FC-NW9: NW FC 9 Runoff Area=217,535 sf 7.43% Impervious Runoff Depth=0.75"
Flow Length=767' Tc=12.3 min CN=73 Runoff=5.01 cfs 0.314 af

Subcatchment FC-W1: W FC 1 Runoff Area=261,734 sf 0.00% Impervious Runoff Depth=0.66"
Flow Length=1,589' Tc=20.0 min CN=71 Runoff=3.86 cfs 0.333 af

Subcatchment FC-W2: W FC 2 Runoff Area=227,154 sf 0.00% Impervious Runoff Depth=0.66"
Flow Length=1,468' Tc=18.9 min CN=71 Runoff=3.47 cfs 0.289 af

Subcatchment FC-W3: W FC 3 Runoff Area=388,269 sf 0.00% Impervious Runoff Depth=0.66"
Flow Length=1,865' Tc=22.7 min CN=71 Runoff=5.27 cfs 0.494 af

Subcatchment FC-W4: W FC 4 Runoff Area=333,000 sf 0.00% Impervious Runoff Depth=0.66"
Flow Length=1,817' Tc=22.2 min CN=71 Runoff=4.58 cfs 0.423 af

Subcatchment FC-W5: W FC 5 Runoff Area=330,928 sf 0.00% Impervious Runoff Depth=0.66"
Flow Length=1,612' Tc=19.2 min CN=71 Runoff=5.02 cfs 0.421 af

Subcatchment FC-W6: W FC 6 Runoff Area=274,510 sf 0.00% Impervious Runoff Depth=0.66"
Flow Length=1,371' Tc=16.4 min CN=71 Runoff=4.59 cfs 0.349 af

Subcatchment FC-W7: W FC 7 Runoff Area=190,046 sf 0.00% Impervious Runoff Depth=0.66"
Flow Length=1,193' Tc=14.2 min CN=71 Runoff=3.45 cfs 0.242 af

Subcatchment FC-W8: W FC 8 Runoff Area=86,180 sf 0.00% Impervious Runoff Depth=0.66"
Flow Length=1,001' Tc=13.8 min CN=71 Runoff=1.59 cfs 0.110 af

Subcatchment PD-N1: N Pond Direct Runoff Area=104,271 sf 0.00% Impervious Runoff Depth=2.60"
Tc=0.0 min CN=98 Runoff=11.37 cfs 0.518 af

Subcatchment PD-NW1: NW Pond Direct Runoff Area=89,015 sf 0.00% Impervious Runoff Depth=2.60"
Tc=0.0 min CN=98 Runoff=9.71 cfs 0.443 af

Subcatchment PD-W1: W Pond Direct Runoff Area=62,704 sf 0.00% Impervious Runoff Depth=2.60"
Tc=0.0 min CN=98 Runoff=6.84 cfs 0.312 af

Reach CH-N1: N Chnl 1 - 16' FlxM Avg. Flow Depth=0.34' Max Vel=7.50 fps Inflow=31.24 cfs 2.469 af
n=0.052 L=28.8' S=0.3056 '/' Capacity=362.90 cfs Outflow=31.24 cfs 2.469 af

Reach CH-N10: N Chnl 10 - 8' FlxM Avg. Flow Depth=0.30' Max Vel=5.29 fps Inflow=6.52 cfs 0.446 af
n=0.056 L=85.7' S=0.2305 '/' Capacity=99.33 cfs Outflow=6.52 cfs 0.446 af

Reach CH-N11: N Chnl 11 - 5.5' FlxM Avg. Flow Depth=0.48' Max Vel=6.29 fps Inflow=5.25 cfs 0.365 af
n=0.053 L=96.5' S=0.2306 '/' Capacity=45.88 cfs Outflow=5.25 cfs 0.365 af

Reach CH-N12: N Chnl 12 - 5.5' FlxM Avg. Flow Depth=0.38' Max Vel=5.40 fps Inflow=3.39 cfs 0.209 af
n=0.055 L=84.5' S=0.2308 '/' Capacity=44.23 cfs Outflow=3.39 cfs 0.209 af

Reach CH-N13: N Chnl 13 - 5.5' FlxM Avg. Flow Depth=0.32' Max Vel=4.83 fps Inflow=2.46 cfs 0.154 af
n=0.057 L=86.7' S=0.2364 '/' Capacity=43.20 cfs Outflow=2.46 cfs 0.154 af

Reach CH-N14: N Chnl 14 - 5.5' FlxM Avg. Flow Depth=0.22' Max Vel=3.39 fps Inflow=1.08 cfs 0.056 af
n=0.066 L=92.2' S=0.2386 '/' Capacity=37.48 cfs Outflow=1.08 cfs 0.056 af

Reach CH-N15: N Chnl 15 - 5.5' FlxM Avg. Flow Depth=0.16' Max Vel=2.66 fps Inflow=0.58 cfs 0.029 af
n=0.074 L=60.0' S=0.2667 '/' Capacity=35.34 cfs Outflow=0.58 cfs 0.029 af

Reach CH-N2: N Chnl 2 - 16' FlxM Avg. Flow Depth=0.32' Max Vel=7.06 fps Inflow=27.57 cfs 2.207 af
n=0.053 L=119.1' S=0.3039 '/' Capacity=355.12 cfs Outflow=27.57 cfs 2.207 af

Reach CH-N3: N Chnl 3 - 16' FlxM Avg. Flow Depth=0.30' Max Vel=6.54 fps Inflow=23.75 cfs 1.933 af
n=0.055 L=122.8' S=0.3086 '/' Capacity=344.83 cfs Outflow=23.74 cfs 1.933 af

Reach CH-N4A: N Chnl 4 - 16' FlxM Avg. Flow Depth=0.28' Max Vel=6.20 fps Inflow=20.62 cfs 1.708 af
n=0.057 L=24.2' S=0.3306 '/' Capacity=344.36 cfs Outflow=20.62 cfs 1.708 af

Reach CH-N4B: N Chnl 4 - 16' FlxM Avg. Flow Depth=0.28' Max Vel=6.14 fps Inflow=20.62 cfs 1.708 af
n=0.057 L=87.0' S=0.3207 '/' Capacity=339.17 cfs Outflow=20.61 cfs 1.708 af

Reach CH-N5: N Chnl 5 - 12' FlxM Avg. Flow Depth=0.32' Max Vel=7.45 fps Inflow=19.02 cfs 1.504 af
n=0.051 L=61.6' S=0.3328 '/' Capacity=257.03 cfs Outflow=19.02 cfs 1.504 af

Reach CH-N6: N Chnl 6 - 12' FlxM Avg. Flow Depth=0.32' Max Vel=6.35 fps Inflow=16.58 cfs 1.271 af
n=0.051 L=71.7' S=0.2357 '/' Capacity=216.31 cfs Outflow=16.57 cfs 1.271 af

Reach CH-N7: N Chnl 7 - 8' FlxM Avg. Flow Depth=0.42' Max Vel=7.24 fps Inflow=12.72 cfs 0.958 af
n=0.051 L=89.3' S=0.2452 '/' Capacity=112.51 cfs Outflow=12.72 cfs 0.958 af

Reach CH-N8: N Chnl 8 - 8' FlxM Avg. Flow Depth=0.37' Max Vel=6.66 fps Inflow=10.29 cfs 0.771 af
n=0.052 L=73.4' S=0.2466 '/' Capacity=110.65 cfs Outflow=10.28 cfs 0.771 af

Reach CH-N9: N Chnl 9 - 8' FlxM Avg. Flow Depth=0.35' Max Vel=6.07 fps Inflow=8.70 cfs 0.664 af
n=0.053 L=93.3' S=0.2304 '/' Capacity=104.95 cfs Outflow=8.70 cfs 0.664 af

Reach CH-NB6: N Chnl Bnch 6 Avg. Flow Depth=0.11' Max Vel=1.19 fps Inflow=1.53 cfs 0.105 af
n=0.030 L=793.3' S=0.0120 '/' Capacity=174.96 cfs Outflow=1.04 cfs 0.105 af

Reach CH-NW1: NW Chnl 1 - 16' FlxM Avg. Flow Depth=0.36' Max Vel=7.39 fps Inflow=32.43 cfs 2.370 af
n=0.057 L=26.7' S=0.3333 '/' Capacity=345.79 cfs Outflow=32.43 cfs 2.370 af

Reach CH-NW10: NW Chnl 10 - 5.5' FlxM Avg. Flow Depth=0.36' Max Vel=5.24 fps Inflow=2.99 cfs 0.194 af
n=0.063 L=130.0' S=0.3077 '/' Capacity=44.59 cfs Outflow=2.99 cfs 0.194 af

Reach CH-NW2: NW Chnl 2 - 16' FlxM Avg. Flow Depth=0.33' Max Vel=7.11 fps Inflow=28.11 cfs 2.016 af
n=0.054 L=120.0' S=0.3167 '/' Capacity=355.76 cfs Outflow=28.10 cfs 2.016 af

Reach CH-NW3: NW Chnl 3 - 12' FlxM Avg. Flow Depth=0.40' Max Vel=7.61 fps Inflow=24.58 cfs 1.694 af
n=0.056 L=120.0' S=0.3167 '/' Capacity=228.34 cfs Outflow=24.57 cfs 1.694 af

Reach CH-NW4: NW Chnl 4 - 12' FlxM Avg. Flow Depth=0.36' Max Vel=7.27 fps Inflow=21.08 cfs 1.413 af
n=0.055 L=120.0' S=0.3167 '/' Capacity=232.49 cfs Outflow=21.07 cfs 1.413 af

Reach CH-NW5: NW Chnl 5 - 12' FlxM Avg. Flow Depth=0.32' Max Vel=6.61 fps Inflow=17.37 cfs 1.150 af
n=0.057 L=120.0' S=0.3167 '/' Capacity=224.33 cfs Outflow=17.36 cfs 1.150 af

Reach CH-NW6: NW Chnl 6 - 8' FlxM Avg. Flow Depth=0.42' Max Vel=8.10 fps Inflow=14.34 cfs 0.951 af
n=0.052 L=120.0' S=0.3167 '/' Capacity=125.39 cfs Outflow=14.34 cfs 0.951 af

Reach CH-NW7: NW Chnl 7 - 8' FlxM Avg. Flow Depth=0.40' Max Vel=7.63 fps Inflow=12.76 cfs 0.853 af
n=0.055 L=44.0' S=0.3330 '/' Capacity=121.56 cfs Outflow=12.76 cfs 0.853 af

Reach CH-NW8: NW Chnl 8 - 8' FlxM Avg. Flow Depth=0.39' Max Vel=7.81 fps Inflow=12.56 cfs 0.795 af
n=0.051 L=83.0' S=0.3133 '/' Capacity=127.16 cfs Outflow=12.56 cfs 0.795 af

Reach CH-NW9: NW Chnl 9 - 8' FlxM Avg. Flow Depth=0.31' Max Vel=6.23 fps Inflow=7.99 cfs 0.508 af
n=0.056 L=130.0' S=0.3077 '/' Capacity=114.77 cfs Outflow=7.98 cfs 0.508 af

Reach CH-NWB6: NW Chnl Bnch 6 Avg. Flow Depth=0.06' Max Vel=0.84 fps Inflow=0.41 cfs 0.020 af
n=0.030 L=150.0' S=0.0133 '/' Capacity=184.62 cfs Outflow=0.39 cfs 0.020 af

Reach CH-PN1: Spillway 16' FlxM Avg. Flow Depth=0.00' Max Vel=0.00 fps Inflow=0.00 cfs 0.000 af
n=0.053 L=21.0' S=0.3333 '/' Capacity=531.43 cfs Outflow=0.00 cfs 0.000 af

Reach CH-PNW1: Spillway 16' FlxM Avg. Flow Depth=0.00' Max Vel=0.00 fps Inflow=0.00 cfs 0.000 af
n=0.053 L=25.0' S=0.3200 '/' Capacity=520.69 cfs Outflow=0.00 cfs 0.000 af

Reach CH-PW1: Spillway 16' FlxM Avg. Flow Depth=0.00' Max Vel=0.00 fps Inflow=0.00 cfs 0.000 af
n=0.053 L=30.0' S=0.3233 '/' Capacity=523.39 cfs Outflow=0.00 cfs 0.000 af

Reach CH-W1: W Chnl 1 - 16' FlxM Avg. Flow Depth=0.34' Max Vel=7.60 fps Inflow=31.09 cfs 2.660 af
n=0.053 L=27.0' S=0.3333 '/' Capacity=371.89 cfs Outflow=31.09 cfs 2.660 af

Reach CH-W2: W Chnl 2 - 16' FlxM Avg. Flow Depth=0.31' Max Vel=7.23 fps Inflow=27.23 cfs 2.327 af
n=0.053 L=120.0' S=0.3333 '/' Capacity=371.89 cfs Outflow=27.23 cfs 2.327 af

Reach CH-W3: W Chnl 3 - 16' FlxM Avg. Flow Depth=0.30' Max Vel=6.67 fps Inflow=23.77 cfs 2.038 af
n=0.054 L=120.5' S=0.3154 '/' Capacity=355.02 cfs Outflow=23.77 cfs 2.038 af

Reach CH-W4: W Chnl 4 - 12' FlxM Avg. Flow Depth=0.33' Max Vel=6.96 fps Inflow=18.76 cfs 1.544 af
n=0.055 L=120.0' S=0.3167 '/' Capacity=232.49 cfs Outflow=18.76 cfs 1.544 af

Reach CH-W5: W Chnl 5 - 12' FlxM Avg. Flow Depth=0.28' Max Vel=6.46 fps Inflow=14.47 cfs 1.121 af
n=0.053 L=120.0' S=0.3167 '/' Capacity=241.26 cfs Outflow=14.46 cfs 1.121 af

Reach CH-W6: W Chnl 6 - 12' FlxM Avg. Flow Depth=0.22' Max Vel=5.37 fps Inflow=9.58 cfs 0.700 af
n=0.054 L=130.0' S=0.3000 '/' Capacity=230.48 cfs Outflow=9.57 cfs 0.700 af

Reach CH-W7: W Chnl 7 -5.5' FlxM Avg. Flow Depth=0.47' Max Vel=6.20 fps Inflow=5.01 cfs 0.351 af
n=0.053 L=174.0' S=0.2299 '/' Capacity=45.82 cfs Outflow=5.00 cfs 0.351 af

Reach CH-W8: W Chnl 8 - 5.5' FlxM Avg. Flow Depth=0.25' Max Vel=4.18 fps Inflow=1.58 cfs 0.110 af
n=0.058 L=179.0' S=0.2402 '/' Capacity=42.80 cfs Outflow=1.58 cfs 0.110 af

Reach D-N6: N Ramp Ditch 6 Avg. Flow Depth=0.12' Max Vel=5.50 fps Inflow=1.54 cfs 0.105 af
n=0.016 L=436.5' S=0.0745 '/' Capacity=430.04 cfs Outflow=1.53 cfs 0.105 af

Reach D-NW7: NW Ramp Ditch 7 Avg. Flow Depth=0.00' Max Vel=0.00 fps Inflow=0.00 cfs 0.000 af
n=0.016 L=163.0' S=0.0601 '/' Capacity=386.44 cfs Outflow=0.00 cfs 0.000 af

Pond B-N1: N Bench 1 Peak Elev=726.68' Storage=219 cf Inflow=31.24 cfs 2.469 af
Outflow=31.24 cfs 2.469 af

Pond B-N10: N Bench 10 Peak Elev=958.39' Storage=74 cf Inflow=6.53 cfs 0.446 af
Outflow=6.52 cfs 0.446 af

Pond B-N11: N Bench 11 Peak Elev=980.93' Storage=117 cf Inflow=5.26 cfs 0.365 af
Outflow=5.25 cfs 0.365 af

Pond B-N12: N Bench 12 Peak Elev=1,000.23' Storage=87 cf Inflow=3.40 cfs 0.209 af
Outflow=3.39 cfs 0.209 af

Pond B-N13: N Bench 13 Peak Elev=1,020.62' Storage=70 cf Inflow=2.47 cfs 0.154 af
Outflow=2.46 cfs 0.154 af

Pond B-N14: N Bench 14 Peak Elev=1,042.39' Storage=41 cf Inflow=1.09 cfs 0.056 af
Outflow=1.08 cfs 0.056 af

Pond B-N15: N Bench 15 Peak Elev=1,058.27' Storage=27 cf Inflow=0.59 cfs 0.029 af
Outflow=0.58 cfs 0.029 af

Pond B-N2: N Bench 2 Peak Elev=763.02' Storage=131 cf Inflow=27.57 cfs 2.207 af
Primary=27.57 cfs 2.207 af Secondary=0.00 cfs 0.000 af Outflow=27.57 cfs 2.207 af

Pond B-N3: N Bench 3 Peak Elev=801.84' Storage=87 cf Inflow=23.75 cfs 1.933 af
Outflow=23.75 cfs 1.933 af

Pond B-N4A: N Bench 4A w/ 18" Clvt Peak Elev=842.79' Storage=128 cf Inflow=0.93 cfs 0.058 af
Primary=0.86 cfs 0.058 af Secondary=0.00 cfs 0.000 af Outflow=0.86 cfs 0.058 af

Pond B-N4B: N Bench 4B Peak Elev=838.67' Storage=74 cf Inflow=20.62 cfs 1.708 af
Outflow=20.62 cfs 1.708 af

Pond B-N5: N Bench 5 Peak Elev=859.42' Storage=99 cf Inflow=19.02 cfs 1.504 af
Outflow=19.02 cfs 1.504 af

Pond B-N6: N Bench 6 Peak Elev=877.22' Storage=85 cf Inflow=16.58 cfs 1.271 af
Outflow=16.58 cfs 1.271 af

Pond B-N7: N Bench 7 Peak Elev=899.36' Storage=104 cf Inflow=12.72 cfs 0.958 af
Outflow=12.72 cfs 0.958 af

Pond B-N8: N Bench 8 Peak Elev=917.34' Storage=103 cf Inflow=10.29 cfs 0.771 af
Outflow=10.29 cfs 0.771 af

Pond B-N9: N Bench 9 Peak Elev=938.76' Storage=91 cf Inflow=8.70 cfs 0.664 af
Outflow=8.70 cfs 0.664 af

Pond B-NW1: NW Bench 1 Peak Elev=726.80' Storage=78 cf Inflow=32.43 cfs 2.370 af
Outflow=32.43 cfs 2.370 af

Pond B-NW10: NW Bench 10 Peak Elev=1,036.69' Storage=55 cf Inflow=3.00 cfs 0.194 af
Outflow=2.99 cfs 0.194 af

Pond B-NW2: NW Bench 2 Peak Elev=765.03' Storage=94 cf Inflow=28.11 cfs 2.016 af
Outflow=28.11 cfs 2.016 af

Pond B-NW3: NW Bench 3 Peak Elev=802.96' Storage=87 cf Inflow=24.59 cfs 1.694 af
Outflow=24.58 cfs 1.694 af

Pond B-NW4: NW Bench 4 Peak Elev=840.88' Storage=77 cf Inflow=21.08 cfs 1.413 af
Outflow=21.08 cfs 1.413 af

Pond B-NW5: NW Bench 5 Peak Elev=879.12' Storage=105 cf Inflow=17.37 cfs 1.150 af
Outflow=17.37 cfs 1.150 af

Pond B-NW6: NW Bench 6 Peak Elev=917.02' Storage=93 cf Inflow=14.34 cfs 0.951 af
Outflow=14.34 cfs 0.951 af

Pond B-NW7A: NW Bench 7 w/ Box Cul Peak Elev=931.64' Storage=109 cf Inflow=12.77 cfs 0.853 af
Primary=12.76 cfs 0.853 af Secondary=0.00 cfs 0.000 af Outflow=12.76 cfs 0.853 af

Pond B-NW7B: N Bench 7B w/ 18" Clvt Peak Elev=920.83' Storage=82 cf Inflow=1.97 cfs 0.125 af
Primary=0.41 cfs 0.020 af Secondary=1.54 cfs 0.105 af Outflow=1.95 cfs 0.125 af

Pond B-NW8: NW Bench 8 Peak Elev=956.94' Storage=84 cf Inflow=12.56 cfs 0.795 af
Outflow=12.56 cfs 0.795 af

Pond B-NW9: NW Bench 9 Peak Elev=996.72' Storage=60 cf Inflow=7.99 cfs 0.508 af
Outflow=7.99 cfs 0.508 af

Pond B-W1: W Bench 1 Peak Elev=726.87' Storage=80 cf Inflow=31.09 cfs 2.660 af
Outflow=31.09 cfs 2.660 af

Pond B-W2: W Bench 2 Peak Elev=764.80' Storage=67 cf Inflow=27.23 cfs 2.327 af
Outflow=27.23 cfs 2.327 af

Pond B-W3: W Bench 3 Peak Elev=802.74' Storage=58 cf Inflow=23.77 cfs 2.038 af
Outflow=23.77 cfs 2.038 af

Pond B-W4: W Bench 4 Peak Elev=840.81' Storage=65 cf Inflow=18.76 cfs 1.544 af
Outflow=18.76 cfs 1.544 af

Pond B-W5: W Bench 5 Peak Elev=878.69' Storage=53 cf Inflow=14.47 cfs 1.121 af
Outflow=14.47 cfs 1.121 af

Pond B-W6: W Bench 6 Peak Elev=917.53' Storage=90 cf Inflow=9.58 cfs 0.700 af
Outflow=9.58 cfs 0.700 af

Pond B-W7: W Bench 7 Peak Elev=957.90' Storage=160 cf Inflow=5.02 cfs 0.351 af
Outflow=5.01 cfs 0.351 af

Pond B-W8: W Bench 8 Peak Elev=1,000.48' Storage=102 cf Inflow=1.59 cfs 0.110 af
Outflow=1.58 cfs 0.110 af

Pond CUL-N1: N Box Culvert Peak Elev=717.98' Inflow=31.24 cfs 2.469 af
120.0" x 48.0" Box Culvert n=0.012 L=50.0' S=0.0100 '/' Outflow=31.24 cfs 2.469 af

Pond CUL-N2: N Ramp Box Culvert Peak Elev=830.89' Inflow=20.62 cfs 1.708 af
96.0" x 48.0" Box Culvert n=0.010 L=35.0' S=0.0049 '/' Outflow=20.62 cfs 1.708 af

Pond CUL-NW1: NW Box Culvert Peak Elev=718.01' Inflow=32.43 cfs 2.370 af
120.0" x 48.0" Box Culvert n=0.012 L=40.0' S=0.0100 '/' Outflow=32.43 cfs 2.370 af

Pond CUL-W1: W Box Culvert Peak Elev=717.98' Inflow=31.09 cfs 2.660 af
120.0" x 48.0" Box Culvert n=0.012 L=40.0' S=0.0100 '/' Outflow=31.09 cfs 2.660 af

Pond P-N1: N Pond Peak Elev=702.48' Storage=208,574 cf Inflow=35.82 cfs 3.228 af
Primary=2.21 cfs 3.112 af Secondary=0.00 cfs 0.000 af Tertiary=0.00 cfs 0.000 af Outflow=2.21 cfs 3.112 af

Pond P-NW1: NW Pond Peak Elev=700.73' Storage=139,113 cf Inflow=33.46 cfs 2.812 af
Primary=2.76 cfs 2.766 af Secondary=0.00 cfs 0.000 af Tertiary=0.00 cfs 0.000 af Outflow=2.76 cfs 2.766 af

Pond P-W1: W Pond Peak Elev=714.75' Storage=151,359 cf Inflow=31.76 cfs 2.971 af
Primary=2.78 cfs 2.920 af Secondary=0.00 cfs 0.000 af Tertiary=0.00 cfs 0.000 af Outflow=2.78 cfs 2.920 af

Total Runoff Area = 142.727 ac Runoff Volume = 9.012 af Average Runoff Depth = 0.76"
98.95% Pervious = 141.230 ac 1.05% Impervious = 1.497 ac

Summary for Subcatchment 1S: N EX FC 1

Runoff = 3.46 cfs @ 12.08 hrs, Volume= 0.241 af, Depth= 0.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 2 year - 24 hour Rainfall=2.83"

Area (sf)	CN	Description
189,400	71	Meadow, non-grazed, HSG C
189,400		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	120	0.3300	0.35		**Sheet Flow, 3:1 Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
1.8	230	0.0200	2.12		**Shallow Concentrated Flow, Ditch Flow** Grassed Waterway Kv= 15.0 fps
0.3	140	0.2000	6.71		**Shallow Concentrated Flow, Concentrated Flow** Grassed Waterway Kv= 15.0 fps
6.3	570	0.0100	1.50		**Shallow Concentrated Flow, Ditch Flow** Grassed Waterway Kv= 15.0 fps
14.1	1,060	Total			

Summary for Subcatchment FC-N1: N FC 1

Runoff = 3.74 cfs @ 12.08 hrs, Volume= 0.262 af, Depth= 0.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 2 year - 24 hour Rainfall=2.83"

Area (sf)	CN	Description
206,346	71	Meadow, non-grazed, HSG C
206,346		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	120	0.3300	0.35		**Sheet Flow, Slope Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
8.6	843	0.0120	1.64		**Shallow Concentrated Flow, Ditch Flow** Grassed Waterway Kv= 15.0 fps
14.3	963	Total			

Summary for Subcatchment FC-N10: N FC 10

Runoff = 1.33 cfs @ 12.04 hrs, Volume= 0.081 af, Depth= 0.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 2 year - 24 hour Rainfall=2.83"

Area (sf)	CN	Description
63,734	71	Meadow, non-grazed, HSG C
63,734		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	120	0.3300	0.35		**Sheet Flow, Slope Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
5.2	508	0.0120	1.64		**Shallow Concentrated Flow, Ditch Flow** Grassed Waterway Kv= 15.0 fps
10.9	628	Total			

Summary for Subcatchment FC-N11: N FC 11

Runoff = 2.06 cfs @ 12.11 hrs, Volume= 0.156 af, Depth= 0.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 2 year - 24 hour Rainfall=2.83"

Area (sf)	CN	Description
122,568	71	Meadow, non-grazed, HSG C
122,568		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.5	114	0.3300	0.35		**Sheet Flow, Slope Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
10.8	1,108	0.0130	1.71		**Shallow Concentrated Flow, Ditch Flow** Grassed Waterway Kv= 15.0 fps
16.3	1,222	Total			

Summary for Subcatchment FC-N12: N FC 12

Runoff = 0.96 cfs @ 12.02 hrs, Volume= 0.055 af, Depth= 0.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 2 year - 24 hour Rainfall=2.83"

Area (sf)	CN	Description
43,115	71	Meadow, non-grazed, HSG C
43,115		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	120	0.3300	0.35		**Sheet Flow, Slope Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
3.7	361	0.0120	1.64		**Shallow Concentrated Flow, Ditch Flow** Grassed Waterway Kv= 15.0 fps
9.4	481	Total			

Summary for Subcatchment FC-N13: N FC 13

Runoff = 1.49 cfs @ 12.06 hrs, Volume= 0.098 af, Depth= 0.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 2 year - 24 hour Rainfall=2.83"

Area (sf)	CN	Description
77,429	71	Meadow, non-grazed, HSG C
77,429		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.5	116	0.3330	0.35		**Sheet Flow, SlopeSheet Flow** Grass: Dense n= 0.240 P2= 2.83"
7.3	747	0.0130	1.71		**Shallow Concentrated Flow, Ditch Flow** Grassed Waterway Kv= 15.0 fps
12.8	863	Total			

Summary for Subcatchment FC-N14: N FC 14

Runoff = 0.51 cfs @ 12.00 hrs, Volume= 0.027 af, Depth= 0.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 2 year - 24 hour Rainfall=2.83"

Area (sf)	CN	Description
20,870	71	Meadow, non-grazed, HSG C
20,870		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.3	108	0.3300	0.34		**Sheet Flow, Slope Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
2.2	213	0.0115	1.61		**Shallow Concentrated Flow, Ditch Flow** Grassed Waterway Kv= 15.0 fps
7.5	321	Total			

Summary for Subcatchment FC-N15: N FC 15

Runoff = 0.59 cfs @ 11.99 hrs, Volume= 0.029 af, Depth= 0.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 2 year - 24 hour Rainfall=2.83"

Area (sf)	CN	Description
23,198	71	Meadow, non-grazed, HSG C
23,198		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.6	44	0.3300	0.29		**Sheet Flow, Slope Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
3.9	409	0.0137	1.76		**Shallow Concentrated Flow, Ditch Flow** Grassed Waterway Kv= 15.0 fps
6.5	453	Total			

Summary for Subcatchment FC-N2: N FC 2

Runoff = 3.90 cfs @ 12.08 hrs, Volume= 0.274 af, Depth= 0.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 2 year - 24 hour Rainfall=2.83"

Area (sf)	CN	Description
215,322	71	Meadow, non-grazed, HSG C
215,322		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	120	0.3300	0.35		**Sheet Flow, Slope Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
8.6	865	0.0125	1.68		**Shallow Concentrated Flow, Ditch Flow** Grassed Waterway Kv= 15.0 fps
14.3	985	Total			

Summary for Subcatchment FC-N3: N FC 3

Runoff = 3.17 cfs @ 12.09 hrs, Volume= 0.225 af, Depth= 0.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 2 year - 24 hour Rainfall=2.83"

Area (sf)	CN	Description
177,256	71	Meadow, non-grazed, HSG C
177,256		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.0	60	0.0500	0.14		**Sheet Flow, Top Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
7.6	810	0.0140	1.77		**Shallow Concentrated Flow, Ditch Flow** Grassed Waterway Kv= 15.0 fps
14.6	870	Total			

Summary for Subcatchment FC-N4A: N FC 4

Runoff = 0.93 cfs @ 12.05 hrs, Volume= 0.058 af, Depth= 0.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 2 year - 24 hour Rainfall=2.83"

Area (sf)	CN	Description
45,986	71	Meadow, non-grazed, HSG C
45,986		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	120	0.3300	0.35		**Sheet Flow, Slope Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
5.9	586	0.0120	1.64		**Shallow Concentrated Flow, Ditch Flow** Grassed Waterway Kv= 15.0 fps
11.6	706	Total			

Summary for Subcatchment FC-N4B: N FC 4

Runoff = 3.21 cfs @ 11.97 hrs, Volume= 0.145 af, Depth= 0.85"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 2 year - 24 hour Rainfall=2.83"

Area (sf)	CN	Description
75,024	71	Meadow, non-grazed, HSG C
14,070	98	Paved parking, HSG B
89,094	75	Weighted Average
75,024		84.21% Pervious Area
14,070		15.79% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.4	20	0.3300	0.24		**Sheet Flow, Slope Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
1.6	540	0.0800	5.74		**Shallow Concentrated Flow, Ditch Flow** Paved Kv= 20.3 fps
1.9	192	0.0120	1.64		**Shallow Concentrated Flow, Ditch Flow** Grassed Waterway Kv= 15.0 fps
4.9	752	Total			

Summary for Subcatchment FC-N5: N FC 5

Runoff = 2.68 cfs @ 12.16 hrs, Volume= 0.233 af, Depth= 0.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 2 year - 24 hour Rainfall=2.83"

Area (sf)	CN	Description
183,015	71	Meadow, non-grazed, HSG C
183,015		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	120	0.3300	0.35		**Sheet Flow, Slope Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
14.6	1,471	0.0125	1.68		**Shallow Concentrated Flow, Ditch Flow** Grassed Waterway Kv= 15.0 fps
20.3	1,591	Total			

Summary for Subcatchment FC-N6: N FC 6

Runoff = 3.21 cfs @ 12.07 hrs, Volume= 0.208 af, Depth= 0.75"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 2 year - 24 hour Rainfall=2.83"

Area (sf)	CN	Description
134,846	71	Meadow, non-grazed, HSG C
9,345	98	Paved parking, HSG B
144,191	73	Weighted Average
134,846		93.52% Pervious Area
9,345		6.48% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	120	0.3300	0.35		**Sheet Flow, Slope Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
7.5	755	0.0125	1.68		**Shallow Concentrated Flow, Ditch Flow** Grassed Waterway Kv= 15.0 fps
13.2	875	Total			

Summary for Subcatchment FC-N7: N FC 7

Runoff = 2.46 cfs @ 12.11 hrs, Volume= 0.187 af, Depth= 0.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 2 year - 24 hour Rainfall=2.83"

Area (sf)	CN	Description
146,829	71	Meadow, non-grazed, HSG C
146,829		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	120	0.3300	0.35		**Sheet Flow, Slope Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
10.6	1,089	0.0130	1.71		**Shallow Concentrated Flow, Ditch Flow** Grassed Waterway Kv= 15.0 fps
16.3	1,209	Total			

Summary for Subcatchment FC-N8: N FC 8

Runoff = 1.66 cfs @ 12.06 hrs, Volume= 0.107 af, Depth= 0.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 2 year - 24 hour Rainfall=2.83"

Area (sf)	CN	Description
84,345	71	Meadow, non-grazed, HSG C
84,345		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	120	0.3300	0.35		**Sheet Flow, Slope Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
6.6	655	0.0120	1.64		**Shallow Concentrated Flow, Ditch Flow** Grassed Waterway Kv= 15.0 fps
12.3	775	Total			

Summary for Subcatchment FC-N9: N FC 9

Runoff = 2.54 cfs @ 12.15 hrs, Volume= 0.218 af, Depth= 0.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 2 year - 24 hour Rainfall=2.83"

Area (sf)	CN	Description
171,400	71	Meadow, non-grazed, HSG C
171,400		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.5	114	0.3300	0.35		**Sheet Flow, Slope Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
14.3	1,466	0.0130	1.71		**Shallow Concentrated Flow, Ditch Flow** Grassed Waterway Kv= 15.0 fps
19.8	1,580	Total			

Summary for Subcatchment FC-NW1: NW FC 1

Runoff = 4.44 cfs @ 12.13 hrs, Volume= 0.354 af, Depth= 0.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 2 year - 24 hour Rainfall=2.83"

Area (sf)	CN	Description
278,073	71	Meadow, non-grazed, HSG C
278,073		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	120	0.3300	0.35		**Sheet Flow, Slope Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
12.0	1,207	0.0125	1.68		**Shallow Concentrated Flow, Ditch Flow** Grassed Waterway Kv= 15.0 fps
17.7	1,327	Total			

Summary for Subcatchment FC-NW10: NW FC 10

Runoff = 3.00 cfs @ 12.06 hrs, Volume= 0.194 af, Depth= 0.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 2 year - 24 hour Rainfall=2.83"

Area (sf)	CN	Description
152,624	71	Meadow, non-grazed, HSG C
152,624		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	120	0.3300	0.35		**Sheet Flow, Slope Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
6.6	652	0.0120	1.64		**Shallow Concentrated Flow, Ditch Flow** Grassed Waterway Kv= 15.0 fps
12.3	772	Total			

Summary for Subcatchment FC-NW2: NW FC 2

Runoff = 3.85 cfs @ 12.14 hrs, Volume= 0.323 af, Depth= 0.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 2 year - 24 hour Rainfall=2.83"

Area (sf)	CN	Description
253,669	71	Meadow, non-grazed, HSG C
253,669		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	120	0.3300	0.35		**Sheet Flow, Slope Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
6.8	545	0.0080	1.34		**Shallow Concentrated Flow, Ditch Flow** Grassed Waterway Kv= 15.0 fps
6.7	780	0.0166	1.93		**Shallow Concentrated Flow, Ditch Flow** Grassed Waterway Kv= 15.0 fps
19.2	1,445	Total			

Summary for Subcatchment FC-NW3: NW FC 3

Runoff = 3.64 cfs @ 12.11 hrs, Volume= 0.281 af, Depth= 0.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 2 year - 24 hour Rainfall=2.83"

Area (sf)	CN	Description
220,927	71	Meadow, non-grazed, HSG C
220,927		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	120	0.3300	0.35		**Sheet Flow, Slope Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
5.6	502	0.0100	1.50		**Shallow Concentrated Flow, 1% Shallow Flow** Grassed Waterway Kv= 15.0 fps
5.5	643	0.0170	1.96		**Shallow Concentrated Flow, Ditch Flow** Grassed Waterway Kv= 15.0 fps
16.8	1,265	Total			

Summary for Subcatchment FC-NW4: NW FC 4

Runoff = 3.73 cfs @ 12.08 hrs, Volume= 0.262 af, Depth= 0.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 2 year - 24 hour Rainfall=2.83"

Area (sf)	CN	Description
206,398	71	Meadow, non-grazed, HSG C
206,398		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	120	0.3300	0.35		**Sheet Flow, Slope Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
3.4	440	0.0210	2.17		**Shallow Concentrated Flow, 2% Shallow Flow** Grassed Waterway Kv= 15.0 fps
5.3	529	0.0125	1.68		**Shallow Concentrated Flow, Ditch Flow** Grassed Waterway Kv= 15.0 fps
14.4	1,089	Total			

Summary for Subcatchment FC-NW5: NW FC 5

Runoff = 3.05 cfs @ 12.06 hrs, Volume= 0.199 af, Depth= 0.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 2 year - 24 hour Rainfall=2.83"

Area (sf)	CN	Description
156,508	71	Meadow, non-grazed, HSG C
156,508		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	120	0.3300	0.35		**Sheet Flow, Slope Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
2.3	362	0.0300	2.60		**Shallow Concentrated Flow, 3% Shallow Flow** Grassed Waterway Kv= 15.0 fps
4.5	442	0.0120	1.64		**Shallow Concentrated Flow, Ditch Flow** Grassed Waterway Kv= 15.0 fps
12.5	924	Total			

Summary for Subcatchment FC-NW6: NW FC 6

Runoff = 1.22 cfs @ 12.06 hrs, Volume= 0.079 af, Depth= 0.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 2 year - 24 hour Rainfall=2.83"

Area (sf)	CN	Description
61,906	71	Meadow, non-grazed, HSG C
61,906		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	120	0.3300	0.35		**Sheet Flow, Slope Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
6.5	643	0.0120	1.64		**Shallow Concentrated Flow, Ditch Flow** Grassed Waterway Kv= 15.0 fps
12.2	763	Total			

Summary for Subcatchment FC-NW7A: NW FC 7A

Runoff = 1.43 cfs @ 11.93 hrs, Volume= 0.057 af, Depth= 1.12"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 2 year - 24 hour Rainfall=2.83"

Area (sf)	CN	Description
17,438	71	Meadow, non-grazed, HSG C
9,240	98	Paved parking, HSG B
26,678	80	Weighted Average
17,438		65.36% Pervious Area
9,240		34.64% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.4	20	0.3300	0.24		**Sheet Flow, Slope Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
0.8	274	0.0800	5.74		**Shallow Concentrated Flow, Ditch Flow** Paved Kv= 20.3 fps
2.2	294	Total			

Summary for Subcatchment FC-NW7B: NW FC 7B

Runoff = 1.97 cfs @ 12.05 hrs, Volume= 0.125 af, Depth= 0.71"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 2 year - 24 hour Rainfall=2.83"

Area (sf)	CN	Description
87,786	71	Meadow, non-grazed, HSG C
4,305	98	Paved parking, HSG B
92,091	72	Weighted Average
87,786		95.33% Pervious Area
4,305		4.67% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	120	0.3300	0.35		**Sheet Flow, Slope Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
6.5	645	0.0120	1.64		**Shallow Concentrated Flow, Ditch Flow** Grassed Waterway Kv= 15.0 fps
12.2	765	Total			

Summary for Subcatchment FC-NW8: NW FC 8

Runoff = 4.60 cfs @ 12.05 hrs, Volume= 0.287 af, Depth= 0.75"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 2 year - 24 hour Rainfall=2.83"

Area (sf)	CN	Description
186,810	71	Meadow, non-grazed, HSG C
12,075	98	Paved parking, HSG B
198,885	73	Weighted Average
186,810		93.93% Pervious Area
12,075		6.07% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	120	0.3300	0.35		**Sheet Flow, Slope Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
6.5	645	0.0120	1.64		**Shallow Concentrated Flow, Ditch Flow** Grassed Waterway Kv= 15.0 fps
12.2	765	Total			

Summary for Subcatchment FC-NW9: NW FC 9

Runoff = 5.01 cfs @ 12.06 hrs, Volume= 0.314 af, Depth= 0.75"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 2 year - 24 hour Rainfall=2.83"

Area (sf)	CN	Description
201,365	71	Meadow, non-grazed, HSG C
16,170	98	Paved parking, HSG B
217,535	73	Weighted Average
201,365		92.57% Pervious Area
16,170		7.43% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	120	0.3300	0.35		**Sheet Flow, Slope Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
6.6	647	0.0120	1.64		**Shallow Concentrated Flow, Ditch Flow** Grassed Waterway Kv= 15.0 fps
12.3	767	Total			

Summary for Subcatchment FC-W1: W FC 1

Runoff = 3.86 cfs @ 12.15 hrs, Volume= 0.333 af, Depth= 0.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 2 year - 24 hour Rainfall=2.83"

Area (sf)	CN	Description
261,734	71	Meadow, non-grazed, HSG C
261,734		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	120	0.3300	0.35		**Sheet Flow, Slope Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
14.3	1,469	0.0130	1.71		**Shallow Concentrated Flow, Ditch Flow** Grassed Waterway Kv= 15.0 fps
20.0	1,589	Total			

Summary for Subcatchment FC-W2: W FC 2

Runoff = 3.47 cfs @ 12.14 hrs, Volume= 0.289 af, Depth= 0.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 2 year - 24 hour Rainfall=2.83"

Area (sf)	CN	Description
227,154	71	Meadow, non-grazed, HSG C
227,154		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	120	0.3300	0.35		**Sheet Flow, Slope Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
13.2	1,348	0.0129	1.70		**Shallow Concentrated Flow, Ditch Flow** Grassed Waterway Kv= 15.0 fps
18.9	1,468	Total			

Summary for Subcatchment FC-W3: W FC 3

Runoff = 5.27 cfs @ 12.18 hrs, Volume= 0.494 af, Depth= 0.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 2 year - 24 hour Rainfall=2.83"

Area (sf)	CN	Description
388,269	71	Meadow, non-grazed, HSG C
388,269		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	120	0.3300	0.35		**Sheet Flow, Slope Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
17.0	1,745	0.0130	1.71		**Shallow Concentrated Flow, Ditch Flow** Grassed Waterway Kv= 15.0 fps
22.7	1,865	Total			

Summary for Subcatchment FC-W4: W FC 4

Runoff = 4.58 cfs @ 12.18 hrs, Volume= 0.423 af, Depth= 0.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 2 year - 24 hour Rainfall=2.83"

Area (sf)	CN	Description
333,000	71	Meadow, non-grazed, HSG C
333,000		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	120	0.3300	0.35		**Sheet Flow, Slope Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
16.5	1,697	0.0130	1.71		**Shallow Concentrated Flow, Ditch Flow** Grassed Waterway Kv= 15.0 fps
22.2	1,817	Total			

Summary for Subcatchment FC-W5: W FC 5

Runoff = 5.02 cfs @ 12.14 hrs, Volume= 0.421 af, Depth= 0.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 2 year - 24 hour Rainfall=2.83"

Area (sf)	CN	Description
330,928	71	Meadow, non-grazed, HSG C
330,928		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	120	0.3300	0.35		**Sheet Flow, Slope Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
0.6	167	0.1000	4.74		**Shallow Concentrated Flow, 10% Shallow Flow** Grassed Waterway Kv= 15.0 fps
12.9	1,325	0.0130	1.71		**Shallow Concentrated Flow, Ditch Flow** Grassed Waterway Kv= 15.0 fps
19.2	1,612	Total			

Summary for Subcatchment FC-W6: W FC 6

Runoff = 4.59 cfs @ 12.11 hrs, Volume= 0.349 af, Depth= 0.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 2 year - 24 hour Rainfall=2.83"

Area (sf)	CN	Description
274,510	71	Meadow, non-grazed, HSG C
274,510		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	120	0.3300	0.35		**Sheet Flow, Slope Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
0.9	266	0.1000	4.74		**Shallow Concentrated Flow, 10% Shallow Flow** Grassed Waterway Kv= 15.0 fps
9.8	985	0.0125	1.68		**Shallow Concentrated Flow, Ditch Flow** Grassed Waterway Kv= 15.0 fps
16.4	1,371	Total			

Summary for Subcatchment FC-W7: W FC 7

Runoff = 3.45 cfs @ 12.08 hrs, Volume= 0.242 af, Depth= 0.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 2 year - 24 hour Rainfall=2.83"

Area (sf)	CN	Description
190,046	71	Meadow, non-grazed, HSG C
190,046		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	120	0.3300	0.35		**Sheet Flow, Slope Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
0.8	233	0.1000	4.74		**Shallow Concentrated Flow, 10% Shallow Flow** Grassed Waterway Kv= 15.0 fps
7.7	840	0.0146	1.81		**Shallow Concentrated Flow, Ditch Flow** Grassed Waterway Kv= 15.0 fps
14.2	1,193	Total			

Summary for Subcatchment FC-W8: W FC 8

Runoff = 1.59 cfs @ 12.07 hrs, Volume= 0.110 af, Depth= 0.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 2 year - 24 hour Rainfall=2.83"

Area (sf)	CN	Description
86,180	71	Meadow, non-grazed, HSG C
86,180		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	120	0.3300	0.35		**Sheet Flow, Slope Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
0.7	211	0.1000	4.74		**Shallow Concentrated Flow, 10% Shallow Flow** Grassed Waterway Kv= 15.0 fps
7.4	670	0.0100	1.50		**Shallow Concentrated Flow, Ditch Flow** Grassed Waterway Kv= 15.0 fps
13.8	1,001	Total			

Summary for Subcatchment PD-N1: N Pond Direct

[46] Hint: Tc=0 (Instant runoff peak depends on dt)

Runoff = 11.37 cfs @ 11.90 hrs, Volume= 0.518 af, Depth= 2.60"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 2 year - 24 hour Rainfall=2.83"

Area (sf)	CN	Description
104,271	98	Water Surface, 0% imp, HSG B
104,271		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0					**Direct Entry, Direct Entry**

Summary for Subcatchment PD-NW1: NW Pond Direct

[46] Hint: Tc=0 (Instant runoff peak depends on dt)

Runoff = 9.71 cfs @ 11.90 hrs, Volume= 0.443 af, Depth= 2.60"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 2 year - 24 hour Rainfall=2.83"

Area (sf)	CN	Description
89,015	98	Water Surface, 0% imp, HSG B
89,015		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0					**Direct Entry, Direct Entry**

Summary for Subcatchment PD-W1: W Pond Direct

[46] Hint: Tc=0 (Instant runoff peak depends on dt)

Runoff = 6.84 cfs @ 11.90 hrs, Volume= 0.312 af, Depth= 2.60"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 2 year - 24 hour Rainfall=2.83"

Area (sf)	CN	Description
62,704	98	Water Surface, 0% imp, HSG B
62,704		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0					**Direct Entry, Direct Entry**

Summary for Reach CH-N1: N Chnl 1 - 16' FlxM

Inflow Area = 41.660 ac, 1.29% Impervious, Inflow Depth = 0.71" for 2 year - 24 hour event
Inflow = 31.24 cfs @ 12.10 hrs, Volume= 2.469 af
Outflow = 31.24 cfs @ 12.10 hrs, Volume= 2.469 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 7.50 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 2.05 fps, Avg. Travel Time= 0.2 min

Peak Storage= 120 cf @ 12.10 hrs
Average Depth at Peak Storage= 0.34'
Bank-Full Depth= 1.50' Flow Area= 19.9 sf, Capacity= 362.90 cfs

11.75' x 1.50' deep channel, n= 0.052
Side Slope Z-value= 1.0 '/' Top Width= 14.75'
Length= 28.8' Slope= 0.3056 '/'
Inlet Invert= 725.80', Outlet Invert= 717.00'

‡

Summary for Reach CH-N10: N Chnl 10 - 8' FlxM

Inflow Area = 8.056 ac, 0.00% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 6.52 cfs @ 12.07 hrs, Volume= 0.446 af
Outflow = 6.52 cfs @ 12.07 hrs, Volume= 0.446 af, Atten= 0%, Lag= 0.2 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 5.29 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 1.57 fps, Avg. Travel Time= 0.9 min

Peak Storage= 106 cf @ 12.07 hrs
Average Depth at Peak Storage= 0.30'
Bank-Full Depth= 1.50' Flow Area= 7.9 sf, Capacity= 99.33 cfs

3.75' x 1.50' deep channel, n= 0.056
Side Slope Z-value= 1.0 '/' Top Width= 6.75'
Length= 85.7' Slope= 0.2305 '/'
Inlet Invert= 957.75', Outlet Invert= 938.00'

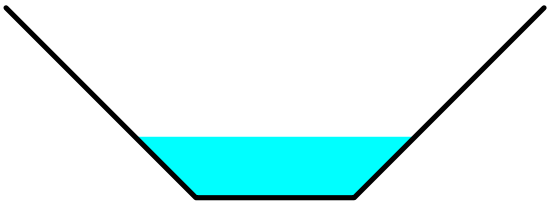
Summary for Reach CH-N11: N Chnl 11 - 5.5' FlxM

Inflow Area = 6.593 ac, 0.00% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 5.25 cfs @ 12.07 hrs, Volume= 0.365 af
Outflow = 5.25 cfs @ 12.07 hrs, Volume= 0.365 af, Atten= 0%, Lag= 0.2 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 6.29 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 2.17 fps, Avg. Travel Time= 0.7 min

Peak Storage= 81 cf @ 12.07 hrs
Average Depth at Peak Storage= 0.48'
Bank-Full Depth= 1.50' Flow Area= 4.1 sf, Capacity= 45.88 cfs

1.25' x 1.50' deep channel, n= 0.053
Side Slope Z-value= 1.0 '/' Top Width= 4.25'
Length= 96.5' Slope= 0.2306 '/'
Inlet Invert= 980.00', Outlet Invert= 957.75'



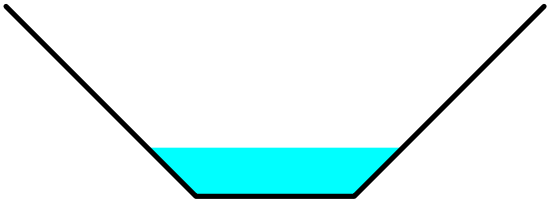
Summary for Reach CH-N12: N Chnl 12 - 5.5' FlxM

Inflow Area = 3.779 ac, 0.00% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 3.39 cfs @ 12.04 hrs, Volume= 0.209 af
Outflow = 3.39 cfs @ 12.05 hrs, Volume= 0.209 af, Atten= 0%, Lag= 0.2 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 5.40 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 1.76 fps, Avg. Travel Time= 0.8 min

Peak Storage= 53 cf @ 12.05 hrs
Average Depth at Peak Storage= 0.38'
Bank-Full Depth= 1.50' Flow Area= 4.1 sf, Capacity= 44.23 cfs

1.25' x 1.50' deep channel, n= 0.055
Side Slope Z-value= 1.0 '/' Top Width= 4.25'
Length= 84.5' Slope= 0.2308 '/'
Inlet Invert= 999.50', Outlet Invert= 980.00'



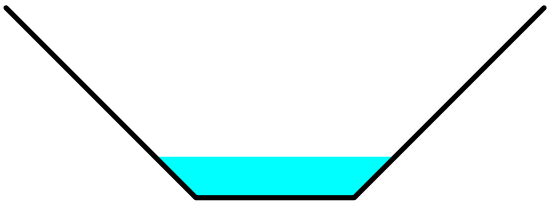
Summary for Reach CH-N13: N Chnl 13 - 5.5' FlxM

Inflow Area = 2.789 ac, 0.00% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 2.46 cfs @ 12.04 hrs, Volume= 0.154 af
Outflow = 2.46 cfs @ 12.05 hrs, Volume= 0.154 af, Atten= 0%, Lag= 0.2 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 4.83 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 1.57 fps, Avg. Travel Time= 0.9 min

Peak Storage= 44 cf @ 12.05 hrs
Average Depth at Peak Storage= 0.32'
Bank-Full Depth= 1.50' Flow Area= 4.1 sf, Capacity= 43.20 cfs

1.25' x 1.50' deep channel, n= 0.057
Side Slope Z-value= 1.0 '/' Top Width= 4.25'
Length= 86.7' Slope= 0.2364 '/'
Inlet Invert= 1,020.00', Outlet Invert= 999.50'



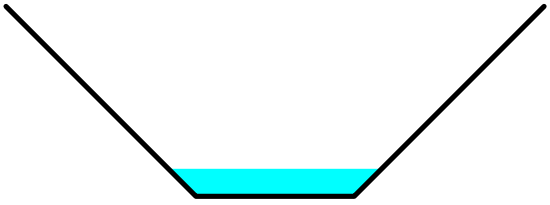
Summary for Reach CH-N14: N Chnl 14 - 5.5' FlxM

Inflow Area = 1.012 ac, 0.00% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 1.08 cfs @ 12.01 hrs, Volume= 0.056 af
Outflow = 1.08 cfs @ 12.02 hrs, Volume= 0.056 af, Atten= 0%, Lag= 0.3 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 3.39 fps, Min. Travel Time= 0.5 min
Avg. Velocity = 1.01 fps, Avg. Travel Time= 1.5 min

Peak Storage= 29 cf @ 12.02 hrs
Average Depth at Peak Storage= 0.22'
Bank-Full Depth= 1.50' Flow Area= 4.1 sf, Capacity= 37.48 cfs

1.25' x 1.50' deep channel, n= 0.066
Side Slope Z-value= 1.0 '/' Top Width= 4.25'
Length= 92.2' Slope= 0.2386 '/'
Inlet Invert= 1,042.00', Outlet Invert= 1,020.00'



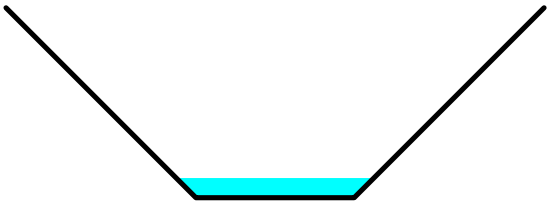
Summary for Reach CH-N15: N Chnl 15 - 5.5' FlxM

Inflow Area = 0.533 ac, 0.00% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 0.58 cfs @ 12.00 hrs, Volume= 0.029 af
Outflow = 0.58 cfs @ 12.00 hrs, Volume= 0.029 af, Atten= 0%, Lag= 0.2 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 2.66 fps, Min. Travel Time= 0.4 min
Avg. Velocity = 0.78 fps, Avg. Travel Time= 1.3 min

Peak Storage= 13 cf @ 12.00 hrs
Average Depth at Peak Storage= 0.16'
Bank-Full Depth= 1.50' Flow Area= 4.1 sf, Capacity= 35.34 cfs

1.25' x 1.50' deep channel, n= 0.074
Side Slope Z-value= 1.0 '/' Top Width= 4.25'
Length= 60.0' Slope= 0.2667 '/'
Inlet Invert= 1,058.00', Outlet Invert= 1,042.00'



Summary for Reach CH-N2: N Chnl 2 - 16' FlxM

Inflow Area = 36.923 ac, 1.46% Impervious, Inflow Depth = 0.72" for 2 year - 24 hour event
Inflow = 27.57 cfs @ 12.10 hrs, Volume= 2.207 af
Outflow = 27.57 cfs @ 12.10 hrs, Volume= 2.207 af, Atten= 0%, Lag= 0.2 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 7.06 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 1.95 fps, Avg. Travel Time= 1.0 min

Peak Storage= 465 cf @ 12.10 hrs
Average Depth at Peak Storage= 0.32'
Bank-Full Depth= 1.50' Flow Area= 19.9 sf, Capacity= 355.12 cfs

11.75' x 1.50' deep channel, n= 0.053
Side Slope Z-value= 1.0 '/' Top Width= 14.75'
Length= 119.1' Slope= 0.3039 '/'
Inlet Invert= 762.00', Outlet Invert= 725.80'

‡

Summary for Reach CH-N3: N Chnl 3 - 16' FlxM

Inflow Area = 31.980 ac, 1.68% Impervious, Inflow Depth = 0.73" for 2 year - 24 hour event
Inflow = 23.75 cfs @ 12.10 hrs, Volume= 1.933 af
Outflow = 23.74 cfs @ 12.10 hrs, Volume= 1.933 af, Atten= 0%, Lag= 0.2 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 6.54 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 1.82 fps, Avg. Travel Time= 1.1 min

Peak Storage= 445 cf @ 12.10 hrs
Average Depth at Peak Storage= 0.30'
Bank-Full Depth= 1.50' Flow Area= 19.9 sf, Capacity= 344.83 cfs

11.75' x 1.50' deep channel, n= 0.055
Side Slope Z-value= 1.0 '/' Top Width= 14.75'
Length= 122.8' Slope= 0.3086 '/'
Inlet Invert= 801.10', Outlet Invert= 763.20'

‡

Summary for Reach CH-N4A: N Chnl 4 - 16' FlxM

Inflow Area = 27.910 ac, 1.93% Impervious, Inflow Depth = 0.73" for 2 year - 24 hour event
Inflow = 20.62 cfs @ 12.10 hrs, Volume= 1.708 af
Outflow = 20.62 cfs @ 12.10 hrs, Volume= 1.708 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 6.20 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 1.75 fps, Avg. Travel Time= 0.2 min

Peak Storage= 81 cf @ 12.10 hrs
Average Depth at Peak Storage= 0.28'
Bank-Full Depth= 1.50' Flow Area= 19.9 sf, Capacity= 344.36 cfs

11.75' x 1.50' deep channel, n= 0.057
Side Slope Z-value= 1.0 '/' Top Width= 14.75'
Length= 24.2' Slope= 0.3306 '/'
Inlet Invert= 838.00', Outlet Invert= 830.00'

‡

Summary for Reach CH-N4B: N Chnl 4 - 16' FlxM

Inflow Area = 27.910 ac, 1.93% Impervious, Inflow Depth = 0.73" for 2 year - 24 hour event
Inflow = 20.62 cfs @ 12.10 hrs, Volume= 1.708 af
Outflow = 20.61 cfs @ 12.10 hrs, Volume= 1.708 af, Atten= 0%, Lag= 0.1 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 6.14 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 1.73 fps, Avg. Travel Time= 0.8 min

Peak Storage= 292 cf @ 12.10 hrs
Average Depth at Peak Storage= 0.28'
Bank-Full Depth= 1.50' Flow Area= 19.9 sf, Capacity= 339.17 cfs

11.75' x 1.50' deep channel, n= 0.057
Side Slope Z-value= 1.0 '/' Top Width= 14.75'
Length= 87.0' Slope= 0.3207 '/'
Inlet Invert= 829.00', Outlet Invert= 801.10'

‡

Summary for Reach CH-N5: N Chnl 5 - 12' FlxM

Inflow Area = 24.809 ac, 0.86% Impervious, Inflow Depth = 0.73" for 2 year - 24 hour event
Inflow = 19.02 cfs @ 12.10 hrs, Volume= 1.504 af
Outflow = 19.02 cfs @ 12.10 hrs, Volume= 1.504 af, Atten= 0%, Lag= 0.1 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 7.45 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 2.11 fps, Avg. Travel Time= 0.5 min

Peak Storage= 157 cf @ 12.10 hrs
Average Depth at Peak Storage= 0.32'
Bank-Full Depth= 1.50' Flow Area= 13.9 sf, Capacity= 257.03 cfs

7.75' x 1.50' deep channel, n= 0.051
Side Slope Z-value= 1.0 '/' Top Width= 10.75'
Length= 61.6' Slope= 0.3328 '/'
Inlet Invert= 858.60', Outlet Invert= 838.10'

Summary for Reach CH-N6: N Chnl 6 - 12' FlxM

Inflow Area = 20.608 ac, 1.04% Impervious, Inflow Depth = 0.74" for 2 year - 24 hour event
Inflow = 16.58 cfs @ 12.09 hrs, Volume= 1.271 af
Outflow = 16.57 cfs @ 12.10 hrs, Volume= 1.271 af, Atten= 0%, Lag= 0.1 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 6.35 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 1.77 fps, Avg. Travel Time= 0.7 min

Peak Storage= 187 cf @ 12.10 hrs
Average Depth at Peak Storage= 0.32'
Bank-Full Depth= 1.50' Flow Area= 13.9 sf, Capacity= 216.31 cfs

7.75' x 1.50' deep channel, n= 0.051
Side Slope Z-value= 1.0 '/' Top Width= 10.75'
Length= 71.7' Slope= 0.2357 '/'
Inlet Invert= 875.50', Outlet Invert= 858.60'

Summary for Reach CH-N7: N Chnl 7 - 8' FlxM

Inflow Area = 17.298 ac, 0.00% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 12.72 cfs @ 12.09 hrs, Volume= 0.958 af
Outflow = 12.72 cfs @ 12.09 hrs, Volume= 0.958 af, Atten= 0%, Lag= 0.1 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 7.24 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 2.23 fps, Avg. Travel Time= 0.7 min

Peak Storage= 157 cf @ 12.09 hrs
Average Depth at Peak Storage= 0.42'
Bank-Full Depth= 1.50' Flow Area= 7.9 sf, Capacity= 112.51 cfs

3.75' x 1.50' deep channel, n= 0.051
Side Slope Z-value= 1.0 '/' Top Width= 6.75'
Length= 89.3' Slope= 0.2452 '/'
Inlet Invert= 898.40', Outlet Invert= 876.50'

Summary for Reach CH-N8: N Chnl 8 - 8' FlxM

Inflow Area = 13.927 ac, 0.00% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 10.29 cfs @ 12.09 hrs, Volume= 0.771 af
Outflow = 10.28 cfs @ 12.09 hrs, Volume= 0.771 af, Atten= 0%, Lag= 0.1 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 6.66 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 2.05 fps, Avg. Travel Time= 0.6 min

Peak Storage= 113 cf @ 12.09 hrs
Average Depth at Peak Storage= 0.37'
Bank-Full Depth= 1.50' Flow Area= 7.9 sf, Capacity= 110.65 cfs

3.75' x 1.50' deep channel, n= 0.052
Side Slope Z-value= 1.0 '/' Top Width= 6.75'
Length= 73.4' Slope= 0.2466 '/'
Inlet Invert= 916.50', Outlet Invert= 898.40'

Summary for Reach CH-N9: N Chnl 9 - 8' FlxM

Inflow Area = 11.991 ac, 0.00% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 8.70 cfs @ 12.09 hrs, Volume= 0.664 af
Outflow = 8.70 cfs @ 12.09 hrs, Volume= 0.664 af, Atten= 0%, Lag= 0.2 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 6.07 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 1.89 fps, Avg. Travel Time= 0.8 min

Peak Storage= 134 cf @ 12.09 hrs
Average Depth at Peak Storage= 0.35'
Bank-Full Depth= 1.50' Flow Area= 7.9 sf, Capacity= 104.95 cfs

3.75' x 1.50' deep channel, n= 0.053
Side Slope Z-value= 1.0 '/' Top Width= 6.75'
Length= 93.3' Slope= 0.2304 '/'
Inlet Invert= 938.00', Outlet Invert= 916.50'

Summary for Reach CH-NB6: N Chnl Bnch 6

[62] Hint: Exceeded Reach D-N6 OUTLET depth by 0.03' @ 12.30 hrs

Inflow = 1.53 cfs @ 12.08 hrs, Volume= 0.105 af
Outflow = 1.04 cfs @ 12.18 hrs, Volume= 0.105 af, Atten= 32%, Lag= 5.9 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 1.19 fps, Min. Travel Time= 11.1 min
Avg. Velocity = 0.45 fps, Avg. Travel Time= 29.6 min

Peak Storage= 692 cf @ 12.18 hrs
Average Depth at Peak Storage= 0.11'
Bank-Full Depth= 2.00' Flow Area= 26.0 sf, Capacity= 174.96 cfs

8.00' x 2.00' deep channel, n= 0.030 Earth, dense weeds
Side Slope Z-value= 2.0 3.0 '/' Top Width= 18.00'
Length= 793.3' Slope= 0.0120 '/'
Inlet Invert= 888.00', Outlet Invert= 878.50'

‡

Summary for Reach CH-NW1: NW Chnl 1 - 16' FlxM

Inflow Area = 42.821 ac, 2.24% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 32.43 cfs @ 12.10 hrs, Volume= 2.370 af
Outflow = 32.43 cfs @ 12.10 hrs, Volume= 2.370 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 7.39 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 2.06 fps, Avg. Travel Time= 0.2 min

Peak Storage= 117 cf @ 12.10 hrs
Average Depth at Peak Storage= 0.36'
Bank-Full Depth= 1.50' Flow Area= 19.9 sf, Capacity= 345.79 cfs

11.75' x 1.50' deep channel, n= 0.057
Side Slope Z-value= 1.0 '/' Top Width= 14.75'
Length= 26.7' Slope= 0.3333 '/'
Inlet Invert= 725.90', Outlet Invert= 717.00'

‡

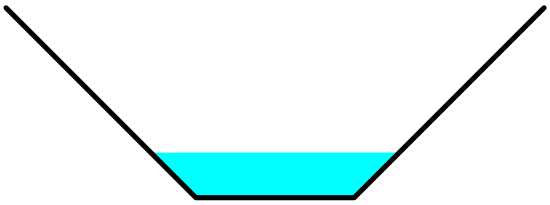
Summary for Reach CH-NW10: NW Chnl 10 - 5.5' FlxM

Inflow Area = 3.504 ac, 0.00% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 2.99 cfs @ 12.06 hrs, Volume= 0.194 af
Outflow = 2.99 cfs @ 12.07 hrs, Volume= 0.194 af, Atten= 0%, Lag= 0.3 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 5.24 fps, Min. Travel Time= 0.4 min
Avg. Velocity = 1.76 fps, Avg. Travel Time= 1.2 min

Peak Storage= 74 cf @ 12.07 hrs
Average Depth at Peak Storage= 0.36'
Bank-Full Depth= 1.50' Flow Area= 4.1 sf, Capacity= 44.59 cfs

1.25' x 1.50' deep channel, n= 0.063
Side Slope Z-value= 1.0 '/' Top Width= 4.25'
Length= 130.0' Slope= 0.3077 '/'
Inlet Invert= 1,036.00', Outlet Invert= 996.00'



Summary for Reach CH-NW2: NW Chnl 2 - 16' FlxM

Inflow Area = 36.438 ac, 2.63% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 28.11 cfs @ 12.09 hrs, Volume= 2.016 af
Outflow = 28.10 cfs @ 12.09 hrs, Volume= 2.016 af, Atten= 0%, Lag= 0.2 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 7.11 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 1.98 fps, Avg. Travel Time= 1.0 min

Peak Storage= 474 cf @ 12.09 hrs
Average Depth at Peak Storage= 0.33'
Bank-Full Depth= 1.50' Flow Area= 19.9 sf, Capacity= 355.76 cfs

11.75' x 1.50' deep channel, n= 0.054
Side Slope Z-value= 1.0 '/' Top Width= 14.75'
Length= 120.0' Slope= 0.3167 '/'
Inlet Invert= 764.00', Outlet Invert= 726.00'

‡

Summary for Reach CH-NW3: NW Chnl 3 - 12' FlxM

Inflow Area = 30.614 ac, 3.13% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 24.58 cfs @ 12.08 hrs, Volume= 1.694 af
Outflow = 24.57 cfs @ 12.09 hrs, Volume= 1.694 af, Atten= 0%, Lag= 0.2 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 7.61 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 2.10 fps, Avg. Travel Time= 1.0 min

Peak Storage= 387 cf @ 12.09 hrs
Average Depth at Peak Storage= 0.40'
Bank-Full Depth= 1.50' Flow Area= 13.9 sf, Capacity= 228.34 cfs

7.75' x 1.50' deep channel, n= 0.056
Side Slope Z-value= 1.0 '/' Top Width= 10.75'
Length= 120.0' Slope= 0.3167 '/'
Inlet Invert= 802.00', Outlet Invert= 764.00'

Summary for Reach CH-NW4: NW Chnl 4 - 12' FlxM

Inflow Area = 25.542 ac, 3.76% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 21.08 cfs @ 12.08 hrs, Volume= 1.413 af
Outflow = 21.07 cfs @ 12.08 hrs, Volume= 1.413 af, Atten= 0%, Lag= 0.2 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 7.27 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 1.99 fps, Avg. Travel Time= 1.0 min

Peak Storage= 348 cf @ 12.08 hrs
Average Depth at Peak Storage= 0.36'
Bank-Full Depth= 1.50' Flow Area= 13.9 sf, Capacity= 232.49 cfs

7.75' x 1.50' deep channel, n= 0.055
Side Slope Z-value= 1.0 '/' Top Width= 10.75'
Length= 120.0' Slope= 0.3167 '/'
Inlet Invert= 840.00', Outlet Invert= 802.00'

Summary for Reach CH-NW5: NW Chnl 5 - 12' FlxM

Inflow Area = 20.804 ac, 4.61% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 17.37 cfs @ 12.07 hrs, Volume= 1.150 af
Outflow = 17.36 cfs @ 12.07 hrs, Volume= 1.150 af, Atten= 0%, Lag= 0.2 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 6.61 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 1.80 fps, Avg. Travel Time= 1.1 min

Peak Storage= 315 cf @ 12.07 hrs
Average Depth at Peak Storage= 0.32'
Bank-Full Depth= 1.50' Flow Area= 13.9 sf, Capacity= 224.33 cfs

7.75' x 1.50' deep channel, n= 0.057
Side Slope Z-value= 1.0 '/' Top Width= 10.75'
Length= 120.0' Slope= 0.3167 '/'
Inlet Invert= 878.00', Outlet Invert= 840.00'

Summary for Reach CH-NW6: NW Chnl 6 - 8' FlxM

Inflow Area = 17.211 ac, 5.57% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 14.34 cfs @ 12.07 hrs, Volume= 0.951 af
Outflow = 14.34 cfs @ 12.07 hrs, Volume= 0.951 af, Atten= 0%, Lag= 0.2 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 8.10 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 2.29 fps, Avg. Travel Time= 0.9 min

Peak Storage= 212 cf @ 12.07 hrs
Average Depth at Peak Storage= 0.42'
Bank-Full Depth= 1.50' Flow Area= 7.9 sf, Capacity= 125.39 cfs

3.75' x 1.50' deep channel, n= 0.052
Side Slope Z-value= 1.0 '/' Top Width= 6.75'
Length= 120.0' Slope= 0.3167 '/'
Inlet Invert= 916.00', Outlet Invert= 878.00'

Summary for Reach CH-NW7: NW Chnl 7 - 8' FlxM

Inflow Area = 13.676 ac, 6.29% Impervious, Inflow Depth = 0.75" for 2 year - 24 hour event
Inflow = 12.76 cfs @ 12.07 hrs, Volume= 0.853 af
Outflow = 12.76 cfs @ 12.07 hrs, Volume= 0.853 af, Atten= 0%, Lag= 0.1 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 7.63 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 2.16 fps, Avg. Travel Time= 0.3 min

Peak Storage= 74 cf @ 12.07 hrs
Average Depth at Peak Storage= 0.40'
Bank-Full Depth= 1.50' Flow Area= 7.9 sf, Capacity= 121.56 cfs

3.75' x 1.50' deep channel, n= 0.055
Side Slope Z-value= 1.0 '/' Top Width= 6.75'
Length= 44.0' Slope= 0.3330 '/'
Inlet Invert= 930.65', Outlet Invert= 916.00'

Summary for Reach CH-NW8: NW Chnl 8 - 8' FlxM

Inflow Area = 13.063 ac, 4.96% Impervious, Inflow Depth = 0.73" for 2 year - 24 hour event
Inflow = 12.56 cfs @ 12.06 hrs, Volume= 0.795 af
Outflow = 12.56 cfs @ 12.06 hrs, Volume= 0.795 af, Atten= 0%, Lag= 0.1 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 7.81 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 2.30 fps, Avg. Travel Time= 0.6 min

Peak Storage= 133 cf @ 12.06 hrs
Average Depth at Peak Storage= 0.39'
Bank-Full Depth= 1.50' Flow Area= 7.9 sf, Capacity= 127.16 cfs

3.75' x 1.50' deep channel, n= 0.051
Side Slope Z-value= 1.0 '/' Top Width= 6.75'
Length= 83.0' Slope= 0.3133 '/'
Inlet Invert= 956.00', Outlet Invert= 930.00'

Summary for Reach CH-NW9: NW Chnl 9 - 8' FlxM

Inflow Area = 8.498 ac, 4.37% Impervious, Inflow Depth = 0.72" for 2 year - 24 hour event
Inflow = 7.99 cfs @ 12.06 hrs, Volume= 0.508 af
Outflow = 7.98 cfs @ 12.07 hrs, Volume= 0.508 af, Atten= 0%, Lag= 0.2 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 6.23 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 1.83 fps, Avg. Travel Time= 1.2 min

Peak Storage= 166 cf @ 12.07 hrs
Average Depth at Peak Storage= 0.31'
Bank-Full Depth= 1.50' Flow Area= 7.9 sf, Capacity= 114.77 cfs

3.75' x 1.50' deep channel, n= 0.056
Side Slope Z-value= 1.0 '/' Top Width= 6.75'
Length= 130.0' Slope= 0.3077 '/'
Inlet Invert= 996.00', Outlet Invert= 956.00'

Summary for Reach CH-NWB6: NW Chnl Bnch 6

Inflow Area = 2.114 ac, 4.67% Impervious, Inflow Depth = 0.11" for 2 year - 24 hour event
Inflow = 0.41 cfs @ 12.07 hrs, Volume= 0.020 af
Outflow = 0.39 cfs @ 12.10 hrs, Volume= 0.020 af, Atten= 5%, Lag= 1.9 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 0.84 fps, Min. Travel Time= 3.0 min
Avg. Velocity = 0.43 fps, Avg. Travel Time= 5.8 min

Peak Storage= 69 cf @ 12.10 hrs
Average Depth at Peak Storage= 0.06'
Bank-Full Depth= 2.00' Flow Area= 26.0 sf, Capacity= 184.62 cfs

8.00' x 2.00' deep channel, n= 0.030 Earth, dense weeds
Side Slope Z-value= 2.0 3.0 '/' Top Width= 18.00'
Length= 150.0' Slope= 0.0133 '/'
Inlet Invert= 920.00', Outlet Invert= 918.00'

‡

Summary for Reach CH-PN1: Spillway 16' FlxM

Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 0.00 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 0.00 fps, Avg. Travel Time= 0.0 min

Peak Storage= 0 cf @ 0.00 hrs
Average Depth at Peak Storage= 0.00'
Bank-Full Depth= 2.00' Flow Area= 24.6 sf, Capacity= 531.43 cfs

10.30' x 2.00' deep channel, n= 0.053
Side Slope Z-value= 1.0 '/' Top Width= 14.30'
Length= 21.0' Slope= 0.3333 '/'
Inlet Invert= 707.00', Outlet Invert= 700.00'

Summary for Reach CH-PNW1: Spillway 16' FlxM

Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 0.00 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 0.00 fps, Avg. Travel Time= 0.0 min

Peak Storage= 0 cf @ 0.00 hrs
Average Depth at Peak Storage= 0.00'
Bank-Full Depth= 2.00' Flow Area= 24.6 sf, Capacity= 520.69 cfs

10.30' x 2.00' deep channel, n= 0.053
Side Slope Z-value= 1.0 '/' Top Width= 14.30'
Length= 25.0' Slope= 0.3200 '/'
Inlet Invert= 708.00', Outlet Invert= 700.00'

Summary for Reach CH-PW1: Spillway 16' FlxM

Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 0.00 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 0.00 fps, Avg. Travel Time= 0.0 min

Peak Storage= 0 cf @ 0.00 hrs
Average Depth at Peak Storage= 0.00'
Bank-Full Depth= 2.00' Flow Area= 24.6 sf, Capacity= 523.39 cfs

10.30' x 2.00' deep channel, n= 0.053
Side Slope Z-value= 1.0 '/' Top Width= 14.30'
Length= 30.0' Slope= 0.3233 '/'
Inlet Invert= 719.70', Outlet Invert= 710.00'

Summary for Reach CH-W1: W Chnl 1 - 16' FlxM

Inflow Area = 48.022 ac, 0.00% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 31.09 cfs @ 12.15 hrs, Volume= 2.660 af
Outflow = 31.09 cfs @ 12.15 hrs, Volume= 2.660 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 7.60 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 2.34 fps, Avg. Travel Time= 0.2 min

Peak Storage= 110 cf @ 12.15 hrs
Average Depth at Peak Storage= 0.34'
Bank-Full Depth= 1.50' Flow Area= 19.9 sf, Capacity= 371.89 cfs

11.75' x 1.50' deep channel, n= 0.053
Side Slope Z-value= 1.0 '/' Top Width= 14.75'
Length= 27.0' Slope= 0.3333 '/'
Inlet Invert= 726.00', Outlet Invert= 717.00'

‡

Summary for Reach CH-W2: W Chnl 2 - 16' FlxM

Inflow Area = 42.013 ac, 0.00% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 27.23 cfs @ 12.15 hrs, Volume= 2.327 af
Outflow = 27.23 cfs @ 12.15 hrs, Volume= 2.327 af, Atten= 0%, Lag= 0.2 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 7.23 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 2.23 fps, Avg. Travel Time= 0.9 min

Peak Storage= 452 cf @ 12.15 hrs
Average Depth at Peak Storage= 0.31'
Bank-Full Depth= 1.50' Flow Area= 19.9 sf, Capacity= 371.89 cfs

11.75' x 1.50' deep channel, n= 0.053
Side Slope Z-value= 1.0 '/' Top Width= 14.75'
Length= 120.0' Slope= 0.3333 '/'
Inlet Invert= 764.00', Outlet Invert= 724.00'

‡

Summary for Reach CH-W3: W Chnl 3 - 16' FlxM

Inflow Area = 36.798 ac, 0.00% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 23.77 cfs @ 12.14 hrs, Volume= 2.038 af
Outflow = 23.77 cfs @ 12.15 hrs, Volume= 2.038 af, Atten= 0%, Lag= 0.2 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 6.67 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 2.07 fps, Avg. Travel Time= 1.0 min

Peak Storage= 430 cf @ 12.15 hrs
Average Depth at Peak Storage= 0.30'
Bank-Full Depth= 1.50' Flow Area= 19.9 sf, Capacity= 355.02 cfs

11.75' x 1.50' deep channel, n= 0.054
Side Slope Z-value= 1.0 '/' Top Width= 14.75'
Length= 120.5' Slope= 0.3154 '/'
Inlet Invert= 802.00', Outlet Invert= 764.00'

‡

Summary for Reach CH-W4: W Chnl 4 - 12' FlxM

Inflow Area = 27.885 ac, 0.00% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 18.76 cfs @ 12.13 hrs, Volume= 1.544 af
Outflow = 18.76 cfs @ 12.14 hrs, Volume= 1.544 af, Atten= 0%, Lag= 0.2 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 6.96 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 2.15 fps, Avg. Travel Time= 0.9 min

Peak Storage= 323 cf @ 12.14 hrs
Average Depth at Peak Storage= 0.33'
Bank-Full Depth= 1.50' Flow Area= 13.9 sf, Capacity= 232.49 cfs

7.75' x 1.50' deep channel, n= 0.055
Side Slope Z-value= 1.0 '/' Top Width= 10.75'
Length= 120.0' Slope= 0.3167 '/'
Inlet Invert= 840.00', Outlet Invert= 802.00'

Summary for Reach CH-W5: W Chnl 5 - 12' FlxM

Inflow Area = 20.240 ac, 0.00% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 14.47 cfs @ 12.12 hrs, Volume= 1.121 af
Outflow = 14.46 cfs @ 12.12 hrs, Volume= 1.121 af, Atten= 0%, Lag= 0.2 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 6.46 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 1.95 fps, Avg. Travel Time= 1.0 min

Peak Storage= 269 cf @ 12.12 hrs
Average Depth at Peak Storage= 0.28'
Bank-Full Depth= 1.50' Flow Area= 13.9 sf, Capacity= 241.26 cfs

7.75' x 1.50' deep channel, n= 0.053
Side Slope Z-value= 1.0 '/' Top Width= 10.75'
Length= 120.0' Slope= 0.3167 '/'
Inlet Invert= 878.00', Outlet Invert= 840.00'

Summary for Reach CH-W6: W Chnl 6 - 12' FlxM

Inflow Area = 12.643 ac, 0.00% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 9.58 cfs @ 12.10 hrs, Volume= 0.700 af
Outflow = 9.57 cfs @ 12.11 hrs, Volume= 0.700 af, Atten= 0%, Lag= 0.2 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 5.37 fps, Min. Travel Time= 0.4 min
Avg. Velocity = 1.61 fps, Avg. Travel Time= 1.3 min

Peak Storage= 232 cf @ 12.11 hrs
Average Depth at Peak Storage= 0.22'
Bank-Full Depth= 1.50' Flow Area= 13.9 sf, Capacity= 230.48 cfs

7.75' x 1.50' deep channel, n= 0.054
Side Slope Z-value= 1.0 '/' Top Width= 10.75'
Length= 130.0' Slope= 0.3000 '/'
Inlet Invert= 917.00', Outlet Invert= 878.00'

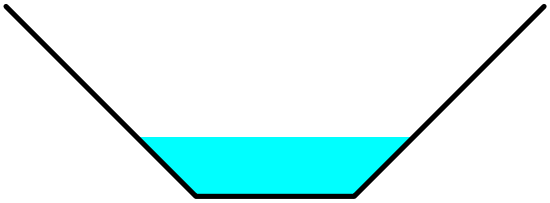
Summary for Reach CH-W7: W Chnl 7 -5.5' FlxM

Inflow Area = 6.341 ac, 0.00% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 5.01 cfs @ 12.09 hrs, Volume= 0.351 af
Outflow = 5.00 cfs @ 12.10 hrs, Volume= 0.351 af, Atten= 0%, Lag= 0.3 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 6.20 fps, Min. Travel Time= 0.5 min
Avg. Velocity = 2.13 fps, Avg. Travel Time= 1.4 min

Peak Storage= 140 cf @ 12.10 hrs
Average Depth at Peak Storage= 0.47'
Bank-Full Depth= 1.50' Flow Area= 4.1 sf, Capacity= 45.82 cfs

1.25' x 1.50' deep channel, n= 0.053
Side Slope Z-value= 1.0 '/' Top Width= 4.25'
Length= 174.0' Slope= 0.2299 '/'
Inlet Invert= 957.00', Outlet Invert= 917.00'



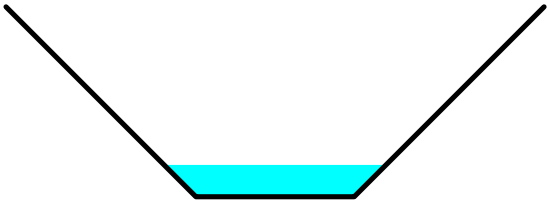
Summary for Reach CH-W8: W Chnl 8 - 5.5' FlxM

Inflow Area = 1.978 ac, 0.00% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 1.58 cfs @ 12.09 hrs, Volume= 0.110 af
Outflow = 1.58 cfs @ 12.10 hrs, Volume= 0.110 af, Atten= 0%, Lag= 0.5 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 4.18 fps, Min. Travel Time= 0.7 min
Avg. Velocity = 1.38 fps, Avg. Travel Time= 2.2 min

Peak Storage= 67 cf @ 12.10 hrs
Average Depth at Peak Storage= 0.25'
Bank-Full Depth= 1.50' Flow Area= 4.1 sf, Capacity= 42.80 cfs

1.25' x 1.50' deep channel, n= 0.058
Side Slope Z-value= 1.0 '/' Top Width= 4.25'
Length= 179.0' Slope= 0.2402 '/'
Inlet Invert= 1,000.00', Outlet Invert= 957.00'



Summary for Reach D-N6: N Ramp Ditch 6

Inflow = 1.54 cfs @ 12.07 hrs, Volume= 0.105 af
Outflow = 1.53 cfs @ 12.08 hrs, Volume= 0.105 af, Atten= 1%, Lag= 0.9 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 5.50 fps, Min. Travel Time= 1.3 min
Avg. Velocity = 2.03 fps, Avg. Travel Time= 3.6 min

Peak Storage= 121 cf @ 12.08 hrs
Average Depth at Peak Storage= 0.12'
Bank-Full Depth= 2.00' Flow Area= 16.0 sf, Capacity= 430.04 cfs

2.00' x 2.00' deep channel, n= 0.016 Asphalt, rough
Side Slope Z-value= 3.0 '/' Top Width= 14.00'
Length= 436.5' Slope= 0.0745 '/'
Inlet Invert= 920.50', Outlet Invert= 888.00'

Summary for Reach D-NW7: NW Ramp Ditch 7

Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 0.00 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 0.00 fps, Avg. Travel Time= 0.0 min

Peak Storage= 0 cf @ 0.00 hrs
Average Depth at Peak Storage= 0.00'
Bank-Full Depth= 2.00' Flow Area= 16.0 sf, Capacity= 386.44 cfs

2.00' x 2.00' deep channel, n= 0.016 Asphalt, rough
Side Slope Z-value= 3.0 '/' Top Width= 14.00'
Length= 163.0' Slope= 0.0601 '/'
Inlet Invert= 930.00', Outlet Invert= 920.20'

Summary for Pond B-N1: N Bench 1

[62] Hint: Exceeded Reach CH-N2 OUTLET depth by 0.55' @ 12.10 hrs

Inflow Area = 41.660 ac, 1.29% Impervious, Inflow Depth = 0.71" for 2 year - 24 hour event
Inflow = 31.24 cfs @ 12.10 hrs, Volume= 2.469 af
Outflow = 31.24 cfs @ 12.10 hrs, Volume= 2.469 af, Atten= 0%, Lag= 0.1 min
Primary = 31.24 cfs @ 12.10 hrs, Volume= 2.469 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 726.68' @ 12.10 hrs Surf.Area= 330 sf Storage= 219 cf
Flood Elev= 730.00' Surf.Area= 5,118 sf Storage= 6,508 cf

Plug-Flow detention time= 0.2 min calculated for 2.469 af (100% of inflow)
Center-of-Mass det. time= 0.2 min (890.4 - 890.2)

Volume	Invert	Avail.Storage	Storage Description
#1	725.80'	6,508 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
725.80	170	0	0
728.00	573	817	817
730.00	5,118	5,691	6,508

Device	Routing	Invert	Outlet Devices
#1	Primary	725.80'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 4.00 Width (feet) 11.75 19.75

Primary OutFlow Max=31.22 cfs @ 12.10 hrs HW=726.68' TW=726.14' (Dynamic Tailwater)
↑—**1=Custom Weir/Orifice** (Weir Controls 31.22 cfs @ 2.82 fps)

Summary for Pond B-N10: N Bench 10

[62] Hint: Exceeded Reach CH-N11 OUTLET depth by 0.16' @ 12.06 hrs

Inflow Area = 8.056 ac, 0.00% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 6.53 cfs @ 12.06 hrs, Volume= 0.446 af
Outflow = 6.52 cfs @ 12.07 hrs, Volume= 0.446 af, Atten= 0%, Lag= 0.1 min
Primary = 6.52 cfs @ 12.07 hrs, Volume= 0.446 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 958.39' @ 12.07 hrs Surf.Area= 140 sf Storage= 74 cf
Flood Elev= 961.75' Surf.Area= 2,270 sf Storage= 2,850 cf

Plug-Flow detention time= 0.4 min calculated for 0.446 af (100% of inflow)
Center-of-Mass det. time= 0.4 min (888.0 - 887.6)

Volume	Invert	Avail.Storage	Storage Description
#1	957.75'	2,850 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
957.75	90	0	0
959.75	245	335	335
961.75	2,270	2,515	2,850

Device	Routing	Invert	Outlet Devices
#1	Primary	957.75'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 4.00 Width (feet) 3.75 11.75

Primary OutFlow Max=6.52 cfs @ 12.07 hrs HW=958.39' TW=958.05' (Dynamic Tailwater)
└**1=Custom Weir/Orifice** (Weir Controls 6.52 cfs @ 2.31 fps)

Summary for Pond B-N11: N Bench 11

[62] Hint: Exceeded Reach CH-N12 OUTLET depth by 0.56' @ 12.09 hrs

Inflow Area = 6.593 ac, 0.00% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 5.26 cfs @ 12.06 hrs, Volume= 0.365 af
Outflow = 5.25 cfs @ 12.07 hrs, Volume= 0.365 af, Atten= 0%, Lag= 0.3 min
Primary = 5.25 cfs @ 12.07 hrs, Volume= 0.365 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 980.93' @ 12.07 hrs Surf.Area= 162 sf Storage= 117 cf
Flood Elev= 984.00' Surf.Area= 2,270 sf Storage= 2,850 cf

Plug-Flow detention time= 0.8 min calculated for 0.365 af (100% of inflow)
Center-of-Mass det. time= 0.8 min (888.1 - 887.3)

Volume	Invert	Avail.Storage	Storage Description
#1	980.00'	2,850 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
980.00	90	0	0
982.00	245	335	335
984.00	2,270	2,515	2,850

Device	Routing	Invert	Outlet Devices
#1	Primary	980.00'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 4.00 Width (feet) 1.25 9.25

Primary OutFlow Max=5.25 cfs @ 12.07 hrs HW=980.93' TW=980.48' (Dynamic Tailwater)
└**1=Custom Weir/Orifice** (Weir Controls 5.25 cfs @ 2.60 fps)

Summary for Pond B-N12: N Bench 12

[62] Hint: Exceeded Reach CH-N13 OUTLET depth by 0.41' @ 12.04 hrs

Inflow Area = 3.779 ac, 0.00% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 3.40 cfs @ 12.04 hrs, Volume= 0.209 af
Outflow = 3.39 cfs @ 12.04 hrs, Volume= 0.209 af, Atten= 0%, Lag= 0.3 min
Primary = 3.39 cfs @ 12.04 hrs, Volume= 0.209 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 1,000.23' @ 12.04 hrs Surf.Area= 147 sf Storage= 87 cf
Flood Elev= 1,003.50' Surf.Area= 2,270 sf Storage= 2,850 cf

Plug-Flow detention time= 1.0 min calculated for 0.209 af (100% of inflow)
Center-of-Mass det. time= 1.0 min (886.0 - 885.1)

Volume	Invert	Avail.Storage	Storage Description
#1	999.50'	2,850 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
999.50	90	0	0
1,001.50	245	335	335
1,003.50	2,270	2,515	2,850

Device	Routing	Invert	Outlet Devices
#1	Primary	999.50'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 4.00 Width (feet) 1.25 9.25

Primary OutFlow Max=3.39 cfs @ 12.04 hrs HW=1,000.23' TW=999.88' (Dynamic Tailwater)
↑**1=Custom Weir/Orifice** (Weir Controls 3.39 cfs @ 2.32 fps)

Summary for Pond B-N13: N Bench 13

[62] Hint: Exceeded Reach CH-N14 OUTLET depth by 0.42' @ 12.07 hrs

Inflow Area = 2.789 ac, 0.00% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 2.47 cfs @ 12.04 hrs, Volume= 0.154 af
Outflow = 2.46 cfs @ 12.04 hrs, Volume= 0.154 af, Atten= 0%, Lag= 0.3 min
Primary = 2.46 cfs @ 12.04 hrs, Volume= 0.154 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 1,020.62' @ 12.04 hrs Surf.Area= 138 sf Storage= 70 cf
Flood Elev= 1,024.00' Surf.Area= 2,270 sf Storage= 2,850 cf

Plug-Flow detention time= 1.1 min calculated for 0.154 af (100% of inflow)
Center-of-Mass det. time= 1.1 min (885.5 - 884.5)

Volume	Invert	Avail.Storage	Storage Description
#1	1,020.00'	2,850 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,020.00	90	0	0
1,022.00	245	335	335
1,024.00	2,270	2,515	2,850

Device	Routing	Invert	Outlet Devices
#1	Primary	1,020.00'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 4.00 Width (feet) 1.25 9.25

Primary OutFlow Max=2.46 cfs @ 12.04 hrs HW=1,020.62' TW=1,020.32' (Dynamic Tailwater)
↑**1=Custom Weir/Orifice** (Weir Controls 2.46 cfs @ 2.14 fps)

Summary for Pond B-N14: N Bench 14

[62] Hint: Exceeded Reach CH-N15 OUTLET depth by 0.24' @ 12.02 hrs

Inflow Area = 1.012 ac, 0.00% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 1.09 cfs @ 12.00 hrs, Volume= 0.056 af
Outflow = 1.08 cfs @ 12.01 hrs, Volume= 0.056 af, Atten= 1%, Lag= 0.4 min
Primary = 1.08 cfs @ 12.01 hrs, Volume= 0.056 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 1,042.39' @ 12.01 hrs Surf.Area= 120 sf Storage= 41 cf
Flood Elev= 1,046.00' Surf.Area= 2,270 sf Storage= 2,850 cf

Plug-Flow detention time= 1.5 min calculated for 0.056 af (100% of inflow)
Center-of-Mass det. time= 1.5 min (882.6 - 881.0)

Volume	Invert	Avail.Storage	Storage Description
#1	1,042.00'	2,850 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,042.00	90	0	0
1,044.00	245	335	335
1,046.00	2,270	2,515	2,850

Device	Routing	Invert	Outlet Devices
#1	Primary	1,042.00'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 4.00 Width (feet) 1.25 9.25

Primary OutFlow Max=1.08 cfs @ 12.01 hrs HW=1,042.39' TW=1,042.22' (Dynamic Tailwater)
↑**1=Custom Weir/Orifice** (Weir Controls 1.08 cfs @ 1.69 fps)

Summary for Pond B-N15: N Bench 15

Inflow Area = 0.533 ac, 0.00% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 0.59 cfs @ 11.99 hrs, Volume= 0.029 af
Outflow = 0.58 cfs @ 12.00 hrs, Volume= 0.029 af, Atten= 1%, Lag= 0.5 min
Primary = 0.58 cfs @ 12.00 hrs, Volume= 0.029 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 1,058.27' @ 12.00 hrs Surf.Area= 111 sf Storage= 27 cf
Flood Elev= 1,062.00' Surf.Area= 2,270 sf Storage= 2,850 cf

Plug-Flow detention time= 2.1 min calculated for 0.029 af (100% of inflow)
Center-of-Mass det. time= 1.9 min (881.0 - 879.1)

Volume	Invert	Avail.Storage	Storage Description
#1	1,058.00'	2,850 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,058.00	90	0	0
1,060.00	245	335	335
1,062.00	2,270	2,515	2,850

Device	Routing	Invert	Outlet Devices
#1	Primary	1,058.00'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 4.00 Width (feet) 1.25 9.25

Primary OutFlow Max=0.58 cfs @ 12.00 hrs HW=1,058.27' TW=1,058.16' (Dynamic Tailwater)
└**1=Custom Weir/Orifice** (Weir Controls 0.58 cfs @ 1.41 fps)

Summary for Pond B-N2: N Bench 2

Inflow Area = 36.923 ac, 1.46% Impervious, Inflow Depth = 0.72" for 2 year - 24 hour event
Inflow = 27.57 cfs @ 12.10 hrs, Volume= 2.207 af
Outflow = 27.57 cfs @ 12.10 hrs, Volume= 2.207 af, Atten= 0%, Lag= 0.1 min
Primary = 27.57 cfs @ 12.10 hrs, Volume= 2.207 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 763.02' @ 12.10 hrs Surf.Area= 169 sf Storage= 131 cf
Flood Elev= 766.00' Surf.Area= 2,270 sf Storage= 2,850 cf

Plug-Flow detention time= 0.1 min calculated for 2.207 af (100% of inflow)
Center-of-Mass det. time= 0.1 min (890.0 - 889.8)

Volume	Invert	Avail.Storage	Storage Description
#1	762.00'	14,348 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
762.00	90	0	0
764.00	245	335	335
766.00	2,270	2,515	2,850
768.00	9,228	11,498	14,348

Device	Routing	Invert	Outlet Devices
#1	Primary	762.00'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 4.00 Width (feet) 7.75 15.75
#2	Secondary	766.00'	**100.0' long x 2.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32

Primary OutFlow Max=27.57 cfs @ 12.10 hrs HW=763.02' TW=762.32' (Dynamic Tailwater)
└**1=Custom Weir/Orifice** (Weir Controls 27.57 cfs @ 3.10 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=762.00' TW=725.80' (Dynamic Tailwater)
└**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond B-N3: N Bench 3

[62] Hint: Exceeded Reach CH-N4B OUTLET depth by 0.46' @ 12.10 hrs

Inflow Area = 31.980 ac, 1.68% Impervious, Inflow Depth = 0.73" for 2 year - 24 hour event
Inflow = 23.75 cfs @ 12.10 hrs, Volume= 1.933 af
Outflow = 23.75 cfs @ 12.10 hrs, Volume= 1.933 af, Atten= 0%, Lag= 0.1 min
Primary = 23.75 cfs @ 12.10 hrs, Volume= 1.933 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 801.84' @ 12.10 hrs Surf.Area= 147 sf Storage= 87 cf
Flood Elev= 805.10' Surf.Area= 2,270 sf Storage= 2,850 cf

Plug-Flow detention time= 0.1 min calculated for 1.933 af (100% of inflow)
Center-of-Mass det. time= 0.1 min (889.6 - 889.5)

Volume	Invert	Avail.Storage	Storage Description
#1	801.10'	2,850 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
801.10	90	0	0
803.10	245	335	335
805.10	2,270	2,515	2,850

Device	Routing	Invert	Outlet Devices
#1	Primary	801.10'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 4.00 Width (feet) 11.75 19.75

Primary OutFlow Max=23.75 cfs @ 12.10 hrs HW=801.84' TW=801.40' (Dynamic Tailwater)
↑**1=Custom Weir/Orifice** (Weir Controls 23.75 cfs @ 2.58 fps)

Summary for Pond B-N4A: N Bench 4A w/ 18" Clvt

Inflow Area = 1.056 ac, 0.00% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 0.93 cfs @ 12.05 hrs, Volume= 0.058 af
Outflow = 0.86 cfs @ 12.09 hrs, Volume= 0.058 af, Atten= 8%, Lag= 2.3 min
Primary = 0.86 cfs @ 12.09 hrs, Volume= 0.058 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 842.79' @ 12.09 hrs Surf.Area= 528 sf Storage= 128 cf
Flood Elev= 844.00' Surf.Area= 1,545 sf Storage= 1,419 cf

Plug-Flow detention time= 2.3 min calculated for 0.058 af (100% of inflow)
Center-of-Mass det. time= 2.3 min (886.2 - 883.8)

Volume	Invert	Avail.Storage	Storage Description
#1	842.30'	7,494 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
842.30	0	0	0
843.00	760	266	266
844.00	1,545	1,153	1,419
846.00	4,530	6,075	7,494

Device	Routing	Invert	Outlet Devices
#1	Primary	842.30'	**15.8" Round 18" Dia PEP SDR 17** L= 50.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 842.30' / 842.00' S= 0.0060 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 1.36 sf
#2	Secondary	844.00'	**4.0' long x 2.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32

Primary OutFlow Max=0.86 cfs @ 12.09 hrs HW=842.79' TW=838.67' (Dynamic Tailwater)
└**1=18" Dia PEP SDR 17** (Inlet Controls 0.86 cfs @ 1.87 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=842.30' TW=801.10' (Dynamic Tailwater)
└**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond B-N4B: N Bench 4B

[62] Hint: Exceeded Reach CH-N5 OUTLET depth by 0.26' @ 12.09 hrs

Inflow Area = 27.910 ac, 1.93% Impervious, Inflow Depth = 0.73" for 2 year - 24 hour event
Inflow = 20.62 cfs @ 12.10 hrs, Volume= 1.708 af
Outflow = 20.62 cfs @ 12.10 hrs, Volume= 1.708 af, Atten= 0%, Lag= 0.0 min
Primary = 20.62 cfs @ 12.10 hrs, Volume= 1.708 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 838.67' @ 12.10 hrs Surf.Area= 130 sf Storage= 74 cf
Flood Elev= 842.00' Surf.Area= 3,623 sf Storage= 4,501 cf

Plug-Flow detention time= 0.1 min calculated for 1.707 af (100% of inflow)
Center-of-Mass det. time= 0.1 min (889.1 - 889.0)

Volume	Invert	Avail.Storage	Storage Description
#1	838.00'	4,501 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
838.00	90	0	0
840.00	209	299	299
841.00	2,286	1,248	1,547
842.00	3,623	2,955	4,501

Device	Routing	Invert	Outlet Devices
#1	Primary	838.00'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 4.00 Width (feet) 11.75 19.75

Primary OutFlow Max=20.61 cfs @ 12.10 hrs HW=838.67' TW=838.28' (Dynamic Tailwater)
└**1=Custom Weir/Orifice** (Weir Controls 20.61 cfs @ 2.46 fps)

Summary for Pond B-N5: N Bench 5

[62] Hint: Exceeded Reach CH-N6 OUTLET depth by 0.49' @ 12.11 hrs

Inflow Area = 24.809 ac, 0.86% Impervious, Inflow Depth = 0.73" for 2 year - 24 hour event
Inflow = 19.02 cfs @ 12.10 hrs, Volume= 1.504 af
Outflow = 19.02 cfs @ 12.10 hrs, Volume= 1.504 af, Atten= 0%, Lag= 0.1 min
Primary = 19.02 cfs @ 12.10 hrs, Volume= 1.504 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 859.42' @ 12.10 hrs Surf.Area= 153 sf Storage= 99 cf
Flood Elev= 862.60' Surf.Area= 2,270 sf Storage= 2,850 cf

Plug-Flow detention time= 0.2 min calculated for 1.504 af (100% of inflow)
Center-of-Mass det. time= 0.2 min (891.4 - 891.2)

Volume	Invert	Avail.Storage	Storage Description
#1	858.60'	2,850 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
858.60	90	0	0
860.60	245	335	335
862.60	2,270	2,515	2,850

Device	Routing	Invert	Outlet Devices
#1	Primary	858.60'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 4.00 Width (feet) 7.75 15.75

Primary OutFlow Max=19.01 cfs @ 12.10 hrs HW=859.42' TW=858.92' (Dynamic Tailwater)
↑—**1=Custom Weir/Orifice** (Weir Controls 19.01 cfs @ 2.72 fps)

Summary for Pond B-N6: N Bench 6

[62] Hint: Exceeded Reach CH-N7 OUTLET depth by 0.30' @ 12.09 hrs

Inflow Area = 20.608 ac, 1.04% Impervious, Inflow Depth = 0.74" for 2 year - 24 hour event
Inflow = 16.58 cfs @ 12.09 hrs, Volume= 1.271 af
Outflow = 16.58 cfs @ 12.09 hrs, Volume= 1.271 af, Atten= 0%, Lag= 0.1 min
Primary = 16.58 cfs @ 12.09 hrs, Volume= 1.271 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 877.22' @ 12.09 hrs Surf.Area= 146 sf Storage= 85 cf
Flood Elev= 880.50' Surf.Area= 2,270 sf Storage= 2,850 cf

Plug-Flow detention time= 0.2 min calculated for 1.271 af (100% of inflow)
Center-of-Mass det. time= 0.2 min (890.7 - 890.5)

Volume	Invert	Avail.Storage	Storage Description
#1	876.50'	2,850 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
876.50	90	0	0
878.50	245	335	335
880.50	2,270	2,515	2,850

Device	Routing	Invert	Outlet Devices
#1	Primary	876.50'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 4.00 Width (feet) 7.75 15.75

Primary OutFlow Max=16.56 cfs @ 12.09 hrs HW=877.22' TW=875.82' (Dynamic Tailwater)
└**1=Custom Weir/Orifice** (Weir Controls 16.56 cfs @ 2.73 fps)

Summary for Pond B-N7: N Bench 7

[62] Hint: Exceeded Reach CH-N8 OUTLET depth by 0.58' @ 12.10 hrs

Inflow Area = 17.298 ac, 0.00% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 12.72 cfs @ 12.09 hrs, Volume= 0.958 af
Outflow = 12.72 cfs @ 12.09 hrs, Volume= 0.958 af, Atten= 0%, Lag= 0.1 min
Primary = 12.72 cfs @ 12.09 hrs, Volume= 0.958 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 899.36' @ 12.09 hrs Surf.Area= 127 sf Storage= 104 cf
Flood Elev= 902.40' Surf.Area= 245 sf Storage= 670 cf

Plug-Flow detention time= 0.3 min calculated for 0.958 af (100% of inflow)
Center-of-Mass det. time= 0.3 min (890.2 - 890.0)

Volume	Invert	Avail.Storage	Storage Description
#1	898.40'	3,185 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
898.40	90	0	0
902.40	245	670	670
904.40	2,270	2,515	3,185

Device	Routing	Invert	Outlet Devices
#1	Primary	898.40'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 4.00 Width (feet) 3.75 11.75

Primary OutFlow Max=12.71 cfs @ 12.09 hrs HW=899.35' TW=898.82' (Dynamic Tailwater)
└**1=Custom Weir/Orifice** (Weir Controls 12.71 cfs @ 2.83 fps)

Summary for Pond B-N8: N Bench 8

[62] Hint: Exceeded Reach CH-N9 OUTLET depth by 0.49' @ 12.08 hrs

Inflow Area = 13.927 ac, 0.00% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 10.29 cfs @ 12.08 hrs, Volume= 0.771 af
Outflow = 10.29 cfs @ 12.09 hrs, Volume= 0.771 af, Atten= 0%, Lag= 0.1 min
Primary = 10.29 cfs @ 12.09 hrs, Volume= 0.771 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 917.34' @ 12.09 hrs Surf.Area= 155 sf Storage= 103 cf
Flood Elev= 920.50' Surf.Area= 2,270 sf Storage= 2,850 cf

Plug-Flow detention time= 0.3 min calculated for 0.771 af (100% of inflow)
Center-of-Mass det. time= 0.3 min (890.0 - 889.6)

Volume	Invert	Avail.Storage	Storage Description
#1	916.50'	2,850 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
916.50	90	0	0
918.50	245	335	335
920.50	2,270	2,515	2,850

Device	Routing	Invert	Outlet Devices
#1	Primary	916.50'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 4.00 Width (feet) 3.75 11.75

Primary OutFlow Max=10.28 cfs @ 12.09 hrs HW=917.34' TW=916.87' (Dynamic Tailwater)
1=Custom Weir/Orifice (Weir Controls 10.28 cfs @ 2.66 fps)

Summary for Pond B-N9: N Bench 9

[62] Hint: Exceeded Reach CH-N10 OUTLET depth by 0.46' @ 12.10 hrs

Inflow Area = 11.991 ac, 0.00% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 8.70 cfs @ 12.08 hrs, Volume= 0.664 af
Outflow = 8.70 cfs @ 12.09 hrs, Volume= 0.664 af, Atten= 0%, Lag= 0.1 min
Primary = 8.70 cfs @ 12.09 hrs, Volume= 0.664 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 938.76' @ 12.09 hrs Surf.Area= 149 sf Storage= 91 cf
Flood Elev= 942.00' Surf.Area= 2,270 sf Storage= 2,850 cf

Plug-Flow detention time= 0.3 min calculated for 0.664 af (100% of inflow)
Center-of-Mass det. time= 0.3 min (889.9 - 889.6)

Volume	Invert	Avail.Storage	Storage Description
#1	938.00'	2,850 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
938.00	90	0	0
940.00	245	335	335
942.00	2,270	2,515	2,850

Device	Routing	Invert	Outlet Devices
#1	Primary	938.00'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 4.00 Width (feet) 3.75 11.75

Primary OutFlow Max=8.69 cfs @ 12.09 hrs HW=938.76' TW=938.35' (Dynamic Tailwater)
1=Custom Weir/Orifice (Weir Controls 8.69 cfs @ 2.52 fps)

Summary for Pond B-NW1: NW Bench 1

[62] Hint: Exceeded Reach CH-NW2 OUTLET depth by 0.47' @ 12.10 hrs

Inflow Area = 42.821 ac, 2.24% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 32.43 cfs @ 12.10 hrs, Volume= 2.370 af
Outflow = 32.43 cfs @ 12.10 hrs, Volume= 2.370 af, Atten= 0%, Lag= 0.0 min
Primary = 32.43 cfs @ 12.10 hrs, Volume= 2.370 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 726.80' @ 12.10 hrs Surf.Area= 111 sf Storage= 78 cf
Flood Elev= 729.90' Surf.Area= 3,707 sf Storage= 3,938 cf

Plug-Flow detention time= 0.1 min calculated for 2.370 af (100% of inflow)
Center-of-Mass det. time= 0.1 min (886.7 - 886.6)

Volume	Invert	Avail.Storage	Storage Description
#1	725.90'	4,318 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
725.90	63	0	0
728.00	175	250	250
730.00	3,893	4,068	4,318

Device	Routing	Invert	Outlet Devices
#1	Primary	725.90'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 4.00 Width (feet) 11.75 19.75

Primary OutFlow Max=32.41 cfs @ 12.10 hrs HW=726.80' TW=726.26' (Dynamic Tailwater)
↑**1=Custom Weir/Orifice** (Weir Controls 32.41 cfs @ 2.85 fps)

Summary for Pond B-NW10: NW Bench 10

Inflow Area = 3.504 ac, 0.00% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 3.00 cfs @ 12.06 hrs, Volume= 0.194 af
Outflow = 2.99 cfs @ 12.06 hrs, Volume= 0.194 af, Atten= 0%, Lag= 0.2 min
Primary = 2.99 cfs @ 12.06 hrs, Volume= 0.194 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 1,036.69' @ 12.06 hrs Surf.Area= 99 sf Storage= 55 cf
Flood Elev= 1,038.00' Surf.Area= 175 sf Storage= 235 cf

Plug-Flow detention time= 0.8 min calculated for 0.194 af (100% of inflow)
Center-of-Mass det. time= 0.7 min (885.1 - 884.5)

Volume	Invert	Avail.Storage	Storage Description
#1	1,036.00'	4,303 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,036.00	60	0	0
1,038.00	175	235	235
1,040.00	3,893	4,068	4,303

Device	Routing	Invert	Outlet Devices
#1	Primary	1,036.00'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 1.00 2.00 4.00 Width (feet) 1.25 3.25 5.25 9.25

Primary OutFlow Max=2.99 cfs @ 12.06 hrs HW=1,036.69' TW=1,036.36' (Dynamic Tailwater)
1=Custom Weir/Orifice (Weir Controls 2.99 cfs @ 2.26 fps)

Summary for Pond B-NW2: NW Bench 2

[62] Hint: Exceeded Reach CH-NW3 OUTLET depth by 0.63' @ 12.10 hrs

Inflow Area = 36.438 ac, 2.63% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 28.11 cfs @ 12.09 hrs, Volume= 2.016 af
Outflow = 28.11 cfs @ 12.09 hrs, Volume= 2.016 af, Atten= 0%, Lag= 0.0 min
Primary = 28.11 cfs @ 12.09 hrs, Volume= 2.016 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 765.03' @ 12.09 hrs Surf.Area= 121 sf Storage= 94 cf
Flood Elev= 768.00' Surf.Area= 3,893 sf Storage= 4,306 cf

Plug-Flow detention time= 0.1 min calculated for 2.016 af (100% of inflow)
Center-of-Mass det. time= 0.1 min (885.5 - 885.4)

Volume	Invert	Avail.Storage	Storage Description
#1	764.00'	4,306 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
764.00	63	0	0
766.00	175	238	238
768.00	3,893	4,068	4,306

Device	Routing	Invert	Outlet Devices
#1	Primary	764.00'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 4.00 Width (feet) 7.75 15.75

Primary OutFlow Max=28.09 cfs @ 12.09 hrs HW=765.03' TW=764.33' (Dynamic Tailwater)
1=Custom Weir/Orifice (Weir Controls 28.09 cfs @ 3.11 fps)

Summary for Pond B-NW3: NW Bench 3

[62] Hint: Exceeded Reach CH-NW4 OUTLET depth by 0.61' @ 12.09 hrs

Inflow Area = 30.614 ac, 3.13% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 24.59 cfs @ 12.08 hrs, Volume= 1.694 af
Outflow = 24.58 cfs @ 12.08 hrs, Volume= 1.694 af, Atten= 0%, Lag= 0.1 min
Primary = 24.58 cfs @ 12.08 hrs, Volume= 1.694 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 802.96' @ 12.08 hrs Surf.Area= 117 sf Storage= 87 cf
Flood Elev= 806.00' Surf.Area= 3,893 sf Storage= 4,306 cf

Plug-Flow detention time= 0.1 min calculated for 1.694 af (100% of inflow)
Center-of-Mass det. time= 0.1 min (883.7 - 883.6)

Volume	Invert	Avail.Storage	Storage Description
#1	802.00'	4,306 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
802.00	63	0	0
804.00	175	238	238
806.00	3,893	4,068	4,306

Device	Routing	Invert	Outlet Devices
#1	Primary	802.00'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 4.00 Width (feet) 7.75 15.75

Primary OutFlow Max=24.56 cfs @ 12.08 hrs HW=802.96' TW=802.40' (Dynamic Tailwater)
1=Custom Weir/Orifice (Weir Controls 24.56 cfs @ 2.92 fps)

Summary for Pond B-NW4: NW Bench 4

[62] Hint: Exceeded Reach CH-NW5 OUTLET depth by 0.55' @ 12.08 hrs

Inflow Area = 25.542 ac, 3.76% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 21.08 cfs @ 12.08 hrs, Volume= 1.413 af
Outflow = 21.08 cfs @ 12.08 hrs, Volume= 1.413 af, Atten= 0%, Lag= 0.1 min
Primary = 21.08 cfs @ 12.08 hrs, Volume= 1.413 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 840.88' @ 12.08 hrs Surf.Area= 112 sf Storage= 77 cf
Flood Elev= 844.00' Surf.Area= 3,893 sf Storage= 4,306 cf

Plug-Flow detention time= 0.1 min calculated for 1.412 af (100% of inflow)
Center-of-Mass det. time= 0.1 min (881.9 - 881.7)

Volume	Invert	Avail.Storage	Storage Description
#1	840.00'	4,306 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
840.00	63	0	0
842.00	175	238	238
844.00	3,893	4,068	4,306

Device	Routing	Invert	Outlet Devices
#1	Primary	840.00'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 4.00 Width (feet) 7.75 15.75

Primary OutFlow Max=21.05 cfs @ 12.08 hrs HW=840.87' TW=840.36' (Dynamic Tailwater)
1=Custom Weir/Orifice (Weir Controls 21.05 cfs @ 2.79 fps)

Summary for Pond B-NW5: NW Bench 5

[62] Hint: Exceeded Reach CH-NW6 OUTLET depth by 0.69' @ 12.07 hrs

Inflow Area = 20.804 ac, 4.61% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 17.37 cfs @ 12.07 hrs, Volume= 1.150 af
Outflow = 17.37 cfs @ 12.07 hrs, Volume= 1.150 af, Atten= 0%, Lag= 0.1 min
Primary = 17.37 cfs @ 12.07 hrs, Volume= 1.150 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 879.12' @ 12.07 hrs Surf.Area= 125 sf Storage= 105 cf
Flood Elev= 882.00' Surf.Area= 3,893 sf Storage= 4,306 cf

Plug-Flow detention time= 0.2 min calculated for 1.150 af (100% of inflow)
Center-of-Mass det. time= 0.2 min (879.9 - 879.7)

Volume	Invert	Avail.Storage	Storage Description
#1	878.00'	4,306 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
878.00	63	0	0
880.00	175	238	238
882.00	3,893	4,068	4,306

Device	Routing	Invert	Outlet Devices
#1	Primary	878.00'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 4.00 Width (feet) 3.75 11.75

Primary OutFlow Max=17.37 cfs @ 12.07 hrs HW=879.12' TW=878.32' (Dynamic Tailwater)
↑—**1=Custom Weir/Orifice** (Weir Controls 17.37 cfs @ 3.20 fps)

Summary for Pond B-NW6: NW Bench 6

[62] Hint: Exceeded Reach CH-NW7 OUTLET depth by 0.62' @ 12.07 hrs

Inflow Area = 17.211 ac, 5.57% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 14.34 cfs @ 12.07 hrs, Volume= 0.951 af
Outflow = 14.34 cfs @ 12.07 hrs, Volume= 0.951 af, Atten= 0%, Lag= 0.1 min
Primary = 14.34 cfs @ 12.07 hrs, Volume= 0.951 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 917.02' @ 12.07 hrs Surf.Area= 120 sf Storage= 93 cf
Flood Elev= 920.00' Surf.Area= 3,893 sf Storage= 4,306 cf

Plug-Flow detention time= 0.2 min calculated for 0.951 af (100% of inflow)
Center-of-Mass det. time= 0.2 min (878.1 - 877.9)

Volume	Invert	Avail.Storage	Storage Description
#1	916.00'	4,306 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
916.00	63	0	0
918.00	175	238	238
920.00	3,893	4,068	4,306

Device	Routing	Invert	Outlet Devices
#1	Primary	916.00'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 4.00 Width (feet) 3.75 11.75

Primary OutFlow Max=14.33 cfs @ 12.07 hrs HW=917.02' TW=916.42' (Dynamic Tailwater)
└**1=Custom Weir/Orifice** (Weir Controls 14.33 cfs @ 2.95 fps)

Summary for Pond B-NW7A: NW Bench 7 w/ Box Cul

[62] Hint: Exceeded Reach CH-NW8 OUTLET depth by 1.26' @ 12.07 hrs

Inflow Area = 13.676 ac, 6.29% Impervious, Inflow Depth = 0.75" for 2 year - 24 hour event
Inflow = 12.77 cfs @ 12.06 hrs, Volume= 0.853 af
Outflow = 12.76 cfs @ 12.07 hrs, Volume= 0.853 af, Atten= 0%, Lag= 0.2 min
Primary = 12.76 cfs @ 12.07 hrs, Volume= 0.853 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 931.64' @ 12.07 hrs Surf.Area= 279 sf Storage= 109 cf
Flood Elev= 934.00' Surf.Area= 1,200 sf Storage= 1,830 cf

Plug-Flow detention time= 0.2 min calculated for 0.853 af (100% of inflow)
Center-of-Mass det. time= 0.2 min (877.8 - 877.7)

Volume	Invert	Avail.Storage	Storage Description
#1	931.00'	1,830 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
931.00	60	0	0
932.00	400	230	230
933.00	800	600	830
934.00	1,200	1,000	1,830

Device	Routing	Invert	Outlet Devices
#1	Primary	931.00'	**96.0" W x 48.0" H Box 4' x 8' Box Culvert** L= 35.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 931.00' / 930.83' S= 0.0049 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 32.00 sf
#2	Secondary	932.00'	**143.1 deg x 2.0' long x 2.00' rise Sharp-Crested Vee/Trap Weir** Cv= 2.47 (C= 3.09)

Primary OutFlow Max=12.75 cfs @ 12.07 hrs HW=931.64' TW=931.05' (Dynamic Tailwater)
└**1=4' x 8' Box Culvert** (Barrel Controls 12.75 cfs @ 3.30 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=931.00' TW=930.00' (Dynamic Tailwater)
└**2=Sharp-Crested Vee/Trap Weir** (Controls 0.00 cfs)

Summary for Pond B-NW7B: N Bench 7B w/ 18" Clvt

[62] Hint: Exceeded Reach D-NW7 OUTLET depth by 0.63' @ 12.07 hrs

Inflow Area = 2.114 ac, 4.67% Impervious, Inflow Depth = 0.71" for 2 year - 24 hour event
Inflow = 1.97 cfs @ 12.05 hrs, Volume= 0.125 af
Outflow = 1.95 cfs @ 12.07 hrs, Volume= 0.125 af, Atten= 1%, Lag= 0.8 min
Primary = 0.41 cfs @ 12.07 hrs, Volume= 0.020 af
Secondary = 1.54 cfs @ 12.07 hrs, Volume= 0.105 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 920.83' @ 12.07 hrs Surf.Area= 498 sf Storage= 82 cf
Flood Elev= 922.00' Surf.Area= 1,545 sf Storage= 1,343 cf

Plug-Flow detention time= 0.5 min calculated for 0.125 af (100% of inflow)
Center-of-Mass det. time= 0.5 min (880.9 - 880.4)

Volume	Invert	Avail.Storage	Storage Description
#1	920.50'	8,598 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
920.50	0	0	0
921.00	760	190	190
922.00	1,545	1,153	1,343
924.00	5,710	7,255	8,598

Device	Routing	Invert	Outlet Devices
#1	Primary	920.50'	**15.8" Round 18" Dia PEP SDR 17** L= 50.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 920.50' / 920.00' S= 0.0100 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 1.36 sf
#2	Secondary	920.50'	**143.1 deg x 2.0' long x 2.00' rise Sharp-Crested Vee/Trap Weir** Cv= 2.47 (C= 3.09)
#3	Secondary	922.00'	**20.0' long x 2.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32

Primary OutFlow Max=0.41 cfs @ 12.07 hrs HW=920.83' TW=920.05' (Dynamic Tailwater)
└**1=18" Dia PEP SDR 17** (Inlet Controls 0.41 cfs @ 1.54 fps)

Secondary OutFlow Max=1.54 cfs @ 12.07 hrs HW=920.83' TW=920.62' (Dynamic Tailwater)
└**2=Sharp-Crested Vee/Trap Weir** (Weir Controls 1.54 cfs @ 1.58 fps)
└**3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond B-NW8: NW Bench 8

[62] Hint: Exceeded Reach CH-NW9 OUTLET depth by 0.63' @ 12.06 hrs

Inflow Area = 13.063 ac, 4.96% Impervious, Inflow Depth = 0.73" for 2 year - 24 hour event
Inflow = 12.56 cfs @ 12.06 hrs, Volume= 0.795 af
Outflow = 12.56 cfs @ 12.06 hrs, Volume= 0.795 af, Atten= 0%, Lag= 0.1 min
Primary = 12.56 cfs @ 12.06 hrs, Volume= 0.795 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2

Peak Elev= 956.94' @ 12.06 hrs Surf.Area= 116 sf Storage= 84 cf
Flood Elev= 960.00' Surf.Area= 3,893 sf Storage= 4,306 cf

Plug-Flow detention time= 0.2 min calculated for 0.795 af (100% of inflow)
Center-of-Mass det. time= 0.2 min (879.8 - 879.6)

Volume	Invert	Avail.Storage	Storage Description
#1	956.00'	4,306 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
956.00	63	0	0
958.00	175	238	238
960.00	3,893	4,068	4,306

Device	Routing	Invert	Outlet Devices
#1	Primary	956.00'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 4.00 Width (feet) 3.75 11.75

Primary OutFlow Max=12.55 cfs @ 12.06 hrs HW=956.94' TW=956.39' (Dynamic Tailwater)
↑**1=Custom Weir/Orifice** (Weir Controls 12.55 cfs @ 2.84 fps)

Summary for Pond B-NW9: NW Bench 9

[62] Hint: Exceeded Reach CH-NW10 OUTLET depth by 0.37' @ 12.06 hrs

Inflow Area = 8.498 ac, 4.37% Impervious, Inflow Depth = 0.72" for 2 year - 24 hour event
Inflow = 7.99 cfs @ 12.06 hrs, Volume= 0.508 af
Outflow = 7.99 cfs @ 12.06 hrs, Volume= 0.508 af, Atten= 0%, Lag= 0.1 min
Primary = 7.99 cfs @ 12.06 hrs, Volume= 0.508 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 996.72' @ 12.06 hrs Surf.Area= 103 sf Storage= 60 cf
Flood Elev= 1,000.00' Surf.Area= 3,893 sf Storage= 4,306 cf

Plug-Flow detention time= 0.2 min calculated for 0.508 af (100% of inflow)
Center-of-Mass det. time= 0.2 min (880.5 - 880.2)

Volume	Invert	Avail.Storage	Storage Description
#1	996.00'	4,306 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
996.00	63	0	0
998.00	175	238	238
1,000.00	3,893	4,068	4,306

Device	Routing	Invert	Outlet Devices
#1	Primary	996.00'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 4.00 Width (feet) 3.75 11.75

Primary OutFlow Max=7.98 cfs @ 12.06 hrs HW=996.72' TW=996.31' (Dynamic Tailwater)
↑**1=Custom Weir/Orifice** (Weir Controls 7.98 cfs @ 2.48 fps)

Summary for Pond B-W1: W Bench 1

[62] Hint: Exceeded Reach CH-W2 OUTLET depth by 2.56' @ 12.15 hrs

Inflow Area = 48.022 ac, 0.00% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 31.09 cfs @ 12.15 hrs, Volume= 2.660 af
Outflow = 31.09 cfs @ 12.15 hrs, Volume= 2.660 af, Atten= 0%, Lag= 0.0 min
Primary = 31.09 cfs @ 12.15 hrs, Volume= 2.660 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 726.87' @ 12.15 hrs Surf.Area= 118 sf Storage= 80 cf
Flood Elev= 730.00' Surf.Area= 3,339 sf Storage= 3,481 cf

Plug-Flow detention time= 0.1 min calculated for 2.660 af (100% of inflow)
Center-of-Mass det. time= 0.1 min (893.9 - 893.8)

Volume	Invert	Avail.Storage	Storage Description
#1	726.00'	3,481 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
726.00	67	0	0
727.00	125	96	96
728.00	194	160	256
729.00	1,459	827	1,082
730.00	3,339	2,399	3,481

Device	Routing	Invert	Outlet Devices
#1	Primary	726.00'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 1.00 2.00 3.00 4.00 Width (feet) 11.75 13.75 15.75 17.75 19.75

Primary OutFlow Max=31.08 cfs @ 12.15 hrs HW=726.87' TW=726.34' (Dynamic Tailwater)
↑└**1=Custom Weir/Orifice** (Weir Controls 31.08 cfs @ 2.82 fps)

Summary for Pond B-W2: W Bench 2

[62] Hint: Exceeded Reach CH-W3 OUTLET depth by 0.51' @ 12.15 hrs

Inflow Area = 42.013 ac, 0.00% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 27.23 cfs @ 12.15 hrs, Volume= 2.327 af
Outflow = 27.23 cfs @ 12.15 hrs, Volume= 2.327 af, Atten= 0%, Lag= 0.0 min
Primary = 27.23 cfs @ 12.15 hrs, Volume= 2.327 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 764.80' @ 12.15 hrs Surf.Area= 105 sf Storage= 67 cf
Flood Elev= 768.00' Surf.Area= 3,245 sf Storage= 3,343 cf

Plug-Flow detention time= 0.1 min calculated for 2.327 af (100% of inflow)
Center-of-Mass det. time= 0.1 min (893.5 - 893.4)

Volume	Invert	Avail.Storage	Storage Description
#1	764.00'	3,343 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
764.00	63	0	0
765.00	115	89	89
766.00	176	146	235
767.00	1,398	787	1,022
768.00	3,245	2,322	3,343

Device	Routing	Invert	Outlet Devices
#1	Primary	764.00'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 1.00 2.00 3.00 4.00 Width (feet) 11.75 13.75 15.75 17.75 19.75

Primary OutFlow Max=27.21 cfs @ 12.15 hrs HW=764.80' TW=764.31' (Dynamic Tailwater)
↑**1=Custom Weir/Orifice** (Weir Controls 27.21 cfs @ 2.71 fps)

Summary for Pond B-W3: W Bench 3

[62] Hint: Exceeded Reach CH-W4 OUTLET depth by 0.40' @ 12.15 hrs

Inflow Area = 36.798 ac, 0.00% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 23.77 cfs @ 12.14 hrs, Volume= 2.038 af
Outflow = 23.77 cfs @ 12.14 hrs, Volume= 2.038 af, Atten= 0%, Lag= 0.0 min
Primary = 23.77 cfs @ 12.14 hrs, Volume= 2.038 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 802.74' @ 12.14 hrs Surf.Area= 95 sf Storage= 58 cf
Flood Elev= 806.00' Surf.Area= 3,168 sf Storage= 3,251 cf

Plug-Flow detention time= 0.1 min calculated for 2.038 af (100% of inflow)
Center-of-Mass det. time= 0.1 min (893.1 - 893.0)

Volume	Invert	Avail.Storage	Storage Description
#1	802.00'	3,251 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
802.00	62	0	0
803.00	107	85	85
804.00	160	134	218
805.00	1,369	765	983
806.00	3,168	2,269	3,251

Device	Routing	Invert	Outlet Devices
#1	Primary	802.00'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 1.00 2.00 3.00 4.00 Width (feet) 11.75 13.75 15.75 17.75 19.75

Primary OutFlow Max=23.76 cfs @ 12.14 hrs HW=802.74' TW=802.30' (Dynamic Tailwater)
↑**1=Custom Weir/Orifice** (Weir Controls 23.76 cfs @ 2.59 fps)

Summary for Pond B-W4: W Bench 4

[62] Hint: Exceeded Reach CH-W5 OUTLET depth by 0.54' @ 12.14 hrs

Inflow Area = 27.885 ac, 0.00% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 18.76 cfs @ 12.13 hrs, Volume= 1.544 af
Outflow = 18.76 cfs @ 12.13 hrs, Volume= 1.544 af, Atten= 0%, Lag= 0.1 min
Primary = 18.76 cfs @ 12.13 hrs, Volume= 1.544 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 840.81' @ 12.13 hrs Surf.Area= 99 sf Storage= 65 cf
Flood Elev= 844.00' Surf.Area= 3,168 sf Storage= 3,251 cf

Plug-Flow detention time= 0.1 min calculated for 1.544 af (100% of inflow)
Center-of-Mass det. time= 0.1 min (892.0 - 891.9)

Volume	Invert	Avail.Storage	Storage Description
#1	840.00'	3,251 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
840.00	62	0	0
841.00	107	85	85
842.00	160	134	218
843.00	1,369	765	983
844.00	3,168	2,269	3,251

Device	Routing	Invert	Outlet Devices
#1	Primary	840.00'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 1.00 2.00 3.00 4.00 Width (feet) 7.75 9.75 11.75 13.75 15.75

Primary OutFlow Max=18.75 cfs @ 12.13 hrs HW=840.81' TW=840.33' (Dynamic Tailwater)
↑└**1=Custom Weir/Orifice** (Weir Controls 18.75 cfs @ 2.69 fps)

Summary for Pond B-W5: W Bench 5

[62] Hint: Exceeded Reach CH-W6 OUTLET depth by 0.47' @ 12.12 hrs

Inflow Area = 20.240 ac, 0.00% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 14.47 cfs @ 12.12 hrs, Volume= 1.121 af
Outflow = 14.47 cfs @ 12.12 hrs, Volume= 1.121 af, Atten= 0%, Lag= 0.0 min
Primary = 14.47 cfs @ 12.12 hrs, Volume= 1.121 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 878.69' @ 12.12 hrs Surf.Area= 93 sf Storage= 53 cf
Flood Elev= 882.00' Surf.Area= 3,168 sf Storage= 3,251 cf

Plug-Flow detention time= 0.1 min calculated for 1.121 af (100% of inflow)
Center-of-Mass det. time= 0.1 min (890.5 - 890.4)

Volume	Invert	Avail.Storage	Storage Description
#1	878.00'	3,251 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
878.00	62	0	0
879.00	107	85	85
880.00	160	134	218
881.00	1,369	765	983
882.00	3,168	2,269	3,251

Device	Routing	Invert	Outlet Devices
#1	Primary	878.00'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 1.00 2.00 3.00 4.00 Width (feet) 7.75 9.75 11.75 13.75 15.75

Primary OutFlow Max=14.46 cfs @ 12.12 hrs HW=878.69' TW=878.28' (Dynamic Tailwater)
↑**1=Custom Weir/Orifice** (Weir Controls 14.46 cfs @ 2.49 fps)

Summary for Pond B-W6: W Bench 6

[62] Hint: Exceeded Reach CH-W7 OUTLET depth by 0.06' @ 12.13 hrs

Inflow Area = 12.643 ac, 0.00% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 9.58 cfs @ 12.10 hrs, Volume= 0.700 af
Outflow = 9.58 cfs @ 12.10 hrs, Volume= 0.700 af, Atten= 0%, Lag= 0.1 min
Primary = 9.58 cfs @ 12.10 hrs, Volume= 0.700 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 917.53' @ 12.10 hrs Surf.Area= 181 sf Storage= 90 cf
Flood Elev= 921.00' Surf.Area= 1,413 sf Storage= 1,712 cf

Plug-Flow detention time= 0.3 min calculated for 0.700 af (100% of inflow)
Center-of-Mass det. time= 0.3 min (889.2 - 888.8)

Volume	Invert	Avail.Storage	Storage Description
#1	917.00'	1,712 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
917.00	158	0	0
919.00	243	401	401
920.00	483	363	764
921.00	1,413	948	1,712

Device	Routing	Invert	Outlet Devices
#1	Primary	917.00'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 1.00 2.00 3.00 4.00 Width (feet) 7.75 9.75 11.75 13.75 15.75

Primary OutFlow Max=9.57 cfs @ 12.10 hrs HW=917.53' TW=917.22' (Dynamic Tailwater)
↑**1=Custom Weir/Orifice** (Weir Controls 9.57 cfs @ 2.18 fps)

Summary for Pond B-W7: W Bench 7

[62] Hint: Exceeded Reach CH-W8 OUTLET depth by 0.65' @ 12.09 hrs

Inflow Area = 6.341 ac, 0.00% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 5.02 cfs @ 12.09 hrs, Volume= 0.351 af
Outflow = 5.01 cfs @ 12.09 hrs, Volume= 0.351 af, Atten= 0%, Lag= 0.4 min
Primary = 5.01 cfs @ 12.09 hrs, Volume= 0.351 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 957.90' @ 12.09 hrs Surf.Area= 252 sf Storage= 160 cf
Flood Elev= 961.00' Surf.Area= 2,467 sf Storage= 3,090 cf

Plug-Flow detention time= 1.0 min calculated for 0.351 af (100% of inflow)
Center-of-Mass det. time= 1.0 min (888.4 - 887.4)

Volume	Invert	Avail.Storage	Storage Description
#1	957.00'	3,090 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
957.00	102	0	0
958.00	268	185	185
959.00	372	320	505
960.00	1,165	769	1,274
961.00	2,467	1,816	3,090

Device	Routing	Invert	Outlet Devices
#1	Primary	957.00'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 1.00 2.00 3.00 4.00 Width (feet) 1.25 3.25 5.25 7.25 9.25

Primary OutFlow Max=5.00 cfs @ 12.09 hrs HW=957.90' TW=957.47' (Dynamic Tailwater)
↑—**1=Custom Weir/Orifice** (Weir Controls 5.00 cfs @ 2.57 fps)

Summary for Pond B-W8: W Bench 8

Inflow Area = 1.978 ac, 0.00% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 1.59 cfs @ 12.07 hrs, Volume= 0.110 af
Outflow = 1.58 cfs @ 12.09 hrs, Volume= 0.110 af, Atten= 1%, Lag= 0.8 min
Primary = 1.58 cfs @ 12.09 hrs, Volume= 0.110 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 1,000.48' @ 12.09 hrs Surf.Area= 237 sf Storage= 102 cf
Flood Elev= 1,004.00' Surf.Area= 3,908 sf Storage= 3,489 cf

Plug-Flow detention time= 2.4 min calculated for 0.110 af (100% of inflow)
Center-of-Mass det. time= 2.4 min (888.3 - 885.9)

Volume	Invert	Avail.Storage	Storage Description
#1	1,000.00'	3,489 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,000.00	187	0	0
1,001.00	291	239	239
1,002.00	1,150	721	960
1,003.00	3,908	2,529	3,489

Device	Routing	Invert	Outlet Devices
#1	Primary	1,000.00'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 1.00 2.00 Width (feet) 1.25 3.25 5.25

Primary OutFlow Max=1.58 cfs @ 12.09 hrs HW=1,000.48' TW=1,000.25' (Dynamic Tailwater)
└**1=Custom Weir/Orifice** (Weir Controls 1.58 cfs @ 1.90 fps)

Summary for Pond CUL-N1: N Box Culvert

[62] Hint: Exceeded Reach CH-N1 OUTLET depth by 0.64' @ 12.10 hrs

Inflow Area = 41.660 ac, 1.29% Impervious, Inflow Depth = 0.71" for 2 year - 24 hour event
Inflow = 31.24 cfs @ 12.10 hrs, Volume= 2.469 af
Outflow = 31.24 cfs @ 12.10 hrs, Volume= 2.469 af, Atten= 0%, Lag= 0.0 min
Primary = 31.24 cfs @ 12.10 hrs, Volume= 2.469 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 717.98' @ 12.10 hrs
Flood Elev= 722.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	717.00'	**120.0" W x 48.0" H Box Culvert** L= 50.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 717.00' / 716.50' S= 0.0100 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 40.00 sf

Primary OutFlow Max=31.22 cfs @ 12.10 hrs HW=717.98' TW=701.65' (Dynamic Tailwater)
└**1=Culvert** (Inlet Controls 31.22 cfs @ 3.18 fps)

Summary for Pond CUL-N2: N Ramp Box Culvert

[62] Hint: Exceeded Reach CH-N4A OUTLET depth by 0.62' @ 12.10 hrs

Inflow Area = 27.910 ac, 1.93% Impervious, Inflow Depth = 0.73" for 2 year - 24 hour event
Inflow = 20.62 cfs @ 12.10 hrs, Volume= 1.708 af
Outflow = 20.62 cfs @ 12.10 hrs, Volume= 1.708 af, Atten= 0%, Lag= 0.0 min
Primary = 20.62 cfs @ 12.10 hrs, Volume= 1.708 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 830.89' @ 12.10 hrs
Flood Elev= 834.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	830.00'	**96.0" W x 48.0" H Box Culvert** L= 35.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 830.00' / 829.83' S= 0.0049 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 32.00 sf

Primary OutFlow Max=20.62 cfs @ 12.10 hrs HW=830.89' TW=829.28' (Dynamic Tailwater)
└**1=Culvert** (Barrel Controls 20.62 cfs @ 3.84 fps)

Summary for Pond CUL-NW1: NW Box Culvert

[62] Hint: Exceeded Reach CH-NW1 OUTLET depth by 0.64' @ 12.10 hrs

Inflow Area = 42.821 ac, 2.24% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 32.43 cfs @ 12.10 hrs, Volume= 2.370 af
Outflow = 32.43 cfs @ 12.10 hrs, Volume= 2.370 af, Atten= 0%, Lag= 0.0 min
Primary = 32.43 cfs @ 12.10 hrs, Volume= 2.370 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 718.01' @ 12.10 hrs
Flood Elev= 722.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	717.00'	**120.0" W x 48.0" H Box Culvert** L= 40.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 717.00' / 716.60' S= 0.0100 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 40.00 sf

Primary OutFlow Max=32.42 cfs @ 12.10 hrs HW=718.01' TW=699.86' (Dynamic Tailwater)
1=Culvert (Inlet Controls 32.42 cfs @ 3.22 fps)

Summary for Pond CUL-W1: W Box Culvert

[62] Hint: Exceeded Reach CH-W1 OUTLET depth by 0.64' @ 12.15 hrs

Inflow Area = 48.022 ac, 0.00% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 31.09 cfs @ 12.15 hrs, Volume= 2.660 af
Outflow = 31.09 cfs @ 12.15 hrs, Volume= 2.660 af, Atten= 0%, Lag= 0.0 min
Primary = 31.09 cfs @ 12.15 hrs, Volume= 2.660 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 717.98' @ 12.15 hrs
Flood Elev= 722.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	717.00'	**120.0" W x 48.0" H Box Culvert** L= 40.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 717.00' / 716.60' S= 0.0100 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 40.00 sf

Primary OutFlow Max=31.08 cfs @ 12.15 hrs HW=717.98' TW=713.74' (Dynamic Tailwater)
1=Culvert (Inlet Controls 31.08 cfs @ 3.18 fps)

Summary for Pond P-N1: N Pond

Inflow Area = 48.401 ac, 1.11% Impervious, Inflow Depth = 0.80" for 2 year - 24 hour event
Inflow = 35.82 cfs @ 12.10 hrs, Volume= 3.228 af
Outflow = 2.21 cfs @ 15.28 hrs, Volume= 3.112 af, Atten= 94%, Lag= 190.6 min
Primary = 2.21 cfs @ 15.28 hrs, Volume= 3.112 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Tertiary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Starting Elev= 701.00' Surf.Area= 48,455 sf Storage= 134,178 cf
Peak Elev= 702.48' @ 15.28 hrs Surf.Area= 52,257 sf Storage= 208,574 cf (74,396 cf above start)
Flood Elev= 709.00' Surf.Area= 70,530 sf Storage= 607,730 cf (473,553 cf above start)

Plug-Flow detention time= 3,018.0 min calculated for 0.031 af (1% of inflow)
Center-of-Mass det. time= 485.4 min (1,352.9 - 867.6)

Volume	Invert	Avail.Storage	Storage Description
#1	698.00'	669,733 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
698.00	41,070	0	0
700.00	45,920	86,990	86,990
702.00	50,990	96,910	183,900
704.00	56,290	107,280	291,180
706.00	61,820	118,110	409,290
708.00	67,570	129,390	538,680
709.00	70,530	69,050	607,730
709.70	106,620	62,003	669,733

Device	Routing	Invert	Outlet Devices
#1	Primary	701.00'	**9.4" Round Culvert** L= 50.0' CPP, end-section conforming to fill, Ke= 0.500 Inlet / Outlet Invert= 701.00' / 700.50' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.48 sf
#2	Secondary	707.00'	**90.0 deg x 10.3' long x 2.00' rise Sharp-Crested Vee/Trap Weir** Cv= 2.50 (C= 3.13)
#3	Tertiary	709.00'	**480.0' long x 10.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64

Primary OutFlow Max=2.21 cfs @ 15.28 hrs HW=702.48' (Free Discharge)
└**1=Culvert** (Barrel Controls 2.21 cfs @ 4.58 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=701.00' TW=707.00' (Dynamic Tailwater)
└**2=Sharp-Crested Vee/Trap Weir** (Controls 0.00 cfs)

Tertiary OutFlow Max=0.00 cfs @ 0.00 hrs HW=701.00' (Free Discharge)
└**3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond P-NW1: NW Pond

Inflow Area = 44.865 ac, 2.14% Impervious, Inflow Depth = 0.75" for 2 year - 24 hour event
Inflow = 33.46 cfs @ 12.10 hrs, Volume= 2.812 af
Outflow = 2.76 cfs @ 13.82 hrs, Volume= 2.766 af, Atten= 92%, Lag= 103.4 min
Primary = 2.76 cfs @ 13.82 hrs, Volume= 2.766 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Tertiary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Starting Elev= 699.00' Surf.Area= 31,396 sf Storage= 81,473 cf
Peak Elev= 700.73' @ 13.82 hrs Surf.Area= 35,335 sf Storage= 139,113 cf (57,640 cf above start)
Flood Elev= 710.00' Surf.Area= 60,211 sf Storage= 577,158 cf (495,685 cf above start)

Plug-Flow detention time= 904.6 min calculated for 0.896 af (32% of inflow)
Center-of-Mass det. time= 317.2 min (1,182.4 - 865.3)

Volume	Invert	Avail.Storage	Storage Description
#1	696.00'	612,293 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
696.00	22,005	0	0
698.00	29,180	51,185	51,185
700.00	33,612	62,792	113,977
702.00	38,339	71,951	185,928
704.00	43,362	81,701	267,629
706.00	48,680	92,042	359,671
708.00	54,298	102,978	462,649
710.00	60,211	114,509	577,158
710.50	80,330	35,135	612,293

Device	Routing	Invert	Outlet Devices
#1	Primary	699.00'	**10.0" Round 10" Dia PEP SDR 17** L= 50.0' CPP, end-section conforming to fill, Ke= 0.500 Inlet / Outlet Invert= 699.00' / 698.50' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.55 sf
#2	Secondary	708.00'	**90.0 deg x 10.3' long x 2.00' rise Sharp-Crested Vee/Trap Weir** Cv= 2.50 (C= 3.13)
#3	Tertiary	710.00'	**730.0' long x 10.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64

Primary OutFlow Max=2.76 cfs @ 13.82 hrs HW=700.73' (Free Discharge)
└**1=10" Dia PEP SDR 17** (Barrel Controls 2.76 cfs @ 5.07 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=699.00' TW=708.00' (Dynamic Tailwater)
└**2=Sharp-Crested Vee/Trap Weir** (Controls 0.00 cfs)

Tertiary OutFlow Max=0.00 cfs @ 0.00 hrs HW=699.00' (Free Discharge)
└**3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond P-W1: W Pond

Inflow Area = 49.461 ac, 0.00% Impervious, Inflow Depth = 0.72" for 2 year - 24 hour event
Inflow = 31.76 cfs @ 12.15 hrs, Volume= 2.971 af
Outflow = 2.78 cfs @ 14.10 hrs, Volume= 2.920 af, Atten= 91%, Lag= 117.1 min
Primary = 2.78 cfs @ 14.10 hrs, Volume= 2.920 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Tertiary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Starting Elev= 713.00' Surf.Area= 32,954 sf Storage= 91,190 cf
Peak Elev= 714.75' @ 14.10 hrs Surf.Area= 36,025 sf Storage= 151,359 cf (60,170 cf above start)
Flood Elev= 721.70' Surf.Area= 49,174 sf Storage= 446,853 cf (355,663 cf above start)

Plug-Flow detention time= 973.8 min calculated for 0.827 af (28% of inflow)
Center-of-Mass det. time= 327.3 min (1,206.2 - 878.9)

Volume	Invert	Avail.Storage	Storage Description
#1	710.00'	479,186 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

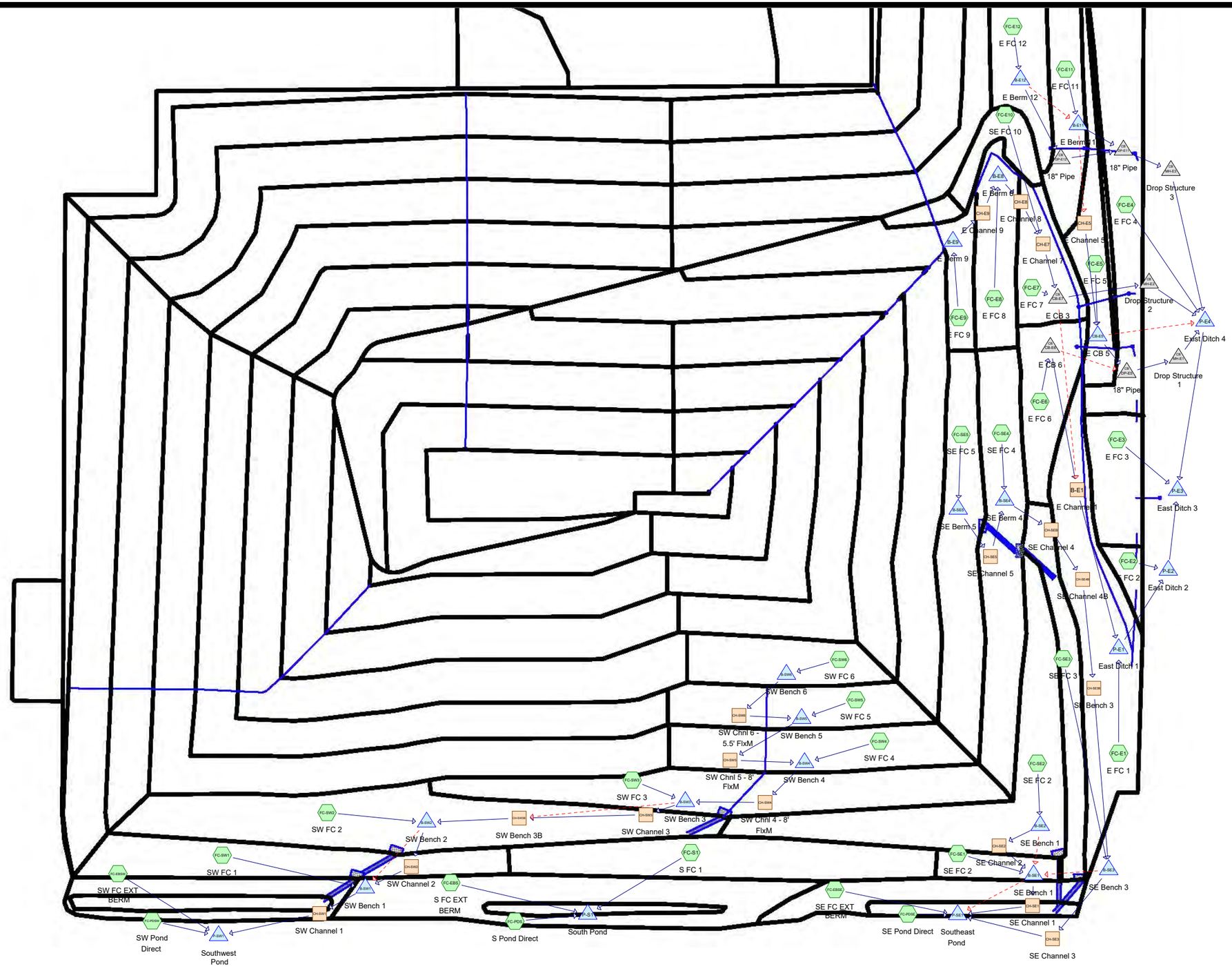
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
710.00	27,881	0	0
712.00	31,221	59,102	59,102
714.00	34,687	65,908	125,010
716.00	38,279	72,966	197,976
718.00	41,998	80,277	278,253
720.00	45,840	87,838	366,091
721.70	49,174	80,762	446,853
721.90	49,174	9,835	456,688
722.30	63,320	22,499	479,186

Device	Routing	Invert	Outlet Devices
#1	Primary	713.00'	**10.0" Round 10" Dia PEP SDR 17** L= 50.0' CMP, end-section conforming to fill, Ke= 0.500 Inlet / Outlet Invert= 713.00' / 712.50' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.55 sf
#2	Secondary	719.70'	**90.0 deg x 10.3' long x 2.00' rise Sharp-Crested Vee/Trap Weir** Cv= 2.50 (C= 3.13)
#3	Tertiary	721.70'	**580.0' long x 10.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64

Primary OutFlow Max=2.78 cfs @ 14.10 hrs HW=714.75' (Free Discharge)
└**1=10" Dia PEP SDR 17** (Barrel Controls 2.78 cfs @ 5.10 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=713.00' TW=719.70' (Dynamic Tailwater)
└**2=Sharp-Crested Vee/Trap Weir** (Controls 0.00 cfs)

Tertiary OutFlow Max=0.00 cfs @ 0.00 hrs HW=713.00' (Free Discharge)
└**3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)



Subcat Reach Pond Link

Routing Diagram for BLSI Permit Expansion 2019_SE & Existing

Prepared by Carlson McCain, Inc., Printed 12/18/2019

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Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
74.539	71	Meadow, non-grazed, HSG C (FC-E1, FC-E10, FC-E11, FC-E12, FC-E2, FC-E3, FC-E4, FC-E5, FC-E6, FC-E7, FC-E8, FC-E9, FC-EBS, FC-EBSE, FC-EBSW, FC-S1, FC-SE1, FC-SE2, FC-SE3, FC-SE4, FC-SE5, FC-SW1, FC-SW2, FC-SW3, FC-SW4, FC-SW5, FC-SW6)
1.192	91	Urban industrial, 72% imp, HSG C (FC-EBS)
2.042	98	Water Surface, HSG C (FC-PDS, FC-PDSE, FC-PDSW)
77.773	**72**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
77.773	HSG C	FC-E1, FC-E10, FC-E11, FC-E12, FC-E2, FC-E3, FC-E4, FC-E5, FC-E6, FC-E7, FC-E8, FC-E9, FC-EBS, FC-EBSE, FC-EBSW, FC-PDS, FC-PDSE, FC-PDSW, FC-S1, FC-SE1, FC-SE2, FC-SE3, FC-SE4, FC-SE5, FC-SW1, FC-SW2, FC-SW3, FC-SW4, FC-SW5, FC-SW6
0.000	HSG D	
0.000	Other	
77.773		**TOTAL AREA**

Pipe Listing (all nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Diam/Width (inches)	Height (inches)	Inside-Fill (inches)
1	B-SW1	744.50	744.00	46.0	0.0109	0.011	96.0	36.0	0.0
2	CB-E6	752.00	722.50	123.0	0.2398	0.013	18.0	0.0	0.0
3	CB-E7	752.00	712.20	157.0	0.2535	0.013	18.0	0.0	0.0
4	DP-E11	747.00	713.75	150.0	0.2217	0.013	18.0	0.0	0.0
5	DP-E12	770.00	747.00	110.0	0.2091	0.013	18.0	0.0	0.0
6	DP-E5	722.50	712.00	60.0	0.1750	0.010	18.0	0.0	0.0
7	MH-E1	712.00	711.70	30.0	0.0100	0.010	18.0	0.0	0.0
8	MH-E2	712.20	712.00	20.0	0.0100	0.010	18.0	0.0	0.0
9	MH-E3	713.75	713.50	25.0	0.0100	0.010	18.0	0.0	0.0
10	P-E1	711.50	709.00	230.0	0.0109	0.010	16.0	0.0	0.0
11	P-E2	709.50	708.50	90.0	0.0111	0.011	16.0	0.0	0.0
12	P-E3	708.19	707.50	75.0	0.0092	0.011	16.0	0.0	0.0
13	P-E4	709.72	709.24	65.0	0.0074	0.010	16.0	0.0	0.0
14	P-SE1	712.00	710.90	73.0	0.0151	0.015	36.0	0.0	0.0
15	P-SW1	715.05	714.37	134.0	0.0051	0.015	18.0	0.0	0.0

Time span=0.00-60.00 hrs, dt=0.01 hrs, 6001 points x 2
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment FC-E1: E FC 1 Runoff Area=207,322 sf 0.00% Impervious Runoff Depth=0.66"
Flow Length=950' Tc=3.0 min CN=71 Runoff=6.12 cfs 0.264 af

Subcatchment FC-E10: SE FC 10 Runoff Area=38,960 sf 0.00% Impervious Runoff Depth=0.66"
Flow Length=540' Tc=4.4 min CN=71 Runoff=1.08 cfs 0.050 af

Subcatchment FC-E11: E FC 11 Runoff Area=110,581 sf 0.00% Impervious Runoff Depth=0.66"
Flow Length=815' Tc=11.7 min CN=71 Runoff=2.23 cfs 0.141 af

Subcatchment FC-E12: E FC 12 Runoff Area=113,402 sf 0.00% Impervious Runoff Depth=0.66"
Flow Length=840' Tc=13.5 min CN=71 Runoff=2.12 cfs 0.144 af

Subcatchment FC-E2: E FC 2 Runoff Area=17,645 sf 0.00% Impervious Runoff Depth=0.66"
Flow Length=80' Slope=0.3300 '/' Tc=4.1 min CN=71 Runoff=0.50 cfs 0.022 af

Subcatchment FC-E3: E FC 3 Runoff Area=68,100 sf 0.00% Impervious Runoff Depth=0.66"
Flow Length=126' Slope=0.3300 '/' Tc=5.9 min CN=71 Runoff=1.77 cfs 0.087 af

Subcatchment FC-E4: E FC 4 Runoff Area=244,950 sf 0.00% Impervious Runoff Depth=0.66"
Flow Length=660' Tc=15.1 min CN=71 Runoff=4.30 cfs 0.311 af

Subcatchment FC-E5: E FC 5 Runoff Area=95,558 sf 0.00% Impervious Runoff Depth=0.66"
Flow Length=1,290' Tc=9.9 min CN=71 Runoff=2.08 cfs 0.121 af

Subcatchment FC-E6: E FC 6 Runoff Area=82,761 sf 0.00% Impervious Runoff Depth=0.66"
Flow Length=353' Tc=6.0 min CN=71 Runoff=2.15 cfs 0.105 af

Subcatchment FC-E7: E FC 7 Runoff Area=71,155 sf 0.00% Impervious Runoff Depth=0.66"
Flow Length=240' Tc=3.2 min CN=71 Runoff=2.08 cfs 0.090 af

Subcatchment FC-E8: E FC 8 Runoff Area=82,564 sf 0.00% Impervious Runoff Depth=0.66"
Flow Length=630' Tc=10.2 min CN=71 Runoff=1.77 cfs 0.105 af

Subcatchment FC-E9: E FC 9 Runoff Area=40,680 sf 0.00% Impervious Runoff Depth=0.66"
Flow Length=590' Tc=9.6 min CN=71 Runoff=0.90 cfs 0.052 af

Subcatchment FC-EBS: S FC EXT BERM Runoff Area=218,410 sf 17.12% Impervious Runoff Depth=0.90"
Flow Length=440' Tc=6.0 min CN=76 Runoff=8.01 cfs 0.377 af

Subcatchment FC-EBSE: SE FC EXT BERM Runoff Area=64,817 sf 0.00% Impervious Runoff Depth=0.66"
Flow Length=80' Slope=0.3333 '/' Tc=4.1 min CN=71 Runoff=1.83 cfs 0.082 af

Subcatchment FC-EBSW: SW FC EXT BERM Runoff Area=90,866 sf 0.00% Impervious Runoff Depth=0.66"
Flow Length=80' Slope=0.2500 '/' Tc=4.6 min CN=71 Runoff=2.50 cfs 0.116 af

Subcatchment FC-PDS: S Pond Direct Runoff Area=22,956 sf 100.00% Impervious Runoff Depth=2.60"
Tc=0.0 min CN=98 Runoff=2.50 cfs 0.114 af

Subcatchment FC-PDSE: SE Pond Direct Runoff Area=29,534 sf 100.00% Impervious Runoff Depth=2.60"
Tc=0.0 min CN=98 Runoff=3.22 cfs 0.147 af

Subcatchment FC-PDSW: SW Pond Direct Runoff Area=0.837 ac 100.00% Impervious Runoff Depth=2.60"
Tc=0.0 min CN=98 Runoff=3.98 cfs 0.181 af

Subcatchment FC-S1: S FC 1 Runoff Area=156,870 sf 0.00% Impervious Runoff Depth=0.66"
Flow Length=1,258' Tc=16.0 min CN=71 Runoff=2.66 cfs 0.199 af

Subcatchment FC-SE1: SE FC 2 Runoff Area=32,441 sf 0.00% Impervious Runoff Depth=0.66"
Flow Length=471' Tc=7.6 min CN=71 Runoff=0.78 cfs 0.041 af

Subcatchment FC-SE2: SE FC 2 Runoff Area=220,544 sf 0.00% Impervious Runoff Depth=0.66"
Flow Length=935' Tc=11.2 min CN=71 Runoff=4.54 cfs 0.280 af

Subcatchment FC-SE3: SE FC 3 Runoff Area=82,514 sf 0.00% Impervious Runoff Depth=0.66"
Flow Length=948' Tc=8.3 min CN=71 Runoff=1.93 cfs 0.105 af

Subcatchment FC-SE4: SE FC 4 Runoff Area=176,950 sf 0.00% Impervious Runoff Depth=0.66"
Flow Length=890' Tc=13.7 min CN=71 Runoff=3.29 cfs 0.225 af

Subcatchment FC-SE5: SE FC 5 Runoff Area=155,474 sf 0.00% Impervious Runoff Depth=0.66"
Flow Length=880' Tc=13.3 min CN=71 Runoff=2.93 cfs 0.198 af

Subcatchment FC-SW1: SW FC 1 Runoff Area=137,408 sf 0.00% Impervious Runoff Depth=0.66"
Flow Length=920' Tc=14.6 min CN=71 Runoff=2.46 cfs 0.175 af

Subcatchment FC-SW2: SW FC 2 Runoff Area=270,545 sf 0.00% Impervious Runoff Depth=0.66"
Flow Length=915' Tc=14.5 min CN=71 Runoff=4.86 cfs 0.344 af

Subcatchment FC-SW3: SW FC 3 Runoff Area=197,591 sf 0.00% Impervious Runoff Depth=0.66"
Flow Length=971' Tc=11.8 min CN=71 Runoff=3.97 cfs 0.251 af

Subcatchment FC-SW4: SW FC 4 Runoff Area=125,118 sf 0.00% Impervious Runoff Depth=0.66"
Flow Length=671' Tc=11.3 min CN=71 Runoff=2.56 cfs 0.159 af

Subcatchment FC-SW5: SW FC 5 Runoff Area=106,215 sf 0.00% Impervious Runoff Depth=0.66"
Flow Length=527' Tc=9.8 min CN=71 Runoff=2.33 cfs 0.135 af

Subcatchment FC-SW6: SW FC 6 Runoff Area=89,383 sf 0.00% Impervious Runoff Depth=0.66"
Flow Length=404' Tc=8.5 min CN=71 Runoff=2.07 cfs 0.114 af

Reach B-E1: E Channel 1 Avg. Flow Depth=0.47' Max Vel=3.35 fps Inflow=6.39 cfs 0.384 af
n=0.040 L=930.0' S=0.0366 '/' Capacity=317.10 cfs Outflow=5.39 cfs 0.384 af

Reach CH-E5: E Channel 5 Avg. Flow Depth=0.00' Max Vel=0.00 fps Inflow=0.00 cfs 0.000 af
n=0.022 L=650.0' S=0.0246 '/' Capacity=470.34 cfs Outflow=0.00 cfs 0.000 af

Reach CH-E7: E Channel 7 Avg. Flow Depth=0.25' Max Vel=4.15 fps Inflow=3.37 cfs 0.206 af
n=0.040 L=293.0' S=0.0956 '/' Capacity=194.34 cfs Outflow=3.34 cfs 0.206 af

Reach CH-E8: E Channel 8 Avg. Flow Depth=0.15' Max Vel=5.46 fps Inflow=2.67 cfs 0.157 af
n=0.040 L=62.0' S=0.2903 '/' Capacity=486.14 cfs Outflow=2.67 cfs 0.157 af

Reach CH-E9: E Channel 9 Avg. Flow Depth=0.08' Max Vel=3.74 fps Inflow=0.90 cfs 0.052 af
n=0.040 L=96.0' S=0.3125 '/' Capacity=504.36 cfs Outflow=0.90 cfs 0.052 af

Reach CH-SE1: SE Channel 1 Avg. Flow Depth=0.22' Max Vel=7.22 fps Inflow=5.08 cfs 0.322 af
n=0.040 L=100.0' S=0.3350 '/' Capacity=522.20 cfs Outflow=5.08 cfs 0.322 af

Reach CH-SE2: SE Channel 2 Avg. Flow Depth=0.21' Max Vel=6.78 fps Inflow=4.48 cfs 0.280 af
n=0.040 L=60.0' S=0.3167 '/' Capacity=507.71 cfs Outflow=4.48 cfs 0.280 af

Reach CH-SE3: SE Channel 3 Avg. Flow Depth=0.24' Max Vel=7.08 fps Inflow=5.43 cfs 0.528 af
n=0.040 L=130.0' S=0.2923 '/' Capacity=487.80 cfs Outflow=5.43 cfs 0.528 af

Reach CH-SE3B: SE Bench 3 Avg. Flow Depth=0.23' Max Vel=1.70 fps Inflow=6.10 cfs 0.423 af
n=0.040 L=743.0' S=0.0162 '/' Capacity=124.24 cfs Outflow=4.86 cfs 0.423 af

Reach CH-SE4B: SE Channel 4B Avg. Flow Depth=0.16' Max Vel=1.85 fps Inflow=6.20 cfs 0.423 af
n=0.040 L=191.0' S=0.0288 '/' Capacity=435.42 cfs Outflow=6.10 cfs 0.423 af

Reach CH-SE5: SE Channel 5 Avg. Flow Depth=0.17' Max Vel=5.39 fps Inflow=2.93 cfs 0.198 af
n=0.040 L=140.0' S=0.2500 '/' Capacity=451.12 cfs Outflow=2.93 cfs 0.198 af

Reach CH-SEB: SE Channel 4 Avg. Flow Depth=0.26' Max Vel=7.34 fps Inflow=6.20 cfs 0.423 af
n=0.040 L=108.0' S=0.2824 '/' Capacity=479.46 cfs Outflow=6.20 cfs 0.423 af

Reach CH-SW1: SW Channel 1 Avg. Flow Depth=0.25' Max Vel=7.29 fps Inflow=14.97 cfs 1.166 af
n=0.040 L=110.0' S=0.2636 '/' Capacity=491.98 cfs Outflow=14.97 cfs 1.166 af

Reach CH-SW2: SW Channel 2 Avg. Flow Depth=0.46' Max Vel=7.97 fps Inflow=12.79 cfs 0.992 af
n=0.040 L=122.0' S=0.1721 '/' Capacity=374.32 cfs Outflow=12.79 cfs 0.992 af

Reach CH-SW3: SW Channel 3 Avg. Flow Depth=0.44' Max Vel=6.83 fps Inflow=10.34 cfs 0.648 af
n=0.040 L=104.0' S=0.1337 '/' Capacity=329.84 cfs Outflow=10.33 cfs 0.648 af

Reach CH-SW3B: SW Bench 3B Avg. Flow Depth=0.27' Max Vel=2.74 fps Inflow=10.33 cfs 0.648 af
n=0.030 L=933.0' S=0.0194 '/' Capacity=285.18 cfs Outflow=8.52 cfs 0.648 af

Reach CH-SW4: SW Chnl 4 - 8' FlxM Avg. Flow Depth=0.33' Max Vel=5.20 fps Inflow=6.92 cfs 0.408 af
n=0.055 L=170.0' S=0.1988 '/' Capacity=93.94 cfs Outflow=6.90 cfs 0.408 af

Reach CH-SW5: SW Chnl 5 - 8' FlxM Avg. Flow Depth=0.23' Max Vel=4.80 fps Inflow=4.39 cfs 0.249 af
n=0.061 L=123.0' S=0.3171 '/' Capacity=106.96 cfs Outflow=4.38 cfs 0.249 af

Reach CH-SW6: SW Chnl 6 - 5.5' FlxM Avg. Flow Depth=0.27' Max Vel=4.95 fps Inflow=2.07 cfs 0.114 af
n=0.059 L=123.0' S=0.3171 '/' Capacity=48.34 cfs Outflow=2.07 cfs 0.114 af

Pond B-E11: E Berm 11 Peak Elev=750.28' Storage=18 cf Inflow=2.23 cfs 0.141 af
Primary=2.23 cfs 0.141 af Secondary=0.00 cfs 0.000 af Outflow=2.23 cfs 0.141 af

Pond B-E12: E Berm 12 Peak Elev=773.27' Storage=17 cf Inflow=2.12 cfs 0.144 af
Primary=2.12 cfs 0.144 af Secondary=0.00 cfs 0.000 af Outflow=2.12 cfs 0.144 af

Pond B-E8: E Berm 8 Peak Elev=800.34' Storage=14 cf Inflow=2.67 cfs 0.157 af
Outflow=2.67 cfs 0.157 af

Pond B-E9: E Berm 9 Peak Elev=830.17' Storage=7 cf Inflow=0.90 cfs 0.052 af
Outflow=0.90 cfs 0.052 af

Pond B-SE1: SE Bench 1 Peak Elev=746.28' Storage=64 cf Inflow=5.10 cfs 0.322 af
Primary=5.08 cfs 0.322 af Secondary=0.00 cfs 0.000 af Outflow=5.08 cfs 0.322 af

Pond B-SE2: SE Bench 1 Peak Elev=765.22' Storage=175 cf Inflow=4.54 cfs 0.280 af
Primary=4.48 cfs 0.280 af Secondary=0.00 cfs 0.000 af Outflow=4.48 cfs 0.280 af

Pond B-SE3: SE Bench 3 Peak Elev=750.54' Storage=141 cf Inflow=5.44 cfs 0.528 af
Primary=5.43 cfs 0.528 af Secondary=0.00 cfs 0.000 af Outflow=5.43 cfs 0.528 af

Pond B-SE4: SE Berm 4 Peak Elev=798.59' Storage=84 cf Inflow=6.21 cfs 0.423 af
Outflow=6.20 cfs 0.423 af

Pond B-SE5: SE Berm 5 Peak Elev=833.36' Storage=32 cf Inflow=2.93 cfs 0.198 af
Outflow=2.93 cfs 0.198 af

Pond B-SW1: SW Bench 1 Peak Elev=745.20' Storage=10 cf Inflow=14.97 cfs 1.166 af
Outflow=14.97 cfs 1.166 af

Pond B-SW2: SW Bench 2 Peak Elev=766.96' Storage=591 cf Inflow=12.95 cfs 0.992 af
Primary=12.79 cfs 0.992 af Secondary=0.00 cfs 0.000 af Outflow=12.79 cfs 0.992 af

Pond B-SW3: SW Bench 3 Peak Elev=798.85' Storage=1,755 cf Inflow=10.86 cfs 0.659 af
Primary=10.34 cfs 0.648 af Secondary=0.00 cfs 0.000 af Outflow=10.34 cfs 0.648 af

Pond B-SW4: SW Bench 4 Peak Elev=832.47' Storage=57 cf Inflow=6.92 cfs 0.408 af
Outflow=6.92 cfs 0.408 af

Pond B-SW5: SW Bench 5 Peak Elev=871.30' Storage=37 cf Inflow=4.39 cfs 0.249 af
Outflow=4.39 cfs 0.249 af

Pond B-SW6: SW Bench 6 Peak Elev=910.35' Storage=42 cf Inflow=2.07 cfs 0.114 af
Outflow=2.07 cfs 0.114 af

Pond CB-E5: E CB 5 Peak Elev=725.74' Storage=3 cf Inflow=2.08 cfs 0.121 af
Primary=2.08 cfs 0.121 af Secondary=0.00 cfs 0.000 af Outflow=2.08 cfs 0.121 af

Pond CB-E6: E CB 6 Peak Elev=752.19' Inflow=2.15 cfs 0.105 af
Primary=1.99 cfs 0.101 af Secondary=0.16 cfs 0.004 af Outflow=2.15 cfs 0.105 af

Pond CB-E7: E CB 3 Peak Elev=752.30' Inflow=4.77 cfs 0.297 af
Primary=0.37 cfs 0.014 af Secondary=4.40 cfs 0.283 af Outflow=4.77 cfs 0.297 af

Pond DP-E11: 18" Pipe Peak Elev=748.01' Inflow=4.32 cfs 0.285 af
18.0" Round Culvert n=0.013 L=150.0' S=0.2217 '/' Outflow=4.32 cfs 0.285 af

Pond DP-E12: 18" Pipe Peak Elev=770.67' Inflow=2.12 cfs 0.144 af
18.0" Round Culvert n=0.013 L=110.0' S=0.2091 '/' Outflow=2.12 cfs 0.144 af

Pond DP-E5: 18" Pipe Peak Elev=723.18' Inflow=2.20 cfs 0.126 af
18.0" Round Culvert n=0.010 L=60.0' S=0.1750 '/' Outflow=2.20 cfs 0.126 af

Pond MH-E1: Drop Structure 1 Peak Elev=712.70' Inflow=2.20 cfs 0.126 af
18.0" Round Culvert n=0.010 L=30.0' S=0.0100 '/' Outflow=2.20 cfs 0.126 af

Pond MH-E2: Drop Structure 2 Peak Elev=712.47' Inflow=0.37 cfs 0.014 af
18.0" Round Culvert n=0.010 L=20.0' S=0.0100 '/' Outflow=0.37 cfs 0.014 af

Pond MH-E3: Drop Structure 3 Peak Elev=714.84' Inflow=4.32 cfs 0.285 af
18.0" Round Culvert n=0.010 L=25.0' S=0.0100 '/' Outflow=4.32 cfs 0.285 af

Pond P-E1: East Ditch 1 Peak Elev=713.12' Storage=3,110 cf Inflow=9.76 cfs 0.648 af
Primary=6.55 cfs 0.641 af Secondary=0.00 cfs 0.000 af Outflow=6.55 cfs 0.641 af

Pond P-E2: East Ditch 2 Peak Elev=711.15' Storage=3,120 cf Inflow=6.75 cfs 0.664 af
Primary=4.72 cfs 0.659 af Secondary=0.00 cfs 0.000 af Outflow=4.72 cfs 0.659 af

Pond P-E3: East Ditch 3 Peak Elev=710.73' Storage=4,202 cf Inflow=11.89 cfs 1.472 af
Primary=9.20 cfs 1.472 af Secondary=0.00 cfs 0.000 af Outflow=9.20 cfs 1.472 af

Pond P-E4: Exist Ditch 4 Peak Elev=711.46' Storage=4,518 cf Inflow=10.75 cfs 0.736 af
Primary=6.77 cfs 0.727 af Secondary=0.00 cfs 0.000 af Outflow=6.77 cfs 0.727 af

Pond P-S1: South Pond Peak Elev=719.45' Storage=27,073 cf Inflow=10.21 cfs 0.691 af
Discarded=0.07 cfs 0.256 af Secondary=0.00 cfs 0.000 af Tertiary=0.00 cfs 0.000 af Outflow=0.07 cfs 0.256 af

Pond P-SE1: Southeast Pond Peak Elev=712.86' Storage=45,576 cf Inflow=10.01 cfs 1.078 af
Primary=5.24 cfs 1.074 af Secondary=0.00 cfs 0.000 af Outflow=5.24 cfs 1.074 af

Pond P-SW1: Southwest Pond Peak Elev=720.05' Storage=58,025 cf Inflow=15.83 cfs 1.463 af
Primary=0.45 cfs 0.162 af Secondary=0.00 cfs 0.000 af Outflow=0.45 cfs 0.162 af

Total Runoff Area = 77.773 ac Runoff Volume = 4.736 af Average Runoff Depth = 0.73"
96.27% Pervious = 74.872 ac 3.73% Impervious = 2.900 ac

Summary for Subcatchment FC-E1: E FC 1

Runoff = 6.12 cfs @ 11.95 hrs, Volume= 0.264 af, Depth= 0.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 2 year - 24 hour Rainfall=2.83"

Area (sf)	CN	Description
207,322	71	Meadow, non-grazed, HSG C
207,322		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.4	20	0.3330	0.25		**Sheet Flow, Slope Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
1.6	930	0.0366	9.61	317.28	**Trap/Vee/Rect Channel Flow, Ditch Flow** Bot.W=2.00' D=3.00' Z= 3.0 '/' Top.W=20.00' n= 0.040 Mountain streams
3.0	950	Total			

Summary for Subcatchment FC-E10: SE FC 10

Runoff = 1.08 cfs @ 11.96 hrs, Volume= 0.050 af, Depth= 0.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 2 year - 24 hour Rainfall=2.83"

Area (sf)	CN	Description
38,960	71	Meadow, non-grazed, HSG C
38,960		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.4	40	0.3330	0.28		**Sheet Flow, Slope Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
2.0	500	0.0800	4.24		**Shallow Concentrated Flow, Ditch Flow** Grassed Waterway Kv= 15.0 fps
4.4	540	Total			

Summary for Subcatchment FC-E11: E FC 11

Runoff = 2.23 cfs @ 12.05 hrs, Volume= 0.141 af, Depth= 0.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 2 year - 24 hour Rainfall=2.83"

Area (sf)	CN	Description
110,581	71	Meadow, non-grazed, HSG C
110,581		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.5	90	0.3300	0.33		**Sheet Flow, Slope Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
7.2	725	0.0125	1.68		**Shallow Concentrated Flow, Ditch Flow** Grassed Waterway Kv= 15.0 fps
11.7	815	Total			

Summary for Subcatchment FC-E12: E FC 12

Runoff = 2.12 cfs @ 12.07 hrs, Volume= 0.144 af, Depth= 0.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 2 year - 24 hour Rainfall=2.83"

Area (sf)	CN	Description
113,402	71	Meadow, non-grazed, HSG C
113,402		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.5	140	0.3300	0.36		**Sheet Flow, Slope Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
7.0	700	0.0125	1.68		**Shallow Concentrated Flow, Ditch Flow** Grassed Waterway Kv= 15.0 fps
13.5	840	Total			

Summary for Subcatchment FC-E2: E FC 2

Runoff = 0.50 cfs @ 11.96 hrs, Volume= 0.022 af, Depth= 0.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 2 year - 24 hour Rainfall=2.83"

Area (sf)	CN	Description
17,645	71	Meadow, non-grazed, HSG C
17,645		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.1	80	0.3300	0.32		**Sheet Flow, 3:1 Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"

Summary for Subcatchment FC-E3: E FC 3

Runoff = 1.77 cfs @ 11.98 hrs, Volume= 0.087 af, Depth= 0.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 2 year - 24 hour Rainfall=2.83"

Area (sf)	CN	Description
68,100	71	Meadow, non-grazed, HSG C
68,100		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.9	126	0.3300	0.35		**Sheet Flow, 3:1 Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"

Summary for Subcatchment FC-E4: E FC 4

Runoff = 4.30 cfs @ 12.09 hrs, Volume= 0.311 af, Depth= 0.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 2 year - 24 hour Rainfall=2.83"

Area (sf)	CN	Description
244,950	71	Meadow, non-grazed, HSG C
244,950		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.2	160	0.3300	0.37		**Sheet Flow, Slope Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
7.9	500	0.0050	1.06		**Shallow Concentrated Flow, Ditch Flow** Grassed Waterway Kv= 15.0 fps
15.1	660	Total			

Summary for Subcatchment FC-E5: E FC 5

Runoff = 2.08 cfs @ 12.03 hrs, Volume= 0.121 af, Depth= 0.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 2 year - 24 hour Rainfall=2.83"

Area (sf)	CN	Description
95,558	71	Meadow, non-grazed, HSG C
95,558		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.4	40	0.3330	0.28		**Sheet Flow, Slope Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
7.5	1,250	0.0300	2.79		**Shallow Concentrated Flow, Ditch Flow** Unpaved Kv= 16.1 fps
9.9	1,290	Total			

Summary for Subcatchment FC-E6: E FC 6

Runoff = 2.15 cfs @ 11.98 hrs, Volume= 0.105 af, Depth= 0.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 2 year - 24 hour Rainfall=2.83"

Area (sf)	CN	Description
82,761	71	Meadow, non-grazed, HSG C
82,761		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0	103	0.3330	0.34		**Sheet Flow, Slope Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
1.0	250	0.0700	3.97		**Shallow Concentrated Flow, Ditch Flow** Grassed Waterway Kv= 15.0 fps
6.0	353	Total			

Summary for Subcatchment FC-E7: E FC 7

Runoff = 2.08 cfs @ 11.95 hrs, Volume= 0.090 af, Depth= 0.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 2 year - 24 hour Rainfall=2.83"

Area (sf)	CN	Description
71,155	71	Meadow, non-grazed, HSG C
71,155		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.4	40	0.3330	0.28		**Sheet Flow, Slope Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
0.8	200	0.0700	4.26		**Shallow Concentrated Flow, Ditch Flow** Unpaved Kv= 16.1 fps
3.2	240	Total			

Summary for Subcatchment FC-E8: E FC 8

Runoff = 1.77 cfs @ 12.03 hrs, Volume= 0.105 af, Depth= 0.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 2 year - 24 hour Rainfall=2.83"

Area (sf)	CN	Description
82,564	71	Meadow, non-grazed, HSG C
82,564		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.9	100	0.3330	0.34		**Sheet Flow, Slope Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
5.3	530	0.0125	1.68		**Shallow Concentrated Flow, Ditch Flow** Grassed Waterway Kv= 15.0 fps
10.2	630	Total			

Summary for Subcatchment FC-E9: E FC 9

Runoff = 0.90 cfs @ 12.03 hrs, Volume= 0.052 af, Depth= 0.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 2 year - 24 hour Rainfall=2.83"

Area (sf)	CN	Description
40,680	71	Meadow, non-grazed, HSG C
40,680		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.7	95	0.3330	0.33		**Sheet Flow, Slope Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
4.9	495	0.0125	1.68		**Shallow Concentrated Flow, Ditch Flow** Grassed Waterway Kv= 15.0 fps
9.6	590	Total			

Summary for Subcatchment FC-EBS: S FC EXT BERM

Runoff = 8.01 cfs @ 11.98 hrs, Volume= 0.377 af, Depth= 0.90"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 2 year - 24 hour Rainfall=2.83"

Area (sf)	CN	Description
166,486	71	Meadow, non-grazed, HSG C
51,924	91	Urban industrial, 72% imp, HSG C
218,410	76	Weighted Average
181,025		82.88% Pervious Area
37,385		17.12% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.8	50	0.3333	0.29		**Sheet Flow, 3:1 Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
3.2	390	0.0100	2.03		**Shallow Concentrated Flow, 1% Shallow Flow** Paved Kv= 20.3 fps
6.0	440	Total			

Summary for Subcatchment FC-EBSE: SE FC EXT BERM

Runoff = 1.83 cfs @ 11.96 hrs, Volume= 0.082 af, Depth= 0.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 2 year - 24 hour Rainfall=2.83"

Area (sf)	CN	Description
64,817	71	Meadow, non-grazed, HSG C
64,817		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.1	80	0.3333	0.32		**Sheet Flow, 3:1 Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"

Summary for Subcatchment FC-EBSW: SW FC EXT BERM

Runoff = 2.50 cfs @ 11.97 hrs, Volume= 0.116 af, Depth= 0.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 2 year - 24 hour Rainfall=2.83"

Area (sf)	CN	Description
90,866	71	Meadow, non-grazed, HSG C
90,866		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.6	80	0.2500	0.29		**Sheet Flow, 4:1 Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"

Summary for Subcatchment FC-PDS: S Pond Direct

[46] Hint: Tc=0 (Instant runoff peak depends on dt)

Runoff = 2.50 cfs @ 11.90 hrs, Volume= 0.114 af, Depth= 2.60"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 2 year - 24 hour Rainfall=2.83"

Area (sf)	CN	Description
22,956	98	Water Surface, HSG C
22,956		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0					**Direct Entry, Direct Entry**

Summary for Subcatchment FC-PDSE: SE Pond Direct

[46] Hint: Tc=0 (Instant runoff peak depends on dt)

Runoff = 3.22 cfs @ 11.90 hrs, Volume= 0.147 af, Depth= 2.60"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 2 year - 24 hour Rainfall=2.83"

Area (sf)	CN	Description
29,534	98	Water Surface, HSG C
29,534		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0					**Direct Entry, Direct Entry**

Summary for Subcatchment FC-PDSW: SW Pond Direct

[46] Hint: Tc=0 (Instant runoff peak depends on dt)

Runoff = 3.98 cfs @ 11.90 hrs, Volume= 0.181 af, Depth= 2.60"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 2 year - 24 hour Rainfall=2.83"

Area (ac)	CN	Description
0.837	98	Water Surface, HSG C
0.837		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0					**Direct Entry, Direct Entry**

Summary for Subcatchment FC-S1: S FC 1

Runoff = 2.66 cfs @ 12.10 hrs, Volume= 0.199 af, Depth= 0.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 2 year - 24 hour Rainfall=2.83"

Area (sf)	CN	Description
156,870	71	Meadow, non-grazed, HSG C
156,870		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.5	90	0.3330	0.33		**Sheet Flow, Sheet Flow Slope** Grass: Dense n= 0.240 P2= 2.83"
10.8	968	0.0100	1.50		**Shallow Concentrated Flow, Ditch Flow** Grassed Waterway Kv= 15.0 fps
0.7	200	0.1000	5.09		**Shallow Concentrated Flow, Concentrated Flow** Unpaved Kv= 16.1 fps
16.0	1,258	Total			

Summary for Subcatchment FC-SE1: SE FC 2

Runoff = 0.78 cfs @ 12.00 hrs, Volume= 0.041 af, Depth= 0.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 2 year - 24 hour Rainfall=2.83"

Area (sf)	CN	Description
32,441	71	Meadow, non-grazed, HSG C
32,441		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.6	91	0.3330	0.33		**Sheet Flow, Slope Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
3.0	380	0.0200	2.12		**Shallow Concentrated Flow, Ditch Flow** Grassed Waterway Kv= 15.0 fps
7.6	471	Total			

Summary for Subcatchment FC-SE2: SE FC 2

Runoff = 4.54 cfs @ 12.05 hrs, Volume= 0.280 af, Depth= 0.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 2 year - 24 hour Rainfall=2.83"

Area (sf)	CN	Description
220,544	71	Meadow, non-grazed, HSG C
220,544		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.3	60	0.3330	0.31		**Sheet Flow, Slope Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
7.9	875	0.0150	1.84		**Shallow Concentrated Flow, Ditch Flow** Grassed Waterway Kv= 15.0 fps
11.2	935	Total			

Summary for Subcatchment FC-SE3: SE FC 3

Runoff = 1.93 cfs @ 12.01 hrs, Volume= 0.105 af, Depth= 0.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 2 year - 24 hour Rainfall=2.83"

Area (sf)	CN	Description
82,514	71	Meadow, non-grazed, HSG C
82,514		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.3	38	0.3330	0.28		**Sheet Flow, Slope Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
6.0	910	0.0280	2.51		**Shallow Concentrated Flow, Ditch Flow** Grassed Waterway Kv= 15.0 fps
8.3	948	Total			

Summary for Subcatchment FC-SE4: SE FC 4

Runoff = 3.29 cfs @ 12.07 hrs, Volume= 0.225 af, Depth= 0.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 2 year - 24 hour Rainfall=2.83"

Area (sf)	CN	Description
176,950	71	Meadow, non-grazed, HSG C
176,950		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.1	130	0.3330	0.36		**Sheet Flow, Slope Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
7.6	760	0.0125	1.68		**Shallow Concentrated Flow, Ditch Flow** Grassed Waterway Kv= 15.0 fps
13.7	890	Total			

Summary for Subcatchment FC-SE5: SE FC 5

Runoff = 2.93 cfs @ 12.07 hrs, Volume= 0.198 af, Depth= 0.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 2 year - 24 hour Rainfall=2.83"

Area (sf)	CN	Description
155,474	71	Meadow, non-grazed, HSG C
155,474		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	120	0.3330	0.35		**Sheet Flow, Slope Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
7.6	760	0.0125	1.68		**Shallow Concentrated Flow, Ditch Flow** Grassed Waterway Kv= 15.0 fps
13.3	880	Total			

Summary for Subcatchment FC-SW1: SW FC 1

Runoff = 2.46 cfs @ 12.09 hrs, Volume= 0.175 af, Depth= 0.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 2 year - 24 hour Rainfall=2.83"

Area (sf)	CN	Description
137,408	71	Meadow, non-grazed, HSG C
137,408		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	120	0.3330	0.35		**Sheet Flow, Slope Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
8.9	800	0.0100	1.50		**Shallow Concentrated Flow, Ditch Flow** Grassed Waterway Kv= 15.0 fps
14.6	920	Total			

Summary for Subcatchment FC-SW2: SW FC 2

Runoff = 4.86 cfs @ 12.08 hrs, Volume= 0.344 af, Depth= 0.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 2 year - 24 hour Rainfall=2.83"

Area (sf)	CN	Description
270,545	71	Meadow, non-grazed, HSG C
270,545		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	120	0.3330	0.35		**Sheet Flow, Slope Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
8.8	795	0.0100	1.50		**Shallow Concentrated Flow, Ditch Flow** Grassed Waterway Kv= 15.0 fps
14.5	915	Total			

Summary for Subcatchment FC-SW3: SW FC 3

Runoff = 3.97 cfs @ 12.05 hrs, Volume= 0.251 af, Depth= 0.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 2 year - 24 hour Rainfall=2.83"

Area (sf)	CN	Description
197,591	71	Meadow, non-grazed, HSG C
197,591		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.6	46	0.3330	0.29		**Sheet Flow, Slope Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
9.2	925	0.0125	1.68		**Shallow Concentrated Flow, Ditch Flow** Grassed Waterway Kv= 15.0 fps
11.8	971	Total			

Summary for Subcatchment FC-SW4: SW FC 4

Runoff = 2.56 cfs @ 12.05 hrs, Volume= 0.159 af, Depth= 0.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 2 year - 24 hour Rainfall=2.83"

Area (sf)	CN	Description
125,118	71	Meadow, non-grazed, HSG C
125,118		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	120	0.3300	0.35		**Sheet Flow, Slope Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
5.6	551	0.0120	1.64		**Shallow Concentrated Flow, Ditch Flow** Grassed Waterway Kv= 15.0 fps
11.3	671	Total			

Summary for Subcatchment FC-SW5: SW FC 5

Runoff = 2.33 cfs @ 12.03 hrs, Volume= 0.135 af, Depth= 0.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 2 year - 24 hour Rainfall=2.83"

Area (sf)	CN	Description
106,215	71	Meadow, non-grazed, HSG C
106,215		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	120	0.3300	0.35		**Sheet Flow, Slope Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
4.1	407	0.0120	1.64		**Shallow Concentrated Flow, Ditch Flow** Grassed Waterway Kv= 15.0 fps
9.8	527	Total			

Summary for Subcatchment FC-SW6: SW FC 6

Runoff = 2.07 cfs @ 12.01 hrs, Volume= 0.114 af, Depth= 0.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 2 year - 24 hour Rainfall=2.83"

Area (sf)	CN	Description
89,383	71	Meadow, non-grazed, HSG C
89,383		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	120	0.3300	0.35		**Sheet Flow, Slope Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
2.8	284	0.0125	1.68		**Shallow Concentrated Flow, Ditch Flow** Grassed Waterway Kv= 15.0 fps
8.5	404	Total			

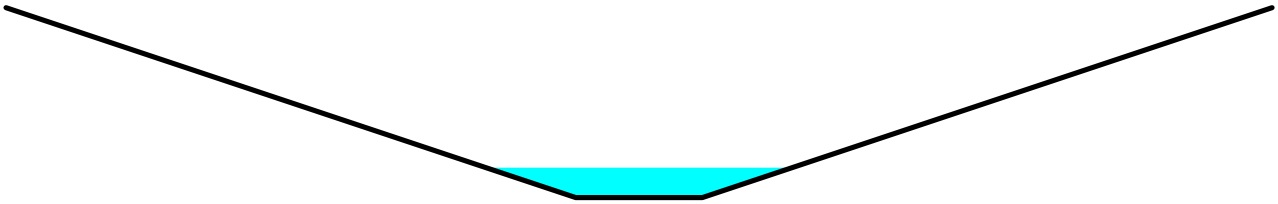
Summary for Reach B-E1: E Channel 1

Inflow Area = 1.900 ac, 0.00% Impervious, Inflow Depth = 2.43" for 2 year - 24 hour event
Inflow = 6.39 cfs @ 11.98 hrs, Volume= 0.384 af
Outflow = 5.39 cfs @ 12.03 hrs, Volume= 0.384 af, Atten= 16%, Lag= 2.9 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 3.35 fps, Min. Travel Time= 4.6 min
Avg. Velocity = 1.18 fps, Avg. Travel Time= 13.1 min

Peak Storage= 1,497 cf @ 12.03 hrs
Average Depth at Peak Storage= 0.47'
Bank-Full Depth= 3.00' Flow Area= 33.0 sf, Capacity= 317.10 cfs

2.00' x 3.00' deep channel, n= 0.040 Mountain streams
Side Slope Z-value= 3.0 '/' Top Width= 20.00'
Length= 930.0' Slope= 0.0366 '/'
Inlet Invert= 748.00', Outlet Invert= 714.00'



Summary for Reach CH-E5: E Channel 5

Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 0.00 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 0.00 fps, Avg. Travel Time= 0.0 min

Peak Storage= 0 cf @ 0.00 hrs
Average Depth at Peak Storage= 0.00'
Bank-Full Depth= 2.00' Flow Area= 34.0 sf, Capacity= 470.34 cfs

12.00' x 2.00' deep channel, n= 0.022 Earth, clean & straight
Side Slope Z-value= 3.0 2.0 '/' Top Width= 22.00'
Length= 650.0' Slope= 0.0246 '/'
Inlet Invert= 742.00', Outlet Invert= 726.00'

‡

Summary for Reach CH-E7: E Channel 7

[62] Hint: Exceeded Reach CH-E8 OUTLET depth by 0.10' @ 12.00 hrs

Inflow Area = 3.724 ac, 0.00% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 3.37 cfs @ 12.01 hrs, Volume= 0.206 af
Outflow = 3.34 cfs @ 12.02 hrs, Volume= 0.206 af, Atten= 1%, Lag= 0.8 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 4.15 fps, Min. Travel Time= 1.2 min
Avg. Velocity = 1.27 fps, Avg. Travel Time= 3.9 min

Peak Storage= 236 cf @ 12.02 hrs
Average Depth at Peak Storage= 0.25'
Bank-Full Depth= 2.50' Flow Area= 13.8 sf, Capacity= 194.34 cfs

3.00' x 2.50' deep channel, n= 0.040 Earth, cobble bottom, clean sides
Side Slope Z-value= 1.0 '/' Top Width= 8.00'
Length= 293.0' Slope= 0.0956 '/'
Inlet Invert= 782.00', Outlet Invert= 754.00'

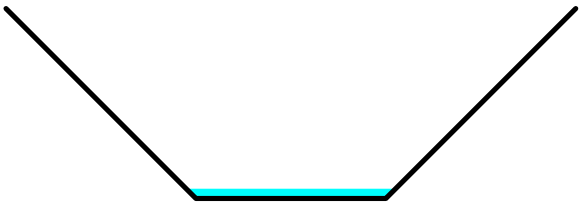
Summary for Reach CH-E8: E Channel 8

Inflow Area = 2.829 ac, 0.00% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 2.67 cfs @ 12.04 hrs, Volume= 0.157 af
Outflow = 2.67 cfs @ 12.04 hrs, Volume= 0.157 af, Atten= 0%, Lag= 0.1 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 5.46 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 2.04 fps, Avg. Travel Time= 0.5 min

Peak Storage= 30 cf @ 12.04 hrs
Average Depth at Peak Storage= 0.15'
Bank-Full Depth= 3.00' Flow Area= 18.0 sf, Capacity= 486.14 cfs

3.00' x 3.00' deep channel, n= 0.040 Earth, cobble bottom, clean sides
Side Slope Z-value= 1.0 '/' Top Width= 9.00'
Length= 62.0' Slope= 0.2903 '/'
Inlet Invert= 800.00', Outlet Invert= 782.00'



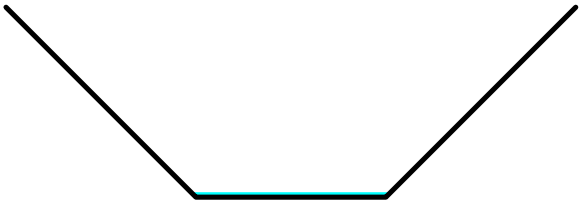
Summary for Reach CH-E9: E Channel 9

Inflow Area = 0.934 ac, 0.00% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 0.90 cfs @ 12.03 hrs, Volume= 0.052 af
Outflow = 0.90 cfs @ 12.03 hrs, Volume= 0.052 af, Atten= 0%, Lag= 0.3 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 3.74 fps, Min. Travel Time= 0.4 min
Avg. Velocity = 2.01 fps, Avg. Travel Time= 0.8 min

Peak Storage= 23 cf @ 12.03 hrs
Average Depth at Peak Storage= 0.08'
Bank-Full Depth= 3.00' Flow Area= 18.0 sf, Capacity= 504.36 cfs

3.00' x 3.00' deep channel, n= 0.040 Earth, cobble bottom, clean sides
Side Slope Z-value= 1.0 '/' Top Width= 9.00'
Length= 96.0' Slope= 0.3125 '/'
Inlet Invert= 830.00', Outlet Invert= 800.00'



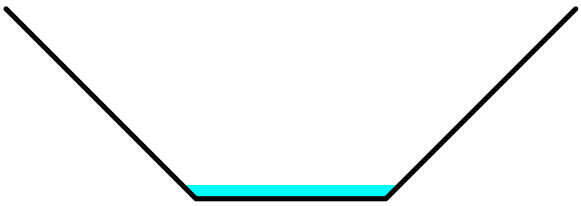
Summary for Reach CH-SE1: SE Channel 1

Inflow Area = 5.808 ac, 0.00% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 5.08 cfs @ 12.06 hrs, Volume= 0.322 af
Outflow = 5.08 cfs @ 12.06 hrs, Volume= 0.322 af, Atten= 0%, Lag= 0.1 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 7.22 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 2.38 fps, Avg. Travel Time= 0.7 min

Peak Storage= 70 cf @ 12.06 hrs
Average Depth at Peak Storage= 0.22'
Bank-Full Depth= 3.00' Flow Area= 18.0 sf, Capacity= 522.20 cfs

3.00' x 3.00' deep channel, n= 0.040 Earth, cobble bottom, clean sides
Side Slope Z-value= 1.0 '/' Top Width= 9.00'
Length= 100.0' Slope= 0.3350 '/'
Inlet Invert= 745.50', Outlet Invert= 712.00'



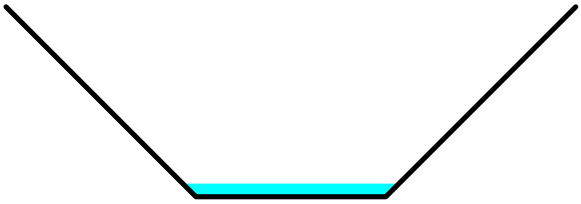
Summary for Reach CH-SE2: SE Channel 2

Inflow Area = 5.063 ac, 0.00% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 4.48 cfs @ 12.06 hrs, Volume= 0.280 af
Outflow = 4.48 cfs @ 12.06 hrs, Volume= 0.280 af, Atten= 0%, Lag= 0.1 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 6.78 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 2.27 fps, Avg. Travel Time= 0.4 min

Peak Storage= 40 cf @ 12.06 hrs
Average Depth at Peak Storage= 0.21'
Bank-Full Depth= 3.00' Flow Area= 18.0 sf, Capacity= 507.71 cfs

3.00' x 3.00' deep channel, n= 0.040 Earth, cobble bottom, clean sides
Side Slope Z-value= 1.0 '/' Top Width= 9.00'
Length= 60.0' Slope= 0.3167 '/'
Inlet Invert= 764.50', Outlet Invert= 745.50'



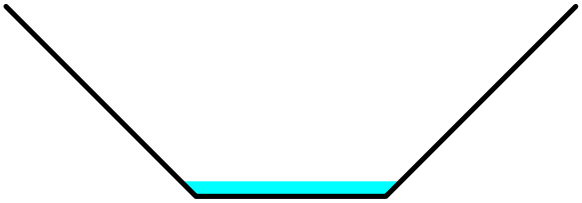
Summary for Reach CH-SE3: SE Channel 3

Inflow Area = 9.526 ac, 0.00% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 5.43 cfs @ 12.18 hrs, Volume= 0.528 af
Outflow = 5.43 cfs @ 12.18 hrs, Volume= 0.528 af, Atten= 0%, Lag= 0.2 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 7.08 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 2.43 fps, Avg. Travel Time= 0.9 min

Peak Storage= 100 cf @ 12.18 hrs
Average Depth at Peak Storage= 0.24'
Bank-Full Depth= 3.00' Flow Area= 18.0 sf, Capacity= 487.80 cfs

3.00' x 3.00' deep channel, n= 0.040 Earth, cobble bottom, clean sides
Side Slope Z-value= 1.0 '/' Top Width= 9.00'
Length= 130.0' Slope= 0.2923 '/'
Inlet Invert= 750.00', Outlet Invert= 712.00'



Summary for Reach CH-SE3B: SE Bench 3

[62] Hint: Exceeded Reach CH-SE4B OUTLET depth by 0.10' @ 12.25 hrs

Inflow Area = 7.631 ac, 0.00% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 6.10 cfs @ 12.10 hrs, Volume= 0.423 af
Outflow = 4.86 cfs @ 12.18 hrs, Volume= 0.423 af, Atten= 20%, Lag= 4.6 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 1.70 fps, Min. Travel Time= 7.3 min
Avg. Velocity = 0.48 fps, Avg. Travel Time= 25.6 min

Peak Storage= 2,124 cf @ 12.18 hrs
Average Depth at Peak Storage= 0.23'
Bank-Full Depth= 1.50' Flow Area= 23.6 sf, Capacity= 124.24 cfs

12.00' x 1.50' deep channel, n= 0.040
Side Slope Z-value= 2.0 3.0 '/' Top Width= 19.50'
Length= 743.0' Slope= 0.0162 '/'
Inlet Invert= 762.00', Outlet Invert= 750.00'

‡

Summary for Reach CH-SE4B: SE Channel 4B

[61] Hint: Exceeded Reach CH-SEB outlet invert by 0.16' @ 12.10 hrs

Inflow Area = 7.631 ac, 0.00% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 6.20 cfs @ 12.08 hrs, Volume= 0.423 af
Outflow = 6.10 cfs @ 12.10 hrs, Volume= 0.423 af, Atten= 2%, Lag= 1.1 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 1.85 fps, Min. Travel Time= 1.7 min
Avg. Velocity = 0.57 fps, Avg. Travel Time= 5.6 min

Peak Storage= 631 cf @ 12.10 hrs
Average Depth at Peak Storage= 0.16'
Bank-Full Depth= 2.00' Flow Area= 50.0 sf, Capacity= 435.42 cfs

20.00' x 2.00' deep channel, n= 0.040 Earth, cobble bottom, clean sides
Side Slope Z-value= 3.0 2.0 '/' Top Width= 30.00'
Length= 191.0' Slope= 0.0288 '/'
Inlet Invert= 767.50', Outlet Invert= 762.00'

‡

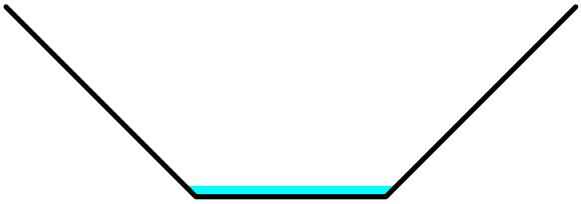
Summary for Reach CH-SE5: SE Channel 5

Inflow Area = 3.569 ac, 0.00% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 2.93 cfs @ 12.07 hrs, Volume= 0.198 af
Outflow = 2.93 cfs @ 12.08 hrs, Volume= 0.198 af, Atten= 0%, Lag= 0.3 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 5.39 fps, Min. Travel Time= 0.4 min
Avg. Velocity = 1.95 fps, Avg. Travel Time= 1.2 min

Peak Storage= 76 cf @ 12.08 hrs
Average Depth at Peak Storage= 0.17'
Bank-Full Depth= 3.00' Flow Area= 18.0 sf, Capacity= 451.12 cfs

3.00' x 3.00' deep channel, n= 0.040 Earth, cobble bottom, clean sides
Side Slope Z-value= 1.0 '/' Top Width= 9.00'
Length= 140.0' Slope= 0.2500 '/'
Inlet Invert= 833.00', Outlet Invert= 798.00'



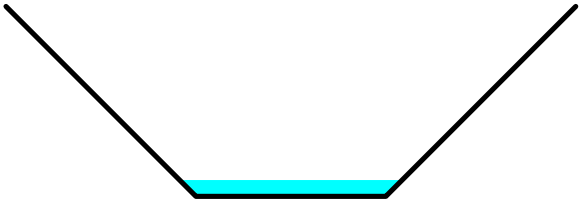
Summary for Reach CH-SEB: SE Channel 4

Inflow Area = 7.631 ac, 0.00% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 6.20 cfs @ 12.08 hrs, Volume= 0.423 af
Outflow = 6.20 cfs @ 12.08 hrs, Volume= 0.423 af, Atten= 0%, Lag= 0.2 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 7.34 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 2.37 fps, Avg. Travel Time= 0.8 min

Peak Storage= 91 cf @ 12.08 hrs
Average Depth at Peak Storage= 0.26'
Bank-Full Depth= 3.00' Flow Area= 18.0 sf, Capacity= 479.46 cfs

3.00' x 3.00' deep channel, n= 0.040 Earth, cobble bottom, clean sides
Side Slope Z-value= 1.0 '/' Top Width= 9.00'
Length= 108.0' Slope= 0.2824 '/'
Inlet Invert= 798.00', Outlet Invert= 767.50'



Summary for Reach CH-SW1: SW Channel 1

Inflow Area = 21.264 ac, 0.00% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 14.97 cfs @ 12.14 hrs, Volume= 1.166 af
Outflow = 14.97 cfs @ 12.14 hrs, Volume= 1.166 af, Atten= 0%, Lag= 0.2 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 7.29 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 2.14 fps, Avg. Travel Time= 0.9 min

Peak Storage= 226 cf @ 12.14 hrs
Average Depth at Peak Storage= 0.25'
Bank-Full Depth= 2.00' Flow Area= 20.0 sf, Capacity= 491.98 cfs

8.00' x 2.00' deep channel, n= 0.040 Earth, cobble bottom, clean sides
Side Slope Z-value= 1.0 '/' Top Width= 12.00'
Length= 110.0' Slope= 0.2636 '/'
Inlet Invert= 744.00', Outlet Invert= 715.00'

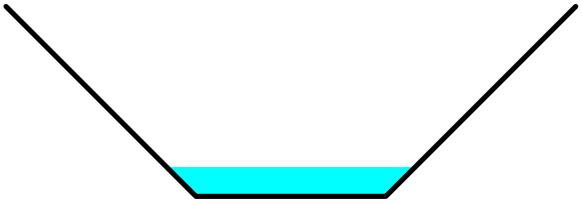
Summary for Reach CH-SW2: SW Channel 2

Inflow Area = 18.110 ac, 0.00% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 12.79 cfs @ 12.14 hrs, Volume= 0.992 af
Outflow = 12.79 cfs @ 12.14 hrs, Volume= 0.992 af, Atten= 0%, Lag= 0.2 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 7.97 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 2.48 fps, Avg. Travel Time= 0.8 min

Peak Storage= 196 cf @ 12.14 hrs
Average Depth at Peak Storage= 0.46'
Bank-Full Depth= 3.00' Flow Area= 18.0 sf, Capacity= 374.32 cfs

3.00' x 3.00' deep channel, n= 0.040 Earth, cobble bottom, clean sides
Side Slope Z-value= 1.0 '/' Top Width= 9.00'
Length= 122.0' Slope= 0.1721 '/'
Inlet Invert= 766.00', Outlet Invert= 745.00'



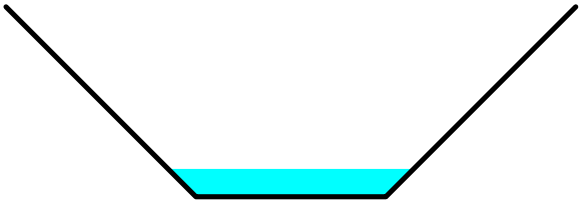
Summary for Reach CH-SW3: SW Channel 3

Inflow Area = 11.899 ac, 0.00% Impervious, Inflow Depth = 0.65" for 2 year - 24 hour event
Inflow = 10.34 cfs @ 12.07 hrs, Volume= 0.648 af
Outflow = 10.33 cfs @ 12.08 hrs, Volume= 0.648 af, Atten= 0%, Lag= 0.2 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 6.83 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 2.09 fps, Avg. Travel Time= 0.8 min

Peak Storage= 157 cf @ 12.08 hrs
Average Depth at Peak Storage= 0.44'
Bank-Full Depth= 3.00' Flow Area= 18.0 sf, Capacity= 329.84 cfs

3.00' x 3.00' deep channel, n= 0.040
Side Slope Z-value= 1.0 '/' Top Width= 9.00'
Length= 104.0' Slope= 0.1337 '/'
Inlet Invert= 798.00', Outlet Invert= 784.10'



Summary for Reach CH-SW3B: SW Bench 3B

[62] Hint: Exceeded Reach CH-SW3 OUTLET depth by 0.01' @ 24.58 hrs

Inflow Area = 11.899 ac, 0.00% Impervious, Inflow Depth = 0.65" for 2 year - 24 hour event
Inflow = 10.33 cfs @ 12.08 hrs, Volume= 0.648 af
Outflow = 8.52 cfs @ 12.14 hrs, Volume= 0.648 af, Atten= 18%, Lag= 3.8 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 2.74 fps, Min. Travel Time= 5.7 min
Avg. Velocity = 0.79 fps, Avg. Travel Time= 19.6 min

Peak Storage= 2,901 cf @ 12.14 hrs
Average Depth at Peak Storage= 0.27'
Bank-Full Depth= 2.00' Flow Area= 32.0 sf, Capacity= 285.18 cfs

11.00' x 2.00' deep channel, n= 0.030 Earth, dense weeds
Side Slope Z-value= 2.0 3.0 '/' Top Width= 21.00'
Length= 933.0' Slope= 0.0194 '/'
Inlet Invert= 784.10', Outlet Invert= 766.00'

‡

Summary for Reach CH-SW4: SW Chnl 4 - 8' FlxM

Inflow Area = 7.363 ac, 0.00% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 6.92 cfs @ 12.04 hrs, Volume= 0.408 af
Outflow = 6.90 cfs @ 12.04 hrs, Volume= 0.408 af, Atten= 0%, Lag= 0.4 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 5.20 fps, Min. Travel Time= 0.5 min
Avg. Velocity = 1.50 fps, Avg. Travel Time= 1.9 min

Peak Storage= 225 cf @ 12.04 hrs
Average Depth at Peak Storage= 0.33'
Bank-Full Depth= 1.50' Flow Area= 7.9 sf, Capacity= 93.94 cfs

3.75' x 1.50' deep channel, n= 0.055
Side Slope Z-value= 1.0 '/' Top Width= 6.75'
Length= 170.0' Slope= 0.1988 '/'
Inlet Invert= 831.80', Outlet Invert= 798.00'

Summary for Reach CH-SW5: SW Chnl 5 - 8' FlxM

Inflow Area = 4.490 ac, 0.00% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 4.39 cfs @ 12.03 hrs, Volume= 0.249 af
Outflow = 4.38 cfs @ 12.03 hrs, Volume= 0.249 af, Atten= 0%, Lag= 0.3 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 4.80 fps, Min. Travel Time= 0.4 min
Avg. Velocity = 1.38 fps, Avg. Travel Time= 1.5 min

Peak Storage= 112 cf @ 12.03 hrs
Average Depth at Peak Storage= 0.23'
Bank-Full Depth= 1.50' Flow Area= 7.9 sf, Capacity= 106.96 cfs

3.75' x 1.50' deep channel, n= 0.061
Side Slope Z-value= 1.0 '/' Top Width= 6.75'
Length= 123.0' Slope= 0.3171 '/'
Inlet Invert= 870.80', Outlet Invert= 831.80'

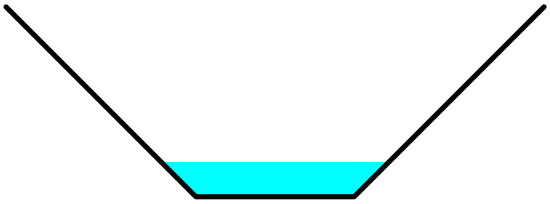
Summary for Reach CH-SW6: SW Chnl 6 - 5.5' FlxM

Inflow Area = 2.052 ac, 0.00% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 2.07 cfs @ 12.02 hrs, Volume= 0.114 af
Outflow = 2.07 cfs @ 12.02 hrs, Volume= 0.114 af, Atten= 0%, Lag= 0.3 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 4.95 fps, Min. Travel Time= 0.4 min
Avg. Velocity = 1.54 fps, Avg. Travel Time= 1.3 min

Peak Storage= 51 cf @ 12.02 hrs
Average Depth at Peak Storage= 0.27'
Bank-Full Depth= 1.50' Flow Area= 4.1 sf, Capacity= 48.34 cfs

1.25' x 1.50' deep channel, n= 0.059
Side Slope Z-value= 1.0 '/' Top Width= 4.25'
Length= 123.0' Slope= 0.3171 '/'
Inlet Invert= 909.80', Outlet Invert= 870.80'



Summary for Pond B-E11: E Berm 11

Inflow Area = 2.539 ac, 0.00% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 2.23 cfs @ 12.05 hrs, Volume= 0.141 af
Outflow = 2.23 cfs @ 12.05 hrs, Volume= 0.141 af, Atten= 0%, Lag= 0.2 min
Primary = 2.23 cfs @ 12.05 hrs, Volume= 0.141 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 750.28' @ 12.05 hrs Surf.Area= 134 sf Storage= 18 cf
Flood Elev= 753.00' Surf.Area= 4,316 sf Storage= 4,566 cf

Plug-Flow detention time= 0.1 min calculated for 0.141 af (100% of inflow)
Center-of-Mass det. time= 0.1 min (884.0 - 883.9)

Volume	Invert	Avail.Storage	Storage Description
#1	750.00'	87,134 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
750.00	0	0	0
751.00	485	243	243
752.00	1,923	1,204	1,447
753.00	4,316	3,120	4,566
754.00	4,800	4,558	9,124
756.00	8,955	13,755	22,879
758.00	15,400	24,355	47,234
760.00	24,500	39,900	87,134

Device	Routing	Invert	Outlet Devices
#1	Primary	750.00'	**18.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Secondary	753.00'	**120.0' long x 2.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32

Primary OutFlow Max=2.22 cfs @ 12.05 hrs HW=750.28' TW=748.01' (Dynamic Tailwater)
└**1=Orifice/Grate** (Weir Controls 2.22 cfs @ 1.72 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=750.00' TW=742.00' (Dynamic Tailwater)
└**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond B-E12: E Berm 12

Inflow Area = 2.603 ac, 0.00% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 2.12 cfs @ 12.07 hrs, Volume= 0.144 af
Outflow = 2.12 cfs @ 12.08 hrs, Volume= 0.144 af, Atten= 0%, Lag= 0.2 min
Primary = 2.12 cfs @ 12.08 hrs, Volume= 0.144 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 773.27' @ 12.08 hrs Surf.Area= 129 sf Storage= 17 cf
Flood Elev= 776.00' Surf.Area= 4,316 sf Storage= 4,566 cf

Plug-Flow detention time= 0.1 min calculated for 0.144 af (100% of inflow)
Center-of-Mass det. time= 0.1 min (885.7 - 885.6)

Volume	Invert	Avail.Storage	Storage Description
#1	773.00'	14,292 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
773.00	0	0	0
774.00	485	243	243
775.00	1,923	1,204	1,447
776.00	4,316	3,120	4,566
778.00	5,410	9,726	14,292

Device	Routing	Invert	Outlet Devices
#1	Primary	773.00'	**18.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Secondary	776.00'	**120.0' long x 2.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32

Primary OutFlow Max=2.12 cfs @ 12.08 hrs HW=773.27' TW=770.67' (Dynamic Tailwater)
└**1=Orifice/Grate** (Weir Controls 2.12 cfs @ 1.69 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=773.00' TW=750.00' (Dynamic Tailwater)
└**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond B-E8: E Berm 8

[62] Hint: Exceeded Reach CH-E9 OUTLET depth by 0.26' @ 12.04 hrs

Inflow Area = 2.829 ac, 0.00% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 2.67 cfs @ 12.03 hrs, Volume= 0.157 af
Outflow = 2.67 cfs @ 12.04 hrs, Volume= 0.157 af, Atten= 0%, Lag= 0.1 min
Primary = 2.67 cfs @ 12.04 hrs, Volume= 0.157 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 800.34' @ 12.04 hrs Surf.Area= 82 sf Storage= 14 cf
Flood Elev= 803.00' Surf.Area= 2,160 sf Storage= 2,280 cf

Plug-Flow detention time= 0.0 min calculated for 0.157 af (100% of inflow)
Center-of-Mass det. time= 0.0 min (882.7 - 882.6)

Volume	Invert	Avail.Storage	Storage Description
#1	800.00'	2,280 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
800.00	0	0	0
801.00	240	120	120
802.00	960	600	720
803.00	2,160	1,560	2,280

Device	Routing	Invert	Outlet Devices
#1	Primary	800.00'	**6.0' long x 2.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32

Primary OutFlow Max=2.67 cfs @ 12.04 hrs HW=800.34' TW=800.15' (Dynamic Tailwater)
└**1=Broad-Crested Rectangular Weir** (Weir Controls 2.67 cfs @ 1.31 fps)

Summary for Pond B-E9: E Berm 9

Inflow Area = 0.934 ac, 0.00% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 0.90 cfs @ 12.03 hrs, Volume= 0.052 af
Outflow = 0.90 cfs @ 12.03 hrs, Volume= 0.052 af, Atten= 0%, Lag= 0.2 min
Primary = 0.90 cfs @ 12.03 hrs, Volume= 0.052 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 830.17' @ 12.03 hrs Surf.Area= 80 sf Storage= 7 cf
Flood Elev= 833.00' Surf.Area= 4,320 sf Storage= 4,560 cf

Plug-Flow detention time= 0.1 min calculated for 0.052 af (100% of inflow)
Center-of-Mass det. time= 0.1 min (882.0 - 882.0)

Volume	Invert	Avail.Storage	Storage Description
#1	830.00'	4,560 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
830.00	0	0	0
831.00	480	240	240
832.00	1,920	1,200	1,440
833.00	4,320	3,120	4,560

Device	Routing	Invert	Outlet Devices
#1	Primary	830.00'	**6.0' long x 2.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32

Primary OutFlow Max=0.90 cfs @ 12.03 hrs HW=830.17' TW=830.08' (Dynamic Tailwater)
└**1=Broad-Crested Rectangular Weir** (Weir Controls 0.90 cfs @ 0.90 fps)

Summary for Pond B-SE1: SE Bench 1

[62] Hint: Exceeded Reach CH-SE2 OUTLET depth by 0.58' @ 12.06 hrs

Inflow Area = 5.808 ac, 0.00% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 5.10 cfs @ 12.05 hrs, Volume= 0.322 af
Outflow = 5.08 cfs @ 12.06 hrs, Volume= 0.322 af, Atten= 0%, Lag= 0.5 min
Primary = 5.08 cfs @ 12.06 hrs, Volume= 0.322 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 746.28' @ 12.06 hrs Surf.Area= 284 sf Storage= 64 cf
Flood Elev= 748.00' Surf.Area= 1,641 sf Storage= 1,717 cf

Plug-Flow detention time= 0.1 min calculated for 0.322 af (100% of inflow)
Center-of-Mass det. time= 0.1 min (883.7 - 883.6)

Volume	Invert	Avail.Storage	Storage Description
#1	745.50'	10,578 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
745.50	0	0	0
746.00	61	15	15
748.00	1,641	1,702	1,717
750.00	7,220	8,861	10,578

Device	Routing	Invert	Outlet Devices
#1	Primary	745.50'	**3.0' long x 2.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32
#2	Secondary	748.00'	**20.0' long x 2.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32

Primary OutFlow Max=5.08 cfs @ 12.06 hrs HW=746.28' TW=745.72' (Dynamic Tailwater)
↑**1=Broad-Crested Rectangular Weir** (Weir Controls 5.08 cfs @ 2.16 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=745.50' TW=712.00' (Dynamic Tailwater)
↑**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond B-SE2: SE Bench 1

Inflow Area = 5.063 ac, 0.00% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 4.54 cfs @ 12.05 hrs, Volume= 0.280 af
Outflow = 4.48 cfs @ 12.06 hrs, Volume= 0.280 af, Atten= 1%, Lag= 0.9 min
Primary = 4.48 cfs @ 12.06 hrs, Volume= 0.280 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 765.22' @ 12.06 hrs Surf.Area= 504 sf Storage= 175 cf
Flood Elev= 767.00' Surf.Area= 2,766 sf Storage= 2,760 cf

Plug-Flow detention time= 0.4 min calculated for 0.280 af (100% of inflow)
Center-of-Mass det. time= 0.4 min (883.8 - 883.5)

Volume	Invert	Avail.Storage	Storage Description
#1	764.50'	8,191 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
764.50	0	0	0
765.00	330	83	83
765.50	725	264	346
766.00	1,133	465	811
767.00	2,766	1,950	2,760
768.00	8,095	5,431	8,191

Device	Routing	Invert	Outlet Devices
#1	Primary	764.50'	**3.0' long x 2.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32
#2	Secondary	767.00'	**50.0' long x 2.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32

Primary OutFlow Max=4.48 cfs @ 12.06 hrs HW=765.22' TW=764.71' (Dynamic Tailwater)
↑**1=Broad-Crested Rectangular Weir** (Weir Controls 4.48 cfs @ 2.07 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=764.50' TW=745.50' (Dynamic Tailwater)
↑**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond B-SE3: SE Bench 3

[62] Hint: Exceeded Reach CH-SE3B OUTLET depth by 0.31' @ 12.17 hrs

Inflow Area = 9.526 ac, 0.00% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 5.44 cfs @ 12.17 hrs, Volume= 0.528 af
Outflow = 5.43 cfs @ 12.18 hrs, Volume= 0.528 af, Atten= 0%, Lag= 0.5 min
Primary = 5.43 cfs @ 12.18 hrs, Volume= 0.528 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 750.54' @ 12.18 hrs Surf.Area= 432 sf Storage= 141 cf
Flood Elev= 752.00' Surf.Area= 2,890 sf Storage= 2,215 cf

Plug-Flow detention time= 0.6 min calculated for 0.528 af (100% of inflow)
Center-of-Mass det. time= 0.5 min (903.1 - 902.6)

Volume	Invert	Avail.Storage	Storage Description
#1	750.00'	13,455 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
750.00	90	0	0
751.00	725	408	408
752.00	2,890	1,808	2,215
754.00	8,350	11,240	13,455

Device	Routing	Invert	Outlet Devices
#1	Primary	750.00'	**6.0' long x 2.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32
#2	Secondary	752.00'	**10.0' long x 60.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=5.43 cfs @ 12.18 hrs HW=750.54' TW=750.24' (Dynamic Tailwater)
└**1=Broad-Crested Rectangular Weir** (Weir Controls 5.43 cfs @ 1.68 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=750.00' TW=745.50' (Dynamic Tailwater)
└**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond B-SE4: SE Berm 4

[62] Hint: Exceeded Reach CH-SE5 OUTLET depth by 0.42' @ 12.08 hrs

Inflow Area = 7.631 ac, 0.00% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 6.21 cfs @ 12.08 hrs, Volume= 0.423 af
Outflow = 6.20 cfs @ 12.08 hrs, Volume= 0.423 af, Atten= 0%, Lag= 0.3 min
Primary = 6.20 cfs @ 12.08 hrs, Volume= 0.423 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 798.59' @ 12.08 hrs Surf.Area= 286 sf Storage= 84 cf
Flood Elev= 801.00' Surf.Area= 4,316 sf Storage= 4,566 cf

Plug-Flow detention time= 0.1 min calculated for 0.423 af (100% of inflow)
Center-of-Mass det. time= 0.1 min (886.2 - 886.1)

Volume	Invert	Avail.Storage	Storage Description
#1	798.00'	4,566 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
798.00	0	0	0
799.00	485	243	243
800.00	1,923	1,204	1,447
801.00	4,316	3,120	4,566

Device	Routing	Invert	Outlet Devices
#1	Primary	798.00'	**6.0' long x 2.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32

Primary OutFlow Max=6.20 cfs @ 12.08 hrs HW=798.59' TW=798.26' (Dynamic Tailwater)
1=Broad-Crested Rectangular Weir (Weir Controls 6.20 cfs @ 1.75 fps)

Summary for Pond B-SE5: SE Berm 5

Inflow Area = 3.569 ac, 0.00% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 2.93 cfs @ 12.07 hrs, Volume= 0.198 af
Outflow = 2.93 cfs @ 12.07 hrs, Volume= 0.198 af, Atten= 0%, Lag= 0.2 min
Primary = 2.93 cfs @ 12.07 hrs, Volume= 0.198 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 833.36' @ 12.07 hrs Surf.Area= 176 sf Storage= 32 cf
Flood Elev= 836.00' Surf.Area= 4,316 sf Storage= 4,566 cf

Plug-Flow detention time= 0.1 min calculated for 0.198 af (100% of inflow)
Center-of-Mass det. time= 0.1 min (885.5 - 885.4)

Volume	Invert	Avail.Storage	Storage Description
#1	833.00'	4,566 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
833.00	0	0	0
834.00	485	243	243
835.00	1,923	1,204	1,447
836.00	4,316	3,120	4,566

Device	Routing	Invert	Outlet Devices
#1	Primary	833.00'	**6.0' long x 2.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32

Primary OutFlow Max=2.93 cfs @ 12.07 hrs HW=833.36' TW=833.17' (Dynamic Tailwater)
1=Broad-Crested Rectangular Weir (Weir Controls 2.93 cfs @ 1.35 fps)

Summary for Pond B-SW1: SW Bench 1

[61] Hint: Exceeded Reach CH-SW2 outlet invert by 0.20' @ 12.14 hrs

Inflow Area = 21.264 ac, 0.00% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 14.97 cfs @ 12.14 hrs, Volume= 1.166 af
Outflow = 14.97 cfs @ 12.14 hrs, Volume= 1.166 af, Atten= 0%, Lag= 0.0 min
Primary = 14.97 cfs @ 12.14 hrs, Volume= 1.166 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 745.20' @ 12.14 hrs Surf.Area= 27 sf Storage= 10 cf
Flood Elev= 746.00' Surf.Area= 59 sf Storage= 44 cf

Plug-Flow detention time= 0.0 min calculated for 1.166 af (100% of inflow)
Center-of-Mass det. time= 0.0 min (898.0 - 898.0)

Volume	Invert	Avail.Storage	Storage Description
#1	744.50'	1,235 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
744.50	0	0	0
746.00	59	44	44
748.00	1,132	1,191	1,235

Device	Routing	Invert	Outlet Devices
#1	Primary	744.50'	**96.0" W x 36.0" H Box Culvert** L= 46.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 744.50' / 744.00' S= 0.0109 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 24.00 sf
#2	Primary	746.00'	**120.0' long x 2.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32

Primary OutFlow Max=14.96 cfs @ 12.14 hrs HW=745.20' TW=744.25' (Dynamic Tailwater)
└─**1=Culvert** (Inlet Controls 14.96 cfs @ 2.68 fps)
└─**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond B-SW2: SW Bench 2

[62] Hint: Exceeded Reach CH-SW3B OUTLET depth by 0.69' @ 12.14 hrs

Inflow Area = 18.110 ac, 0.00% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 12.95 cfs @ 12.12 hrs, Volume= 0.992 af
Outflow = 12.79 cfs @ 12.14 hrs, Volume= 0.992 af, Atten= 1%, Lag= 1.0 min
Primary = 12.79 cfs @ 12.14 hrs, Volume= 0.992 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 766.96' @ 12.14 hrs Surf.Area= 1,292 sf Storage= 591 cf
Flood Elev= 769.00' Surf.Area= 5,770 sf Storage= 7,375 cf

Plug-Flow detention time= 0.4 min calculated for 0.992 af (100% of inflow)
Center-of-Mass det. time= 0.4 min (899.5 - 899.0)

Volume	Invert	Avail.Storage	Storage Description
#1	766.00'	13,760 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
766.00	0	0	0
766.50	611	153	153
767.00	1,350	490	643
767.50	2,214	891	1,534
768.00	3,203	1,354	2,888
769.00	5,770	4,487	7,375
770.00	7,000	6,385	13,760

Device	Routing	Invert	Outlet Devices
#1	Primary	766.00'	**6.0' long x 2.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00

3.50
Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32

#2 Secondary 769.00' **120.0' long x 2.0' breadth Broad-Crested Rectangular Weir**
Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50
Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32

Primary OutFlow Max=12.79 cfs @ 12.14 hrs HW=766.96' TW=766.46' (Dynamic Tailwater)
1=Broad-Crested Rectangular Weir (Weir Controls 12.79 cfs @ 2.22 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=766.00' TW=744.50' (Dynamic Tailwater)
2=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Summary for Pond B-SW3: SW Bench 3

[62] Hint: Exceeded Reach CH-SW4 OUTLET depth by 0.55' @ 12.09 hrs

Inflow Area = 11.899 ac, 0.00% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 10.86 cfs @ 12.05 hrs, Volume= 0.659 af
Outflow = 10.34 cfs @ 12.07 hrs, Volume= 0.648 af, Atten= 5%, Lag= 1.7 min
Primary = 10.34 cfs @ 12.07 hrs, Volume= 0.648 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 798.85' @ 12.08 hrs Surf.Area= 1,987 sf Storage= 1,755 cf
Flood Elev= 800.00' Surf.Area= 5,126 sf Storage= 5,654 cf

Plug-Flow detention time= 16.1 min calculated for 0.648 af (98% of inflow)
Center-of-Mass det. time= 6.6 min (891.4 - 884.8)

Volume	Invert	Avail.Storage	Storage Description
#1	797.00'	23,170 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
797.00	0	0	0
798.00	980	490	490
799.00	2,161	1,571	2,061
799.50	3,543	1,426	3,487
800.00	5,126	2,167	5,654
802.00	12,390	17,516	23,170

Device	Routing	Invert	Outlet Devices
#1	Primary	798.00'	**6.0' long x 2.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32
#2	Secondary	800.00'	**150.0' long x 2.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32

Primary OutFlow Max=10.33 cfs @ 12.07 hrs HW=798.85' TW=798.44' (Dynamic Tailwater)
1=Broad-Crested Rectangular Weir (Weir Controls 10.33 cfs @ 2.02 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=797.00' TW=784.10' (Dynamic Tailwater)
2=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Summary for Pond B-SW4: SW Bench 4

[62] Hint: Exceeded Reach CH-SW5 OUTLET depth by 0.44' @ 12.04 hrs

Inflow Area = 7.363 ac, 0.00% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 6.92 cfs @ 12.04 hrs, Volume= 0.408 af
Outflow = 6.92 cfs @ 12.04 hrs, Volume= 0.408 af, Atten= 0%, Lag= 0.1 min
Primary = 6.92 cfs @ 12.04 hrs, Volume= 0.408 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 832.47' @ 12.04 hrs Surf.Area= 111 sf Storage= 57 cf
Flood Elev= 835.80' Surf.Area= 4,335 sf Storage= 4,821 cf

Plug-Flow detention time= 0.3 min calculated for 0.408 af (100% of inflow)
Center-of-Mass det. time= 0.3 min (884.0 - 883.7)

Volume	Invert	Avail.Storage	Storage Description
#1	831.80'	4,821 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
831.80	60	0	0
833.80	213	273	273
835.80	4,335	4,548	4,821

Device	Routing	Invert	Outlet Devices
#1	Primary	831.80'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 4.00 Width (feet) 3.75 11.75

Primary OutFlow Max=6.91 cfs @ 12.04 hrs HW=832.47' TW=832.12' (Dynamic Tailwater)
1=Custom Weir/Orifice (Weir Controls 6.91 cfs @ 2.34 fps)

Summary for Pond B-SW5: SW Bench 5

[62] Hint: Exceeded Reach CH-SW6 OUTLET depth by 0.23' @ 12.03 hrs

Inflow Area = 4.490 ac, 0.00% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 4.39 cfs @ 12.03 hrs, Volume= 0.249 af
Outflow = 4.39 cfs @ 12.03 hrs, Volume= 0.249 af, Atten= 0%, Lag= 0.1 min
Primary = 4.39 cfs @ 12.03 hrs, Volume= 0.249 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 871.30' @ 12.03 hrs Surf.Area= 89 sf Storage= 37 cf
Flood Elev= 874.80' Surf.Area= 3,893 sf Storage= 4,303 cf

Plug-Flow detention time= 0.3 min calculated for 0.249 af (100% of inflow)
Center-of-Mass det. time= 0.3 min (882.7 - 882.4)

Volume	Invert	Avail.Storage	Storage Description
#1	870.80'	4,303 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
870.80	60	0	0
872.80	175	235	235
874.80	3,893	4,068	4,303

Device	Routing	Invert	Outlet Devices
#1	Primary	870.80'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 4.00 Width (feet) 3.75 11.75

Primary OutFlow Max=4.38 cfs @ 12.03 hrs HW=871.30' TW=871.03' (Dynamic Tailwater)
└**1=Custom Weir/Orifice** (Weir Controls 4.38 cfs @ 2.06 fps)

Summary for Pond B-SW6: SW Bench 6

Inflow Area = 2.052 ac, 0.00% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 2.07 cfs @ 12.01 hrs, Volume= 0.114 af
Outflow = 2.07 cfs @ 12.02 hrs, Volume= 0.114 af, Atten= 0%, Lag= 0.2 min
Primary = 2.07 cfs @ 12.02 hrs, Volume= 0.114 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 910.35' @ 12.02 hrs Surf.Area= 92 sf Storage= 42 cf
Flood Elev= 913.80' Surf.Area= 3,893 sf Storage= 4,303 cf

Plug-Flow detention time= 0.8 min calculated for 0.114 af (100% of inflow)
Center-of-Mass det. time= 0.8 min (881.7 - 881.0)

Volume	Invert	Avail.Storage	Storage Description
#1	909.80'	4,303 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
909.80	60	0	0
911.80	175	235	235
913.80	3,893	4,068	4,303

Device	Routing	Invert	Outlet Devices
#1	Primary	909.80'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 4.00 Width (feet) 1.25 9.25

Primary OutFlow Max=2.07 cfs @ 12.02 hrs HW=910.35' TW=910.07' (Dynamic Tailwater)
└**1=Custom Weir/Orifice** (Weir Controls 2.07 cfs @ 2.07 fps)

Summary for Pond CB-E5: E CB 5

Inflow Area = 2.194 ac, 0.00% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 2.08 cfs @ 12.03 hrs, Volume= 0.121 af
Outflow = 2.08 cfs @ 12.03 hrs, Volume= 0.121 af, Atten= 0%, Lag= 0.0 min
Primary = 2.08 cfs @ 12.03 hrs, Volume= 0.121 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 725.74' @ 12.03 hrs Surf.Area= 21 sf Storage= 3 cf
Flood Elev= 728.00' Surf.Area= 1,300 sf Storage= 1,048 cf

Plug-Flow detention time= 0.0 min calculated for 0.121 af (100% of inflow)
Center-of-Mass det. time= 0.0 min (882.3 - 882.3)

Volume	Invert	Avail.Storage	Storage Description
#1	725.50'	5,463 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
725.50	0	0	0
726.00	43	11	11
727.00	366	205	215
728.00	1,300	833	1,048
730.00	3,115	4,415	5,463

Device	Routing	Invert	Outlet Devices
#1	Primary	725.50'	**20.5" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Secondary	728.00'	**60.0' long x 2.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32

Primary OutFlow Max=2.08 cfs @ 12.03 hrs HW=725.74' TW=723.18' (Dynamic Tailwater)
└**1=Orifice/Grate** (Weir Controls 2.08 cfs @ 1.61 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=725.50' TW=709.00' (Dynamic Tailwater)
└**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond CB-E6: E CB 6

Inflow Area = 1.900 ac, 0.00% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 2.15 cfs @ 11.98 hrs, Volume= 0.105 af
Outflow = 2.15 cfs @ 11.98 hrs, Volume= 0.105 af, Atten= 0%, Lag= 0.0 min
Primary = 1.99 cfs @ 11.98 hrs, Volume= 0.101 af
Secondary = 0.16 cfs @ 11.98 hrs, Volume= 0.004 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 752.19' @ 11.98 hrs
Flood Elev= 755.50'

Device	Routing	Invert	Outlet Devices
#1	Primary	752.00'	**10.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88
#2	Secondary	752.00'	**18.0" Round Culvert** L= 123.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 752.00' / 722.50' S= 0.2398 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf

Primary OutFlow Max=1.98 cfs @ 11.98 hrs HW=752.19' TW=748.44' (Dynamic Tailwater)
1=Broad-Crested Rectangular Weir (Weir Controls 1.98 cfs @ 1.03 fps)

Secondary OutFlow Max=0.16 cfs @ 11.98 hrs HW=752.19' TW=723.14' (Dynamic Tailwater)
2=Culvert (Inlet Controls 0.16 cfs @ 1.18 fps)

Summary for Pond CB-E7: E CB 3

Inflow Area = 5.357 ac, 0.00% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 4.77 cfs @ 11.98 hrs, Volume= 0.297 af
Outflow = 4.77 cfs @ 11.98 hrs, Volume= 0.297 af, Atten= 0%, Lag= 0.0 min
Primary = 0.37 cfs @ 11.98 hrs, Volume= 0.014 af
Secondary = 4.40 cfs @ 11.98 hrs, Volume= 0.283 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 752.30' @ 11.98 hrs
Flood Elev= 756.50'

Device	Routing	Invert	Outlet Devices
#1	Primary	752.00'	**18.0" Round Culvert** L= 157.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 752.00' / 712.20' S= 0.2535 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf
#2	Secondary	752.00'	**10.0' long x 140.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=0.37 cfs @ 11.98 hrs HW=752.30' TW=712.46' (Dynamic Tailwater)
1=Culvert (Inlet Controls 0.37 cfs @ 1.47 fps)

Secondary OutFlow Max=4.39 cfs @ 11.98 hrs HW=752.30' TW=748.43' (Dynamic Tailwater)
2=Broad-Crested Rectangular Weir (Weir Controls 4.39 cfs @ 1.47 fps)

Summary for Pond DP-E11: 18" Pipe

Inflow Area = 5.142 ac, 0.00% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 4.32 cfs @ 12.06 hrs, Volume= 0.285 af
Outflow = 4.32 cfs @ 12.06 hrs, Volume= 0.285 af, Atten= 0%, Lag= 0.0 min
Primary = 4.32 cfs @ 12.06 hrs, Volume= 0.285 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 748.01' @ 12.06 hrs
Flood Elev= 750.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	747.00'	**18.0" Round Culvert** L= 150.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 747.00' / 713.75' S= 0.2217 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf

Primary OutFlow Max=4.32 cfs @ 12.06 hrs HW=748.01' TW=714.84' (Dynamic Tailwater)
1=Culvert (Inlet Controls 4.32 cfs @ 3.42 fps)

Summary for Pond DP-E12: 18" Pipe

Inflow Area = 2.603 ac, 0.00% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 2.12 cfs @ 12.08 hrs, Volume= 0.144 af
Outflow = 2.12 cfs @ 12.08 hrs, Volume= 0.144 af, Atten= 0%, Lag= 0.0 min
Primary = 2.12 cfs @ 12.08 hrs, Volume= 0.144 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 770.67' @ 12.08 hrs
Flood Elev= 776.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	770.00'	**18.0" Round Culvert** L= 110.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 770.00' / 747.00' S= 0.2091 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf

Primary OutFlow Max=2.12 cfs @ 12.08 hrs HW=770.67' TW=748.00' (Dynamic Tailwater)
1=Culvert (Inlet Controls 2.12 cfs @ 2.78 fps)

Summary for Pond DP-E5: 18" Pipe

Inflow Area = 2.194 ac, 0.00% Impervious, Inflow Depth = 0.69" for 2 year - 24 hour event
Inflow = 2.20 cfs @ 12.03 hrs, Volume= 0.126 af
Outflow = 2.20 cfs @ 12.03 hrs, Volume= 0.126 af, Atten= 0%, Lag= 0.0 min
Primary = 2.20 cfs @ 12.03 hrs, Volume= 0.126 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 723.18' @ 12.03 hrs
Flood Elev= 725.50'

Device	Routing	Invert	Outlet Devices
#1	Primary	722.50'	**18.0" Round Culvert** L= 60.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 722.50' / 712.00' S= 0.1750 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 1.77 sf

Primary OutFlow Max=2.20 cfs @ 12.03 hrs HW=723.18' TW=712.70' (Dynamic Tailwater)
1=Culvert (Inlet Controls 2.20 cfs @ 2.81 fps)

Summary for Pond MH-E1: Drop Structure 1

Inflow Area = 2.194 ac, 0.00% Impervious, Inflow Depth = 0.69" for 2 year - 24 hour event
Inflow = 2.20 cfs @ 12.03 hrs, Volume= 0.126 af
Outflow = 2.20 cfs @ 12.03 hrs, Volume= 0.126 af, Atten= 0%, Lag= 0.0 min
Primary = 2.20 cfs @ 12.03 hrs, Volume= 0.126 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 712.70' @ 12.03 hrs
Flood Elev= 716.50'

Device	Routing	Invert	Outlet Devices
#1	Primary	712.00'	**18.0" Round Culvert** L= 30.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 712.00' / 711.70' S= 0.0100 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 1.77 sf

Primary OutFlow Max=2.20 cfs @ 12.03 hrs HW=712.70' TW=710.90' (Dynamic Tailwater)
1=Culvert (Barrel Controls 2.20 cfs @ 3.96 fps)

Summary for Pond MH-E2: Drop Structure 2

Inflow Area = 5.357 ac, 0.00% Impervious, Inflow Depth = 0.03" for 2 year - 24 hour event
Inflow = 0.37 cfs @ 11.98 hrs, Volume= 0.014 af
Outflow = 0.37 cfs @ 11.98 hrs, Volume= 0.014 af, Atten= 0%, Lag= 0.0 min
Primary = 0.37 cfs @ 11.98 hrs, Volume= 0.014 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 712.47' @ 11.98 hrs
Flood Elev= 716.50'

Device	Routing	Invert	Outlet Devices
#1	Primary	712.20'	**18.0" Round Culvert** L= 20.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 712.20' / 712.00' S= 0.0100 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 1.77 sf

Primary OutFlow Max=0.37 cfs @ 11.98 hrs HW=712.46' TW=710.60' (Dynamic Tailwater)
1=Culvert (Barrel Controls 0.37 cfs @ 2.65 fps)

Summary for Pond MH-E3: Drop Structure 3

Inflow Area = 5.142 ac, 0.00% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 4.32 cfs @ 12.06 hrs, Volume= 0.285 af
Outflow = 4.32 cfs @ 12.06 hrs, Volume= 0.285 af, Atten= 0%, Lag= 0.0 min
Primary = 4.32 cfs @ 12.06 hrs, Volume= 0.285 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 714.84' @ 12.06 hrs
Flood Elev= 720.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	713.75'	**18.0" Round Culvert** L= 25.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 713.75' / 713.50' S= 0.0100 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 1.77 sf

Primary OutFlow Max=4.32 cfs @ 12.06 hrs HW=714.84' TW=711.13' (Dynamic Tailwater)
1=Culvert (Barrel Controls 4.32 cfs @ 4.38 fps)

Summary for Pond P-E1: East Ditch 1

Inflow Area = 6.659 ac, 0.00% Impervious, Inflow Depth = 1.17" for 2 year - 24 hour event
Inflow = 9.76 cfs @ 11.97 hrs, Volume= 0.648 af
Outflow = 6.55 cfs @ 12.06 hrs, Volume= 0.641 af, Atten= 33%, Lag= 5.4 min
Primary = 6.55 cfs @ 12.06 hrs, Volume= 0.641 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 713.12' @ 12.06 hrs Surf.Area= 2,461 sf Storage= 3,110 cf
Flood Elev= 715.00' Surf.Area= 4,659 sf Storage= 9,544 cf

Plug-Flow detention time= 18.1 min calculated for 0.641 af (99% of inflow)
Center-of-Mass det. time= 12.5 min (898.8 - 886.3)

Volume	Invert	Avail.Storage	Storage Description
#1	711.00'	14,929 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
711.00	254	0	0
712.00	1,520	887	887
714.00	3,205	4,725	5,612
716.00	6,112	9,317	14,929

Device	Routing	Invert	Outlet Devices
#1	Primary	711.50'	**16.0" Round Culvert** L= 230.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 711.50' / 709.00' S= 0.0109 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 1.40 sf
#2	Secondary	715.00'	**115.0' long x 30.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=6.55 cfs @ 12.06 hrs HW=713.12' TW=710.73' (Dynamic Tailwater)
└**1=Culvert** (Inlet Controls 6.55 cfs @ 4.69 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=711.00' (Free Discharge)
└**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond P-E2: East Ditch 2

Inflow Area = 7.064 ac, 0.00% Impervious, Inflow Depth = 1.13" for 2 year - 24 hour event
Inflow = 6.75 cfs @ 12.04 hrs, Volume= 0.664 af
Outflow = 4.72 cfs @ 12.17 hrs, Volume= 0.659 af, Atten= 30%, Lag= 8.2 min
Primary = 4.72 cfs @ 12.17 hrs, Volume= 0.659 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 711.15' @ 12.28 hrs Surf.Area= 2,525 sf Storage= 3,120 cf
Flood Elev= 713.80' Surf.Area= 6,136 sf Storage= 14,023 cf

Plug-Flow detention time= 17.0 min calculated for 0.659 af (99% of inflow)
Center-of-Mass det. time= 12.6 min (910.6 - 898.0)

Volume	Invert	Avail.Storage	Storage Description
#1	709.00'	15,282 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
709.00	0	0	0
710.00	1,558	779	779
712.00	3,244	4,802	5,581
714.00	6,457	9,701	15,282

Device	Routing	Invert	Outlet Devices
#1	Primary	709.50'	**16.0" Round Culvert** L= 90.0' RCP, end-section conforming to fill, Ke= 0.500 Inlet / Outlet Invert= 709.50' / 708.50' S= 0.0111 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 1.40 sf
#2	Secondary	713.80'	**115.0' long x 30.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=4.73 cfs @ 12.17 hrs HW=711.05' TW=710.51' (Dynamic Tailwater)
1=Culvert (Outlet Controls 4.73 cfs @ 3.66 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=709.00' (Free Discharge)
2=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Summary for Pond P-E3: East Ditch 3

Inflow Area = 26.944 ac, 0.00% Impervious, Inflow Depth = 0.66" for 2 year - 24 hour event
Inflow = 11.89 cfs @ 12.13 hrs, Volume= 1.472 af
Outflow = 9.20 cfs @ 12.35 hrs, Volume= 1.472 af, Atten= 23%, Lag= 13.0 min
Primary = 9.20 cfs @ 12.35 hrs, Volume= 1.472 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 710.73' @ 12.35 hrs Surf.Area= 4,763 sf Storage= 4,202 cf
Flood Elev= 713.80' Surf.Area= 20,308 sf Storage= 40,715 cf

Plug-Flow detention time= 4.5 min calculated for 1.472 af (100% of inflow)
Center-of-Mass det. time= 4.2 min (907.2 - 903.0)

Volume	Invert	Avail.Storage	Storage Description
#1	708.00'	44,892 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
708.00	0	0	0
710.00	1,805	1,805	1,805
712.00	9,909	11,714	13,519
714.00	21,464	31,373	44,892

Device	Routing	Invert	Outlet Devices
#1	Primary	708.19'	**16.0" Round Culvert** L= 75.0' RCP, end-section conforming to fill, Ke= 0.500 Inlet / Outlet Invert= 708.19' / 707.50' S= 0.0092 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 1.40 sf
#2	Secondary	713.80'	**300.0' long x 30.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=9.20 cfs @ 12.35 hrs HW=710.73' (Free Discharge)
1=Culvert (Inlet Controls 9.20 cfs @ 6.59 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=708.00' (Free Discharge)
2=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Summary for Pond P-E4: Exist Ditch 4

Inflow Area = 18.316 ac, 0.00% Impervious, Inflow Depth = 0.48" for 2 year - 24 hour event
Inflow = 10.75 cfs @ 12.06 hrs, Volume= 0.736 af
Outflow = 6.77 cfs @ 12.13 hrs, Volume= 0.727 af, Atten= 37%, Lag= 4.2 min
Primary = 6.77 cfs @ 12.13 hrs, Volume= 0.727 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2

Peak Elev= 711.46' @ 12.19 hrs Surf.Area= 3,671 sf Storage= 4,518 cf
Flood Elev= 713.80' Surf.Area= 35,801 sf Storage= 42,961 cf

Plug-Flow detention time= 22.2 min calculated for 0.727 af (99% of inflow)
Center-of-Mass det. time= 15.3 min (899.0 - 883.7)

Volume	Invert	Avail.Storage	Storage Description
#1	709.00'	106,611 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
709.00	0	0	0
712.00	4,475	6,713	6,713
714.00	39,282	43,757	50,470
715.00	73,000	56,141	106,611

Device	Routing	Invert	Outlet Devices
#1	Primary	709.72'	**16.0" Round Culvert** L= 65.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 709.72' / 709.24' S= 0.0074 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 1.40 sf
#2	Secondary	713.80'	**510.0' long x 30.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=6.78 cfs @ 12.13 hrs HW=711.40' TW=710.39' (Dynamic Tailwater)
↑**1=Culvert** (Inlet Controls 6.78 cfs @ 4.86 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=709.00' (Free Discharge)
↑**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond P-S1: South Pond

Inflow Area = 9.142 ac, 15.15% Impervious, Inflow Depth = 0.91" for 2 year - 24 hour event
Inflow = 10.21 cfs @ 11.97 hrs, Volume= 0.691 af
Outflow = 0.07 cfs @ 24.13 hrs, Volume= 0.256 af, Atten= 99%, Lag= 729.6 min
Discarded = 0.07 cfs @ 24.13 hrs, Volume= 0.256 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Tertiary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 719.45' @ 24.13 hrs Surf.Area= 18,507 sf Storage= 27,073 cf
Flood Elev= 720.00' Surf.Area= 22,003 sf Storage= 38,164 cf

Plug-Flow detention time= 1,410.9 min calculated for 0.256 af (37% of inflow)
Center-of-Mass det. time= 1,258.1 min (2,107.8 - 849.7)

Volume	Invert	Avail.Storage	Storage Description
#1	716.50'	95,942 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
716.50	0	0	0
718.00	9,235	6,926	6,926
720.00	22,003	31,238	38,164
722.00	35,775	57,778	95,942

Device	Routing	Invert	Outlet Devices
#1	Discarded	716.50'	**0.150 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 700.00'
#2	Secondary	720.00'	**80.0' long x 30.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63
#3	Tertiary	720.50'	**100.0' long x 30.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Discarded OutFlow Max=0.07 cfs @ 24.13 hrs HW=719.45' (Free Discharge)
└**1=Exfiltration** (Controls 0.07 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=716.50' (Free Discharge)
└**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Tertiary OutFlow Max=0.00 cfs @ 0.00 hrs HW=716.50' (Free Discharge)
└**3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond P-SE1: Southeast Pond

[62] Hint: Exceeded Reach CH-SE1 OUTLET depth by 0.77' @ 12.38 hrs
[62] Hint: Exceeded Reach CH-SE3 OUTLET depth by 0.69' @ 12.43 hrs

Inflow Area = 17.499 ac, 3.87% Impervious, Inflow Depth = 0.74" for 2 year - 24 hour event
Inflow = 10.01 cfs @ 12.09 hrs, Volume= 1.078 af
Outflow = 5.24 cfs @ 12.34 hrs, Volume= 1.074 af, Atten= 48%, Lag= 15.0 min
Primary = 5.24 cfs @ 12.34 hrs, Volume= 1.074 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Starting Elev= 712.00' Surf.Area= 11,817 sf Storage= 33,961 cf
Peak Elev= 712.86' @ 12.34 hrs Surf.Area= 13,315 sf Storage= 45,576 cf (11,615 cf above start)
Flood Elev= 718.00' Surf.Area= 22,487 sf Storage= 136,385 cf (102,424 cf above start)

Plug-Flow detention time= 646.7 min calculated for 0.294 af (27% of inflow)
Center-of-Mass det. time= 89.4 min (964.3 - 874.9)

Volume	Invert	Avail.Storage	Storage Description
#1	708.00'	187,373 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
708.00	5,158	0	0
710.00	8,493	13,651	13,651
712.00	11,817	20,310	33,961
714.00	15,317	27,134	61,095
716.00	18,743	34,060	95,155
718.00	22,487	41,230	136,385
720.00	28,501	50,988	187,373

Device	Routing	Invert	Outlet Devices
#1	Primary	712.00'	**36.0" Round Culvert** L= 73.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 712.00' / 710.90' S= 0.0151 '/' Cc= 0.900 n= 0.015 Concrete sewer w/manholes & inlets, Flow Area= 7.07 sf
#2	Secondary	718.00'	**600.0' long x 60.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60

Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=5.24 cfs @ 12.34 hrs HW=712.86' (Free Discharge)
└**1=Culvert** (Inlet Controls 5.24 cfs @ 3.15 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=712.00' (Free Discharge)
└**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond P-SW1: Southwest Pond

[62] Hint: Exceeded Reach CH-SW1 OUTLET depth by 5.03' @ 24.50 hrs

Inflow Area = 24.187 ac, 3.46% Impervious, Inflow Depth = 0.73" for 2 year - 24 hour event
Inflow = 15.83 cfs @ 12.14 hrs, Volume= 1.463 af
Outflow = 0.45 cfs @ 22.80 hrs, Volume= 0.162 af, Atten= 97%, Lag= 640.1 min
Primary = 0.45 cfs @ 22.80 hrs, Volume= 0.162 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 720.05' @ 22.80 hrs Surf.Area= 23,759 sf Storage= 58,025 cf
Flood Elev= 723.00' Surf.Area= 40,614 sf Storage= 151,443 cf

Plug-Flow detention time= 732.7 min calculated for 0.162 af (11% of inflow)
Center-of-Mass det. time= 519.7 min (1,398.2 - 878.5)

Volume	Invert	Avail.Storage	Storage Description
#1	715.00'	192,056 cf	**Custom Stage Data (Prismatic)** Listed below

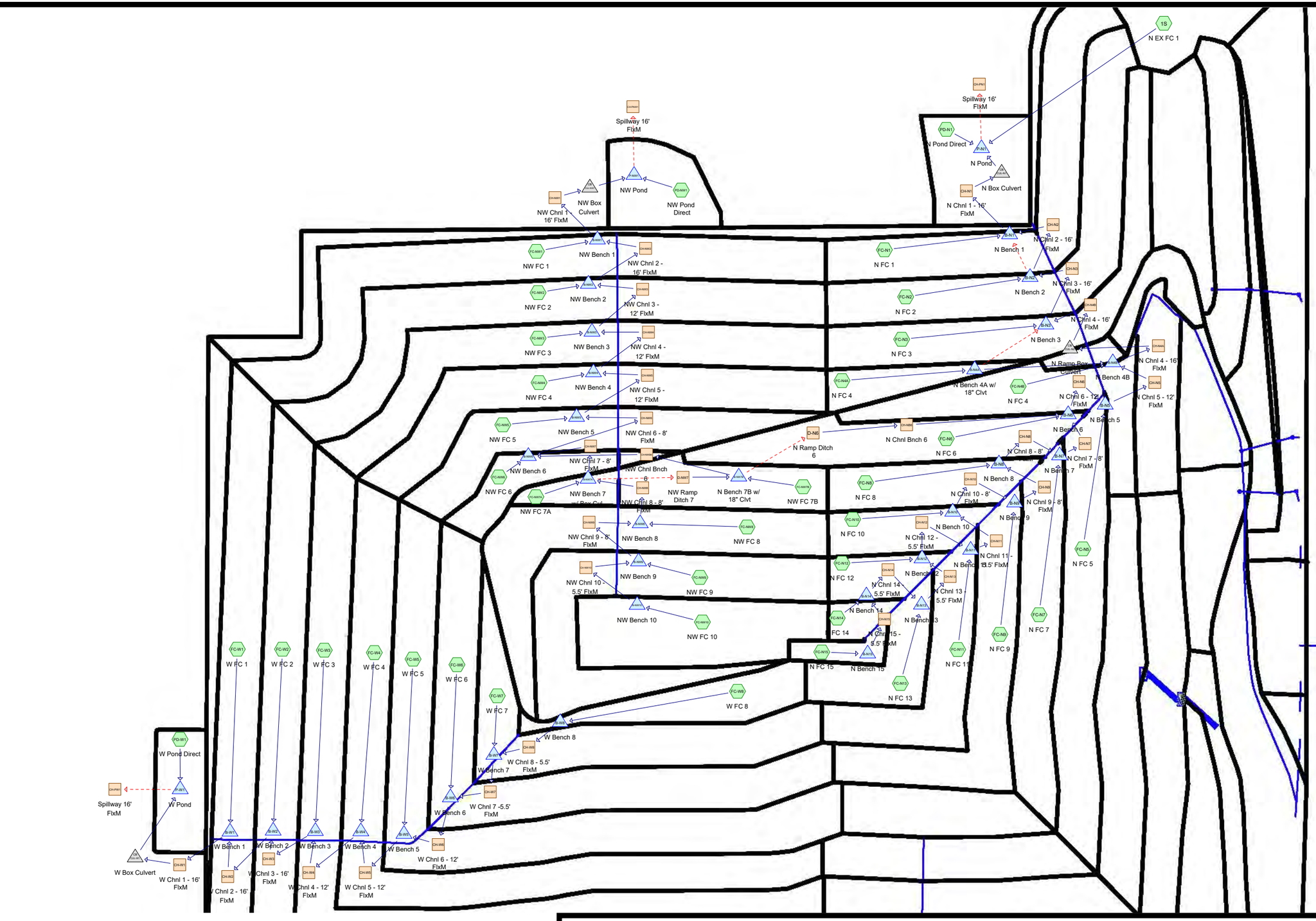
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
715.00	0	0	0
716.00	950	475	475
718.00	15,835	16,785	17,260
720.00	23,586	39,421	56,681
722.00	30,562	54,148	110,829
724.00	50,665	81,227	192,056

Device	Routing	Invert	Outlet Devices
#1	Primary	715.05'	**18.0" Round Culvert** L= 134.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 715.05' / 714.37' S= 0.0051 '/' Cc= 0.900 n= 0.015 Concrete sewer w/manholes & inlets, Flow Area= 1.77 sf
#2	Device 1	720.00'	**48.0" Horiz. Orifice/Grate** C= 0.600 in 48.0" Grate (100% open area) Limited to weir flow at low heads
#3	Secondary	723.00'	**300.0' long x 60.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=0.45 cfs @ 22.80 hrs HW=720.05' (Free Discharge)
└**1=Culvert** (Passes 0.45 cfs of 13.28 cfs potential flow)
└**2=Orifice/Grate** (Weir Controls 0.45 cfs @ 0.73 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=715.00' (Free Discharge)
└**3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Post-Project 10-Year Storm HydroCAD Analysis



Routing Diagram for BSLI Permit Expansion 2019 N & W

Prepared by Carlson McCain, Inc., Printed 12/18/2019

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Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
135.354	71	Meadow, non-grazed, HSG C (1S, FC-N1, FC-N10, FC-N11, FC-N12, FC-N13, FC-N14, FC-N15, FC-N2, FC-N3, FC-N4A, FC-N4B, FC-N5, FC-N6, FC-N7, FC-N8, FC-N9, FC-NW1, FC-NW10, FC-NW2, FC-NW3, FC-NW4, FC-NW5, FC-NW6, FC-NW7A, FC-NW7B, FC-NW8, FC-NW9, FC-W1, FC-W2, FC-W3, FC-W4, FC-W5, FC-W6, FC-W7, FC-W8)
1.497	98	Paved parking, HSG B (FC-N4B, FC-N6, FC-NW7A, FC-NW7B, FC-NW8, FC-NW9)
5.877	98	Water Surface, 0% imp, HSG B (PD-N1, PD-NW1, PD-W1)
142.727	**72**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
7.374	HSG B	FC-N4B, FC-N6, FC-NW7A, FC-NW7B, FC-NW8, FC-NW9, PD-N1, PD-NW1, PD-W1
135.354	HSG C	1S, FC-N1, FC-N10, FC-N11, FC-N12, FC-N13, FC-N14, FC-N15, FC-N2, FC-N3, FC-N4A, FC-N4B, FC-N5, FC-N6, FC-N7, FC-N8, FC-N9, FC-NW1, FC-NW10, FC-NW2, FC-NW3, FC-NW4, FC-NW5, FC-NW6, FC-NW7A, FC-NW7B, FC-NW8, FC-NW9, FC-W1, FC-W2, FC-W3, FC-W4, FC-W5, FC-W6, FC-W7, FC-W8
0.000	HSG D	
0.000	Other	
142.727		**TOTAL AREA**

Pipe Listing (all nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Diam/Width (inches)	Height (inches)	Inside-Fill (inches)
1	B-N4A	842.30	842.00	50.0	0.0060	0.010	15.8	0.0	0.0
2	B-NW7A	931.00	930.83	35.0	0.0049	0.012	96.0	48.0	0.0
3	B-NW7B	920.50	920.00	50.0	0.0100	0.010	15.8	0.0	0.0
4	CUL-N1	717.00	716.50	50.0	0.0100	0.012	120.0	48.0	0.0
5	CUL-N2	830.00	829.83	35.0	0.0049	0.010	96.0	48.0	0.0
6	CUL-NW1	717.00	716.60	40.0	0.0100	0.012	120.0	48.0	0.0
7	CUL-W1	717.00	716.60	40.0	0.0100	0.012	120.0	48.0	0.0
8	P-N1	701.00	700.50	50.0	0.0100	0.013	9.4	0.0	0.0
9	P-NW1	699.00	698.50	50.0	0.0100	0.013	10.0	0.0	0.0
10	P-W1	713.00	712.50	50.0	0.0100	0.013	10.0	0.0	0.0

Time span=0.00-60.00 hrs, dt=0.01 hrs, 6001 points x 2
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: N EX FC 1 Runoff Area=189,400 sf 0.00% Impervious Runoff Depth=1.54"
Flow Length=1,060' Tc=14.1 min CN=71 Runoff=8.76 cfs 0.558 af

Subcatchment FC-N1: N FC 1 Runoff Area=206,346 sf 0.00% Impervious Runoff Depth=1.54"
Flow Length=963' Tc=14.3 min CN=71 Runoff=9.47 cfs 0.608 af

Subcatchment FC-N10: N FC 10 Runoff Area=63,734 sf 0.00% Impervious Runoff Depth=1.54"
Flow Length=628' Tc=10.9 min CN=71 Runoff=3.32 cfs 0.188 af

Subcatchment FC-N11: N FC 11 Runoff Area=122,568 sf 0.00% Impervious Runoff Depth=1.54"
Flow Length=1,222' Tc=16.3 min CN=71 Runoff=5.25 cfs 0.361 af

Subcatchment FC-N12: N FC 12 Runoff Area=43,115 sf 0.00% Impervious Runoff Depth=1.54"
Flow Length=481' Tc=9.4 min CN=71 Runoff=2.38 cfs 0.127 af

Subcatchment FC-N13: N FC 13 Runoff Area=77,429 sf 0.00% Impervious Runoff Depth=1.54"
Flow Length=863' Tc=12.8 min CN=71 Runoff=3.76 cfs 0.228 af

Subcatchment FC-N14: N FC 14 Runoff Area=20,870 sf 0.00% Impervious Runoff Depth=1.54"
Flow Length=321' Tc=7.5 min CN=71 Runoff=1.24 cfs 0.061 af

Subcatchment FC-N15: N FC 15 Runoff Area=23,198 sf 0.00% Impervious Runoff Depth=1.54"
Flow Length=453' Tc=6.5 min CN=71 Runoff=1.44 cfs 0.068 af

Subcatchment FC-N2: N FC 2 Runoff Area=215,322 sf 0.00% Impervious Runoff Depth=1.54"
Flow Length=985' Tc=14.3 min CN=71 Runoff=9.88 cfs 0.634 af

Subcatchment FC-N3: N FC 3 Runoff Area=177,256 sf 0.00% Impervious Runoff Depth=1.54"
Flow Length=870' Tc=14.6 min CN=71 Runoff=8.05 cfs 0.522 af

Subcatchment FC-N4A: N FC 4 Runoff Area=45,986 sf 0.00% Impervious Runoff Depth=1.54"
Flow Length=706' Tc=11.6 min CN=71 Runoff=2.33 cfs 0.135 af

Subcatchment FC-N4B: N FC 4 Runoff Area=89,094 sf 15.79% Impervious Runoff Depth=1.83"
Flow Length=752' Tc=4.9 min CN=75 Runoff=6.98 cfs 0.311 af

Subcatchment FC-N5: N FC 5 Runoff Area=183,015 sf 0.00% Impervious Runoff Depth=1.54"
Flow Length=1,591' Tc=20.3 min CN=71 Runoff=6.90 cfs 0.539 af

Subcatchment FC-N6: N FC 6 Runoff Area=144,191 sf 6.48% Impervious Runoff Depth=1.68"
Flow Length=875' Tc=13.2 min CN=73 Runoff=7.58 cfs 0.463 af

Subcatchment FC-N7: N FC 7 Runoff Area=146,829 sf 0.00% Impervious Runoff Depth=1.54"
Flow Length=1,209' Tc=16.3 min CN=71 Runoff=6.29 cfs 0.432 af

Subcatchment FC-N8: N FC 8 Runoff Area=84,345 sf 0.00% Impervious Runoff Depth=1.54"
Flow Length=775' Tc=12.3 min CN=71 Runoff=4.17 cfs 0.248 af

Subcatchment FC-N9: N FC 9 Runoff Area=171,400 sf 0.00% Impervious Runoff Depth=1.54"
Flow Length=1,580' Tc=19.8 min CN=71 Runoff=6.56 cfs 0.505 af

Subcatchment FC-NW1: NW FC 1 Runoff Area=278,073 sf 0.00% Impervious Runoff Depth=1.54"
Flow Length=1,327' Tc=17.7 min CN=71 Runoff=11.37 cfs 0.819 af

Subcatchment FC-NW10: NW FC 10 Runoff Area=152,624 sf 0.00% Impervious Runoff Depth=1.54"
Flow Length=772' Tc=12.3 min CN=71 Runoff=7.54 cfs 0.450 af

Subcatchment FC-NW2: NW FC 2 Runoff Area=253,669 sf 0.00% Impervious Runoff Depth=1.54"
Flow Length=1,445' Tc=19.2 min CN=71 Runoff=9.90 cfs 0.747 af

Subcatchment FC-NW3: NW FC 3 Runoff Area=220,927 sf 0.00% Impervious Runoff Depth=1.54"
Flow Length=1,265' Tc=16.8 min CN=71 Runoff=9.31 cfs 0.651 af

Subcatchment FC-NW4: NW FC 4 Runoff Area=206,398 sf 0.00% Impervious Runoff Depth=1.54"
Flow Length=1,089' Tc=14.4 min CN=71 Runoff=9.44 cfs 0.608 af

Subcatchment FC-NW5: NW FC 5 Runoff Area=156,508 sf 0.00% Impervious Runoff Depth=1.54"
Flow Length=924' Tc=12.5 min CN=71 Runoff=7.67 cfs 0.461 af

Subcatchment FC-NW6: NW FC 6 Runoff Area=61,906 sf 0.00% Impervious Runoff Depth=1.54"
Flow Length=763' Tc=12.2 min CN=71 Runoff=3.07 cfs 0.182 af

Subcatchment FC-NW7A: NW FC 7A Runoff Area=26,678 sf 34.64% Impervious Runoff Depth=2.22"
Flow Length=294' Tc=2.2 min CN=80 Runoff=2.77 cfs 0.113 af

Subcatchment FC-NW7B: NW FC 7B Runoff Area=92,091 sf 4.67% Impervious Runoff Depth=1.61"
Flow Length=765' Tc=12.2 min CN=72 Runoff=4.80 cfs 0.283 af

Subcatchment FC-NW8: NW FC 8 Runoff Area=198,885 sf 6.07% Impervious Runoff Depth=1.68"
Flow Length=765' Tc=12.2 min CN=73 Runoff=10.85 cfs 0.639 af

Subcatchment FC-NW9: NW FC 9 Runoff Area=217,535 sf 7.43% Impervious Runoff Depth=1.68"
Flow Length=767' Tc=12.3 min CN=73 Runoff=11.81 cfs 0.699 af

Subcatchment FC-W1: W FC 1 Runoff Area=261,734 sf 0.00% Impervious Runoff Depth=1.54"
Flow Length=1,589' Tc=20.0 min CN=71 Runoff=9.96 cfs 0.771 af

Subcatchment FC-W2: W FC 2 Runoff Area=227,154 sf 0.00% Impervious Runoff Depth=1.54"
Flow Length=1,468' Tc=18.9 min CN=71 Runoff=8.96 cfs 0.669 af

Subcatchment FC-W3: W FC 3 Runoff Area=388,269 sf 0.00% Impervious Runoff Depth=1.54"
Flow Length=1,865' Tc=22.7 min CN=71 Runoff=13.67 cfs 1.144 af

Subcatchment FC-W4: W FC 4 Runoff Area=333,000 sf 0.00% Impervious Runoff Depth=1.54"
Flow Length=1,817' Tc=22.2 min CN=71 Runoff=11.92 cfs 0.981 af

Subcatchment FC-W5: W FC 5 Runoff Area=330,928 sf 0.00% Impervious Runoff Depth=1.54"
Flow Length=1,612' Tc=19.2 min CN=71 Runoff=12.91 cfs 0.975 af

Subcatchment FC-W6: W FC 6 Runoff Area=274,510 sf 0.00% Impervious Runoff Depth=1.54"
Flow Length=1,371' Tc=16.4 min CN=71 Runoff=11.72 cfs 0.809 af

Subcatchment FC-W7: W FC 7 Runoff Area=190,046 sf 0.00% Impervious Runoff Depth=1.54"
Flow Length=1,193' Tc=14.2 min CN=71 Runoff=8.77 cfs 0.560 af

Subcatchment FC-W8: W FC 8 Runoff Area=86,180 sf 0.00% Impervious Runoff Depth=1.54"
Flow Length=1,001' Tc=13.8 min CN=71 Runoff=4.03 cfs 0.254 af

Subcatchment PD-N1: N Pond Direct Runoff Area=104,271 sf 0.00% Impervious Runoff Depth=3.97"
Tc=0.0 min CN=98 Runoff=17.03 cfs 0.793 af

Subcatchment PD-NW1: NW Pond Direct Runoff Area=89,015 sf 0.00% Impervious Runoff Depth=3.97"
Tc=0.0 min CN=98 Runoff=14.54 cfs 0.677 af

Subcatchment PD-W1: W Pond Direct Runoff Area=62,704 sf 0.00% Impervious Runoff Depth=3.97"
Tc=0.0 min CN=98 Runoff=10.24 cfs 0.477 af

Reach CH-N1: N Chnl 1 - 16' FlxM Avg. Flow Depth=0.61' Max Vel=10.69 fps Inflow=80.21 cfs 5.669 af
n=0.052 L=28.8' S=0.3056 '/' Capacity=362.90 cfs Outflow=80.20 cfs 5.669 af

Reach CH-N10: N Chnl 10 - 8' FlxM Avg. Flow Depth=0.53' Max Vel=7.28 fps Inflow=16.51 cfs 1.034 af
n=0.056 L=85.7' S=0.2305 '/' Capacity=99.33 cfs Outflow=16.51 cfs 1.034 af

Reach CH-N11: N Chnl 11 - 5.5' FlxM Avg. Flow Depth=0.80' Max Vel=8.10 fps Inflow=13.27 cfs 0.846 af
n=0.053 L=96.5' S=0.2306 '/' Capacity=45.88 cfs Outflow=13.26 cfs 0.846 af

Reach CH-N12: N Chnl 12 - 5.5' FlxM Avg. Flow Depth=0.64' Max Vel=7.00 fps Inflow=8.50 cfs 0.485 af
n=0.055 L=84.5' S=0.2308 '/' Capacity=44.23 cfs Outflow=8.49 cfs 0.485 af

Reach CH-N13: N Chnl 13 - 5.5' FlxM Avg. Flow Depth=0.54' Max Vel=6.30 fps Inflow=6.16 cfs 0.358 af
n=0.057 L=86.7' S=0.2364 '/' Capacity=43.20 cfs Outflow=6.15 cfs 0.358 af

Reach CH-N14: N Chnl 14 - 5.5' FlxM Avg. Flow Depth=0.37' Max Vel=4.47 fps Inflow=2.66 cfs 0.130 af
n=0.066 L=92.2' S=0.2386 '/' Capacity=37.48 cfs Outflow=2.66 cfs 0.130 af

Reach CH-N15: N Chnl 15 - 5.5' FlxM Avg. Flow Depth=0.27' Max Vel=3.56 fps Inflow=1.43 cfs 0.068 af
n=0.074 L=60.0' S=0.2667 '/' Capacity=35.34 cfs Outflow=1.43 cfs 0.068 af

Reach CH-N2: N Chnl 2 - 16' FlxM Avg. Flow Depth=0.57' Max Vel=10.07 fps Inflow=70.83 cfs 5.062 af
n=0.053 L=119.1' S=0.3039 '/' Capacity=355.12 cfs Outflow=70.81 cfs 5.062 af

Reach CH-N3: N Chnl 3 - 16' FlxM Avg. Flow Depth=0.53' Max Vel=9.35 fps Inflow=61.02 cfs 4.427 af
n=0.055 L=122.8' S=0.3086 '/' Capacity=344.83 cfs Outflow=61.01 cfs 4.427 af

Reach CH-N4A: N Chnl 4 - 16' FlxM Avg. Flow Depth=0.49' Max Vel=8.87 fps Inflow=53.00 cfs 3.905 af
n=0.057 L=24.2' S=0.3306 '/' Capacity=344.36 cfs Outflow=53.00 cfs 3.905 af

Reach CH-N4B: N Chnl 4 - 16' FlxM Avg. Flow Depth=0.49' Max Vel=8.78 fps Inflow=53.00 cfs 3.905 af
n=0.057 L=87.0' S=0.3207 '/' Capacity=339.17 cfs Outflow=53.00 cfs 3.905 af

Reach CH-N5: N Chnl 5 - 12' FlxM Avg. Flow Depth=0.56' Max Vel=10.56 fps Inflow=49.06 cfs 3.459 af
n=0.051 L=61.6' S=0.3328 '/' Capacity=257.03 cfs Outflow=49.06 cfs 3.459 af

Reach CH-N6: N Chnl 6 - 12' FlxM Avg. Flow Depth=0.57' Max Vel=8.99 fps Inflow=42.71 cfs 2.919 af
n=0.051 L=71.7' S=0.2357 '/' Capacity=216.31 cfs Outflow=42.71 cfs 2.919 af

Reach CH-N7: N Chnl 7 - 8' FlxM Avg. Flow Depth=0.73' Max Vel=9.86 fps Inflow=32.46 cfs 2.219 af
n=0.051 L=89.3' S=0.2452 '/' Capacity=112.51 cfs Outflow=32.45 cfs 2.219 af

Reach CH-N8: N Chnl 8 - 8' FlxM Avg. Flow Depth=0.65' Max Vel=9.11 fps Inflow=26.25 cfs 1.787 af
n=0.052 L=73.4' S=0.2466 '/' Capacity=110.65 cfs Outflow=26.25 cfs 1.787 af

Reach CH-N9: N Chnl 9 - 8' FlxM Avg. Flow Depth=0.61' Max Vel=8.32 fps Inflow=22.18 cfs 1.538 af
n=0.053 L=93.3' S=0.2304 '/' Capacity=104.95 cfs Outflow=22.18 cfs 1.538 af

Reach CH-NB6: N Chnl Bnch 6 Avg. Flow Depth=0.21' Max Vel=1.84 fps Inflow=4.16 cfs 0.237 af
n=0.030 L=793.3' S=0.0120 '/' Capacity=174.96 cfs Outflow=3.33 cfs 0.237 af

Reach CH-NW1: NW Chnl 1 - 16' FlxM Avg. Flow Depth=0.63' Max Vel=10.38 fps Inflow=80.36 cfs 5.416 af
n=0.057 L=26.7' S=0.3333 '/' Capacity=345.79 cfs Outflow=80.36 cfs 5.416 af

Reach CH-NW10: NW Chnl 10 - 5.5' FlxM Avg. Flow Depth=0.60' Max Vel=6.81 fps Inflow=7.54 cfs 0.450 af
n=0.063 L=130.0' S=0.3077 '/' Capacity=44.59 cfs Outflow=7.53 cfs 0.450 af

Reach CH-NW2: NW Chnl 2 - 16' FlxM Avg. Flow Depth=0.56' Max Vel=10.00 fps Inflow=69.23 cfs 4.597 af
n=0.054 L=120.0' S=0.3167 '/' Capacity=355.76 cfs Outflow=69.21 cfs 4.597 af

Reach CH-NW3: NW Chnl 3 - 12' FlxM Avg. Flow Depth=0.68' Max Vel=10.51 fps Inflow=60.03 cfs 3.850 af
n=0.056 L=120.0' S=0.3167 '/' Capacity=228.34 cfs Outflow=60.02 cfs 3.850 af

Reach CH-NW4: NW Chnl 4 - 12' FlxM Avg. Flow Depth=0.61' Max Vel=10.04 fps Inflow=51.01 cfs 3.199 af
n=0.055 L=120.0' S=0.3167 '/' Capacity=232.49 cfs Outflow=51.00 cfs 3.199 af

Reach CH-NW5: NW Chnl 5 - 12' FlxM Avg. Flow Depth=0.55' Max Vel=9.12 fps Inflow=41.62 cfs 2.591 af
n=0.057 L=120.0' S=0.3167 '/' Capacity=224.33 cfs Outflow=41.60 cfs 2.591 af

Reach CH-NW6: NW Chnl 6 - 8' FlxM Avg. Flow Depth=0.71' Max Vel=10.77 fps Inflow=33.99 cfs 2.130 af
n=0.052 L=120.0' S=0.3167 '/' Capacity=125.39 cfs Outflow=33.98 cfs 2.130 af

Reach CH-NW7: NW Chnl 7 - 8' FlxM Avg. Flow Depth=0.67' Max Vel=10.13 fps Inflow=29.91 cfs 1.896 af
n=0.055 L=44.0' S=0.3330 '/' Capacity=121.56 cfs Outflow=29.90 cfs 1.896 af

Reach CH-NW8: NW Chnl 8 - 8' FlxM Avg. Flow Depth=0.65' Max Vel=10.47 fps Inflow=30.15 cfs 1.788 af
n=0.051 L=83.0' S=0.3133 '/' Capacity=127.16 cfs Outflow=30.15 cfs 1.788 af

Reach CH-NW9: NW Chnl 9 - 8' FlxM Avg. Flow Depth=0.53' Max Vel=8.45 fps Inflow=19.33 cfs 1.149 af
n=0.056 L=130.0' S=0.3077 '/' Capacity=114.77 cfs Outflow=19.33 cfs 1.149 af

Reach CH-NWB6: NW Chnl Bnch 6 Avg. Flow Depth=0.11' Max Vel=1.25 fps Inflow=1.12 cfs 0.051 af
n=0.030 L=150.0' S=0.0133 '/' Capacity=184.62 cfs Outflow=1.09 cfs 0.051 af

Reach CH-PN1: Spillway 16' FlxM Avg. Flow Depth=0.00' Max Vel=0.00 fps Inflow=0.00 cfs 0.000 af
n=0.053 L=21.0' S=0.3333 '/' Capacity=531.43 cfs Outflow=0.00 cfs 0.000 af

Reach CH-PNW1: Spillway 16' FlxM Avg. Flow Depth=0.00' Max Vel=0.00 fps Inflow=0.00 cfs 0.000 af
n=0.053 L=25.0' S=0.3200 '/' Capacity=520.69 cfs Outflow=0.00 cfs 0.000 af

Reach CH-PW1: Spillway 16' FlxM Avg. Flow Depth=0.00' Max Vel=0.00 fps Inflow=0.00 cfs 0.000 af
n=0.053 L=30.0' S=0.3233 '/' Capacity=523.39 cfs Outflow=0.00 cfs 0.000 af

Reach CH-W1: W Chnl 1 - 16' FlxM Avg. Flow Depth=0.60' Max Vel=10.85 fps Inflow=80.13 cfs 6.161 af
n=0.053 L=27.0' S=0.3333 '/' Capacity=371.89 cfs Outflow=80.13 cfs 6.161 af

Reach CH-W2: W Chnl 2 - 16' FlxM Avg. Flow Depth=0.55' Max Vel=10.33 fps Inflow=70.18 cfs 5.391 af
n=0.053 L=120.0' S=0.3333 '/' Capacity=371.89 cfs Outflow=70.18 cfs 5.391 af

Reach CH-W3: W Chnl 3 - 16' FlxM Avg. Flow Depth=0.52' Max Vel=9.54 fps Inflow=61.27 cfs 4.721 af
n=0.054 L=120.5' S=0.3154 '/' Capacity=355.02 cfs Outflow=61.25 cfs 4.721 af

Reach CH-W4: W Chnl 4 - 12' FlxM Avg. Flow Depth=0.59' Max Vel=9.84 fps Inflow=48.19 cfs 3.578 af
n=0.055 L=120.0' S=0.3167 '/' Capacity=232.49 cfs Outflow=48.19 cfs 3.578 af

Reach CH-W5: W Chnl 5 - 12' FlxM Avg. Flow Depth=0.49' Max Vel=9.16 fps Inflow=37.02 cfs 2.597 af
n=0.053 L=120.0' S=0.3167 '/' Capacity=241.26 cfs Outflow=37.02 cfs 2.597 af

Reach CH-W6: W Chnl 6 - 12' FlxM Avg. Flow Depth=0.39' Max Vel=7.64 fps Inflow=24.42 cfs 1.622 af
n=0.054 L=130.0' S=0.3000 '/' Capacity=230.48 cfs Outflow=24.42 cfs 1.622 af

Reach CH-W7: W Chnl 7 -5.5' FlxM Avg. Flow Depth=0.78' Max Vel=8.00 fps Inflow=12.74 cfs 0.814 af
n=0.053 L=174.0' S=0.2299 '/' Capacity=45.82 cfs Outflow=12.73 cfs 0.814 af

Reach CH-W8: W Chnl 8 - 5.5' FlxM Avg. Flow Depth=0.43' Max Vel=5.54 fps Inflow=4.02 cfs 0.254 af
n=0.058 L=179.0' S=0.2402 '/' Capacity=42.80 cfs Outflow=4.01 cfs 0.254 af

Reach D-N6: N Ramp Ditch 6 Avg. Flow Depth=0.21' Max Vel=7.62 fps Inflow=4.20 cfs 0.237 af
n=0.016 L=436.5' S=0.0745 '/' Capacity=430.04 cfs Outflow=4.16 cfs 0.237 af

Reach D-NW7: NW Ramp Ditch 7 Avg. Flow Depth=0.07' Max Vel=3.78 fps Inflow=0.64 cfs 0.005 af
n=0.016 L=163.0' S=0.0601 '/' Capacity=386.44 cfs Outflow=0.63 cfs 0.005 af

Pond B-N1: N Bench 1 Peak Elev=727.39' Storage=501 cf Inflow=80.20 cfs 5.669 af
Outflow=80.21 cfs 5.669 af

Pond B-N10: N Bench 10 Peak Elev=958.87' Storage=150 cf Inflow=16.51 cfs 1.034 af
Outflow=16.51 cfs 1.034 af

Pond B-N11: N Bench 11 Peak Elev=981.50' Storage=222 cf Inflow=13.27 cfs 0.846 af
Outflow=13.27 cfs 0.846 af

Pond B-N12: N Bench 12 Peak Elev=1,000.70' Storage=163 cf Inflow=8.50 cfs 0.485 af
Outflow=8.50 cfs 0.485 af

Pond B-N13: N Bench 13 Peak Elev=1,021.01' Storage=131 cf Inflow=6.16 cfs 0.358 af
Outflow=6.16 cfs 0.358 af

Pond B-N14: N Bench 14 Peak Elev=1,042.65' Storage=75 cf Inflow=2.67 cfs 0.130 af
Outflow=2.66 cfs 0.130 af

Pond B-N15: N Bench 15 Peak Elev=1,058.46' Storage=50 cf Inflow=1.44 cfs 0.068 af
Outflow=1.43 cfs 0.068 af

Pond B-N2: N Bench 2 Peak Elev=763.81' Storage=291 cf Inflow=70.82 cfs 5.062 af
Primary=70.83 cfs 5.062 af Secondary=0.00 cfs 0.000 af Outflow=70.83 cfs 5.062 af

Pond B-N3: N Bench 3 Peak Elev=802.44' Storage=191 cf Inflow=61.02 cfs 4.427 af
Outflow=61.02 cfs 4.427 af

Pond B-N4A: N Bench 4A w/ 18" Clvt Peak Elev=843.11' Storage=354 cf Inflow=2.33 cfs 0.135 af
Primary=2.13 cfs 0.135 af Secondary=0.00 cfs 0.000 af Outflow=2.13 cfs 0.135 af

Pond B-N4B: N Bench 4B Peak Elev=839.23' Storage=155 cf Inflow=53.00 cfs 3.905 af
Outflow=53.00 cfs 3.905 af

Pond B-N5: N Bench 5 Peak Elev=860.07' Storage=216 cf Inflow=49.07 cfs 3.459 af
Outflow=49.06 cfs 3.459 af

Pond B-N6: N Bench 6 Peak Elev=877.80' Storage=183 cf Inflow=42.71 cfs 2.919 af
Outflow=42.71 cfs 2.919 af

Pond B-N7: N Bench 7 Peak Elev=900.05' Storage=201 cf Inflow=32.46 cfs 2.219 af
Outflow=32.46 cfs 2.219 af

Pond B-N8: N Bench 8 Peak Elev=917.96' Storage=214 cf Inflow=26.25 cfs 1.787 af
Outflow=26.25 cfs 1.787 af

Pond B-N9: N Bench 9 Peak Elev=939.33' Storage=188 cf Inflow=22.18 cfs 1.538 af
Outflow=22.18 cfs 1.538 af

Pond B-NW1: NW Bench 1 Peak Elev=727.49' Storage=168 cf Inflow=80.36 cfs 5.416 af
Outflow=80.36 cfs 5.416 af

Pond B-NW10: NW Bench 10 Peak Elev=1,037.13' Storage=104 cf Inflow=7.54 cfs 0.450 af
Outflow=7.54 cfs 0.450 af

Pond B-NW2: NW Bench 2 Peak Elev=765.79' Storage=202 cf Inflow=69.23 cfs 4.597 af
Outflow=69.23 cfs 4.597 af

Pond B-NW3: NW Bench 3 Peak Elev=803.67' Storage=183 cf Inflow=60.03 cfs 3.850 af
Outflow=60.03 cfs 3.850 af

Pond B-NW4: NW Bench 4 Peak Elev=841.51' Storage=159 cf Inflow=51.01 cfs 3.199 af
Outflow=51.01 cfs 3.199 af

Pond B-NW5: NW Bench 5 Peak Elev=879.84' Storage=211 cf Inflow=41.62 cfs 2.591 af
Outflow=41.62 cfs 2.591 af

Pond B-NW6: NW Bench 6 Peak Elev=917.68' Storage=185 cf Inflow=33.99 cfs 2.130 af
Outflow=33.99 cfs 2.130 af

Pond B-NW7A: NW Bench 7 w/ Box Cul Peak Elev=932.19' Storage=314 cf Inflow=30.56 cfs 1.901 af
Primary=29.91 cfs 1.896 af Secondary=0.64 cfs 0.005 af Outflow=30.55 cfs 1.901 af

Pond B-NW7B: N Bench 7B w/ 18" Clvt Peak Elev=921.06' Storage=240 cf Inflow=5.39 cfs 0.288 af
Primary=1.12 cfs 0.051 af Secondary=4.20 cfs 0.237 af Outflow=5.32 cfs 0.288 af

Pond B-NW8: NW Bench 8 Peak Elev=957.57' Storage=168 cf Inflow=30.16 cfs 1.788 af
Outflow=30.15 cfs 1.788 af

Pond B-NW9: NW Bench 9 Peak Elev=997.22' Storage=119 cf Inflow=19.33 cfs 1.149 af
Outflow=19.33 cfs 1.149 af

Pond B-W1: W Bench 1 Peak Elev=727.58' Storage=181 cf Inflow=80.13 cfs 6.161 af
Outflow=80.13 cfs 6.161 af

Pond B-W2: W Bench 2 Peak Elev=765.46' Storage=148 cf Inflow=70.18 cfs 5.391 af
Outflow=70.18 cfs 5.391 af

Pond B-W3: W Bench 3 Peak Elev=803.34' Storage=124 cf Inflow=61.27 cfs 4.721 af
Outflow=61.27 cfs 4.721 af

Pond B-W4: W Bench 4 Peak Elev=841.46' Storage=139 cf Inflow=48.20 cfs 3.578 af
Outflow=48.19 cfs 3.578 af

Pond B-W5: W Bench 5 Peak Elev=879.24' Storage=112 cf Inflow=37.02 cfs 2.597 af
Outflow=37.02 cfs 2.597 af

Pond B-W6: W Bench 6 Peak Elev=917.96' Storage=171 cf Inflow=24.42 cfs 1.622 af
Outflow=24.42 cfs 1.622 af

Pond B-W7: W Bench 7 Peak Elev=958.47' Storage=322 cf Inflow=12.77 cfs 0.814 af
Outflow=12.74 cfs 0.814 af

Pond B-W8: W Bench 8 Peak Elev=1,000.81' Storage=185 cf Inflow=4.03 cfs 0.254 af
Outflow=4.02 cfs 0.254 af

Pond CUL-N1: N Box Culvert Peak Elev=718.84' Inflow=80.20 cfs 5.669 af
120.0" x 48.0" Box Culvert n=0.012 L=50.0' S=0.0100 '/' Outflow=80.20 cfs 5.669 af

Pond CUL-N2: N Ramp Box Culvert Peak Elev=831.78' Inflow=53.00 cfs 3.905 af
96.0" x 48.0" Box Culvert n=0.010 L=35.0' S=0.0049 '/' Outflow=53.00 cfs 3.905 af

Pond CUL-NW1: NW Box Culvert Peak Elev=718.85' Inflow=80.36 cfs 5.416 af
120.0" x 48.0" Box Culvert n=0.012 L=40.0' S=0.0100 '/' Outflow=80.36 cfs 5.416 af

Pond CUL-W1: W Box Culvert Peak Elev=718.84' Inflow=80.13 cfs 6.161 af
120.0" x 48.0" Box Culvert n=0.012 L=40.0' S=0.0100 '/' Outflow=80.13 cfs 6.161 af

Pond P-N1: N Pond Peak Elev=704.51' Storage=320,490 cf Inflow=90.69 cfs 7.020 af
Primary=3.63 cfs 6.854 af Secondary=0.00 cfs 0.000 af Tertiary=0.00 cfs 0.000 af Outflow=3.63 cfs 6.854 af

Pond P-NW1: NW Pond Peak Elev=703.04' Storage=227,357 cf Inflow=81.92 cfs 6.093 af
Primary=4.51 cfs 6.037 af Secondary=0.00 cfs 0.000 af Tertiary=0.00 cfs 0.000 af Outflow=4.51 cfs 6.037 af

Pond P-W1: W Pond Peak Elev=717.33' Storage=250,584 cf Inflow=81.16 cfs 6.638 af
Primary=4.68 cfs 6.575 af Secondary=0.00 cfs 0.000 af Tertiary=0.00 cfs 0.000 af Outflow=4.68 cfs 6.575 af

Total Runoff Area = 142.727 ac Runoff Volume = 19.751 af Average Runoff Depth = 1.66"
98.95% Pervious = 141.230 ac 1.05% Impervious = 1.497 ac

Summary for Subcatchment 1S: N EX FC 1

Runoff = 8.76 cfs @ 12.07 hrs, Volume= 0.558 af, Depth= 1.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 year - 24 hour Rainfall=4.21"

Area (sf)	CN	Description
189,400	71	Meadow, non-grazed, HSG C
189,400		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	120	0.3300	0.35		**Sheet Flow, 3:1 Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
1.8	230	0.0200	2.12		**Shallow Concentrated Flow, Ditch Flow** Grassed Waterway Kv= 15.0 fps
0.3	140	0.2000	6.71		**Shallow Concentrated Flow, Concentrated Flow** Grassed Waterway Kv= 15.0 fps
6.3	570	0.0100	1.50		**Shallow Concentrated Flow, Ditch Flow** Grassed Waterway Kv= 15.0 fps
14.1	1,060	Total			

Summary for Subcatchment FC-N1: N FC 1

Runoff = 9.47 cfs @ 12.07 hrs, Volume= 0.608 af, Depth= 1.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 year - 24 hour Rainfall=4.21"

Area (sf)	CN	Description
206,346	71	Meadow, non-grazed, HSG C
206,346		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	120	0.3300	0.35		**Sheet Flow, Slope Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
8.6	843	0.0120	1.64		**Shallow Concentrated Flow, Ditch Flow** Grassed Waterway Kv= 15.0 fps
14.3	963	Total			

Summary for Subcatchment FC-N10: N FC 10

Runoff = 3.32 cfs @ 12.03 hrs, Volume= 0.188 af, Depth= 1.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 year - 24 hour Rainfall=4.21"

Area (sf)	CN	Description
63,734	71	Meadow, non-grazed, HSG C
63,734		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	120	0.3300	0.35		**Sheet Flow, Slope Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
5.2	508	0.0120	1.64		**Shallow Concentrated Flow, Ditch Flow** Grassed Waterway Kv= 15.0 fps
10.9	628	Total			

Summary for Subcatchment FC-N11: N FC 11

Runoff = 5.25 cfs @ 12.09 hrs, Volume= 0.361 af, Depth= 1.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 year - 24 hour Rainfall=4.21"

Area (sf)	CN	Description
122,568	71	Meadow, non-grazed, HSG C
122,568		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.5	114	0.3300	0.35		**Sheet Flow, Slope Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
10.8	1,108	0.0130	1.71		**Shallow Concentrated Flow, Ditch Flow** Grassed Waterway Kv= 15.0 fps
16.3	1,222	Total			

Summary for Subcatchment FC-N12: N FC 12

Runoff = 2.38 cfs @ 12.02 hrs, Volume= 0.127 af, Depth= 1.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 year - 24 hour Rainfall=4.21"

Area (sf)	CN	Description
43,115	71	Meadow, non-grazed, HSG C
43,115		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	120	0.3300	0.35		**Sheet Flow, Slope Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
3.7	361	0.0120	1.64		**Shallow Concentrated Flow, Ditch Flow** Grassed Waterway Kv= 15.0 fps
9.4	481	Total			

Summary for Subcatchment FC-N13: N FC 13

Runoff = 3.76 cfs @ 12.05 hrs, Volume= 0.228 af, Depth= 1.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 year - 24 hour Rainfall=4.21"

Area (sf)	CN	Description
77,429	71	Meadow, non-grazed, HSG C
77,429		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.5	116	0.3330	0.35		**Sheet Flow, SlopeSheet Flow** Grass: Dense n= 0.240 P2= 2.83"
7.3	747	0.0130	1.71		**Shallow Concentrated Flow, Ditch Flow** Grassed Waterway Kv= 15.0 fps
12.8	863	Total			

Summary for Subcatchment FC-N14: N FC 14

Runoff = 1.24 cfs @ 12.00 hrs, Volume= 0.061 af, Depth= 1.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 year - 24 hour Rainfall=4.21"

Area (sf)	CN	Description
20,870	71	Meadow, non-grazed, HSG C
20,870		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.3	108	0.3300	0.34		**Sheet Flow, Slope Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
2.2	213	0.0115	1.61		**Shallow Concentrated Flow, Ditch Flow** Grassed Waterway Kv= 15.0 fps
7.5	321	Total			

Summary for Subcatchment FC-N15: N FC 15

Runoff = 1.44 cfs @ 11.98 hrs, Volume= 0.068 af, Depth= 1.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 year - 24 hour Rainfall=4.21"

Area (sf)	CN	Description
23,198	71	Meadow, non-grazed, HSG C
23,198		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.6	44	0.3300	0.29		**Sheet Flow, Slope Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
3.9	409	0.0137	1.76		**Shallow Concentrated Flow, Ditch Flow** Grassed Waterway Kv= 15.0 fps
6.5	453	Total			

Summary for Subcatchment FC-N2: N FC 2

Runoff = 9.88 cfs @ 12.07 hrs, Volume= 0.634 af, Depth= 1.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 year - 24 hour Rainfall=4.21"

Area (sf)	CN	Description
215,322	71	Meadow, non-grazed, HSG C
215,322		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	120	0.3300	0.35		**Sheet Flow, Slope Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
8.6	865	0.0125	1.68		**Shallow Concentrated Flow, Ditch Flow** Grassed Waterway Kv= 15.0 fps
14.3	985	Total			

Summary for Subcatchment FC-N3: N FC 3

Runoff = 8.05 cfs @ 12.08 hrs, Volume= 0.522 af, Depth= 1.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 year - 24 hour Rainfall=4.21"

Area (sf)	CN	Description
177,256	71	Meadow, non-grazed, HSG C
177,256		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.0	60	0.0500	0.14		**Sheet Flow, Top Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
7.6	810	0.0140	1.77		**Shallow Concentrated Flow, Ditch Flow** Grassed Waterway Kv= 15.0 fps
14.6	870	Total			

Summary for Subcatchment FC-N4A: N FC 4

Runoff = 2.33 cfs @ 12.04 hrs, Volume= 0.135 af, Depth= 1.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 year - 24 hour Rainfall=4.21"

Area (sf)	CN	Description
45,986	71	Meadow, non-grazed, HSG C
45,986		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	120	0.3300	0.35		**Sheet Flow, Slope Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
5.9	586	0.0120	1.64		**Shallow Concentrated Flow, Ditch Flow** Grassed Waterway Kv= 15.0 fps
11.6	706	Total			

Summary for Subcatchment FC-N4B: N FC 4

Runoff = 6.98 cfs @ 11.96 hrs, Volume= 0.311 af, Depth= 1.83"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 year - 24 hour Rainfall=4.21"

Area (sf)	CN	Description
75,024	71	Meadow, non-grazed, HSG C
14,070	98	Paved parking, HSG B
89,094	75	Weighted Average
75,024		84.21% Pervious Area
14,070		15.79% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.4	20	0.3300	0.24		**Sheet Flow, Slope Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
1.6	540	0.0800	5.74		**Shallow Concentrated Flow, Ditch Flow** Paved Kv= 20.3 fps
1.9	192	0.0120	1.64		**Shallow Concentrated Flow, Ditch Flow** Grassed Waterway Kv= 15.0 fps
4.9	752	Total			

Summary for Subcatchment FC-N5: N FC 5

Runoff = 6.90 cfs @ 12.14 hrs, Volume= 0.539 af, Depth= 1.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 year - 24 hour Rainfall=4.21"

Area (sf)	CN	Description
183,015	71	Meadow, non-grazed, HSG C
183,015		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	120	0.3300	0.35		**Sheet Flow, Slope Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
14.6	1,471	0.0125	1.68		**Shallow Concentrated Flow, Ditch Flow** Grassed Waterway Kv= 15.0 fps
20.3	1,591	Total			

Summary for Subcatchment FC-N6: N FC 6

Runoff = 7.58 cfs @ 12.06 hrs, Volume= 0.463 af, Depth= 1.68"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 year - 24 hour Rainfall=4.21"

Area (sf)	CN	Description
134,846	71	Meadow, non-grazed, HSG C
9,345	98	Paved parking, HSG B
144,191	73	Weighted Average
134,846		93.52% Pervious Area
9,345		6.48% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	120	0.3300	0.35		**Sheet Flow, Slope Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
7.5	755	0.0125	1.68		**Shallow Concentrated Flow, Ditch Flow** Grassed Waterway Kv= 15.0 fps
13.2	875	Total			

Summary for Subcatchment FC-N7: N FC 7

Runoff = 6.29 cfs @ 12.09 hrs, Volume= 0.432 af, Depth= 1.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 year - 24 hour Rainfall=4.21"

Area (sf)	CN	Description
146,829	71	Meadow, non-grazed, HSG C
146,829		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	120	0.3300	0.35		**Sheet Flow, Slope Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
10.6	1,089	0.0130	1.71		**Shallow Concentrated Flow, Ditch Flow** Grassed Waterway Kv= 15.0 fps
16.3	1,209	Total			

Summary for Subcatchment FC-N8: N FC 8

Runoff = 4.17 cfs @ 12.05 hrs, Volume= 0.248 af, Depth= 1.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 year - 24 hour Rainfall=4.21"

Area (sf)	CN	Description
84,345	71	Meadow, non-grazed, HSG C
84,345		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	120	0.3300	0.35		**Sheet Flow, Slope Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
6.6	655	0.0120	1.64		**Shallow Concentrated Flow, Ditch Flow** Grassed Waterway Kv= 15.0 fps
12.3	775	Total			

Summary for Subcatchment FC-N9: N FC 9

Runoff = 6.56 cfs @ 12.13 hrs, Volume= 0.505 af, Depth= 1.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 year - 24 hour Rainfall=4.21"

Area (sf)	CN	Description
171,400	71	Meadow, non-grazed, HSG C
171,400		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.5	114	0.3300	0.35		**Sheet Flow, Slope Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
14.3	1,466	0.0130	1.71		**Shallow Concentrated Flow, Ditch Flow** Grassed Waterway Kv= 15.0 fps
19.8	1,580	Total			

Summary for Subcatchment FC-NW1: NW FC 1

Runoff = 11.37 cfs @ 12.11 hrs, Volume= 0.819 af, Depth= 1.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 year - 24 hour Rainfall=4.21"

Area (sf)	CN	Description
278,073	71	Meadow, non-grazed, HSG C
278,073		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	120	0.3300	0.35		**Sheet Flow, Slope Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
12.0	1,207	0.0125	1.68		**Shallow Concentrated Flow, Ditch Flow** Grassed Waterway Kv= 15.0 fps
17.7	1,327	Total			

Summary for Subcatchment FC-NW10: NW FC 10

Runoff = 7.54 cfs @ 12.05 hrs, Volume= 0.450 af, Depth= 1.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 year - 24 hour Rainfall=4.21"

Area (sf)	CN	Description
152,624	71	Meadow, non-grazed, HSG C
152,624		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	120	0.3300	0.35		**Sheet Flow, Slope Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
6.6	652	0.0120	1.64		**Shallow Concentrated Flow, Ditch Flow** Grassed Waterway Kv= 15.0 fps
12.3	772	Total			

Summary for Subcatchment FC-NW2: NW FC 2

Runoff = 9.90 cfs @ 12.13 hrs, Volume= 0.747 af, Depth= 1.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 year - 24 hour Rainfall=4.21"

Area (sf)	CN	Description
253,669	71	Meadow, non-grazed, HSG C
253,669		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	120	0.3300	0.35		**Sheet Flow, Slope Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
6.8	545	0.0080	1.34		**Shallow Concentrated Flow, Ditch Flow** Grassed Waterway Kv= 15.0 fps
6.7	780	0.0166	1.93		**Shallow Concentrated Flow, Ditch Flow** Grassed Waterway Kv= 15.0 fps
19.2	1,445	Total			

Summary for Subcatchment FC-NW3: NW FC 3

Runoff = 9.31 cfs @ 12.10 hrs, Volume= 0.651 af, Depth= 1.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 year - 24 hour Rainfall=4.21"

Area (sf)	CN	Description
220,927	71	Meadow, non-grazed, HSG C
220,927		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	120	0.3300	0.35		**Sheet Flow, Slope Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
5.6	502	0.0100	1.50		**Shallow Concentrated Flow, 1% Shallow Flow** Grassed Waterway Kv= 15.0 fps
5.5	643	0.0170	1.96		**Shallow Concentrated Flow, Ditch Flow** Grassed Waterway Kv= 15.0 fps
16.8	1,265	Total			

Summary for Subcatchment FC-NW4: NW FC 4

Runoff = 9.44 cfs @ 12.07 hrs, Volume= 0.608 af, Depth= 1.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 year - 24 hour Rainfall=4.21"

Area (sf)	CN	Description
206,398	71	Meadow, non-grazed, HSG C
206,398		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	120	0.3300	0.35		**Sheet Flow, Slope Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
3.4	440	0.0210	2.17		**Shallow Concentrated Flow, 2% Shallow Flow** Grassed Waterway Kv= 15.0 fps
5.3	529	0.0125	1.68		**Shallow Concentrated Flow, Ditch Flow** Grassed Waterway Kv= 15.0 fps
14.4	1,089	Total			

Summary for Subcatchment FC-NW5: NW FC 5

Runoff = 7.67 cfs @ 12.05 hrs, Volume= 0.461 af, Depth= 1.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 year - 24 hour Rainfall=4.21"

Area (sf)	CN	Description
156,508	71	Meadow, non-grazed, HSG C
156,508		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	120	0.3300	0.35		**Sheet Flow, Slope Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
2.3	362	0.0300	2.60		**Shallow Concentrated Flow, 3% Shallow Flow** Grassed Waterway Kv= 15.0 fps
4.5	442	0.0120	1.64		**Shallow Concentrated Flow, Ditch Flow** Grassed Waterway Kv= 15.0 fps
12.5	924	Total			

Summary for Subcatchment FC-NW6: NW FC 6

Runoff = 3.07 cfs @ 12.05 hrs, Volume= 0.182 af, Depth= 1.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 year - 24 hour Rainfall=4.21"

Area (sf)	CN	Description
61,906	71	Meadow, non-grazed, HSG C
61,906		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	120	0.3300	0.35		**Sheet Flow, Slope Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
6.5	643	0.0120	1.64		**Shallow Concentrated Flow, Ditch Flow** Grassed Waterway Kv= 15.0 fps
12.2	763	Total			

Summary for Subcatchment FC-NW7A: NW FC 7A

Runoff = 2.77 cfs @ 11.93 hrs, Volume= 0.113 af, Depth= 2.22"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 year - 24 hour Rainfall=4.21"

Area (sf)	CN	Description
17,438	71	Meadow, non-grazed, HSG C
9,240	98	Paved parking, HSG B
26,678	80	Weighted Average
17,438		65.36% Pervious Area
9,240		34.64% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.4	20	0.3300	0.24		**Sheet Flow, Slope Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
0.8	274	0.0800	5.74		**Shallow Concentrated Flow, Ditch Flow** Paved Kv= 20.3 fps
2.2	294	Total			

Summary for Subcatchment FC-NW7B: NW FC 7B

Runoff = 4.80 cfs @ 12.05 hrs, Volume= 0.283 af, Depth= 1.61"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 year - 24 hour Rainfall=4.21"

Area (sf)	CN	Description
87,786	71	Meadow, non-grazed, HSG C
4,305	98	Paved parking, HSG B
92,091	72	Weighted Average
87,786		95.33% Pervious Area
4,305		4.67% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	120	0.3300	0.35		**Sheet Flow, Slope Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
6.5	645	0.0120	1.64		**Shallow Concentrated Flow, Ditch Flow** Grassed Waterway Kv= 15.0 fps
12.2	765	Total			

Summary for Subcatchment FC-NW8: NW FC 8

Runoff = 10.85 cfs @ 12.05 hrs, Volume= 0.639 af, Depth= 1.68"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 year - 24 hour Rainfall=4.21"

Area (sf)	CN	Description
186,810	71	Meadow, non-grazed, HSG C
12,075	98	Paved parking, HSG B
198,885	73	Weighted Average
186,810		93.93% Pervious Area
12,075		6.07% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	120	0.3300	0.35		**Sheet Flow, Slope Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
6.5	645	0.0120	1.64		**Shallow Concentrated Flow, Ditch Flow** Grassed Waterway Kv= 15.0 fps
12.2	765	Total			

Summary for Subcatchment FC-NW9: NW FC 9

Runoff = 11.81 cfs @ 12.05 hrs, Volume= 0.699 af, Depth= 1.68"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 year - 24 hour Rainfall=4.21"

Area (sf)	CN	Description
201,365	71	Meadow, non-grazed, HSG C
16,170	98	Paved parking, HSG B
217,535	73	Weighted Average
201,365		92.57% Pervious Area
16,170		7.43% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	120	0.3300	0.35		**Sheet Flow, Slope Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
6.6	647	0.0120	1.64		**Shallow Concentrated Flow, Ditch Flow** Grassed Waterway Kv= 15.0 fps
12.3	767	Total			

Summary for Subcatchment FC-W1: W FC 1

Runoff = 9.96 cfs @ 12.14 hrs, Volume= 0.771 af, Depth= 1.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 year - 24 hour Rainfall=4.21"

Area (sf)	CN	Description
261,734	71	Meadow, non-grazed, HSG C
261,734		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	120	0.3300	0.35		**Sheet Flow, Slope Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
14.3	1,469	0.0130	1.71		**Shallow Concentrated Flow, Ditch Flow** Grassed Waterway Kv= 15.0 fps
20.0	1,589	Total			

Summary for Subcatchment FC-W2: W FC 2

Runoff = 8.96 cfs @ 12.12 hrs, Volume= 0.669 af, Depth= 1.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 year - 24 hour Rainfall=4.21"

Area (sf)	CN	Description
227,154	71	Meadow, non-grazed, HSG C
227,154		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	120	0.3300	0.35		**Sheet Flow, Slope Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
13.2	1,348	0.0129	1.70		**Shallow Concentrated Flow, Ditch Flow** Grassed Waterway Kv= 15.0 fps
18.9	1,468	Total			

Summary for Subcatchment FC-W3: W FC 3

Runoff = 13.67 cfs @ 12.18 hrs, Volume= 1.144 af, Depth= 1.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 year - 24 hour Rainfall=4.21"

Area (sf)	CN	Description
388,269	71	Meadow, non-grazed, HSG C
388,269		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	120	0.3300	0.35		**Sheet Flow, Slope Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
17.0	1,745	0.0130	1.71		**Shallow Concentrated Flow, Ditch Flow** Grassed Waterway Kv= 15.0 fps
22.7	1,865	Total			

Summary for Subcatchment FC-W4: W FC 4

Runoff = 11.92 cfs @ 12.16 hrs, Volume= 0.981 af, Depth= 1.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 year - 24 hour Rainfall=4.21"

Area (sf)	CN	Description
333,000	71	Meadow, non-grazed, HSG C
333,000		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	120	0.3300	0.35		**Sheet Flow, Slope Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
16.5	1,697	0.0130	1.71		**Shallow Concentrated Flow, Ditch Flow** Grassed Waterway Kv= 15.0 fps
22.2	1,817	Total			

Summary for Subcatchment FC-W5: W FC 5

Runoff = 12.91 cfs @ 12.13 hrs, Volume= 0.975 af, Depth= 1.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 year - 24 hour Rainfall=4.21"

Area (sf)	CN	Description
330,928	71	Meadow, non-grazed, HSG C
330,928		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	120	0.3300	0.35		**Sheet Flow, Slope Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
0.6	167	0.1000	4.74		**Shallow Concentrated Flow, 10% Shallow Flow** Grassed Waterway Kv= 15.0 fps
12.9	1,325	0.0130	1.71		**Shallow Concentrated Flow, Ditch Flow** Grassed Waterway Kv= 15.0 fps
19.2	1,612	Total			

Summary for Subcatchment FC-W6: W FC 6

Runoff = 11.72 cfs @ 12.10 hrs, Volume= 0.809 af, Depth= 1.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 year - 24 hour Rainfall=4.21"

Area (sf)	CN	Description
274,510	71	Meadow, non-grazed, HSG C
274,510		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	120	0.3300	0.35		**Sheet Flow, Slope Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
0.9	266	0.1000	4.74		**Shallow Concentrated Flow, 10% Shallow Flow** Grassed Waterway Kv= 15.0 fps
9.8	985	0.0125	1.68		**Shallow Concentrated Flow, Ditch Flow** Grassed Waterway Kv= 15.0 fps
16.4	1,371	Total			

Summary for Subcatchment FC-W7: W FC 7

Runoff = 8.77 cfs @ 12.07 hrs, Volume= 0.560 af, Depth= 1.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 year - 24 hour Rainfall=4.21"

Area (sf)	CN	Description
190,046	71	Meadow, non-grazed, HSG C
190,046		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	120	0.3300	0.35		**Sheet Flow, Slope Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
0.8	233	0.1000	4.74		**Shallow Concentrated Flow, 10% Shallow Flow** Grassed Waterway Kv= 15.0 fps
7.7	840	0.0146	1.81		**Shallow Concentrated Flow, Ditch Flow** Grassed Waterway Kv= 15.0 fps
14.2	1,193	Total			

Summary for Subcatchment FC-W8: W FC 8

Runoff = 4.03 cfs @ 12.07 hrs, Volume= 0.254 af, Depth= 1.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 year - 24 hour Rainfall=4.21"

Area (sf)	CN	Description
86,180	71	Meadow, non-grazed, HSG C
86,180		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	120	0.3300	0.35		**Sheet Flow, Slope Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
0.7	211	0.1000	4.74		**Shallow Concentrated Flow, 10% Shallow Flow** Grassed Waterway Kv= 15.0 fps
7.4	670	0.0100	1.50		**Shallow Concentrated Flow, Ditch Flow** Grassed Waterway Kv= 15.0 fps
13.8	1,001	Total			

Summary for Subcatchment PD-N1: N Pond Direct

[46] Hint: Tc=0 (Instant runoff peak depends on dt)

Runoff = 17.03 cfs @ 11.90 hrs, Volume= 0.793 af, Depth= 3.97"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 year - 24 hour Rainfall=4.21"

Area (sf)	CN	Description
104,271	98	Water Surface, 0% imp, HSG B
104,271		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0					**Direct Entry, Direct Entry**

Summary for Subcatchment PD-NW1: NW Pond Direct

[46] Hint: Tc=0 (Instant runoff peak depends on dt)

Runoff = 14.54 cfs @ 11.90 hrs, Volume= 0.677 af, Depth= 3.97"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 year - 24 hour Rainfall=4.21"

Area (sf)	CN	Description
89,015	98	Water Surface, 0% imp, HSG B
89,015		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0					**Direct Entry, Direct Entry**

Summary for Subcatchment PD-W1: W Pond Direct

[46] Hint: Tc=0 (Instant runoff peak depends on dt)

Runoff = 10.24 cfs @ 11.90 hrs, Volume= 0.477 af, Depth= 3.97"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 year - 24 hour Rainfall=4.21"

Area (sf)	CN	Description
62,704	98	Water Surface, 0% imp, HSG B
62,704		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0					**Direct Entry, Direct Entry**

Summary for Reach CH-N1: N Chnl 1 - 16' FlxM

Inflow Area = 41.660 ac, 1.29% Impervious, Inflow Depth = 1.63" for 10 year - 24 hour event
Inflow = 80.21 cfs @ 12.09 hrs, Volume= 5.669 af
Outflow = 80.20 cfs @ 12.09 hrs, Volume= 5.669 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 10.69 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 2.52 fps, Avg. Travel Time= 0.2 min

Peak Storage= 216 cf @ 12.09 hrs
Average Depth at Peak Storage= 0.61'
Bank-Full Depth= 1.50' Flow Area= 19.9 sf, Capacity= 362.90 cfs

11.75' x 1.50' deep channel, n= 0.052
Side Slope Z-value= 1.0 '/' Top Width= 14.75'
Length= 28.8' Slope= 0.3056 '/'
Inlet Invert= 725.80', Outlet Invert= 717.00'

‡

Summary for Reach CH-N10: N Chnl 10 - 8' FlxM

Inflow Area = 8.056 ac, 0.00% Impervious, Inflow Depth = 1.54" for 10 year - 24 hour event
Inflow = 16.51 cfs @ 12.05 hrs, Volume= 1.034 af
Outflow = 16.51 cfs @ 12.05 hrs, Volume= 1.034 af, Atten= 0%, Lag= 0.1 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 7.28 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 2.00 fps, Avg. Travel Time= 0.7 min

Peak Storage= 194 cf @ 12.05 hrs
Average Depth at Peak Storage= 0.53'
Bank-Full Depth= 1.50' Flow Area= 7.9 sf, Capacity= 99.33 cfs

3.75' x 1.50' deep channel, n= 0.056
Side Slope Z-value= 1.0 '/' Top Width= 6.75'
Length= 85.7' Slope= 0.2305 '/'
Inlet Invert= 957.75', Outlet Invert= 938.00'

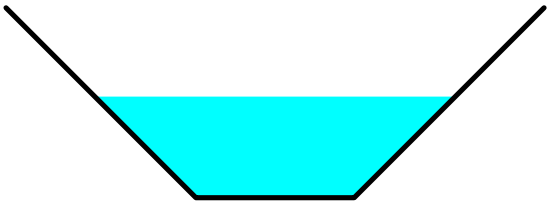
Summary for Reach CH-N11: N Chnl 11 - 5.5' FlxM

Inflow Area = 6.593 ac, 0.00% Impervious, Inflow Depth = 1.54" for 10 year - 24 hour event
Inflow = 13.27 cfs @ 12.05 hrs, Volume= 0.846 af
Outflow = 13.26 cfs @ 12.06 hrs, Volume= 0.846 af, Atten= 0%, Lag= 0.1 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 8.10 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 2.70 fps, Avg. Travel Time= 0.6 min

Peak Storage= 158 cf @ 12.06 hrs
Average Depth at Peak Storage= 0.80'
Bank-Full Depth= 1.50' Flow Area= 4.1 sf, Capacity= 45.88 cfs

1.25' x 1.50' deep channel, n= 0.053
Side Slope Z-value= 1.0 '/' Top Width= 4.25'
Length= 96.5' Slope= 0.2306 '/'
Inlet Invert= 980.00', Outlet Invert= 957.75'



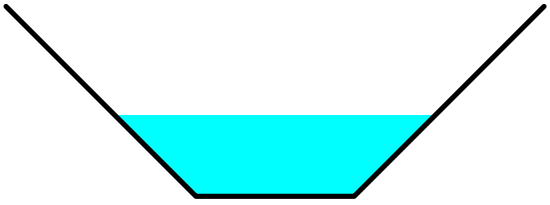
Summary for Reach CH-N12: N Chnl 12 - 5.5' FlxM

Inflow Area = 3.779 ac, 0.00% Impervious, Inflow Depth = 1.54" for 10 year - 24 hour event
Inflow = 8.50 cfs @ 12.03 hrs, Volume= 0.485 af
Outflow = 8.49 cfs @ 12.03 hrs, Volume= 0.485 af, Atten= 0%, Lag= 0.1 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 7.00 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 2.19 fps, Avg. Travel Time= 0.6 min

Peak Storage= 103 cf @ 12.03 hrs
Average Depth at Peak Storage= 0.64'
Bank-Full Depth= 1.50' Flow Area= 4.1 sf, Capacity= 44.23 cfs

1.25' x 1.50' deep channel, n= 0.055
Side Slope Z-value= 1.0 '/' Top Width= 4.25'
Length= 84.5' Slope= 0.2308 '/'
Inlet Invert= 999.50', Outlet Invert= 980.00'



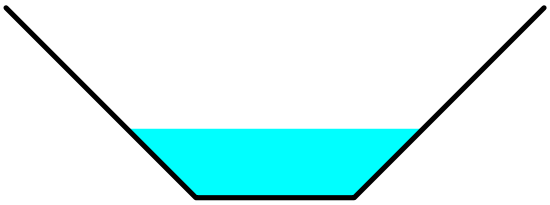
Summary for Reach CH-N13: N Chnl 13 - 5.5' FlxM

Inflow Area = 2.789 ac, 0.00% Impervious, Inflow Depth = 1.54" for 10 year - 24 hour event
Inflow = 6.16 cfs @ 12.03 hrs, Volume= 0.358 af
Outflow = 6.15 cfs @ 12.03 hrs, Volume= 0.358 af, Atten= 0%, Lag= 0.2 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 6.30 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 1.97 fps, Avg. Travel Time= 0.7 min

Peak Storage= 85 cf @ 12.03 hrs
Average Depth at Peak Storage= 0.54'
Bank-Full Depth= 1.50' Flow Area= 4.1 sf, Capacity= 43.20 cfs

1.25' x 1.50' deep channel, n= 0.057
Side Slope Z-value= 1.0 '/' Top Width= 4.25'
Length= 86.7' Slope= 0.2364 '/'
Inlet Invert= 1,020.00', Outlet Invert= 999.50'



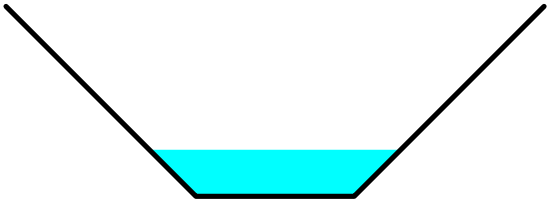
Summary for Reach CH-N14: N Chnl 14 - 5.5' FlxM

Inflow Area = 1.012 ac, 0.00% Impervious, Inflow Depth = 1.54" for 10 year - 24 hour event
Inflow = 2.66 cfs @ 12.00 hrs, Volume= 0.130 af
Outflow = 2.66 cfs @ 12.00 hrs, Volume= 0.130 af, Atten= 0%, Lag= 0.2 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 4.47 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 1.27 fps, Avg. Travel Time= 1.2 min

Peak Storage= 55 cf @ 12.00 hrs
Average Depth at Peak Storage= 0.37'
Bank-Full Depth= 1.50' Flow Area= 4.1 sf, Capacity= 37.48 cfs

1.25' x 1.50' deep channel, n= 0.066
Side Slope Z-value= 1.0 '/' Top Width= 4.25'
Length= 92.2' Slope= 0.2386 '/'
Inlet Invert= 1,042.00', Outlet Invert= 1,020.00'



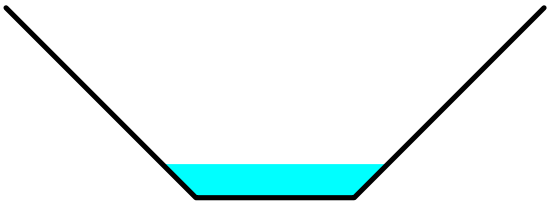
Summary for Reach CH-N15: N Chnl 15 - 5.5' FlxM

Inflow Area = 0.533 ac, 0.00% Impervious, Inflow Depth = 1.54" for 10 year - 24 hour event
Inflow = 1.43 cfs @ 11.99 hrs, Volume= 0.068 af
Outflow = 1.43 cfs @ 11.99 hrs, Volume= 0.068 af, Atten= 0%, Lag= 0.2 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 3.56 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 0.99 fps, Avg. Travel Time= 1.0 min

Peak Storage= 24 cf @ 11.99 hrs
Average Depth at Peak Storage= 0.27'
Bank-Full Depth= 1.50' Flow Area= 4.1 sf, Capacity= 35.34 cfs

1.25' x 1.50' deep channel, n= 0.074
Side Slope Z-value= 1.0 '/' Top Width= 4.25'
Length= 60.0' Slope= 0.2667 '/'
Inlet Invert= 1,058.00', Outlet Invert= 1,042.00'



Summary for Reach CH-N2: N Chnl 2 - 16' FlxM

Inflow Area = 36.923 ac, 1.46% Impervious, Inflow Depth = 1.65" for 10 year - 24 hour event
Inflow = 70.83 cfs @ 12.09 hrs, Volume= 5.062 af
Outflow = 70.81 cfs @ 12.09 hrs, Volume= 5.062 af, Atten= 0%, Lag= 0.1 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 10.07 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 2.39 fps, Avg. Travel Time= 0.8 min

Peak Storage= 837 cf @ 12.09 hrs
Average Depth at Peak Storage= 0.57'
Bank-Full Depth= 1.50' Flow Area= 19.9 sf, Capacity= 355.12 cfs

11.75' x 1.50' deep channel, n= 0.053
Side Slope Z-value= 1.0 '/' Top Width= 14.75'
Length= 119.1' Slope= 0.3039 '/'
Inlet Invert= 762.00', Outlet Invert= 725.80'

‡

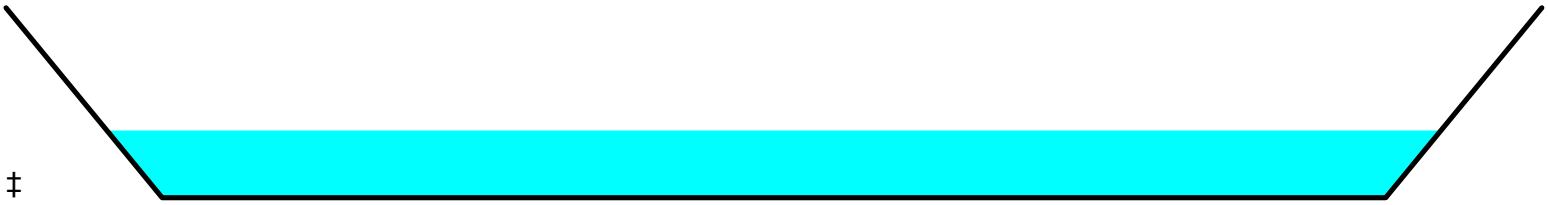
Summary for Reach CH-N3: N Chnl 3 - 16' FlxM

Inflow Area = 31.980 ac, 1.68% Impervious, Inflow Depth = 1.66" for 10 year - 24 hour event
Inflow = 61.02 cfs @ 12.08 hrs, Volume= 4.427 af
Outflow = 61.01 cfs @ 12.09 hrs, Volume= 4.427 af, Atten= 0%, Lag= 0.1 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 9.35 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 2.24 fps, Avg. Travel Time= 0.9 min

Peak Storage= 801 cf @ 12.09 hrs
Average Depth at Peak Storage= 0.53'
Bank-Full Depth= 1.50' Flow Area= 19.9 sf, Capacity= 344.83 cfs

11.75' x 1.50' deep channel, n= 0.055
Side Slope Z-value= 1.0 '/' Top Width= 14.75'
Length= 122.8' Slope= 0.3086 '/'
Inlet Invert= 801.10', Outlet Invert= 763.20'



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Summary for Reach CH-N4A: N Chnl 4 - 16' FlxM

Inflow Area = 27.910 ac, 1.93% Impervious, Inflow Depth = 1.68" for 10 year - 24 hour event
Inflow = 53.00 cfs @ 12.08 hrs, Volume= 3.905 af
Outflow = 53.00 cfs @ 12.08 hrs, Volume= 3.905 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 8.87 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 2.15 fps, Avg. Travel Time= 0.2 min

Peak Storage= 145 cf @ 12.08 hrs
Average Depth at Peak Storage= 0.49'
Bank-Full Depth= 1.50' Flow Area= 19.9 sf, Capacity= 344.36 cfs

11.75' x 1.50' deep channel, n= 0.057
Side Slope Z-value= 1.0 '/' Top Width= 14.75'
Length= 24.2' Slope= 0.3306 '/'
Inlet Invert= 838.00', Outlet Invert= 830.00'

‡

Summary for Reach CH-N4B: N Chnl 4 - 16' FlxM

Inflow Area = 27.910 ac, 1.93% Impervious, Inflow Depth = 1.68" for 10 year - 24 hour event
Inflow = 53.00 cfs @ 12.08 hrs, Volume= 3.905 af
Outflow = 53.00 cfs @ 12.08 hrs, Volume= 3.905 af, Atten= 0%, Lag= 0.1 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 8.78 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 2.13 fps, Avg. Travel Time= 0.7 min

Peak Storage= 525 cf @ 12.08 hrs
Average Depth at Peak Storage= 0.49'
Bank-Full Depth= 1.50' Flow Area= 19.9 sf, Capacity= 339.17 cfs

11.75' x 1.50' deep channel, n= 0.057
Side Slope Z-value= 1.0 '/' Top Width= 14.75'
Length= 87.0' Slope= 0.3207 '/'
Inlet Invert= 829.00', Outlet Invert= 801.10'

‡

Summary for Reach CH-N5: N Chnl 5 - 12' FlxM

Inflow Area = 24.809 ac, 0.86% Impervious, Inflow Depth = 1.67" for 10 year - 24 hour event
Inflow = 49.06 cfs @ 12.09 hrs, Volume= 3.459 af
Outflow = 49.06 cfs @ 12.09 hrs, Volume= 3.459 af, Atten= 0%, Lag= 0.1 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 10.56 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 2.61 fps, Avg. Travel Time= 0.4 min

Peak Storage= 286 cf @ 12.09 hrs
Average Depth at Peak Storage= 0.56'
Bank-Full Depth= 1.50' Flow Area= 13.9 sf, Capacity= 257.03 cfs

7.75' x 1.50' deep channel, n= 0.051
Side Slope Z-value= 1.0 '/' Top Width= 10.75'
Length= 61.6' Slope= 0.3328 '/'
Inlet Invert= 858.60', Outlet Invert= 838.10'

Summary for Reach CH-N6: N Chnl 6 - 12' FlxM

Inflow Area = 20.608 ac, 1.04% Impervious, Inflow Depth = 1.70" for 10 year - 24 hour event
Inflow = 42.71 cfs @ 12.08 hrs, Volume= 2.919 af
Outflow = 42.71 cfs @ 12.08 hrs, Volume= 2.919 af, Atten= 0%, Lag= 0.1 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 8.99 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 2.19 fps, Avg. Travel Time= 0.5 min

Peak Storage= 340 cf @ 12.08 hrs
Average Depth at Peak Storage= 0.57'
Bank-Full Depth= 1.50' Flow Area= 13.9 sf, Capacity= 216.31 cfs

7.75' x 1.50' deep channel, n= 0.051
Side Slope Z-value= 1.0 '/' Top Width= 10.75'
Length= 71.7' Slope= 0.2357 '/'
Inlet Invert= 875.50', Outlet Invert= 858.60'

Summary for Reach CH-N7: N Chnl 7 - 8' FlxM

Inflow Area = 17.298 ac, 0.00% Impervious, Inflow Depth = 1.54" for 10 year - 24 hour event
Inflow = 32.46 cfs @ 12.08 hrs, Volume= 2.219 af
Outflow = 32.45 cfs @ 12.08 hrs, Volume= 2.219 af, Atten= 0%, Lag= 0.1 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 9.86 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 2.83 fps, Avg. Travel Time= 0.5 min

Peak Storage= 294 cf @ 12.08 hrs
Average Depth at Peak Storage= 0.73'
Bank-Full Depth= 1.50' Flow Area= 7.9 sf, Capacity= 112.51 cfs

3.75' x 1.50' deep channel, n= 0.051
Side Slope Z-value= 1.0 '/' Top Width= 6.75'
Length= 89.3' Slope= 0.2452 '/'
Inlet Invert= 898.40', Outlet Invert= 876.50'

Summary for Reach CH-N8: N Chnl 8 - 8' FlxM

Inflow Area = 13.927 ac, 0.00% Impervious, Inflow Depth = 1.54" for 10 year - 24 hour event
Inflow = 26.25 cfs @ 12.07 hrs, Volume= 1.787 af
Outflow = 26.25 cfs @ 12.07 hrs, Volume= 1.787 af, Atten= 0%, Lag= 0.1 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 9.11 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 2.60 fps, Avg. Travel Time= 0.5 min

Peak Storage= 211 cf @ 12.07 hrs
Average Depth at Peak Storage= 0.65'
Bank-Full Depth= 1.50' Flow Area= 7.9 sf, Capacity= 110.65 cfs

3.75' x 1.50' deep channel, n= 0.052
Side Slope Z-value= 1.0 '/' Top Width= 6.75'
Length= 73.4' Slope= 0.2466 '/'
Inlet Invert= 916.50', Outlet Invert= 898.40'

Summary for Reach CH-N9: N Chnl 9 - 8' FlxM

Inflow Area = 11.991 ac, 0.00% Impervious, Inflow Depth = 1.54" for 10 year - 24 hour event
Inflow = 22.18 cfs @ 12.07 hrs, Volume= 1.538 af
Outflow = 22.18 cfs @ 12.07 hrs, Volume= 1.538 af, Atten= 0%, Lag= 0.1 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 8.32 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 2.39 fps, Avg. Travel Time= 0.7 min

Peak Storage= 249 cf @ 12.07 hrs
Average Depth at Peak Storage= 0.61'
Bank-Full Depth= 1.50' Flow Area= 7.9 sf, Capacity= 104.95 cfs

3.75' x 1.50' deep channel, n= 0.053
Side Slope Z-value= 1.0 '/' Top Width= 6.75'
Length= 93.3' Slope= 0.2304 '/'
Inlet Invert= 938.00', Outlet Invert= 916.50'

Summary for Reach CH-NB6: N Chnl Bnch 6

[62] Hint: Exceeded Reach D-N6 OUTLET depth by 0.06' @ 12.23 hrs

Inflow = 4.16 cfs @ 12.08 hrs, Volume= 0.237 af
Outflow = 3.33 cfs @ 12.13 hrs, Volume= 0.237 af, Atten= 20%, Lag= 3.5 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 1.84 fps, Min. Travel Time= 7.2 min
Avg. Velocity = 0.52 fps, Avg. Travel Time= 25.7 min

Peak Storage= 1,435 cf @ 12.13 hrs
Average Depth at Peak Storage= 0.21'
Bank-Full Depth= 2.00' Flow Area= 26.0 sf, Capacity= 174.96 cfs

8.00' x 2.00' deep channel, n= 0.030 Earth, dense weeds
Side Slope Z-value= 2.0 3.0 '/' Top Width= 18.00'
Length= 793.3' Slope= 0.0120 '/'
Inlet Invert= 888.00', Outlet Invert= 878.50'

‡

Summary for Reach CH-NW1: NW Chnl 1 - 16' FlxM

Inflow Area = 42.821 ac, 2.24% Impervious, Inflow Depth = 1.52" for 10 year - 24 hour event
Inflow = 80.36 cfs @ 12.09 hrs, Volume= 5.416 af
Outflow = 80.36 cfs @ 12.09 hrs, Volume= 5.416 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 10.38 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 2.54 fps, Avg. Travel Time= 0.2 min

Peak Storage= 207 cf @ 12.09 hrs
Average Depth at Peak Storage= 0.63'
Bank-Full Depth= 1.50' Flow Area= 19.9 sf, Capacity= 345.79 cfs

11.75' x 1.50' deep channel, n= 0.057
Side Slope Z-value= 1.0 '/' Top Width= 14.75'
Length= 26.7' Slope= 0.3333 '/'
Inlet Invert= 725.90', Outlet Invert= 717.00'

‡

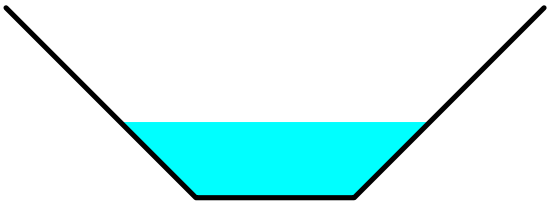
Summary for Reach CH-NW10: NW Chnl 10 - 5.5' FlxM

Inflow Area = 3.504 ac, 0.00% Impervious, Inflow Depth = 1.54" for 10 year - 24 hour event
Inflow = 7.54 cfs @ 12.05 hrs, Volume= 0.450 af
Outflow = 7.53 cfs @ 12.05 hrs, Volume= 0.450 af, Atten= 0%, Lag= 0.2 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 6.81 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 2.20 fps, Avg. Travel Time= 1.0 min

Peak Storage= 144 cf @ 12.05 hrs
Average Depth at Peak Storage= 0.60'
Bank-Full Depth= 1.50' Flow Area= 4.1 sf, Capacity= 44.59 cfs

1.25' x 1.50' deep channel, n= 0.063
Side Slope Z-value= 1.0 '/' Top Width= 4.25'
Length= 130.0' Slope= 0.3077 '/'
Inlet Invert= 1,036.00', Outlet Invert= 996.00'



Summary for Reach CH-NW2: NW Chnl 2 - 16' FlxM

Inflow Area = 36.438 ac, 2.63% Impervious, Inflow Depth = 1.51" for 10 year - 24 hour event
Inflow = 69.23 cfs @ 12.08 hrs, Volume= 4.597 af
Outflow = 69.21 cfs @ 12.08 hrs, Volume= 4.597 af, Atten= 0%, Lag= 0.1 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 10.00 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 2.44 fps, Avg. Travel Time= 0.8 min

Peak Storage= 831 cf @ 12.08 hrs
Average Depth at Peak Storage= 0.56'
Bank-Full Depth= 1.50' Flow Area= 19.9 sf, Capacity= 355.76 cfs

11.75' x 1.50' deep channel, n= 0.054
Side Slope Z-value= 1.0 '/' Top Width= 14.75'
Length= 120.0' Slope= 0.3167 '/'
Inlet Invert= 764.00', Outlet Invert= 726.00'

‡

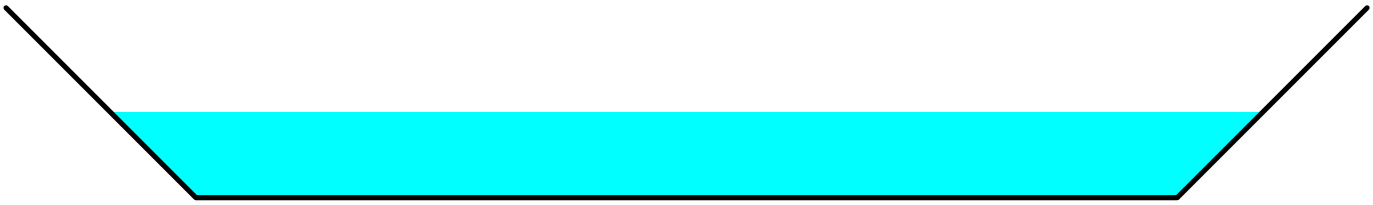
Summary for Reach CH-NW3: NW Chnl 3 - 12' FlxM

Inflow Area = 30.614 ac, 3.13% Impervious, Inflow Depth = 1.51" for 10 year - 24 hour event
Inflow = 60.03 cfs @ 12.07 hrs, Volume= 3.850 af
Outflow = 60.02 cfs @ 12.07 hrs, Volume= 3.850 af, Atten= 0%, Lag= 0.1 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 10.51 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 2.58 fps, Avg. Travel Time= 0.8 min

Peak Storage= 685 cf @ 12.07 hrs
Average Depth at Peak Storage= 0.68'
Bank-Full Depth= 1.50' Flow Area= 13.9 sf, Capacity= 228.34 cfs

7.75' x 1.50' deep channel, n= 0.056
Side Slope Z-value= 1.0 '/' Top Width= 10.75'
Length= 120.0' Slope= 0.3167 '/'
Inlet Invert= 802.00', Outlet Invert= 764.00'



Summary for Reach CH-NW4: NW Chnl 4 - 12' FlxM

Inflow Area = 25.542 ac, 3.76% Impervious, Inflow Depth = 1.50" for 10 year - 24 hour event
Inflow = 51.01 cfs @ 12.06 hrs, Volume= 3.199 af
Outflow = 51.00 cfs @ 12.07 hrs, Volume= 3.199 af, Atten= 0%, Lag= 0.1 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 10.04 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 2.44 fps, Avg. Travel Time= 0.8 min

Peak Storage= 610 cf @ 12.07 hrs
Average Depth at Peak Storage= 0.61'
Bank-Full Depth= 1.50' Flow Area= 13.9 sf, Capacity= 232.49 cfs

7.75' x 1.50' deep channel, n= 0.055
Side Slope Z-value= 1.0 '/' Top Width= 10.75'
Length= 120.0' Slope= 0.3167 '/'
Inlet Invert= 840.00', Outlet Invert= 802.00'

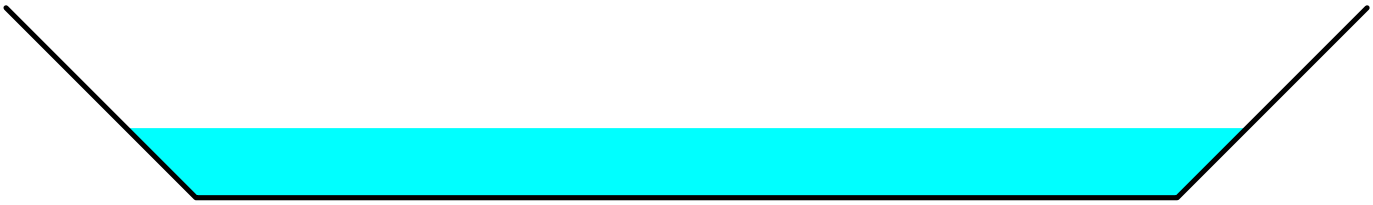
Summary for Reach CH-NW5: NW Chnl 5 - 12' FlxM

Inflow Area = 20.804 ac, 4.61% Impervious, Inflow Depth = 1.49" for 10 year - 24 hour event
Inflow = 41.62 cfs @ 12.06 hrs, Volume= 2.591 af
Outflow = 41.60 cfs @ 12.06 hrs, Volume= 2.591 af, Atten= 0%, Lag= 0.1 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 9.12 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 2.21 fps, Avg. Travel Time= 0.9 min

Peak Storage= 547 cf @ 12.06 hrs
Average Depth at Peak Storage= 0.55'
Bank-Full Depth= 1.50' Flow Area= 13.9 sf, Capacity= 224.33 cfs

7.75' x 1.50' deep channel, n= 0.057
Side Slope Z-value= 1.0 '/' Top Width= 10.75'
Length= 120.0' Slope= 0.3167 '/'
Inlet Invert= 878.00', Outlet Invert= 840.00'



Summary for Reach CH-NW6: NW Chnl 6 - 8' FlxM

Inflow Area = 17.211 ac, 5.57% Impervious, Inflow Depth = 1.49" for 10 year - 24 hour event
Inflow = 33.99 cfs @ 12.06 hrs, Volume= 2.130 af
Outflow = 33.98 cfs @ 12.06 hrs, Volume= 2.130 af, Atten= 0%, Lag= 0.1 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 10.77 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 2.80 fps, Avg. Travel Time= 0.7 min

Peak Storage= 378 cf @ 12.06 hrs
Average Depth at Peak Storage= 0.71'
Bank-Full Depth= 1.50' Flow Area= 7.9 sf, Capacity= 125.39 cfs

3.75' x 1.50' deep channel, n= 0.052
Side Slope Z-value= 1.0 '/' Top Width= 6.75'
Length= 120.0' Slope= 0.3167 '/'
Inlet Invert= 916.00', Outlet Invert= 878.00'

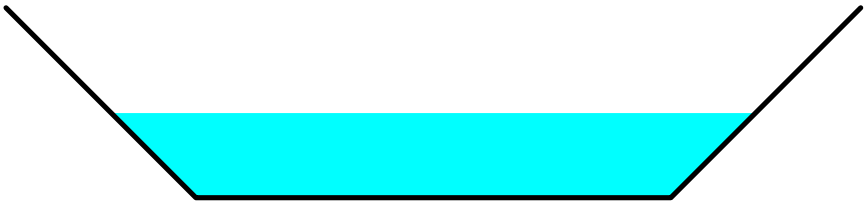
Summary for Reach CH-NW7: NW Chnl 7 - 8' FlxM

Inflow Area = 13.676 ac, 6.29% Impervious, Inflow Depth = 1.66" for 10 year - 24 hour event
Inflow = 29.91 cfs @ 12.06 hrs, Volume= 1.896 af
Outflow = 29.90 cfs @ 12.06 hrs, Volume= 1.896 af, Atten= 0%, Lag= 0.1 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 10.13 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 2.64 fps, Avg. Travel Time= 0.3 min

Peak Storage= 130 cf @ 12.06 hrs
Average Depth at Peak Storage= 0.67'
Bank-Full Depth= 1.50' Flow Area= 7.9 sf, Capacity= 121.56 cfs

3.75' x 1.50' deep channel, n= 0.055
Side Slope Z-value= 1.0 '/' Top Width= 6.75'
Length= 44.0' Slope= 0.3330 '/'
Inlet Invert= 930.65', Outlet Invert= 916.00'



Summary for Reach CH-NW8: NW Chnl 8 - 8' FlxM

Inflow Area = 13.063 ac, 4.96% Impervious, Inflow Depth = 1.64" for 10 year - 24 hour event
Inflow = 30.15 cfs @ 12.05 hrs, Volume= 1.788 af
Outflow = 30.15 cfs @ 12.05 hrs, Volume= 1.788 af, Atten= 0%, Lag= 0.1 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 10.47 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 2.88 fps, Avg. Travel Time= 0.5 min

Peak Storage= 239 cf @ 12.05 hrs
Average Depth at Peak Storage= 0.65'
Bank-Full Depth= 1.50' Flow Area= 7.9 sf, Capacity= 127.16 cfs

3.75' x 1.50' deep channel, n= 0.051
Side Slope Z-value= 1.0 '/' Top Width= 6.75'
Length= 83.0' Slope= 0.3133 '/'
Inlet Invert= 956.00', Outlet Invert= 930.00'

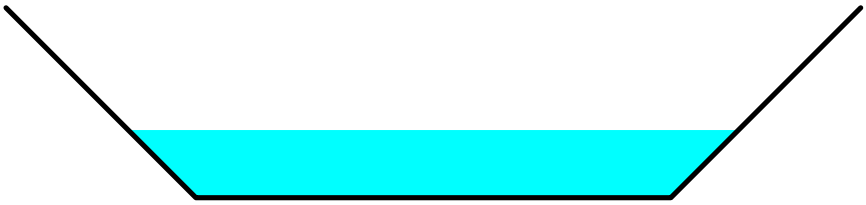
Summary for Reach CH-NW9: NW Chnl 9 - 8' FlxM

Inflow Area = 8.498 ac, 4.37% Impervious, Inflow Depth = 1.62" for 10 year - 24 hour event
Inflow = 19.33 cfs @ 12.05 hrs, Volume= 1.149 af
Outflow = 19.33 cfs @ 12.05 hrs, Volume= 1.149 af, Atten= 0%, Lag= 0.2 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 8.45 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 2.30 fps, Avg. Travel Time= 0.9 min

Peak Storage= 297 cf @ 12.05 hrs
Average Depth at Peak Storage= 0.53'
Bank-Full Depth= 1.50' Flow Area= 7.9 sf, Capacity= 114.77 cfs

3.75' x 1.50' deep channel, n= 0.056
Side Slope Z-value= 1.0 '/' Top Width= 6.75'
Length= 130.0' Slope= 0.3077 '/'
Inlet Invert= 996.00', Outlet Invert= 956.00'



Summary for Reach CH-NWB6: NW Chnl Bnch 6

Inflow Area = 2.114 ac, 4.67% Impervious, Inflow Depth = 0.29" for 10 year - 24 hour event
Inflow = 1.12 cfs @ 12.07 hrs, Volume= 0.051 af
Outflow = 1.09 cfs @ 12.09 hrs, Volume= 0.051 af, Atten= 3%, Lag= 1.2 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 1.25 fps, Min. Travel Time= 2.0 min
Avg. Velocity = 0.44 fps, Avg. Travel Time= 5.6 min

Peak Storage= 131 cf @ 12.09 hrs
Average Depth at Peak Storage= 0.11'
Bank-Full Depth= 2.00' Flow Area= 26.0 sf, Capacity= 184.62 cfs

8.00' x 2.00' deep channel, n= 0.030 Earth, dense weeds
Side Slope Z-value= 2.0 3.0 '/' Top Width= 18.00'
Length= 150.0' Slope= 0.0133 '/'
Inlet Invert= 920.00', Outlet Invert= 918.00'

‡

Summary for Reach CH-PN1: Spillway 16' FlxM

Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 0.00 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 0.00 fps, Avg. Travel Time= 0.0 min

Peak Storage= 0 cf @ 0.00 hrs
Average Depth at Peak Storage= 0.00'
Bank-Full Depth= 2.00' Flow Area= 24.6 sf, Capacity= 531.43 cfs

10.30' x 2.00' deep channel, n= 0.053
Side Slope Z-value= 1.0 '/' Top Width= 14.30'
Length= 21.0' Slope= 0.3333 '/'
Inlet Invert= 707.00', Outlet Invert= 700.00'

Summary for Reach CH-PNW1: Spillway 16' FlxM

Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 0.00 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 0.00 fps, Avg. Travel Time= 0.0 min

Peak Storage= 0 cf @ 0.00 hrs
Average Depth at Peak Storage= 0.00'
Bank-Full Depth= 2.00' Flow Area= 24.6 sf, Capacity= 520.69 cfs

10.30' x 2.00' deep channel, n= 0.053
Side Slope Z-value= 1.0 '/' Top Width= 14.30'
Length= 25.0' Slope= 0.3200 '/'
Inlet Invert= 708.00', Outlet Invert= 700.00'

Summary for Reach CH-PW1: Spillway 16' FlxM

Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 0.00 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 0.00 fps, Avg. Travel Time= 0.0 min

Peak Storage= 0 cf @ 0.00 hrs
Average Depth at Peak Storage= 0.00'
Bank-Full Depth= 2.00' Flow Area= 24.6 sf, Capacity= 523.39 cfs

10.30' x 2.00' deep channel, n= 0.053
Side Slope Z-value= 1.0 '/' Top Width= 14.30'
Length= 30.0' Slope= 0.3233 '/'
Inlet Invert= 719.70', Outlet Invert= 710.00'

Summary for Reach CH-W1: W Chnl 1 - 16' FlxM

Inflow Area = 48.022 ac, 0.00% Impervious, Inflow Depth = 1.54" for 10 year - 24 hour event
Inflow = 80.13 cfs @ 12.13 hrs, Volume= 6.161 af
Outflow = 80.13 cfs @ 12.13 hrs, Volume= 6.161 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 10.85 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 2.99 fps, Avg. Travel Time= 0.2 min

Peak Storage= 199 cf @ 12.13 hrs
Average Depth at Peak Storage= 0.60'
Bank-Full Depth= 1.50' Flow Area= 19.9 sf, Capacity= 371.89 cfs

11.75' x 1.50' deep channel, n= 0.053
Side Slope Z-value= 1.0 '/' Top Width= 14.75'
Length= 27.0' Slope= 0.3333 '/'
Inlet Invert= 726.00', Outlet Invert= 717.00'

‡

Summary for Reach CH-W2: W Chnl 2 - 16' FlxM

Inflow Area = 42.013 ac, 0.00% Impervious, Inflow Depth = 1.54" for 10 year - 24 hour event
Inflow = 70.18 cfs @ 12.13 hrs, Volume= 5.391 af
Outflow = 70.18 cfs @ 12.13 hrs, Volume= 5.391 af, Atten= 0%, Lag= 0.1 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 10.33 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 2.85 fps, Avg. Travel Time= 0.7 min

Peak Storage= 815 cf @ 12.13 hrs
Average Depth at Peak Storage= 0.55'
Bank-Full Depth= 1.50' Flow Area= 19.9 sf, Capacity= 371.89 cfs

11.75' x 1.50' deep channel, n= 0.053
Side Slope Z-value= 1.0 '/' Top Width= 14.75'
Length= 120.0' Slope= 0.3333 '/'
Inlet Invert= 764.00', Outlet Invert= 724.00'

‡

Summary for Reach CH-W3: W Chnl 3 - 16' FlxM

Inflow Area = 36.798 ac, 0.00% Impervious, Inflow Depth = 1.54" for 10 year - 24 hour event
Inflow = 61.27 cfs @ 12.13 hrs, Volume= 4.721 af
Outflow = 61.25 cfs @ 12.13 hrs, Volume= 4.721 af, Atten= 0%, Lag= 0.1 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 9.54 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 2.64 fps, Avg. Travel Time= 0.8 min

Peak Storage= 773 cf @ 12.13 hrs
Average Depth at Peak Storage= 0.52'
Bank-Full Depth= 1.50' Flow Area= 19.9 sf, Capacity= 355.02 cfs

11.75' x 1.50' deep channel, n= 0.054
Side Slope Z-value= 1.0 '/' Top Width= 14.75'
Length= 120.5' Slope= 0.3154 '/'
Inlet Invert= 802.00', Outlet Invert= 764.00'

‡

Summary for Reach CH-W4: W Chnl 4 - 12' FlxM

Inflow Area = 27.885 ac, 0.00% Impervious, Inflow Depth = 1.54" for 10 year - 24 hour event
Inflow = 48.19 cfs @ 12.12 hrs, Volume= 3.578 af
Outflow = 48.19 cfs @ 12.12 hrs, Volume= 3.578 af, Atten= 0%, Lag= 0.1 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 9.84 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 2.74 fps, Avg. Travel Time= 0.7 min

Peak Storage= 588 cf @ 12.12 hrs
Average Depth at Peak Storage= 0.59'
Bank-Full Depth= 1.50' Flow Area= 13.9 sf, Capacity= 232.49 cfs

7.75' x 1.50' deep channel, n= 0.055
Side Slope Z-value= 1.0 '/' Top Width= 10.75'
Length= 120.0' Slope= 0.3167 '/'
Inlet Invert= 840.00', Outlet Invert= 802.00'

Summary for Reach CH-W5: W Chnl 5 - 12' FlxM

Inflow Area = 20.240 ac, 0.00% Impervious, Inflow Depth = 1.54" for 10 year - 24 hour event
Inflow = 37.02 cfs @ 12.10 hrs, Volume= 2.597 af
Outflow = 37.02 cfs @ 12.10 hrs, Volume= 2.597 af, Atten= 0%, Lag= 0.1 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 9.16 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 2.49 fps, Avg. Travel Time= 0.8 min

Peak Storage= 485 cf @ 12.10 hrs
Average Depth at Peak Storage= 0.49'
Bank-Full Depth= 1.50' Flow Area= 13.9 sf, Capacity= 241.26 cfs

7.75' x 1.50' deep channel, n= 0.053
Side Slope Z-value= 1.0 '/' Top Width= 10.75'
Length= 120.0' Slope= 0.3167 '/'
Inlet Invert= 878.00', Outlet Invert= 840.00'

Summary for Reach CH-W6: W Chnl 6 - 12' FlxM

Inflow Area = 12.643 ac, 0.00% Impervious, Inflow Depth = 1.54" for 10 year - 24 hour event
Inflow = 24.42 cfs @ 12.09 hrs, Volume= 1.622 af
Outflow = 24.42 cfs @ 12.09 hrs, Volume= 1.622 af, Atten= 0%, Lag= 0.2 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 7.64 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 2.04 fps, Avg. Travel Time= 1.1 min

Peak Storage= 416 cf @ 12.09 hrs
Average Depth at Peak Storage= 0.39'
Bank-Full Depth= 1.50' Flow Area= 13.9 sf, Capacity= 230.48 cfs

7.75' x 1.50' deep channel, n= 0.054
Side Slope Z-value= 1.0 '/' Top Width= 10.75'
Length= 130.0' Slope= 0.3000 '/'
Inlet Invert= 917.00', Outlet Invert= 878.00'

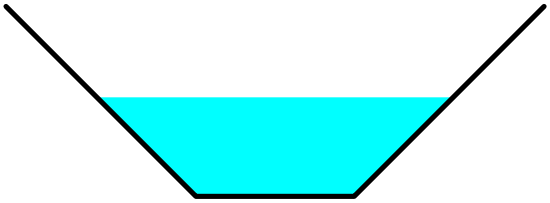
Summary for Reach CH-W7: W Chnl 7 -5.5' FlxM

Inflow Area = 6.341 ac, 0.00% Impervious, Inflow Depth = 1.54" for 10 year - 24 hour event
Inflow = 12.74 cfs @ 12.08 hrs, Volume= 0.814 af
Outflow = 12.73 cfs @ 12.08 hrs, Volume= 0.814 af, Atten= 0%, Lag= 0.3 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 8.00 fps, Min. Travel Time= 0.4 min
Avg. Velocity = 2.64 fps, Avg. Travel Time= 1.1 min

Peak Storage= 277 cf @ 12.08 hrs
Average Depth at Peak Storage= 0.78'
Bank-Full Depth= 1.50' Flow Area= 4.1 sf, Capacity= 45.82 cfs

1.25' x 1.50' deep channel, n= 0.053
Side Slope Z-value= 1.0 '/' Top Width= 4.25'
Length= 174.0' Slope= 0.2299 '/'
Inlet Invert= 957.00', Outlet Invert= 917.00'



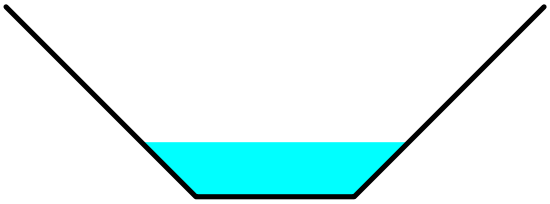
Summary for Reach CH-W8: W Chnl 8 - 5.5' FlxM

Inflow Area = 1.978 ac, 0.00% Impervious, Inflow Depth = 1.54" for 10 year - 24 hour event
Inflow = 4.02 cfs @ 12.07 hrs, Volume= 0.254 af
Outflow = 4.01 cfs @ 12.08 hrs, Volume= 0.254 af, Atten= 0%, Lag= 0.4 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 5.54 fps, Min. Travel Time= 0.5 min
Avg. Velocity = 1.72 fps, Avg. Travel Time= 1.7 min

Peak Storage= 129 cf @ 12.08 hrs
Average Depth at Peak Storage= 0.43'
Bank-Full Depth= 1.50' Flow Area= 4.1 sf, Capacity= 42.80 cfs

1.25' x 1.50' deep channel, n= 0.058
Side Slope Z-value= 1.0 '/' Top Width= 4.25'
Length= 179.0' Slope= 0.2402 '/'
Inlet Invert= 1,000.00', Outlet Invert= 957.00'



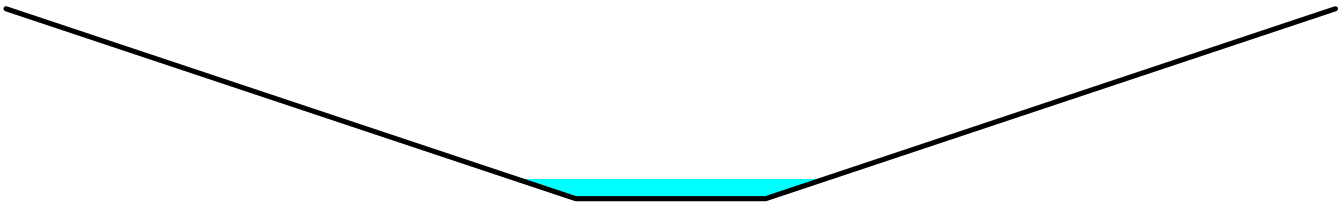
Summary for Reach D-N6: N Ramp Ditch 6

Inflow = 4.20 cfs @ 12.07 hrs, Volume= 0.237 af
Outflow = 4.16 cfs @ 12.08 hrs, Volume= 0.237 af, Atten= 1%, Lag= 0.7 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 7.62 fps, Min. Travel Time= 1.0 min
Avg. Velocity = 2.33 fps, Avg. Travel Time= 3.1 min

Peak Storage= 238 cf @ 12.08 hrs
Average Depth at Peak Storage= 0.21'
Bank-Full Depth= 2.00' Flow Area= 16.0 sf, Capacity= 430.04 cfs

2.00' x 2.00' deep channel, n= 0.016 Asphalt, rough
Side Slope Z-value= 3.0 '/' Top Width= 14.00'
Length= 436.5' Slope= 0.0745 '/'
Inlet Invert= 920.50', Outlet Invert= 888.00'



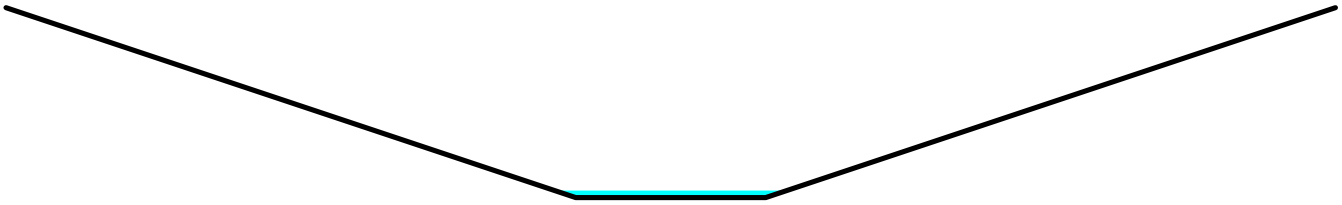
Summary for Reach D-NW7: NW Ramp Ditch 7

Inflow = 0.64 cfs @ 12.06 hrs, Volume= 0.005 af
Outflow = 0.63 cfs @ 12.06 hrs, Volume= 0.005 af, Atten= 2%, Lag= 0.5 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 3.78 fps, Min. Travel Time= 0.7 min
Avg. Velocity = 2.25 fps, Avg. Travel Time= 1.2 min

Peak Storage= 27 cf @ 12.06 hrs
Average Depth at Peak Storage= 0.07'
Bank-Full Depth= 2.00' Flow Area= 16.0 sf, Capacity= 386.44 cfs

2.00' x 2.00' deep channel, n= 0.016 Asphalt, rough
Side Slope Z-value= 3.0 '/' Top Width= 14.00'
Length= 163.0' Slope= 0.0601 '/'
Inlet Invert= 930.00', Outlet Invert= 920.20'



Summary for Pond B-N1: N Bench 1

[90] Warning: Qout>Qin may require smaller dt or Finer Routing
[62] Hint: Exceeded Reach CH-N2 OUTLET depth by 1.02' @ 12.09 hrs

Inflow Area = 41.660 ac, 1.29% Impervious, Inflow Depth = 1.63" for 10 year - 24 hour event
Inflow = 80.20 cfs @ 12.08 hrs, Volume= 5.669 af
Outflow = 80.21 cfs @ 12.09 hrs, Volume= 5.669 af, Atten= 0%, Lag= 0.1 min
Primary = 80.21 cfs @ 12.09 hrs, Volume= 5.669 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 727.39' @ 12.09 hrs Surf.Area= 461 sf Storage= 501 cf
Flood Elev= 730.00' Surf.Area= 5,118 sf Storage= 6,508 cf

Plug-Flow detention time= 0.2 min calculated for 5.669 af (100% of inflow)
Center-of-Mass det. time= 0.2 min (862.0 - 861.9)

Volume	Invert	Avail.Storage	Storage Description
#1	725.80'	6,508 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
725.80	170	0	0
728.00	573	817	817
730.00	5,118	5,691	6,508

Device	Routing	Invert	Outlet Devices
#1	Primary	725.80'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 4.00 Width (feet) 11.75 19.75

Primary OutFlow Max=80.14 cfs @ 12.09 hrs HW=727.39' TW=726.41' (Dynamic Tailwater)
↑—**1=Custom Weir/Orifice** (Weir Controls 80.14 cfs @ 3.79 fps)

Summary for Pond B-N10: N Bench 10

[62] Hint: Exceeded Reach CH-N11 OUTLET depth by 0.32' @ 12.05 hrs

Inflow Area = 8.056 ac, 0.00% Impervious, Inflow Depth = 1.54" for 10 year - 24 hour event
Inflow = 16.51 cfs @ 12.05 hrs, Volume= 1.034 af
Outflow = 16.51 cfs @ 12.05 hrs, Volume= 1.034 af, Atten= 0%, Lag= 0.1 min
Primary = 16.51 cfs @ 12.05 hrs, Volume= 1.034 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 958.87' @ 12.05 hrs Surf.Area= 177 sf Storage= 150 cf
Flood Elev= 961.75' Surf.Area= 2,270 sf Storage= 2,850 cf

Plug-Flow detention time= 0.3 min calculated for 1.033 af (100% of inflow)
Center-of-Mass det. time= 0.3 min (859.7 - 859.5)

Volume	Invert	Avail.Storage	Storage Description
#1	957.75'	2,850 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
957.75	90	0	0
959.75	245	335	335
961.75	2,270	2,515	2,850

Device	Routing	Invert	Outlet Devices
#1	Primary	957.75'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 4.00 Width (feet) 3.75 11.75

Primary OutFlow Max=16.49 cfs @ 12.05 hrs HW=958.87' TW=958.28' (Dynamic Tailwater)
└**1=Custom Weir/Orifice** (Weir Controls 16.49 cfs @ 3.01 fps)

Summary for Pond B-N11: N Bench 11

[62] Hint: Exceeded Reach CH-N12 OUTLET depth by 0.88' @ 12.08 hrs

Inflow Area = 6.593 ac, 0.00% Impervious, Inflow Depth = 1.54" for 10 year - 24 hour event
Inflow = 13.27 cfs @ 12.05 hrs, Volume= 0.846 af
Outflow = 13.27 cfs @ 12.05 hrs, Volume= 0.846 af, Atten= 0%, Lag= 0.2 min
Primary = 13.27 cfs @ 12.05 hrs, Volume= 0.846 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 981.50' @ 12.05 hrs Surf.Area= 206 sf Storage= 222 cf
Flood Elev= 984.00' Surf.Area= 2,270 sf Storage= 2,850 cf

Plug-Flow detention time= 0.6 min calculated for 0.846 af (100% of inflow)
Center-of-Mass det. time= 0.6 min (859.9 - 859.3)

Volume	Invert	Avail.Storage	Storage Description
#1	980.00'	2,850 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
980.00	90	0	0
982.00	245	335	335
984.00	2,270	2,515	2,850

Device	Routing	Invert	Outlet Devices
#1	Primary	980.00'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 4.00 Width (feet) 1.25 9.25

Primary OutFlow Max=13.25 cfs @ 12.05 hrs HW=981.50' TW=980.80' (Dynamic Tailwater)
└**1=Custom Weir/Orifice** (Weir Controls 13.25 cfs @ 3.22 fps)

Summary for Pond B-N12: N Bench 12

[62] Hint: Exceeded Reach CH-N13 OUTLET depth by 0.65' @ 12.03 hrs

Inflow Area = 3.779 ac, 0.00% Impervious, Inflow Depth = 1.54" for 10 year - 24 hour event
Inflow = 8.50 cfs @ 12.03 hrs, Volume= 0.485 af
Outflow = 8.50 cfs @ 12.03 hrs, Volume= 0.485 af, Atten= 0%, Lag= 0.2 min
Primary = 8.50 cfs @ 12.03 hrs, Volume= 0.485 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 1,000.70' @ 12.03 hrs Surf.Area= 183 sf Storage= 163 cf
Flood Elev= 1,003.50' Surf.Area= 2,270 sf Storage= 2,850 cf

Plug-Flow detention time= 0.8 min calculated for 0.485 af (100% of inflow)
Center-of-Mass det. time= 0.7 min (857.7 - 857.0)

Volume	Invert	Avail.Storage	Storage Description
#1	999.50'	2,850 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
999.50	90	0	0
1,001.50	245	335	335
1,003.50	2,270	2,515	2,850

Device	Routing	Invert	Outlet Devices
#1	Primary	999.50'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 4.00 Width (feet) 1.25 9.25

Primary OutFlow Max=8.49 cfs @ 12.03 hrs HW=1,000.70' TW=1,000.14' (Dynamic Tailwater)
1=Custom Weir/Orifice (Weir Controls 8.49 cfs @ 2.90 fps)

Summary for Pond B-N13: N Bench 13

[62] Hint: Exceeded Reach CH-N14 OUTLET depth by 0.67' @ 12.06 hrs

Inflow Area = 2.789 ac, 0.00% Impervious, Inflow Depth = 1.54" for 10 year - 24 hour event
Inflow = 6.16 cfs @ 12.03 hrs, Volume= 0.358 af
Outflow = 6.16 cfs @ 12.03 hrs, Volume= 0.358 af, Atten= 0%, Lag= 0.3 min
Primary = 6.16 cfs @ 12.03 hrs, Volume= 0.358 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 1,021.01' @ 12.03 hrs Surf.Area= 169 sf Storage= 131 cf
Flood Elev= 1,024.00' Surf.Area= 2,270 sf Storage= 2,850 cf

Plug-Flow detention time= 0.8 min calculated for 0.358 af (100% of inflow)
Center-of-Mass det. time= 0.8 min (857.5 - 856.7)

Volume	Invert	Avail.Storage	Storage Description
#1	1,020.00'	2,850 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,020.00	90	0	0
1,022.00	245	335	335
1,024.00	2,270	2,515	2,850

Device	Routing	Invert	Outlet Devices
#1	Primary	1,020.00'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 4.00 Width (feet) 1.25 9.25

Primary OutFlow Max=6.15 cfs @ 12.03 hrs HW=1,021.01' TW=1,020.54' (Dynamic Tailwater)
1=Custom Weir/Orifice (Weir Controls 6.15 cfs @ 2.68 fps)

Summary for Pond B-N14: N Bench 14

[62] Hint: Exceeded Reach CH-N15 OUTLET depth by 0.39' @ 12.01 hrs

Inflow Area = 1.012 ac, 0.00% Impervious, Inflow Depth = 1.54" for 10 year - 24 hour event
Inflow = 2.67 cfs @ 11.99 hrs, Volume= 0.130 af
Outflow = 2.66 cfs @ 12.00 hrs, Volume= 0.130 af, Atten= 0%, Lag= 0.3 min
Primary = 2.66 cfs @ 12.00 hrs, Volume= 0.130 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 1,042.65' @ 12.00 hrs Surf.Area= 141 sf Storage= 75 cf
Flood Elev= 1,046.00' Surf.Area= 2,270 sf Storage= 2,850 cf

Plug-Flow detention time= 1.1 min calculated for 0.130 af (100% of inflow)
Center-of-Mass det. time= 1.1 min (854.4 - 853.2)

Volume	Invert	Avail.Storage	Storage Description
#1	1,042.00'	2,850 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,042.00	90	0	0
1,044.00	245	335	335
1,046.00	2,270	2,515	2,850

Device	Routing	Invert	Outlet Devices
#1	Primary	1,042.00'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 4.00 Width (feet) 1.25 9.25

Primary OutFlow Max=2.66 cfs @ 12.00 hrs HW=1,042.65' TW=1,042.37' (Dynamic Tailwater)
↑**1=Custom Weir/Orifice** (Weir Controls 2.66 cfs @ 2.15 fps)

Summary for Pond B-N15: N Bench 15

Inflow Area = 0.533 ac, 0.00% Impervious, Inflow Depth = 1.54" for 10 year - 24 hour event
Inflow = 1.44 cfs @ 11.98 hrs, Volume= 0.068 af
Outflow = 1.43 cfs @ 11.99 hrs, Volume= 0.068 af, Atten= 0%, Lag= 0.4 min
Primary = 1.43 cfs @ 11.99 hrs, Volume= 0.068 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 1,058.46' @ 11.99 hrs Surf.Area= 126 sf Storage= 50 cf
Flood Elev= 1,062.00' Surf.Area= 2,270 sf Storage= 2,850 cf

Plug-Flow detention time= 1.4 min calculated for 0.068 af (100% of inflow)
Center-of-Mass det. time= 1.4 min (853.1 - 851.7)

Volume	Invert	Avail.Storage	Storage Description
#1	1,058.00'	2,850 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,058.00	90	0	0
1,060.00	245	335	335
1,062.00	2,270	2,515	2,850

Device	Routing	Invert	Outlet Devices
#1	Primary	1,058.00'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 4.00 Width (feet) 1.25 9.25

Primary OutFlow Max=1.43 cfs @ 11.99 hrs HW=1,058.46' TW=1,058.26' (Dynamic Tailwater)
└**1=Custom Weir/Orifice** (Weir Controls 1.43 cfs @ 1.81 fps)

Summary for Pond B-N2: N Bench 2

[90] Warning: Qout>Qin may require smaller dt or Finer Routing
[62] Hint: Exceeded Reach CH-N3 OUTLET depth by 0.08' @ 12.08 hrs

Inflow Area = 36.923 ac, 1.46% Impervious, Inflow Depth = 1.65" for 10 year - 24 hour event
Inflow = 70.82 cfs @ 12.08 hrs, Volume= 5.062 af
Outflow = 70.83 cfs @ 12.09 hrs, Volume= 5.062 af, Atten= 0%, Lag= 0.1 min
Primary = 70.83 cfs @ 12.09 hrs, Volume= 5.062 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 763.81' @ 12.09 hrs Surf.Area= 231 sf Storage= 291 cf
Flood Elev= 766.00' Surf.Area= 2,270 sf Storage= 2,850 cf

Plug-Flow detention time= 0.1 min calculated for 5.061 af (100% of inflow)
Center-of-Mass det. time= 0.1 min (861.7 - 861.6)

Volume	Invert	Avail.Storage	Storage Description
#1	762.00'	14,348 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
762.00	90	0	0
764.00	245	335	335
766.00	2,270	2,515	2,850
768.00	9,228	11,498	14,348

Device	Routing	Invert	Outlet Devices
#1	Primary	762.00'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 4.00 Width (feet) 7.75 15.75
#2	Secondary	766.00'	**100.0' long x 2.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32

Primary OutFlow Max=70.77 cfs @ 12.09 hrs HW=763.81' TW=762.57' (Dynamic Tailwater)
└**1=Custom Weir/Orifice** (Weir Controls 70.77 cfs @ 4.08 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=762.00' TW=725.80' (Dynamic Tailwater)
└**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond B-N3: N Bench 3

[62] Hint: Exceeded Reach CH-N4B OUTLET depth by 0.85' @ 12.08 hrs

Inflow Area = 31.980 ac, 1.68% Impervious, Inflow Depth = 1.66" for 10 year - 24 hour event
Inflow = 61.02 cfs @ 12.08 hrs, Volume= 4.427 af
Outflow = 61.02 cfs @ 12.08 hrs, Volume= 4.427 af, Atten= 0%, Lag= 0.0 min
Primary = 61.02 cfs @ 12.08 hrs, Volume= 4.427 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 802.44' @ 12.08 hrs Surf.Area= 194 sf Storage= 191 cf
Flood Elev= 805.10' Surf.Area= 2,270 sf Storage= 2,850 cf

Plug-Flow detention time= 0.1 min calculated for 4.427 af (100% of inflow)
Center-of-Mass det. time= 0.1 min (861.5 - 861.4)

Volume	Invert	Avail.Storage	Storage Description
#1	801.10'	2,850 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
801.10	90	0	0
803.10	245	335	335
805.10	2,270	2,515	2,850

Device	Routing	Invert	Outlet Devices
#1	Primary	801.10'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 4.00 Width (feet) 11.75 19.75

Primary OutFlow Max=60.98 cfs @ 12.08 hrs HW=802.44' TW=801.63' (Dynamic Tailwater)
↑—**1=Custom Weir/Orifice** (Weir Controls 60.98 cfs @ 3.47 fps)

Summary for Pond B-N4A: N Bench 4A w/ 18" Clvt

Inflow Area = 1.056 ac, 0.00% Impervious, Inflow Depth = 1.54" for 10 year - 24 hour event
Inflow = 2.33 cfs @ 12.04 hrs, Volume= 0.135 af
Outflow = 2.13 cfs @ 12.08 hrs, Volume= 0.135 af, Atten= 9%, Lag= 2.5 min
Primary = 2.13 cfs @ 12.08 hrs, Volume= 0.135 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 843.11' @ 12.08 hrs Surf.Area= 846 sf Storage= 354 cf
Flood Elev= 844.00' Surf.Area= 1,545 sf Storage= 1,419 cf

Plug-Flow detention time= 2.4 min calculated for 0.135 af (100% of inflow)
Center-of-Mass det. time= 2.4 min (858.9 - 856.4)

Volume	Invert	Avail.Storage	Storage Description
#1	842.30'	7,494 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
842.30	0	0	0
843.00	760	266	266
844.00	1,545	1,153	1,419
846.00	4,530	6,075	7,494

Device	Routing	Invert	Outlet Devices
#1	Primary	842.30'	**15.8" Round 18" Dia PEP SDR 17** L= 50.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 842.30' / 842.00' S= 0.0060 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 1.36 sf
#2	Secondary	844.00'	**4.0' long x 2.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32

Primary OutFlow Max=2.12 cfs @ 12.08 hrs HW=843.11' TW=839.23' (Dynamic Tailwater)
└**1=18" Dia PEP SDR 17** (Inlet Controls 2.12 cfs @ 2.42 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=842.30' TW=801.10' (Dynamic Tailwater)
└**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond B-N4B: N Bench 4B

[62] Hint: Exceeded Reach CH-N5 OUTLET depth by 0.57' @ 12.07 hrs

Inflow Area = 27.910 ac, 1.93% Impervious, Inflow Depth = 1.68" for 10 year - 24 hour event
Inflow = 53.00 cfs @ 12.08 hrs, Volume= 3.905 af
Outflow = 53.00 cfs @ 12.08 hrs, Volume= 3.905 af, Atten= 0%, Lag= 0.0 min
Primary = 53.00 cfs @ 12.08 hrs, Volume= 3.905 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 839.23' @ 12.08 hrs Surf.Area= 163 sf Storage= 155 cf
Flood Elev= 842.00' Surf.Area= 3,623 sf Storage= 4,501 cf

Plug-Flow detention time= 0.1 min calculated for 3.905 af (100% of inflow)
Center-of-Mass det. time= 0.1 min (861.2 - 861.1)

Volume	Invert	Avail.Storage	Storage Description
#1	838.00'	4,501 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
838.00	90	0	0
840.00	209	299	299
841.00	2,286	1,248	1,547
842.00	3,623	2,955	4,501

Device	Routing	Invert	Outlet Devices
#1	Primary	838.00'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 4.00 Width (feet) 11.75 19.75

Primary OutFlow Max=52.97 cfs @ 12.08 hrs HW=839.23' TW=838.49' (Dynamic Tailwater)
└**1=Custom Weir/Orifice** (Weir Controls 52.97 cfs @ 3.32 fps)

Summary for Pond B-N5: N Bench 5

[62] Hint: Exceeded Reach CH-N6 OUTLET depth by 0.90' @ 12.09 hrs

Inflow Area = 24.809 ac, 0.86% Impervious, Inflow Depth = 1.67" for 10 year - 24 hour event
Inflow = 49.07 cfs @ 12.09 hrs, Volume= 3.459 af
Outflow = 49.06 cfs @ 12.09 hrs, Volume= 3.459 af, Atten= 0%, Lag= 0.1 min
Primary = 49.06 cfs @ 12.09 hrs, Volume= 3.459 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 860.07' @ 12.09 hrs Surf.Area= 204 sf Storage= 216 cf
Flood Elev= 862.60' Surf.Area= 2,270 sf Storage= 2,850 cf

Plug-Flow detention time= 0.1 min calculated for 3.459 af (100% of inflow)
Center-of-Mass det. time= 0.1 min (862.9 - 862.8)

Volume	Invert	Avail.Storage	Storage Description
#1	858.60'	2,850 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
858.60	90	0	0
860.60	245	335	335
862.60	2,270	2,515	2,850

Device	Routing	Invert	Outlet Devices
#1	Primary	858.60'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 4.00 Width (feet) 7.75 15.75

Primary OutFlow Max=49.04 cfs @ 12.09 hrs HW=860.07' TW=859.16' (Dynamic Tailwater)
↑—**1=Custom Weir/Orifice** (Weir Controls 49.04 cfs @ 3.62 fps)

Summary for Pond B-N6: N Bench 6

[62] Hint: Exceeded Reach CH-N7 OUTLET depth by 0.57' @ 12.08 hrs

Inflow Area = 20.608 ac, 1.04% Impervious, Inflow Depth = 1.70" for 10 year - 24 hour event
Inflow = 42.71 cfs @ 12.08 hrs, Volume= 2.919 af
Outflow = 42.71 cfs @ 12.08 hrs, Volume= 2.919 af, Atten= 0%, Lag= 0.1 min
Primary = 42.71 cfs @ 12.08 hrs, Volume= 2.919 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 877.80' @ 12.08 hrs Surf.Area= 191 sf Storage= 183 cf
Flood Elev= 880.50' Surf.Area= 2,270 sf Storage= 2,850 cf

Plug-Flow detention time= 0.1 min calculated for 2.919 af (100% of inflow)
Center-of-Mass det. time= 0.1 min (862.2 - 862.0)

Volume	Invert	Avail.Storage	Storage Description
#1	876.50'	2,850 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
876.50	90	0	0
878.50	245	335	335
880.50	2,270	2,515	2,850

Device	Routing	Invert	Outlet Devices
#1	Primary	876.50'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 4.00 Width (feet) 7.75 15.75

Primary OutFlow Max=42.70 cfs @ 12.08 hrs HW=877.80' TW=876.07' (Dynamic Tailwater)
└**1=Custom Weir/Orifice** (Weir Controls 42.70 cfs @ 3.63 fps)

Summary for Pond B-N7: N Bench 7

[62] Hint: Exceeded Reach CH-N8 OUTLET depth by 0.99' @ 12.08 hrs

Inflow Area = 17.298 ac, 0.00% Impervious, Inflow Depth = 1.54" for 10 year - 24 hour event
Inflow = 32.46 cfs @ 12.08 hrs, Volume= 2.219 af
Outflow = 32.46 cfs @ 12.08 hrs, Volume= 2.219 af, Atten= 0%, Lag= 0.1 min
Primary = 32.46 cfs @ 12.08 hrs, Volume= 2.219 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 900.05' @ 12.08 hrs Surf.Area= 154 sf Storage= 201 cf
Flood Elev= 902.40' Surf.Area= 245 sf Storage= 670 cf

Plug-Flow detention time= 0.2 min calculated for 2.219 af (100% of inflow)
Center-of-Mass det. time= 0.2 min (862.0 - 861.8)

Volume	Invert	Avail.Storage	Storage Description
#1	898.40'	3,185 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
898.40	90	0	0
902.40	245	670	670
904.40	2,270	2,515	3,185

Device	Routing	Invert	Outlet Devices
#1	Primary	898.40'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 4.00 Width (feet) 3.75 11.75

Primary OutFlow Max=32.43 cfs @ 12.08 hrs HW=900.05' TW=899.13' (Dynamic Tailwater)
└**1=Custom Weir/Orifice** (Weir Controls 32.43 cfs @ 3.65 fps)

Summary for Pond B-N8: N Bench 8

[62] Hint: Exceeded Reach CH-N9 OUTLET depth by 0.85' @ 12.07 hrs

Inflow Area = 13.927 ac, 0.00% Impervious, Inflow Depth = 1.54" for 10 year - 24 hour event
Inflow = 26.25 cfs @ 12.07 hrs, Volume= 1.787 af
Outflow = 26.25 cfs @ 12.07 hrs, Volume= 1.787 af, Atten= 0%, Lag= 0.1 min
Primary = 26.25 cfs @ 12.07 hrs, Volume= 1.787 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 917.96' @ 12.07 hrs Surf.Area= 203 sf Storage= 214 cf
Flood Elev= 920.50' Surf.Area= 2,270 sf Storage= 2,850 cf

Plug-Flow detention time= 0.2 min calculated for 1.787 af (100% of inflow)
Center-of-Mass det. time= 0.2 min (861.7 - 861.4)

Volume	Invert	Avail.Storage	Storage Description
#1	916.50'	2,850 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
916.50	90	0	0
918.50	245	335	335
920.50	2,270	2,515	2,850

Device	Routing	Invert	Outlet Devices
#1	Primary	916.50'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 4.00 Width (feet) 3.75 11.75

Primary OutFlow Max=26.25 cfs @ 12.07 hrs HW=917.96' TW=917.15' (Dynamic Tailwater)
1=Custom Weir/Orifice (Weir Controls 26.25 cfs @ 3.45 fps)

Summary for Pond B-N9: N Bench 9

[62] Hint: Exceeded Reach CH-N10 OUTLET depth by 0.81' @ 12.09 hrs

Inflow Area = 11.991 ac, 0.00% Impervious, Inflow Depth = 1.54" for 10 year - 24 hour event
Inflow = 22.18 cfs @ 12.07 hrs, Volume= 1.538 af
Outflow = 22.18 cfs @ 12.07 hrs, Volume= 1.538 af, Atten= 0%, Lag= 0.1 min
Primary = 22.18 cfs @ 12.07 hrs, Volume= 1.538 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 939.33' @ 12.07 hrs Surf.Area= 193 sf Storage= 188 cf
Flood Elev= 942.00' Surf.Area= 2,270 sf Storage= 2,850 cf

Plug-Flow detention time= 0.3 min calculated for 1.538 af (100% of inflow)
Center-of-Mass det. time= 0.3 min (861.7 - 861.5)

Volume	Invert	Avail.Storage	Storage Description
#1	938.00'	2,850 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
938.00	90	0	0
940.00	245	335	335
942.00	2,270	2,515	2,850

Device	Routing	Invert	Outlet Devices
#1	Primary	938.00'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 4.00 Width (feet) 3.75 11.75

Primary OutFlow Max=22.17 cfs @ 12.07 hrs HW=939.33' TW=938.61' (Dynamic Tailwater)
1=Custom Weir/Orifice (Weir Controls 22.17 cfs @ 3.28 fps)

Summary for Pond B-NW1: NW Bench 1

[62] Hint: Exceeded Reach CH-NW2 OUTLET depth by 0.93' @ 12.09 hrs

Inflow Area = 42.821 ac, 2.24% Impervious, Inflow Depth = 1.52" for 10 year - 24 hour event
Inflow = 80.36 cfs @ 12.09 hrs, Volume= 5.416 af
Outflow = 80.36 cfs @ 12.09 hrs, Volume= 5.416 af, Atten= 0%, Lag= 0.0 min
Primary = 80.36 cfs @ 12.09 hrs, Volume= 5.416 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 727.49' @ 12.09 hrs Surf.Area= 148 sf Storage= 168 cf
Flood Elev= 729.90' Surf.Area= 3,707 sf Storage= 3,938 cf

Plug-Flow detention time= 0.1 min calculated for 5.416 af (100% of inflow)
Center-of-Mass det. time= 0.1 min (859.6 - 859.5)

Volume	Invert	Avail.Storage	Storage Description
#1	725.90'	4,318 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
725.90	63	0	0
728.00	175	250	250
730.00	3,893	4,068	4,318

Device	Routing	Invert	Outlet Devices
#1	Primary	725.90'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 4.00 Width (feet) 11.75 19.75

Primary OutFlow Max=80.28 cfs @ 12.09 hrs HW=727.49' TW=726.53' (Dynamic Tailwater)
↑**1=Custom Weir/Orifice** (Weir Controls 80.28 cfs @ 3.78 fps)

Summary for Pond B-NW10: NW Bench 10

Inflow Area = 3.504 ac, 0.00% Impervious, Inflow Depth = 1.54" for 10 year - 24 hour event
Inflow = 7.54 cfs @ 12.05 hrs, Volume= 0.450 af
Outflow = 7.54 cfs @ 12.05 hrs, Volume= 0.450 af, Atten= 0%, Lag= 0.2 min
Primary = 7.54 cfs @ 12.05 hrs, Volume= 0.450 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 1,037.13' @ 12.05 hrs Surf.Area= 125 sf Storage= 104 cf
Flood Elev= 1,038.00' Surf.Area= 175 sf Storage= 235 cf

Plug-Flow detention time= 0.7 min calculated for 0.450 af (100% of inflow)
Center-of-Mass det. time= 0.5 min (857.6 - 857.1)

Volume	Invert	Avail.Storage	Storage Description
#1	1,036.00'	4,303 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,036.00	60	0	0
1,038.00	175	235	235
1,040.00	3,893	4,068	4,303

Device	Routing	Invert	Outlet Devices
#1	Primary	1,036.00'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 1.00 2.00 4.00 Width (feet) 1.25 3.25 5.25 9.25

Primary OutFlow Max=7.53 cfs @ 12.05 hrs HW=1,037.13' TW=1,036.60' (Dynamic Tailwater)
↑—**1=Custom Weir/Orifice** (Weir Controls 7.53 cfs @ 2.82 fps)

Summary for Pond B-NW2: NW Bench 2

[62] Hint: Exceeded Reach CH-NW3 OUTLET depth by 1.11' @ 12.08 hrs

Inflow Area = 36.438 ac, 2.63% Impervious, Inflow Depth = 1.51" for 10 year - 24 hour event
Inflow = 69.23 cfs @ 12.08 hrs, Volume= 4.597 af
Outflow = 69.23 cfs @ 12.08 hrs, Volume= 4.597 af, Atten= 0%, Lag= 0.0 min
Primary = 69.23 cfs @ 12.08 hrs, Volume= 4.597 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 765.79' @ 12.08 hrs Surf.Area= 163 sf Storage= 202 cf
Flood Elev= 768.00' Surf.Area= 3,893 sf Storage= 4,306 cf

Plug-Flow detention time= 0.1 min calculated for 4.597 af (100% of inflow)
Center-of-Mass det. time= 0.1 min (858.6 - 858.5)

Volume	Invert	Avail.Storage	Storage Description
#1	764.00'	4,306 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
764.00	63	0	0
766.00	175	238	238
768.00	3,893	4,068	4,306

Device	Routing	Invert	Outlet Devices
#1	Primary	764.00'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 4.00 Width (feet) 7.75 15.75

Primary OutFlow Max=69.23 cfs @ 12.08 hrs HW=765.79' TW=764.56' (Dynamic Tailwater)
↑—**1=Custom Weir/Orifice** (Weir Controls 69.23 cfs @ 4.06 fps)

Summary for Pond B-NW3: NW Bench 3

[62] Hint: Exceeded Reach CH-NW4 OUTLET depth by 1.06' @ 12.08 hrs

Inflow Area = 30.614 ac, 3.13% Impervious, Inflow Depth = 1.51" for 10 year - 24 hour event
Inflow = 60.03 cfs @ 12.07 hrs, Volume= 3.850 af
Outflow = 60.03 cfs @ 12.07 hrs, Volume= 3.850 af, Atten= 0%, Lag= 0.0 min
Primary = 60.03 cfs @ 12.07 hrs, Volume= 3.850 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 803.67' @ 12.07 hrs Surf.Area= 157 sf Storage= 183 cf
Flood Elev= 806.00' Surf.Area= 3,893 sf Storage= 4,306 cf

Plug-Flow detention time= 0.1 min calculated for 3.850 af (100% of inflow)
Center-of-Mass det. time= 0.1 min (857.0 - 857.0)

Volume	Invert	Avail.Storage	Storage Description
#1	802.00'	4,306 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
802.00	63	0	0
804.00	175	238	238
806.00	3,893	4,068	4,306

Device	Routing	Invert	Outlet Devices
#1	Primary	802.00'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 4.00 Width (feet) 7.75 15.75

Primary OutFlow Max=59.99 cfs @ 12.07 hrs HW=803.67' TW=802.68' (Dynamic Tailwater)
↑—**1=Custom Weir/Orifice** (Weir Controls 59.99 cfs @ 3.81 fps)

Summary for Pond B-NW4: NW Bench 4

[62] Hint: Exceeded Reach CH-NW5 OUTLET depth by 0.96' @ 12.07 hrs

Inflow Area = 25.542 ac, 3.76% Impervious, Inflow Depth = 1.50" for 10 year - 24 hour event
Inflow = 51.01 cfs @ 12.06 hrs, Volume= 3.199 af
Outflow = 51.01 cfs @ 12.06 hrs, Volume= 3.199 af, Atten= 0%, Lag= 0.0 min
Primary = 51.01 cfs @ 12.06 hrs, Volume= 3.199 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 841.51' @ 12.07 hrs Surf.Area= 148 sf Storage= 159 cf
Flood Elev= 844.00' Surf.Area= 3,893 sf Storage= 4,306 cf

Plug-Flow detention time= 0.1 min calculated for 3.198 af (100% of inflow)
Center-of-Mass det. time= 0.1 min (855.6 - 855.5)

Volume	Invert	Avail.Storage	Storage Description
#1	840.00'	4,306 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
840.00	63	0	0
842.00	175	238	238
844.00	3,893	4,068	4,306

Device	Routing	Invert	Outlet Devices
#1	Primary	840.00'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 4.00 Width (feet) 7.75 15.75

Primary OutFlow Max=50.96 cfs @ 12.06 hrs HW=841.51' TW=840.61' (Dynamic Tailwater)
↑—**1=Custom Weir/Orifice** (Weir Controls 50.96 cfs @ 3.64 fps)

Summary for Pond B-NW5: NW Bench 5

[62] Hint: Exceeded Reach CH-NW6 OUTLET depth by 1.14' @ 12.06 hrs

Inflow Area = 20.804 ac, 4.61% Impervious, Inflow Depth = 1.49" for 10 year - 24 hour event
Inflow = 41.62 cfs @ 12.06 hrs, Volume= 2.591 af
Outflow = 41.62 cfs @ 12.06 hrs, Volume= 2.591 af, Atten= 0%, Lag= 0.1 min
Primary = 41.62 cfs @ 12.06 hrs, Volume= 2.591 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 879.84' @ 12.06 hrs Surf.Area= 166 sf Storage= 211 cf
Flood Elev= 882.00' Surf.Area= 3,893 sf Storage= 4,306 cf

Plug-Flow detention time= 0.1 min calculated for 2.591 af (100% of inflow)
Center-of-Mass det. time= 0.1 min (854.1 - 854.0)

Volume	Invert	Avail.Storage	Storage Description
#1	878.00'	4,306 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
878.00	63	0	0
880.00	175	238	238
882.00	3,893	4,068	4,306

Device	Routing	Invert	Outlet Devices
#1	Primary	878.00'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 4.00 Width (feet) 3.75 11.75

Primary OutFlow Max=41.62 cfs @ 12.06 hrs HW=879.84' TW=878.55' (Dynamic Tailwater)
↑—**1=Custom Weir/Orifice** (Weir Controls 41.62 cfs @ 4.03 fps)

Summary for Pond B-NW6: NW Bench 6

[62] Hint: Exceeded Reach CH-NW7 OUTLET depth by 1.01' @ 12.06 hrs

Inflow Area = 17.211 ac, 5.57% Impervious, Inflow Depth = 1.49" for 10 year - 24 hour event
Inflow = 33.99 cfs @ 12.06 hrs, Volume= 2.130 af
Outflow = 33.99 cfs @ 12.06 hrs, Volume= 2.130 af, Atten= 0%, Lag= 0.1 min
Primary = 33.99 cfs @ 12.06 hrs, Volume= 2.130 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 917.68' @ 12.06 hrs Surf.Area= 157 sf Storage= 185 cf
Flood Elev= 920.00' Surf.Area= 3,893 sf Storage= 4,306 cf

Plug-Flow detention time= 0.2 min calculated for 2.130 af (100% of inflow)
Center-of-Mass det. time= 0.2 min (852.8 - 852.7)

Volume	Invert	Avail.Storage	Storage Description
#1	916.00'	4,306 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
916.00	63	0	0
918.00	175	238	238
920.00	3,893	4,068	4,306

Device	Routing	Invert	Outlet Devices
#1	Primary	916.00'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 4.00 Width (feet) 3.75 11.75

Primary OutFlow Max=33.97 cfs @ 12.06 hrs HW=917.68' TW=916.71' (Dynamic Tailwater)
└**1=Custom Weir/Orifice** (Weir Controls 33.97 cfs @ 3.72 fps)

Summary for Pond B-NW7A: NW Bench 7 w/ Box Cul

[62] Hint: Exceeded Reach CH-NW8 OUTLET depth by 1.54' @ 12.06 hrs

Inflow Area = 13.676 ac, 6.29% Impervious, Inflow Depth = 1.67" for 10 year - 24 hour event
Inflow = 30.56 cfs @ 12.05 hrs, Volume= 1.901 af
Outflow = 30.55 cfs @ 12.06 hrs, Volume= 1.901 af, Atten= 0%, Lag= 0.2 min
Primary = 29.91 cfs @ 12.06 hrs, Volume= 1.896 af
Secondary = 0.64 cfs @ 12.06 hrs, Volume= 0.005 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 932.19' @ 12.06 hrs Surf.Area= 477 sf Storage= 314 cf
Flood Elev= 934.00' Surf.Area= 1,200 sf Storage= 1,830 cf

Plug-Flow detention time= 0.2 min calculated for 1.901 af (100% of inflow)
Center-of-Mass det. time= 0.2 min (852.5 - 852.3)

Volume	Invert	Avail.Storage	Storage Description
#1	931.00'	1,830 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
931.00	60	0	0
932.00	400	230	230
933.00	800	600	830
934.00	1,200	1,000	1,830

Device	Routing	Invert	Outlet Devices
#1	Primary	931.00'	**96.0" W x 48.0" H Box 4' x 8' Box Culvert** L= 35.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 931.00' / 930.83' S= 0.0049 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 32.00 sf
#2	Secondary	932.00'	**143.1 deg x 2.0' long x 2.00' rise Sharp-Crested Vee/Trap Weir** Cv= 2.47 (C= 3.09)

Primary OutFlow Max=29.88 cfs @ 12.06 hrs HW=932.19' TW=931.32' (Dynamic Tailwater)
└**1=4' x 8' Box Culvert** (Barrel Controls 29.88 cfs @ 4.18 fps)

Secondary OutFlow Max=0.63 cfs @ 12.06 hrs HW=932.19' TW=930.07' (Dynamic Tailwater)
└**2=Sharp-Crested Vee/Trap Weir** (Weir Controls 0.63 cfs @ 1.29 fps)

Summary for Pond B-NW7B: N Bench 7B w/ 18" Clvt

[62] Hint: Exceeded Reach D-NW7 OUTLET depth by 0.79' @ 12.07 hrs

Inflow Area = 2.114 ac, 4.67% Impervious, Inflow Depth = 1.64" for 10 year - 24 hour event
Inflow = 5.39 cfs @ 12.05 hrs, Volume= 0.288 af
Outflow = 5.32 cfs @ 12.07 hrs, Volume= 0.288 af, Atten= 1%, Lag= 0.8 min
Primary = 1.12 cfs @ 12.07 hrs, Volume= 0.051 af
Secondary = 4.20 cfs @ 12.07 hrs, Volume= 0.237 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 921.06' @ 12.07 hrs Surf.Area= 810 sf Storage= 240 cf
Flood Elev= 922.00' Surf.Area= 1,545 sf Storage= 1,343 cf

Plug-Flow detention time= 0.6 min calculated for 0.288 af (100% of inflow)
Center-of-Mass det. time= 0.6 min (852.6 - 852.0)

Volume	Invert	Avail.Storage	Storage Description
#1	920.50'	8,598 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
920.50	0	0	0
921.00	760	190	190
922.00	1,545	1,153	1,343
924.00	5,710	7,255	8,598

Device	Routing	Invert	Outlet Devices
#1	Primary	920.50'	**15.8" Round 18" Dia PEP SDR 17** L= 50.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 920.50' / 920.00' S= 0.0100 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 1.36 sf
#2	Secondary	920.50'	**143.1 deg x 2.0' long x 2.00' rise Sharp-Crested Vee/Trap Weir** Cv= 2.47 (C= 3.09)
#3	Secondary	922.00'	**20.0' long x 2.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32

Primary OutFlow Max=1.12 cfs @ 12.07 hrs HW=921.06' TW=920.10' (Dynamic Tailwater)
└**1=18" Dia PEP SDR 17** (Inlet Controls 1.12 cfs @ 2.02 fps)

Secondary OutFlow Max=4.19 cfs @ 12.07 hrs HW=921.06' TW=920.71' (Dynamic Tailwater)
└**2=Sharp-Crested Vee/Trap Weir** (Weir Controls 4.19 cfs @ 2.02 fps)
└**3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond B-NW8: NW Bench 8

[62] Hint: Exceeded Reach CH-NW9 OUTLET depth by 1.04' @ 12.05 hrs

Inflow Area = 13.063 ac, 4.96% Impervious, Inflow Depth = 1.64" for 10 year - 24 hour event
Inflow = 30.16 cfs @ 12.05 hrs, Volume= 1.788 af
Outflow = 30.15 cfs @ 12.05 hrs, Volume= 1.788 af, Atten= 0%, Lag= 0.1 min
Primary = 30.15 cfs @ 12.05 hrs, Volume= 1.788 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2

Peak Elev= 957.57' @ 12.05 hrs Surf.Area= 151 sf Storage= 168 cf
Flood Elev= 960.00' Surf.Area= 3,893 sf Storage= 4,306 cf

Plug-Flow detention time= 0.2 min calculated for 1.788 af (100% of inflow)
Center-of-Mass det. time= 0.2 min (853.9 - 853.7)

Volume	Invert	Avail.Storage	Storage Description
#1	956.00'	4,306 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
956.00	63	0	0
958.00	175	238	238
960.00	3,893	4,068	4,306

Device	Routing	Invert	Outlet Devices
#1	Primary	956.00'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 4.00 Width (feet) 3.75 11.75

Primary OutFlow Max=30.12 cfs @ 12.05 hrs HW=957.57' TW=956.65' (Dynamic Tailwater)
1=Custom Weir/Orifice (Weir Controls 30.12 cfs @ 3.61 fps)

Summary for Pond B-NW9: NW Bench 9

[62] Hint: Exceeded Reach CH-NW10 OUTLET depth by 0.62' @ 12.05 hrs

Inflow Area = 8.498 ac, 4.37% Impervious, Inflow Depth = 1.62" for 10 year - 24 hour event
Inflow = 19.33 cfs @ 12.05 hrs, Volume= 1.149 af
Outflow = 19.33 cfs @ 12.05 hrs, Volume= 1.149 af, Atten= 0%, Lag= 0.1 min
Primary = 19.33 cfs @ 12.05 hrs, Volume= 1.149 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 997.22' @ 12.05 hrs Surf.Area= 131 sf Storage= 119 cf
Flood Elev= 1,000.00' Surf.Area= 3,893 sf Storage= 4,306 cf

Plug-Flow detention time= 0.2 min calculated for 1.148 af (100% of inflow)
Center-of-Mass det. time= 0.2 min (854.3 - 854.1)

Volume	Invert	Avail.Storage	Storage Description
#1	996.00'	4,306 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
996.00	63	0	0
998.00	175	238	238
1,000.00	3,893	4,068	4,306

Device	Routing	Invert	Outlet Devices
#1	Primary	996.00'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 4.00 Width (feet) 3.75 11.75

Primary OutFlow Max=19.32 cfs @ 12.05 hrs HW=997.22' TW=996.53' (Dynamic Tailwater)
1=Custom Weir/Orifice (Weir Controls 19.32 cfs @ 3.18 fps)

Summary for Pond B-W1: W Bench 1

[62] Hint: Exceeded Reach CH-W2 OUTLET depth by 3.03' @ 12.13 hrs

Inflow Area = 48.022 ac, 0.00% Impervious, Inflow Depth = 1.54" for 10 year - 24 hour event
Inflow = 80.13 cfs @ 12.13 hrs, Volume= 6.161 af
Outflow = 80.13 cfs @ 12.13 hrs, Volume= 6.161 af, Atten= 0%, Lag= 0.0 min
Primary = 80.13 cfs @ 12.13 hrs, Volume= 6.161 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 727.58' @ 12.13 hrs Surf.Area= 165 sf Storage= 181 cf
Flood Elev= 730.00' Surf.Area= 3,339 sf Storage= 3,481 cf

Plug-Flow detention time= 0.1 min calculated for 6.160 af (100% of inflow)
Center-of-Mass det. time= 0.1 min (865.7 - 865.6)

Volume	Invert	Avail.Storage	Storage Description
#1	726.00'	3,481 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
726.00	67	0	0
727.00	125	96	96
728.00	194	160	256
729.00	1,459	827	1,082
730.00	3,339	2,399	3,481

Device	Routing	Invert	Outlet Devices
#1	Primary	726.00'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 1.00 2.00 3.00 4.00 Width (feet) 11.75 13.75 15.75 17.75 19.75

Primary OutFlow Max=80.09 cfs @ 12.13 hrs HW=727.58' TW=726.60' (Dynamic Tailwater)
↑**1=Custom Weir/Orifice** (Weir Controls 80.09 cfs @ 3.79 fps)

Summary for Pond B-W2: W Bench 2

[62] Hint: Exceeded Reach CH-W3 OUTLET depth by 0.94' @ 12.13 hrs

Inflow Area = 42.013 ac, 0.00% Impervious, Inflow Depth = 1.54" for 10 year - 24 hour event
Inflow = 70.18 cfs @ 12.13 hrs, Volume= 5.391 af
Outflow = 70.18 cfs @ 12.13 hrs, Volume= 5.391 af, Atten= 0%, Lag= 0.0 min
Primary = 70.18 cfs @ 12.13 hrs, Volume= 5.391 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 765.46' @ 12.13 hrs Surf.Area= 143 sf Storage= 148 cf
Flood Elev= 768.00' Surf.Area= 3,245 sf Storage= 3,343 cf

Plug-Flow detention time= 0.1 min calculated for 5.391 af (100% of inflow)
Center-of-Mass det. time= 0.1 min (865.4 - 865.3)

Volume	Invert	Avail.Storage	Storage Description
#1	764.00'	3,343 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
764.00	63	0	0
765.00	115	89	89
766.00	176	146	235
767.00	1,398	787	1,022
768.00	3,245	2,322	3,343

Device	Routing	Invert	Outlet Devices
#1	Primary	764.00'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 1.00 2.00 3.00 4.00 Width (feet) 11.75 13.75 15.75 17.75 19.75

Primary OutFlow Max=70.17 cfs @ 12.13 hrs HW=765.46' TW=764.55' (Dynamic Tailwater)
↑**1=Custom Weir/Orifice** (Weir Controls 70.17 cfs @ 3.64 fps)

Summary for Pond B-W3: W Bench 3

[62] Hint: Exceeded Reach CH-W4 OUTLET depth by 0.76' @ 12.13 hrs

Inflow Area = 36.798 ac, 0.00% Impervious, Inflow Depth = 1.54" for 10 year - 24 hour event
Inflow = 61.27 cfs @ 12.13 hrs, Volume= 4.721 af
Outflow = 61.27 cfs @ 12.13 hrs, Volume= 4.721 af, Atten= 0%, Lag= 0.0 min
Primary = 61.27 cfs @ 12.13 hrs, Volume= 4.721 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 803.34' @ 12.13 hrs Surf.Area= 125 sf Storage= 124 cf
Flood Elev= 806.00' Surf.Area= 3,168 sf Storage= 3,251 cf

Plug-Flow detention time= 0.1 min calculated for 4.721 af (100% of inflow)
Center-of-Mass det. time= 0.1 min (865.1 - 865.1)

Volume	Invert	Avail.Storage	Storage Description
#1	802.00'	3,251 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
802.00	62	0	0
803.00	107	85	85
804.00	160	134	218
805.00	1,369	765	983
806.00	3,168	2,269	3,251

Device	Routing	Invert	Outlet Devices
#1	Primary	802.00'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 1.00 2.00 3.00 4.00 Width (feet) 11.75 13.75 15.75 17.75 19.75

Primary OutFlow Max=61.24 cfs @ 12.13 hrs HW=803.34' TW=802.52' (Dynamic Tailwater)
↑**1=Custom Weir/Orifice** (Weir Controls 61.24 cfs @ 3.48 fps)

Summary for Pond B-W4: W Bench 4

[62] Hint: Exceeded Reach CH-W5 OUTLET depth by 0.97' @ 12.12 hrs

Inflow Area = 27.885 ac, 0.00% Impervious, Inflow Depth = 1.54" for 10 year - 24 hour event
Inflow = 48.20 cfs @ 12.11 hrs, Volume= 3.578 af
Outflow = 48.19 cfs @ 12.12 hrs, Volume= 3.578 af, Atten= 0%, Lag= 0.1 min
Primary = 48.19 cfs @ 12.12 hrs, Volume= 3.578 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 841.46' @ 12.12 hrs Surf.Area= 131 sf Storage= 139 cf
Flood Elev= 844.00' Surf.Area= 3,168 sf Storage= 3,251 cf

Plug-Flow detention time= 0.1 min calculated for 3.577 af (100% of inflow)
Center-of-Mass det. time= 0.1 min (864.1 - 864.0)

Volume	Invert	Avail.Storage	Storage Description
#1	840.00'	3,251 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
840.00	62	0	0
841.00	107	85	85
842.00	160	134	218
843.00	1,369	765	983
844.00	3,168	2,269	3,251

Device	Routing	Invert	Outlet Devices
#1	Primary	840.00'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 1.00 2.00 3.00 4.00 Width (feet) 7.75 9.75 11.75 13.75 15.75

Primary OutFlow Max=48.16 cfs @ 12.12 hrs HW=841.46' TW=840.59' (Dynamic Tailwater)
↑└**1=Custom Weir/Orifice** (Weir Controls 48.16 cfs @ 3.58 fps)

Summary for Pond B-W5: W Bench 5

[62] Hint: Exceeded Reach CH-W6 OUTLET depth by 0.85' @ 12.11 hrs

Inflow Area = 20.240 ac, 0.00% Impervious, Inflow Depth = 1.54" for 10 year - 24 hour event
Inflow = 37.02 cfs @ 12.10 hrs, Volume= 2.597 af
Outflow = 37.02 cfs @ 12.10 hrs, Volume= 2.597 af, Atten= 0%, Lag= 0.0 min
Primary = 37.02 cfs @ 12.10 hrs, Volume= 2.597 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 879.24' @ 12.10 hrs Surf.Area= 120 sf Storage= 112 cf
Flood Elev= 882.00' Surf.Area= 3,168 sf Storage= 3,251 cf

Plug-Flow detention time= 0.1 min calculated for 2.597 af (100% of inflow)
Center-of-Mass det. time= 0.1 min (862.6 - 862.5)

Volume	Invert	Avail.Storage	Storage Description
#1	878.00'	3,251 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
878.00	62	0	0
879.00	107	85	85
880.00	160	134	218
881.00	1,369	765	983
882.00	3,168	2,269	3,251

Device	Routing	Invert	Outlet Devices
#1	Primary	878.00'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 1.00 2.00 3.00 4.00 Width (feet) 7.75 9.75 11.75 13.75 15.75

Primary OutFlow Max=37.00 cfs @ 12.10 hrs HW=879.24' TW=878.49' (Dynamic Tailwater)
1=Custom Weir/Orifice (Weir Controls 37.00 cfs @ 3.32 fps)

Summary for Pond B-W6: W Bench 6

[90] Warning: Qout>Qin may require smaller dt or Finer Routing
[62] Hint: Exceeded Reach CH-W7 OUTLET depth by 0.18' @ 12.11 hrs

Inflow Area = 12.643 ac, 0.00% Impervious, Inflow Depth = 1.54" for 10 year - 24 hour event
Inflow = 24.42 cfs @ 12.09 hrs, Volume= 1.622 af
Outflow = 24.42 cfs @ 12.09 hrs, Volume= 1.622 af, Atten= 0%, Lag= 0.1 min
Primary = 24.42 cfs @ 12.09 hrs, Volume= 1.622 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 917.96' @ 12.09 hrs Surf.Area= 199 sf Storage= 171 cf
Flood Elev= 921.00' Surf.Area= 1,413 sf Storage= 1,712 cf

Plug-Flow detention time= 0.3 min calculated for 1.622 af (100% of inflow)
Center-of-Mass det. time= 0.2 min (861.3 - 861.0)

Volume	Invert	Avail.Storage	Storage Description
#1	917.00'	1,712 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
917.00	158	0	0
919.00	243	401	401
920.00	483	363	764
921.00	1,413	948	1,712

Device	Routing	Invert	Outlet Devices
#1	Primary	917.00'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 1.00 2.00 3.00 4.00 Width (feet) 7.75 9.75 11.75 13.75 15.75

Primary OutFlow Max=24.41 cfs @ 12.09 hrs HW=917.96' TW=917.39' (Dynamic Tailwater)
1=Custom Weir/Orifice (Weir Controls 24.41 cfs @ 2.92 fps)

Summary for Pond B-W7: W Bench 7

[62] Hint: Exceeded Reach CH-W8 OUTLET depth by 1.04' @ 12.08 hrs

Inflow Area = 6.341 ac, 0.00% Impervious, Inflow Depth = 1.54" for 10 year - 24 hour event
Inflow = 12.77 cfs @ 12.07 hrs, Volume= 0.814 af
Outflow = 12.74 cfs @ 12.08 hrs, Volume= 0.814 af, Atten= 0%, Lag= 0.3 min
Primary = 12.74 cfs @ 12.08 hrs, Volume= 0.814 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 958.47' @ 12.08 hrs Surf.Area= 317 sf Storage= 322 cf
Flood Elev= 961.00' Surf.Area= 2,467 sf Storage= 3,090 cf

Plug-Flow detention time= 0.8 min calculated for 0.813 af (100% of inflow)
Center-of-Mass det. time= 0.8 min (860.4 - 859.6)

Volume	Invert	Avail.Storage	Storage Description
#1	957.00'	3,090 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
957.00	102	0	0
958.00	268	185	185
959.00	372	320	505
960.00	1,165	769	1,274
961.00	2,467	1,816	3,090

Device	Routing	Invert	Outlet Devices
#1	Primary	957.00'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 1.00 2.00 3.00 4.00 Width (feet) 1.25 3.25 5.25 7.25 9.25

Primary OutFlow Max=12.74 cfs @ 12.08 hrs HW=958.47' TW=957.78' (Dynamic Tailwater)
↑└**1=Custom Weir/Orifice** (Weir Controls 12.74 cfs @ 3.19 fps)

Summary for Pond B-W8: W Bench 8

Inflow Area = 1.978 ac, 0.00% Impervious, Inflow Depth = 1.54" for 10 year - 24 hour event
Inflow = 4.03 cfs @ 12.07 hrs, Volume= 0.254 af
Outflow = 4.02 cfs @ 12.07 hrs, Volume= 0.254 af, Atten= 0%, Lag= 0.4 min
Primary = 4.02 cfs @ 12.07 hrs, Volume= 0.254 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 1,000.81' @ 12.07 hrs Surf.Area= 271 sf Storage= 185 cf
Flood Elev= 1,004.00' Surf.Area= 3,908 sf Storage= 3,489 cf

Plug-Flow detention time= 1.8 min calculated for 0.254 af (100% of inflow)
Center-of-Mass det. time= 1.8 min (860.2 - 858.5)

Volume	Invert	Avail.Storage	Storage Description
#1	1,000.00'	3,489 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,000.00	187	0	0
1,001.00	291	239	239
1,002.00	1,150	721	960
1,003.00	3,908	2,529	3,489

Device	Routing	Invert	Outlet Devices
#1	Primary	1,000.00'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 1.00 2.00 Width (feet) 1.25 3.25 5.25

Primary OutFlow Max=4.01 cfs @ 12.07 hrs HW=1,000.81' TW=1,000.43' (Dynamic Tailwater)
↑**1=Custom Weir/Orifice** (Weir Controls 4.01 cfs @ 2.42 fps)

Summary for Pond CUL-N1: N Box Culvert

[62] Hint: Exceeded Reach CH-N1 OUTLET depth by 1.23' @ 12.09 hrs

Inflow Area = 41.660 ac, 1.29% Impervious, Inflow Depth = 1.63" for 10 year - 24 hour event
Inflow = 80.20 cfs @ 12.09 hrs, Volume= 5.669 af
Outflow = 80.20 cfs @ 12.09 hrs, Volume= 5.669 af, Atten= 0%, Lag= 0.0 min
Primary = 80.20 cfs @ 12.09 hrs, Volume= 5.669 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 718.84' @ 12.09 hrs
Flood Elev= 722.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	717.00'	**120.0" W x 48.0" H Box Culvert** L= 50.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 717.00' / 716.50' S= 0.0100 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 40.00 sf

Primary OutFlow Max=80.14 cfs @ 12.09 hrs HW=718.84' TW=702.58' (Dynamic Tailwater)
↑**1=Culvert** (Inlet Controls 80.14 cfs @ 4.35 fps)

Summary for Pond CUL-N2: N Ramp Box Culvert

[62] Hint: Exceeded Reach CH-N4A OUTLET depth by 1.29' @ 12.08 hrs

Inflow Area = 27.910 ac, 1.93% Impervious, Inflow Depth = 1.68" for 10 year - 24 hour event
Inflow = 53.00 cfs @ 12.08 hrs, Volume= 3.905 af
Outflow = 53.00 cfs @ 12.08 hrs, Volume= 3.905 af, Atten= 0%, Lag= 0.0 min
Primary = 53.00 cfs @ 12.08 hrs, Volume= 3.905 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 831.78' @ 12.08 hrs
Flood Elev= 834.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	830.00'	**96.0" W x 48.0" H Box Culvert** L= 35.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 830.00' / 829.83' S= 0.0049 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 32.00 sf

Primary OutFlow Max=52.97 cfs @ 12.08 hrs HW=831.78' TW=829.49' (Dynamic Tailwater)
↑**1=Culvert** (Barrel Controls 52.97 cfs @ 4.97 fps)

Summary for Pond CUL-NW1: NW Box Culvert

[62] Hint: Exceeded Reach CH-NW1 OUTLET depth by 1.22' @ 12.09 hrs

Inflow Area = 42.821 ac, 2.24% Impervious, Inflow Depth = 1.52" for 10 year - 24 hour event
Inflow = 80.36 cfs @ 12.09 hrs, Volume= 5.416 af
Outflow = 80.36 cfs @ 12.09 hrs, Volume= 5.416 af, Atten= 0%, Lag= 0.0 min
Primary = 80.36 cfs @ 12.09 hrs, Volume= 5.416 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 718.85' @ 12.09 hrs
Flood Elev= 722.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	717.00'	**120.0" W x 48.0" H Box Culvert** L= 40.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 717.00' / 716.60' S= 0.0100 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 40.00 sf

Primary OutFlow Max=80.29 cfs @ 12.09 hrs HW=718.85' TW=701.05' (Dynamic Tailwater)
1=Culvert (Barrel Controls 80.29 cfs @ 5.80 fps)

Summary for Pond CUL-W1: W Box Culvert

[62] Hint: Exceeded Reach CH-W1 OUTLET depth by 1.25' @ 12.13 hrs

Inflow Area = 48.022 ac, 0.00% Impervious, Inflow Depth = 1.54" for 10 year - 24 hour event
Inflow = 80.13 cfs @ 12.13 hrs, Volume= 6.161 af
Outflow = 80.13 cfs @ 12.13 hrs, Volume= 6.161 af, Atten= 0%, Lag= 0.0 min
Primary = 80.13 cfs @ 12.13 hrs, Volume= 6.161 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 718.84' @ 12.13 hrs
Flood Elev= 722.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	717.00'	**120.0" W x 48.0" H Box Culvert** L= 40.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 717.00' / 716.60' S= 0.0100 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 40.00 sf

Primary OutFlow Max=80.08 cfs @ 12.13 hrs HW=718.84' TW=714.91' (Dynamic Tailwater)
1=Culvert (Barrel Controls 80.08 cfs @ 5.79 fps)

Summary for Pond P-N1: N Pond

Inflow Area = 48.401 ac, 1.11% Impervious, Inflow Depth = 1.74" for 10 year - 24 hour event
Inflow = 90.69 cfs @ 12.08 hrs, Volume= 7.020 af
Outflow = 3.63 cfs @ 15.95 hrs, Volume= 6.854 af, Atten= 96%, Lag= 231.7 min
Primary = 3.63 cfs @ 15.95 hrs, Volume= 6.854 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Tertiary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Starting Elev= 701.00' Surf.Area= 48,455 sf Storage= 134,178 cf
Peak Elev= 704.51' @ 15.95 hrs Surf.Area= 57,712 sf Storage= 320,490 cf (186,312 cf above start)
Flood Elev= 709.00' Surf.Area= 70,530 sf Storage= 607,730 cf (473,553 cf above start)

Plug-Flow detention time= 1,189.8 min calculated for 3.773 af (54% of inflow)
Center-of-Mass det. time= 665.1 min (1,513.3 - 848.2)

Volume	Invert	Avail.Storage	Storage Description
#1	698.00'	669,733 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
698.00	41,070	0	0
700.00	45,920	86,990	86,990
702.00	50,990	96,910	183,900
704.00	56,290	107,280	291,180
706.00	61,820	118,110	409,290
708.00	67,570	129,390	538,680
709.00	70,530	69,050	607,730
709.70	106,620	62,003	669,733

Device	Routing	Invert	Outlet Devices
#1	Primary	701.00'	**9.4" Round Culvert** L= 50.0' CPP, end-section conforming to fill, Ke= 0.500 Inlet / Outlet Invert= 701.00' / 700.50' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.48 sf
#2	Secondary	707.00'	**90.0 deg x 10.3' long x 2.00' rise Sharp-Crested Vee/Trap Weir** Cv= 2.50 (C= 3.13)
#3	Tertiary	709.00'	**480.0' long x 10.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64

Primary OutFlow Max=3.63 cfs @ 15.95 hrs HW=704.51' (Free Discharge)
1=Culvert (Barrel Controls 3.63 cfs @ 7.53 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=701.00' TW=707.00' (Dynamic Tailwater)
2=Sharp-Crested Vee/Trap Weir (Controls 0.00 cfs)

Tertiary OutFlow Max=0.00 cfs @ 0.00 hrs HW=701.00' (Free Discharge)
3=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Summary for Pond P-NW1: NW Pond

Inflow Area = 44.865 ac, 2.14% Impervious, Inflow Depth = 1.63" for 10 year - 24 hour event
Inflow = 81.92 cfs @ 12.09 hrs, Volume= 6.093 af
Outflow = 4.51 cfs @ 14.26 hrs, Volume= 6.037 af, Atten= 94%, Lag= 130.3 min
Primary = 4.51 cfs @ 14.26 hrs, Volume= 6.037 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Tertiary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Starting Elev= 699.00' Surf.Area= 31,396 sf Storage= 81,473 cf
Peak Elev= 703.04' @ 14.26 hrs Surf.Area= 40,963 sf Storage= 227,357 cf (145,884 cf above start)
Flood Elev= 710.00' Surf.Area= 60,211 sf Storage= 577,158 cf (495,685 cf above start)

Plug-Flow detention time= 737.1 min calculated for 4.167 af (68% of inflow)
Center-of-Mass det. time= 436.2 min (1,282.7 - 846.5)

Volume	Invert	Avail.Storage	Storage Description
#1	696.00'	612,293 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
696.00	22,005	0	0
698.00	29,180	51,185	51,185
700.00	33,612	62,792	113,977
702.00	38,339	71,951	185,928
704.00	43,362	81,701	267,629
706.00	48,680	92,042	359,671
708.00	54,298	102,978	462,649
710.00	60,211	114,509	577,158
710.50	80,330	35,135	612,293

Device	Routing	Invert	Outlet Devices
#1	Primary	699.00'	**10.0" Round 10" Dia PEP SDR 17** L= 50.0' CPP, end-section conforming to fill, Ke= 0.500 Inlet / Outlet Invert= 699.00' / 698.50' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.55 sf
#2	Secondary	708.00'	**90.0 deg x 10.3' long x 2.00' rise Sharp-Crested Vee/Trap Weir** Cv= 2.50 (C= 3.13)
#3	Tertiary	710.00'	**730.0' long x 10.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64

Primary OutFlow Max=4.51 cfs @ 14.26 hrs HW=703.04' (Free Discharge)
└**1=10" Dia PEP SDR 17** (Barrel Controls 4.51 cfs @ 8.26 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=699.00' TW=708.00' (Dynamic Tailwater)
└**2=Sharp-Crested Vee/Trap Weir** (Controls 0.00 cfs)

Tertiary OutFlow Max=0.00 cfs @ 0.00 hrs HW=699.00' (Free Discharge)
└**3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond P-W1: W Pond

Inflow Area = 49.461 ac, 0.00% Impervious, Inflow Depth = 1.61" for 10 year - 24 hour event
Inflow = 81.16 cfs @ 12.13 hrs, Volume= 6.638 af
Outflow = 4.68 cfs @ 14.69 hrs, Volume= 6.575 af, Atten= 94%, Lag= 153.2 min
Primary = 4.68 cfs @ 14.69 hrs, Volume= 6.575 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Tertiary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Starting Elev= 713.00' Surf.Area= 32,954 sf Storage= 91,190 cf
Peak Elev= 717.33' @ 14.69 hrs Surf.Area= 40,755 sf Storage= 250,584 cf (159,395 cf above start)
Flood Elev= 721.70' Surf.Area= 49,174 sf Storage= 446,853 cf (355,663 cf above start)

Plug-Flow detention time= 775.7 min calculated for 4.481 af (68% of inflow)
Center-of-Mass det. time= 459.0 min (1,315.9 - 856.9)

Volume	Invert	Avail.Storage	Storage Description
#1	710.00'	479,186 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

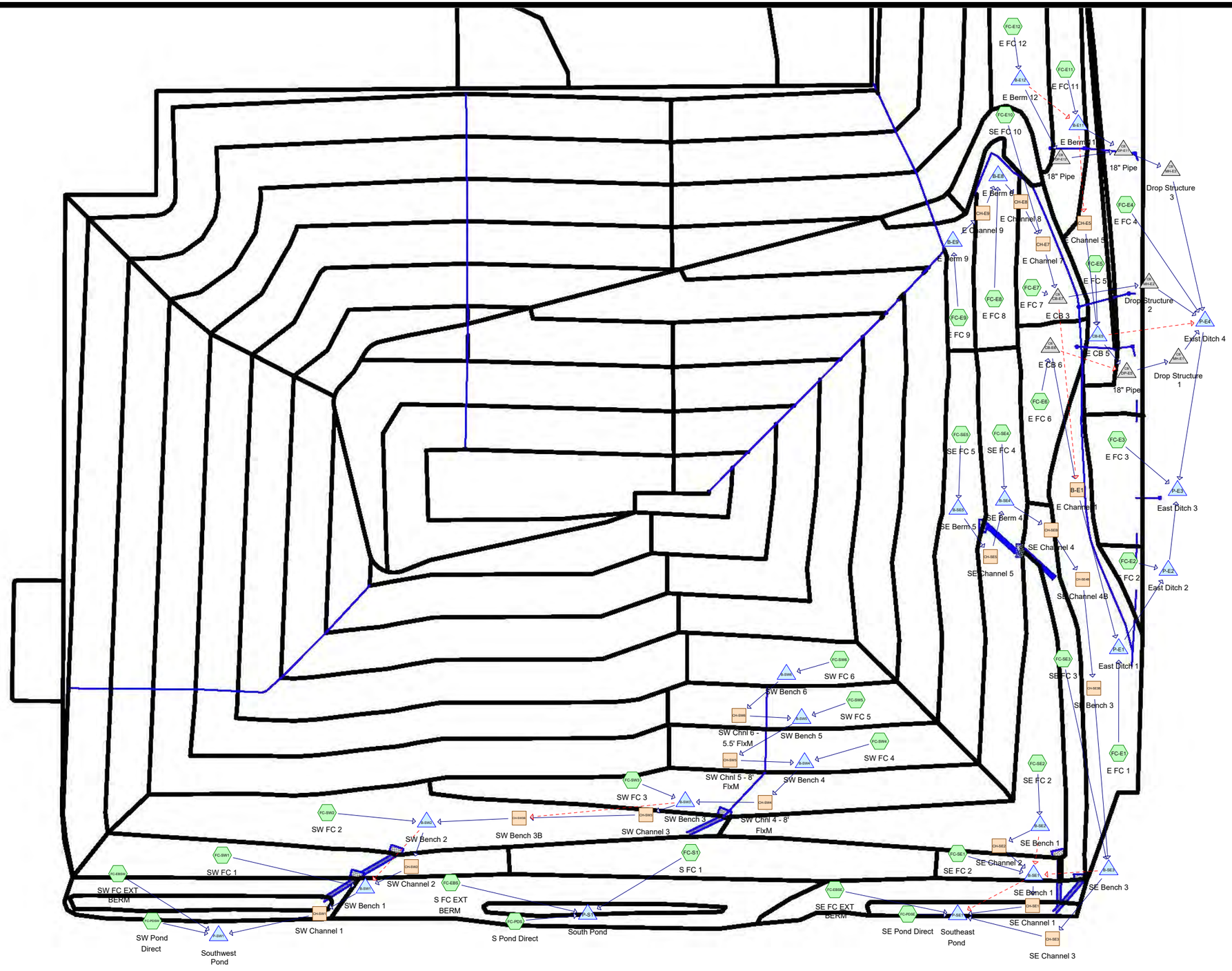
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
710.00	27,881	0	0
712.00	31,221	59,102	59,102
714.00	34,687	65,908	125,010
716.00	38,279	72,966	197,976
718.00	41,998	80,277	278,253
720.00	45,840	87,838	366,091
721.70	49,174	80,762	446,853
721.90	49,174	9,835	456,688
722.30	63,320	22,499	479,186

Device	Routing	Invert	Outlet Devices
#1	Primary	713.00'	**10.0" Round 10" Dia PEP SDR 17** L= 50.0' CMP, end-section conforming to fill, Ke= 0.500 Inlet / Outlet Invert= 713.00' / 712.50' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.55 sf
#2	Secondary	719.70'	**90.0 deg x 10.3' long x 2.00' rise Sharp-Crested Vee/Trap Weir** Cv= 2.50 (C= 3.13)
#3	Tertiary	721.70'	**580.0' long x 10.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64

Primary OutFlow Max=4.68 cfs @ 14.69 hrs HW=717.33' (Free Discharge)
└**1=10" Dia PEP SDR 17** (Barrel Controls 4.68 cfs @ 8.57 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=713.00' TW=719.70' (Dynamic Tailwater)
└**2=Sharp-Crested Vee/Trap Weir** (Controls 0.00 cfs)

Tertiary OutFlow Max=0.00 cfs @ 0.00 hrs HW=713.00' (Free Discharge)
└**3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)



Subcat Reach Pond Link

Routing Diagram for BLSI Permit Expansion 2019_SE & Existing

Prepared by Carlson McCain, Inc., Printed 12/18/2019

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Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
74.539	71	Meadow, non-grazed, HSG C (FC-E1, FC-E10, FC-E11, FC-E12, FC-E2, FC-E3, FC-E4, FC-E5, FC-E6, FC-E7, FC-E8, FC-E9, FC-EBS, FC-EBSE, FC-EBSW, FC-S1, FC-SE1, FC-SE2, FC-SE3, FC-SE4, FC-SE5, FC-SW1, FC-SW2, FC-SW3, FC-SW4, FC-SW5, FC-SW6)
1.192	91	Urban industrial, 72% imp, HSG C (FC-EBS)
2.042	98	Water Surface, HSG C (FC-PDS, FC-PDSE, FC-PDSW)
77.773	**72**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
77.773	HSG C	FC-E1, FC-E10, FC-E11, FC-E12, FC-E2, FC-E3, FC-E4, FC-E5, FC-E6, FC-E7, FC-E8, FC-E9, FC-EBS, FC-EBSE, FC-EBSW, FC-PDS, FC-PDSE, FC-PDSW, FC-S1, FC-SE1, FC-SE2, FC-SE3, FC-SE4, FC-SE5, FC-SW1, FC-SW2, FC-SW3, FC-SW4, FC-SW5, FC-SW6
0.000	HSG D	
0.000	Other	
77.773		**TOTAL AREA**

Pipe Listing (all nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Diam/Width (inches)	Height (inches)	Inside-Fill (inches)
1	B-SW1	744.50	744.00	46.0	0.0109	0.011	96.0	36.0	0.0
2	CB-E6	752.00	722.50	123.0	0.2398	0.013	18.0	0.0	0.0
3	CB-E7	752.00	712.20	157.0	0.2535	0.013	18.0	0.0	0.0
4	DP-E11	747.00	713.75	150.0	0.2217	0.013	18.0	0.0	0.0
5	DP-E12	770.00	747.00	110.0	0.2091	0.013	18.0	0.0	0.0
6	DP-E5	722.50	712.00	60.0	0.1750	0.010	18.0	0.0	0.0
7	MH-E1	712.00	711.70	30.0	0.0100	0.010	18.0	0.0	0.0
8	MH-E2	712.20	712.00	20.0	0.0100	0.010	18.0	0.0	0.0
9	MH-E3	713.75	713.50	25.0	0.0100	0.010	18.0	0.0	0.0
10	P-E1	711.50	709.00	230.0	0.0109	0.010	16.0	0.0	0.0
11	P-E2	709.50	708.50	90.0	0.0111	0.011	16.0	0.0	0.0
12	P-E3	708.19	707.50	75.0	0.0092	0.011	16.0	0.0	0.0
13	P-E4	709.72	709.24	65.0	0.0074	0.010	16.0	0.0	0.0
14	P-SE1	712.00	710.90	73.0	0.0151	0.015	36.0	0.0	0.0
15	P-SW1	715.05	714.37	134.0	0.0051	0.015	18.0	0.0	0.0

Time span=0.00-60.00 hrs, dt=0.01 hrs, 6001 points x 2
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment FC-E1: E FC 1 Runoff Area=207,322 sf 0.00% Impervious Runoff Depth=1.54"
Flow Length=950' Tc=3.0 min CN=71 Runoff=14.73 cfs 0.611 af

Subcatchment FC-E10: SE FC 10 Runoff Area=38,960 sf 0.00% Impervious Runoff Depth=1.54"
Flow Length=540' Tc=4.4 min CN=71 Runoff=2.62 cfs 0.115 af

Subcatchment FC-E11: E FC 11 Runoff Area=110,581 sf 0.00% Impervious Runoff Depth=1.54"
Flow Length=815' Tc=11.7 min CN=71 Runoff=5.59 cfs 0.326 af

Subcatchment FC-E12: E FC 12 Runoff Area=113,402 sf 0.00% Impervious Runoff Depth=1.54"
Flow Length=840' Tc=13.5 min CN=71 Runoff=5.36 cfs 0.334 af

Subcatchment FC-E2: E FC 2 Runoff Area=17,645 sf 0.00% Impervious Runoff Depth=1.54"
Flow Length=80' Slope=0.3300 '/' Tc=4.1 min CN=71 Runoff=1.20 cfs 0.052 af

Subcatchment FC-E3: E FC 3 Runoff Area=68,100 sf 0.00% Impervious Runoff Depth=1.54"
Flow Length=126' Slope=0.3300 '/' Tc=5.9 min CN=71 Runoff=4.32 cfs 0.201 af

Subcatchment FC-E4: E FC 4 Runoff Area=244,950 sf 0.00% Impervious Runoff Depth=1.54"
Flow Length=660' Tc=15.1 min CN=71 Runoff=10.93 cfs 0.722 af

Subcatchment FC-E5: E FC 5 Runoff Area=95,558 sf 0.00% Impervious Runoff Depth=1.54"
Flow Length=1,290' Tc=9.9 min CN=71 Runoff=5.18 cfs 0.281 af

Subcatchment FC-E6: E FC 6 Runoff Area=82,761 sf 0.00% Impervious Runoff Depth=1.54"
Flow Length=353' Tc=6.0 min CN=71 Runoff=5.23 cfs 0.244 af

Subcatchment FC-E7: E FC 7 Runoff Area=71,155 sf 0.00% Impervious Runoff Depth=1.54"
Flow Length=240' Tc=3.2 min CN=71 Runoff=5.02 cfs 0.210 af

Subcatchment FC-E8: E FC 8 Runoff Area=82,564 sf 0.00% Impervious Runoff Depth=1.54"
Flow Length=630' Tc=10.2 min CN=71 Runoff=4.42 cfs 0.243 af

Subcatchment FC-E9: E FC 9 Runoff Area=40,680 sf 0.00% Impervious Runoff Depth=1.54"
Flow Length=590' Tc=9.6 min CN=71 Runoff=2.23 cfs 0.120 af

Subcatchment FC-EBS: S FC EXT BERM Runoff Area=218,410 sf 17.12% Impervious Runoff Depth=1.90"
Flow Length=440' Tc=6.0 min CN=76 Runoff=17.09 cfs 0.794 af

Subcatchment FC-EBSE: SE FC EXT BERM Runoff Area=64,817 sf 0.00% Impervious Runoff Depth=1.54"
Flow Length=80' Slope=0.3333 '/' Tc=4.1 min CN=71 Runoff=4.41 cfs 0.191 af

Subcatchment FC-EBSW: SW FC EXT BERM Runoff Area=90,866 sf 0.00% Impervious Runoff Depth=1.54"
Flow Length=80' Slope=0.2500 '/' Tc=4.6 min CN=71 Runoff=6.06 cfs 0.268 af

Subcatchment FC-PDS: S Pond Direct Runoff Area=22,956 sf 100.00% Impervious Runoff Depth=3.97"
Tc=0.0 min CN=98 Runoff=3.75 cfs 0.175 af

Subcatchment FC-PDSE: SE Pond Direct Runoff Area=29,534 sf 100.00% Impervious Runoff Depth=3.97"
Tc=0.0 min CN=98 Runoff=4.82 cfs 0.225 af

Subcatchment FC-PDSW: SW Pond Direct Runoff Area=0.837 ac 100.00% Impervious Runoff Depth=3.97"
Tc=0.0 min CN=98 Runoff=5.96 cfs 0.277 af

Subcatchment FC-S1: S FC 1 Runoff Area=156,870 sf 0.00% Impervious Runoff Depth=1.54"
Flow Length=1,258' Tc=16.0 min CN=71 Runoff=6.79 cfs 0.462 af

Subcatchment FC-SE1: SE FC 2 Runoff Area=32,441 sf 0.00% Impervious Runoff Depth=1.54"
Flow Length=471' Tc=7.6 min CN=71 Runoff=1.92 cfs 0.096 af

Subcatchment FC-SE2: SE FC 2 Runoff Area=220,544 sf 0.00% Impervious Runoff Depth=1.54"
Flow Length=935' Tc=11.2 min CN=71 Runoff=11.36 cfs 0.650 af

Subcatchment FC-SE3: SE FC 3 Runoff Area=82,514 sf 0.00% Impervious Runoff Depth=1.54"
Flow Length=948' Tc=8.3 min CN=71 Runoff=4.76 cfs 0.243 af

Subcatchment FC-SE4: SE FC 4 Runoff Area=176,950 sf 0.00% Impervious Runoff Depth=1.54"
Flow Length=890' Tc=13.7 min CN=71 Runoff=8.31 cfs 0.521 af

Subcatchment FC-SE5: SE FC 5 Runoff Area=155,474 sf 0.00% Impervious Runoff Depth=1.54"
Flow Length=880' Tc=13.3 min CN=71 Runoff=7.40 cfs 0.458 af

Subcatchment FC-SW1: SW FC 1 Runoff Area=137,408 sf 0.00% Impervious Runoff Depth=1.54"
Flow Length=920' Tc=14.6 min CN=71 Runoff=6.24 cfs 0.405 af

Subcatchment FC-SW2: SW FC 2 Runoff Area=270,545 sf 0.00% Impervious Runoff Depth=1.54"
Flow Length=915' Tc=14.5 min CN=71 Runoff=12.35 cfs 0.797 af

Subcatchment FC-SW3: SW FC 3 Runoff Area=197,591 sf 0.00% Impervious Runoff Depth=1.54"
Flow Length=971' Tc=11.8 min CN=71 Runoff=9.95 cfs 0.582 af

Subcatchment FC-SW4: SW FC 4 Runoff Area=125,118 sf 0.00% Impervious Runoff Depth=1.54"
Flow Length=671' Tc=11.3 min CN=71 Runoff=6.42 cfs 0.369 af

Subcatchment FC-SW5: SW FC 5 Runoff Area=106,215 sf 0.00% Impervious Runoff Depth=1.54"
Flow Length=527' Tc=9.8 min CN=71 Runoff=5.77 cfs 0.313 af

Subcatchment FC-SW6: SW FC 6 Runoff Area=89,383 sf 0.00% Impervious Runoff Depth=1.54"
Flow Length=404' Tc=8.5 min CN=71 Runoff=5.11 cfs 0.263 af

Reach B-E1: E Channel 1 Avg. Flow Depth=0.76' Max Vel=4.35 fps Inflow=15.74 cfs 0.877 af
n=0.040 L=930.0' S=0.0366 '/' Capacity=317.10 cfs Outflow=14.27 cfs 0.877 af

Reach CH-E5: E Channel 5 Avg. Flow Depth=0.00' Max Vel=0.00 fps Inflow=0.00 cfs 0.000 af
n=0.022 L=650.0' S=0.0246 '/' Capacity=470.34 cfs Outflow=0.00 cfs 0.000 af

Reach CH-E7: E Channel 7 Avg. Flow Depth=0.43' Max Vel=5.70 fps Inflow=8.45 cfs 0.478 af
n=0.040 L=293.0' S=0.0956 '/' Capacity=194.34 cfs Outflow=8.41 cfs 0.478 af

Reach CH-E8: E Channel 8 Avg. Flow Depth=0.27' Max Vel=7.58 fps Inflow=6.64 cfs 0.363 af
n=0.040 L=62.0' S=0.2903 '/' Capacity=486.14 cfs Outflow=6.64 cfs 0.363 af

Reach CH-E9: E Channel 9 Avg. Flow Depth=0.14' Max Vel=5.24 fps Inflow=2.23 cfs 0.120 af
n=0.040 L=96.0' S=0.3125 '/' Capacity=504.36 cfs Outflow=2.23 cfs 0.120 af

Reach CH-SE1: SE Channel 1 Avg. Flow Depth=0.38' Max Vel=9.91 fps Inflow=12.58 cfs 0.745 af
n=0.040 L=100.0' S=0.3350 '/' Capacity=522.20 cfs Outflow=12.58 cfs 0.745 af

Reach CH-SE2: SE Channel 2 Avg. Flow Depth=0.36' Max Vel=9.33 fps Inflow=11.17 cfs 0.650 af
n=0.040 L=60.0' S=0.3167 '/' Capacity=507.71 cfs Outflow=11.16 cfs 0.650 af

Reach CH-SE3: SE Channel 3 Avg. Flow Depth=0.45' Max Vel=10.24 fps Inflow=15.93 cfs 1.222 af
n=0.040 L=130.0' S=0.2923 '/' Capacity=487.80 cfs Outflow=15.93 cfs 1.222 af

Reach CH-SE3B: SE Bench 3 Avg. Flow Depth=0.43' Max Vel=2.52 fps Inflow=15.55 cfs 0.979 af
n=0.040 L=743.0' S=0.0162 '/' Capacity=124.24 cfs Outflow=14.06 cfs 0.979 af

Reach CH-SE4B: SE Channel 4B Avg. Flow Depth=0.28' Max Vel=2.65 fps Inflow=15.66 cfs 0.979 af
n=0.040 L=191.0' S=0.0288 '/' Capacity=435.42 cfs Outflow=15.55 cfs 0.979 af

Reach CH-SE5: SE Channel 5 Avg. Flow Depth=0.30' Max Vel=7.50 fps Inflow=7.39 cfs 0.458 af
n=0.040 L=140.0' S=0.2500 '/' Capacity=451.12 cfs Outflow=7.39 cfs 0.458 af

Reach CH-SEB: SE Channel 4 Avg. Flow Depth=0.45' Max Vel=10.06 fps Inflow=15.66 cfs 0.979 af
n=0.040 L=108.0' S=0.2824 '/' Capacity=479.46 cfs Outflow=15.66 cfs 0.979 af

Reach CH-SW1: SW Channel 1 Avg. Flow Depth=0.46' Max Vel=10.61 fps Inflow=40.92 cfs 2.717 af
n=0.040 L=110.0' S=0.2636 '/' Capacity=491.98 cfs Outflow=40.91 cfs 2.717 af

Reach CH-SW2: SW Channel 2 Avg. Flow Depth=0.84' Max Vel=10.94 fps Inflow=35.12 cfs 2.312 af
n=0.040 L=122.0' S=0.1721 '/' Capacity=374.32 cfs Outflow=35.11 cfs 2.312 af

Reach CH-SW3: SW Channel 3 Avg. Flow Depth=0.75' Max Vel=9.13 fps Inflow=25.88 cfs 1.515 af
n=0.040 L=104.0' S=0.1337 '/' Capacity=329.84 cfs Outflow=25.87 cfs 1.515 af

Reach CH-SW3B: SW Bench 3B Avg. Flow Depth=0.49' Max Vel=3.99 fps Inflow=25.87 cfs 1.515 af
n=0.030 L=933.0' S=0.0194 '/' Capacity=285.18 cfs Outflow=23.96 cfs 1.515 af

Reach CH-SW4: SW Chnl 4 - 8' FlxM Avg. Flow Depth=0.56' Max Vel=7.11 fps Inflow=17.21 cfs 0.945 af
n=0.055 L=170.0' S=0.1988 '/' Capacity=93.94 cfs Outflow=17.19 cfs 0.945 af

Reach CH-SW5: SW Chnl 5 - 8' FlxM Avg. Flow Depth=0.39' Max Vel=6.63 fps Inflow=10.87 cfs 0.576 af
n=0.061 L=123.0' S=0.3171 '/' Capacity=106.96 cfs Outflow=10.86 cfs 0.576 af

Reach CH-SW6: SW Chnl 6 - 5.5' FlxM Avg. Flow Depth=0.46' Max Vel=6.48 fps Inflow=5.11 cfs 0.263 af
n=0.059 L=123.0' S=0.3171 '/' Capacity=48.34 cfs Outflow=5.10 cfs 0.263 af

Pond B-E11: E Berm 11 Peak Elev=750.51' Storage=63 cf Inflow=5.59 cfs 0.326 af
Primary=5.58 cfs 0.326 af Secondary=0.00 cfs 0.000 af Outflow=5.58 cfs 0.326 af

Pond B-E12: E Berm 12 Peak Elev=773.49' Storage=59 cf Inflow=5.36 cfs 0.334 af
Primary=5.36 cfs 0.334 af Secondary=0.00 cfs 0.000 af Outflow=5.36 cfs 0.334 af

Pond B-E8: E Berm 8 Peak Elev=800.62' Storage=46 cf Inflow=6.65 cfs 0.363 af
Outflow=6.64 cfs 0.363 af

Pond B-E9: E Berm 9 Peak Elev=830.30' Storage=22 cf Inflow=2.23 cfs 0.120 af
Outflow=2.23 cfs 0.120 af

Pond B-SE1: SE Bench 1 Peak Elev=746.87' Storage=371 cf Inflow=12.69 cfs 0.745 af
Primary=12.58 cfs 0.745 af Secondary=0.00 cfs 0.000 af Outflow=12.58 cfs 0.745 af

Pond B-SE2: SE Bench 1 Peak Elev=765.78' Storage=582 cf Inflow=11.36 cfs 0.650 af
Primary=11.17 cfs 0.650 af Secondary=0.00 cfs 0.000 af Outflow=11.17 cfs 0.650 af

Pond B-SE3: SE Bench 3 Peak Elev=751.08' Storage=471 cf Inflow=15.98 cfs 1.222 af
Primary=15.93 cfs 1.222 af Secondary=0.00 cfs 0.000 af Outflow=15.93 cfs 1.222 af

Pond B-SE4: SE Berm 4 Peak Elev=799.07' Storage=279 cf Inflow=15.70 cfs 0.979 af
Outflow=15.66 cfs 0.979 af

Pond B-SE5: SE Berm 5 Peak Elev=833.67' Storage=107 cf Inflow=7.40 cfs 0.458 af
Outflow=7.39 cfs 0.458 af

Pond B-SW1: SW Bench 1 Peak Elev=745.86' Storage=37 cf Inflow=40.92 cfs 2.717 af
Outflow=40.92 cfs 2.717 af

Pond B-SW2: SW Bench 2 Peak Elev=767.77' Storage=2,214 cf Inflow=35.95 cfs 2.312 af
Primary=35.12 cfs 2.312 af Secondary=0.00 cfs 0.000 af Outflow=35.12 cfs 2.312 af

Pond B-SW3: SW Bench 3 Peak Elev=799.49' Storage=3,445 cf Inflow=27.10 cfs 1.527 af
Primary=25.88 cfs 1.515 af Secondary=0.00 cfs 0.000 af Outflow=25.88 cfs 1.515 af

Pond B-SW4: SW Bench 4 Peak Elev=832.96' Storage=121 cf Inflow=17.22 cfs 0.945 af
Outflow=17.21 cfs 0.945 af

Pond B-SW5: SW Bench 5 Peak Elev=871.67' Storage=74 cf Inflow=10.87 cfs 0.576 af
Outflow=10.87 cfs 0.576 af

Pond B-SW6: SW Bench 6 Peak Elev=910.71' Storage=79 cf Inflow=5.11 cfs 0.263 af
Outflow=5.11 cfs 0.263 af

Pond CB-E5: E CB 5 Peak Elev=725.94' Storage=8 cf Inflow=5.18 cfs 0.281 af
Primary=5.18 cfs 0.281 af Secondary=0.00 cfs 0.000 af Outflow=5.18 cfs 0.281 af

Pond CB-E6: E CB 6 Peak Elev=752.34' Inflow=5.23 cfs 0.244 af
Primary=4.77 cfs 0.231 af Secondary=0.46 cfs 0.013 af Outflow=5.23 cfs 0.244 af

Pond CB-E7: E CB 3 Peak Elev=752.55' Inflow=12.15 cfs 0.687 af
Primary=1.17 cfs 0.041 af Secondary=10.98 cfs 0.646 af Outflow=12.15 cfs 0.687 af

Pond DP-E11: 18" Pipe Peak Elev=749.39' Inflow=10.89 cfs 0.660 af
18.0" Round Culvert n=0.013 L=150.0' S=0.2217 '/' Outflow=10.89 cfs 0.660 af

Pond DP-E12: 18" Pipe Peak Elev=771.16' Inflow=5.36 cfs 0.334 af
18.0" Round Culvert n=0.013 L=110.0' S=0.2091 '/' Outflow=5.36 cfs 0.334 af

Pond DP-E5: 18" Pipe Peak Elev=723.69' Inflow=5.55 cfs 0.294 af
18.0" Round Culvert n=0.010 L=60.0' S=0.1750 '/' Outflow=5.55 cfs 0.294 af

Pond MH-E1: Drop Structure 1 Peak Elev=713.26' Inflow=5.55 cfs 0.294 af
18.0" Round Culvert n=0.010 L=30.0' S=0.0100 '/' Outflow=5.55 cfs 0.294 af

Pond MH-E2: Drop Structure 2 Peak Elev=712.96' Inflow=1.17 cfs 0.041 af
18.0" Round Culvert n=0.010 L=20.0' S=0.0100 '/' Outflow=1.17 cfs 0.041 af

Pond MH-E3: Drop Structure 3 Peak Elev=716.14' Inflow=10.89 cfs 0.660 af
18.0" Round Culvert n=0.010 L=25.0' S=0.0100 '/' Outflow=10.89 cfs 0.660 af

Pond P-E1: East Ditch 1 Peak Elev=715.11' Storage=10,041 cf Inflow=25.97 cfs 1.488 af
Primary=9.96 cfs 1.409 af Secondary=10.48 cfs 0.072 af Outflow=20.34 cfs 1.481 af

Pond P-E2: East Ditch 2 Peak Elev=712.75' Storage=8,472 cf Inflow=10.94 cfs 1.461 af
Primary=6.36 cfs 1.457 af Secondary=0.00 cfs 0.000 af Outflow=6.36 cfs 1.457 af

Pond P-E3: East Ditch 3 Peak Elev=711.95' Storage=13,047 cf Inflow=17.29 cfs 3.365 af
Primary=11.83 cfs 3.365 af Secondary=0.00 cfs 0.000 af Outflow=11.83 cfs 3.365 af

Pond P-E4: Exist Ditch 4 Peak Elev=712.96' Storage=19,026 cf Inflow=27.44 cfs 1.717 af
Primary=8.22 cfs 1.708 af Secondary=0.00 cfs 0.000 af Outflow=8.22 cfs 1.708 af

Pond P-S1: South Pond Peak Elev=720.03' Storage=38,906 cf Inflow=22.60 cfs 1.431 af
Discarded=0.08 cfs 0.321 af Secondary=1.32 cfs 0.460 af Tertiary=0.00 cfs 0.000 af Outflow=1.40 cfs 0.781 af

Pond P-SE1: Southeast Pond Peak Elev=713.74' Storage=57,580 cf Inflow=28.91 cfs 2.383 af
Primary=19.11 cfs 2.378 af Secondary=0.00 cfs 0.000 af Outflow=19.11 cfs 2.378 af

Pond P-SW1: Southwest Pond Peak Elev=720.34' Storage=65,764 cf Inflow=42.65 cfs 3.262 af
Primary=7.98 cfs 1.961 af Secondary=0.00 cfs 0.000 af Outflow=7.98 cfs 1.961 af

Total Runoff Area = 77.773 ac Runoff Volume = 10.544 af Average Runoff Depth = 1.63"
96.27% Pervious = 74.872 ac 3.73% Impervious = 2.900 ac

Summary for Subcatchment FC-E1: E FC 1

Runoff = 14.73 cfs @ 11.94 hrs, Volume= 0.611 af, Depth= 1.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 year - 24 hour Rainfall=4.21"

Area (sf)	CN	Description
207,322	71	Meadow, non-grazed, HSG C
207,322		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.4	20	0.3330	0.25		**Sheet Flow, Slope Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
1.6	930	0.0366	9.61	317.28	**Trap/Vee/Rect Channel Flow, Ditch Flow** Bot.W=2.00' D=3.00' Z= 3.0 '/' Top.W=20.00' n= 0.040 Mountain streams
3.0	950	Total			

Summary for Subcatchment FC-E10: SE FC 10

Runoff = 2.62 cfs @ 11.96 hrs, Volume= 0.115 af, Depth= 1.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 year - 24 hour Rainfall=4.21"

Area (sf)	CN	Description
38,960	71	Meadow, non-grazed, HSG C
38,960		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.4	40	0.3330	0.28		**Sheet Flow, Slope Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
2.0	500	0.0800	4.24		**Shallow Concentrated Flow, Ditch Flow** Grassed Waterway Kv= 15.0 fps
4.4	540	Total			

Summary for Subcatchment FC-E11: E FC 11

Runoff = 5.59 cfs @ 12.04 hrs, Volume= 0.326 af, Depth= 1.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 year - 24 hour Rainfall=4.21"

Area (sf)	CN	Description
110,581	71	Meadow, non-grazed, HSG C
110,581		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.5	90	0.3300	0.33		**Sheet Flow, Slope Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
7.2	725	0.0125	1.68		**Shallow Concentrated Flow, Ditch Flow** Grassed Waterway Kv= 15.0 fps
11.7	815	Total			

Summary for Subcatchment FC-E12: E FC 12

Runoff = 5.36 cfs @ 12.06 hrs, Volume= 0.334 af, Depth= 1.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 year - 24 hour Rainfall=4.21"

Area (sf)	CN	Description
113,402	71	Meadow, non-grazed, HSG C
113,402		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.5	140	0.3300	0.36		**Sheet Flow, Slope Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
7.0	700	0.0125	1.68		**Shallow Concentrated Flow, Ditch Flow** Grassed Waterway Kv= 15.0 fps
13.5	840	Total			

Summary for Subcatchment FC-E2: E FC 2

Runoff = 1.20 cfs @ 11.96 hrs, Volume= 0.052 af, Depth= 1.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 year - 24 hour Rainfall=4.21"

Area (sf)	CN	Description
17,645	71	Meadow, non-grazed, HSG C
17,645		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.1	80	0.3300	0.32		**Sheet Flow, 3:1 Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"

Summary for Subcatchment FC-E3: E FC 3

Runoff = 4.32 cfs @ 11.98 hrs, Volume= 0.201 af, Depth= 1.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 year - 24 hour Rainfall=4.21"

Area (sf)	CN	Description
68,100	71	Meadow, non-grazed, HSG C
68,100		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.9	126	0.3300	0.35		**Sheet Flow, 3:1 Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"

Summary for Subcatchment FC-E4: E FC 4

Runoff = 10.93 cfs @ 12.08 hrs, Volume= 0.722 af, Depth= 1.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 year - 24 hour Rainfall=4.21"

Area (sf)	CN	Description
244,950	71	Meadow, non-grazed, HSG C
244,950		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.2	160	0.3300	0.37		**Sheet Flow, Slope Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
7.9	500	0.0050	1.06		**Shallow Concentrated Flow, Ditch Flow** Grassed Waterway Kv= 15.0 fps
15.1	660	Total			

Summary for Subcatchment FC-E5: E FC 5

Runoff = 5.18 cfs @ 12.02 hrs, Volume= 0.281 af, Depth= 1.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 year - 24 hour Rainfall=4.21"

Area (sf)	CN	Description
95,558	71	Meadow, non-grazed, HSG C
95,558		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.4	40	0.3330	0.28		**Sheet Flow, Slope Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
7.5	1,250	0.0300	2.79		**Shallow Concentrated Flow, Ditch Flow** Unpaved Kv= 16.1 fps
9.9	1,290	Total			

Summary for Subcatchment FC-E6: E FC 6

Runoff = 5.23 cfs @ 11.98 hrs, Volume= 0.244 af, Depth= 1.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 year - 24 hour Rainfall=4.21"

Area (sf)	CN	Description
82,761	71	Meadow, non-grazed, HSG C
82,761		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0	103	0.3330	0.34		**Sheet Flow, Slope Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
1.0	250	0.0700	3.97		**Shallow Concentrated Flow, Ditch Flow** Grassed Waterway Kv= 15.0 fps
6.0	353	Total			

Summary for Subcatchment FC-E7: E FC 7

Runoff = 5.02 cfs @ 11.94 hrs, Volume= 0.210 af, Depth= 1.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 year - 24 hour Rainfall=4.21"

Area (sf)	CN	Description
71,155	71	Meadow, non-grazed, HSG C
71,155		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.4	40	0.3330	0.28		**Sheet Flow, Slope Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
0.8	200	0.0700	4.26		**Shallow Concentrated Flow, Ditch Flow** Unpaved Kv= 16.1 fps
3.2	240	Total			

Summary for Subcatchment FC-E8: E FC 8

Runoff = 4.42 cfs @ 12.03 hrs, Volume= 0.243 af, Depth= 1.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 year - 24 hour Rainfall=4.21"

Area (sf)	CN	Description
82,564	71	Meadow, non-grazed, HSG C
82,564		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.9	100	0.3330	0.34		**Sheet Flow, Slope Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
5.3	530	0.0125	1.68		**Shallow Concentrated Flow, Ditch Flow** Grassed Waterway Kv= 15.0 fps
10.2	630	Total			

Summary for Subcatchment FC-E9: E FC 9

Runoff = 2.23 cfs @ 12.02 hrs, Volume= 0.120 af, Depth= 1.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 year - 24 hour Rainfall=4.21"

Area (sf)	CN	Description
40,680	71	Meadow, non-grazed, HSG C
40,680		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.7	95	0.3330	0.33		**Sheet Flow, Slope Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
4.9	495	0.0125	1.68		**Shallow Concentrated Flow, Ditch Flow** Grassed Waterway Kv= 15.0 fps
9.6	590	Total			

Summary for Subcatchment FC-EBS: S FC EXT BERM

Runoff = 17.09 cfs @ 11.98 hrs, Volume= 0.794 af, Depth= 1.90"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 year - 24 hour Rainfall=4.21"

Area (sf)	CN	Description
166,486	71	Meadow, non-grazed, HSG C
51,924	91	Urban industrial, 72% imp, HSG C
218,410	76	Weighted Average
181,025		82.88% Pervious Area
37,385		17.12% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.8	50	0.3333	0.29		**Sheet Flow, 3:1 Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
3.2	390	0.0100	2.03		**Shallow Concentrated Flow, 1% Shallow Flow** Paved Kv= 20.3 fps
6.0	440	Total			

Summary for Subcatchment FC-EBSE: SE FC EXT BERM

Runoff = 4.41 cfs @ 11.96 hrs, Volume= 0.191 af, Depth= 1.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 year - 24 hour Rainfall=4.21"

Area (sf)	CN	Description
64,817	71	Meadow, non-grazed, HSG C
64,817		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.1	80	0.3333	0.32		**Sheet Flow, 3:1 Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"

Summary for Subcatchment FC-EBSW: SW FC EXT BERM

Runoff = 6.06 cfs @ 11.96 hrs, Volume= 0.268 af, Depth= 1.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 year - 24 hour Rainfall=4.21"

Area (sf)	CN	Description
90,866	71	Meadow, non-grazed, HSG C
90,866		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.6	80	0.2500	0.29		**Sheet Flow, 4:1 Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"

Summary for Subcatchment FC-PDS: S Pond Direct

[46] Hint: Tc=0 (Instant runoff peak depends on dt)

Runoff = 3.75 cfs @ 11.90 hrs, Volume= 0.175 af, Depth= 3.97"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 year - 24 hour Rainfall=4.21"

Area (sf)	CN	Description
22,956	98	Water Surface, HSG C
22,956		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0					**Direct Entry, Direct Entry**

Summary for Subcatchment FC-PDSE: SE Pond Direct

[46] Hint: Tc=0 (Instant runoff peak depends on dt)

Runoff = 4.82 cfs @ 11.90 hrs, Volume= 0.225 af, Depth= 3.97"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 year - 24 hour Rainfall=4.21"

Area (sf)	CN	Description
29,534	98	Water Surface, HSG C
29,534		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0					**Direct Entry, Direct Entry**

Summary for Subcatchment FC-PDSW: SW Pond Direct

[46] Hint: Tc=0 (Instant runoff peak depends on dt)

Runoff = 5.96 cfs @ 11.90 hrs, Volume= 0.277 af, Depth= 3.97"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 year - 24 hour Rainfall=4.21"

Area (ac)	CN	Description
0.837	98	Water Surface, HSG C
0.837		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0					**Direct Entry, Direct Entry**

Summary for Subcatchment FC-S1: S FC 1

Runoff = 6.79 cfs @ 12.09 hrs, Volume= 0.462 af, Depth= 1.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 year - 24 hour Rainfall=4.21"

Area (sf)	CN	Description
156,870	71	Meadow, non-grazed, HSG C
156,870		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.5	90	0.3330	0.33		**Sheet Flow, Sheet Flow Slope** Grass: Dense n= 0.240 P2= 2.83"
10.8	968	0.0100	1.50		**Shallow Concentrated Flow, Ditch Flow** Grassed Waterway Kv= 15.0 fps
0.7	200	0.1000	5.09		**Shallow Concentrated Flow, Concentrated Flow** Unpaved Kv= 16.1 fps
16.0	1,258	Total			

Summary for Subcatchment FC-SE1: SE FC 2

Runoff = 1.92 cfs @ 12.00 hrs, Volume= 0.096 af, Depth= 1.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 year - 24 hour Rainfall=4.21"

Area (sf)	CN	Description
32,441	71	Meadow, non-grazed, HSG C
32,441		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.6	91	0.3330	0.33		**Sheet Flow, Slope Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
3.0	380	0.0200	2.12		**Shallow Concentrated Flow, Ditch Flow** Grassed Waterway Kv= 15.0 fps
7.6	471	Total			

Summary for Subcatchment FC-SE2: SE FC 2

Runoff = 11.36 cfs @ 12.04 hrs, Volume= 0.650 af, Depth= 1.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 year - 24 hour Rainfall=4.21"

Area (sf)	CN	Description
220,544	71	Meadow, non-grazed, HSG C
220,544		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.3	60	0.3330	0.31		**Sheet Flow, Slope Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
7.9	875	0.0150	1.84		**Shallow Concentrated Flow, Ditch Flow** Grassed Waterway Kv= 15.0 fps
11.2	935	Total			

Summary for Subcatchment FC-SE3: SE FC 3

Runoff = 4.76 cfs @ 12.00 hrs, Volume= 0.243 af, Depth= 1.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 year - 24 hour Rainfall=4.21"

Area (sf)	CN	Description
82,514	71	Meadow, non-grazed, HSG C
82,514		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.3	38	0.3330	0.28		**Sheet Flow, Slope Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
6.0	910	0.0280	2.51		**Shallow Concentrated Flow, Ditch Flow** Grassed Waterway Kv= 15.0 fps
8.3	948	Total			

Summary for Subcatchment FC-SE4: SE FC 4

Runoff = 8.31 cfs @ 12.07 hrs, Volume= 0.521 af, Depth= 1.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 year - 24 hour Rainfall=4.21"

Area (sf)	CN	Description
176,950	71	Meadow, non-grazed, HSG C
176,950		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.1	130	0.3330	0.36		**Sheet Flow, Slope Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
7.6	760	0.0125	1.68		**Shallow Concentrated Flow, Ditch Flow** Grassed Waterway Kv= 15.0 fps
13.7	890	Total			

Summary for Subcatchment FC-SE5: SE FC 5

Runoff = 7.40 cfs @ 12.06 hrs, Volume= 0.458 af, Depth= 1.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 year - 24 hour Rainfall=4.21"

Area (sf)	CN	Description
155,474	71	Meadow, non-grazed, HSG C
155,474		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	120	0.3330	0.35		**Sheet Flow, Slope Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
7.6	760	0.0125	1.68		**Shallow Concentrated Flow, Ditch Flow** Grassed Waterway Kv= 15.0 fps
13.3	880	Total			

Summary for Subcatchment FC-SW1: SW FC 1

Runoff = 6.24 cfs @ 12.08 hrs, Volume= 0.405 af, Depth= 1.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 year - 24 hour Rainfall=4.21"

Area (sf)	CN	Description
137,408	71	Meadow, non-grazed, HSG C
137,408		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	120	0.3330	0.35		**Sheet Flow, Slope Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
8.9	800	0.0100	1.50		**Shallow Concentrated Flow, Ditch Flow** Grassed Waterway Kv= 15.0 fps
14.6	920	Total			

Summary for Subcatchment FC-SW2: SW FC 2

Runoff = 12.35 cfs @ 12.07 hrs, Volume= 0.797 af, Depth= 1.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 year - 24 hour Rainfall=4.21"

Area (sf)	CN	Description
270,545	71	Meadow, non-grazed, HSG C
270,545		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	120	0.3330	0.35		**Sheet Flow, Slope Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
8.8	795	0.0100	1.50		**Shallow Concentrated Flow, Ditch Flow** Grassed Waterway Kv= 15.0 fps
14.5	915	Total			

Summary for Subcatchment FC-SW3: SW FC 3

Runoff = 9.95 cfs @ 12.04 hrs, Volume= 0.582 af, Depth= 1.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 year - 24 hour Rainfall=4.21"

Area (sf)	CN	Description
197,591	71	Meadow, non-grazed, HSG C
197,591		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.6	46	0.3330	0.29		**Sheet Flow, Slope Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
9.2	925	0.0125	1.68		**Shallow Concentrated Flow, Ditch Flow** Grassed Waterway Kv= 15.0 fps
11.8	971	Total			

Summary for Subcatchment FC-SW4: SW FC 4

Runoff = 6.42 cfs @ 12.04 hrs, Volume= 0.369 af, Depth= 1.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 year - 24 hour Rainfall=4.21"

Area (sf)	CN	Description
125,118	71	Meadow, non-grazed, HSG C
125,118		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	120	0.3300	0.35		**Sheet Flow, Slope Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
5.6	551	0.0120	1.64		**Shallow Concentrated Flow, Ditch Flow** Grassed Waterway Kv= 15.0 fps
11.3	671	Total			

Summary for Subcatchment FC-SW5: SW FC 5

Runoff = 5.77 cfs @ 12.02 hrs, Volume= 0.313 af, Depth= 1.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 year - 24 hour Rainfall=4.21"

Area (sf)	CN	Description
106,215	71	Meadow, non-grazed, HSG C
106,215		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	120	0.3300	0.35		**Sheet Flow, Slope Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
4.1	407	0.0120	1.64		**Shallow Concentrated Flow, Ditch Flow** Grassed Waterway Kv= 15.0 fps
9.8	527	Total			

Summary for Subcatchment FC-SW6: SW FC 6

Runoff = 5.11 cfs @ 12.01 hrs, Volume= 0.263 af, Depth= 1.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 10 year - 24 hour Rainfall=4.21"

Area (sf)	CN	Description
89,383	71	Meadow, non-grazed, HSG C
89,383		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	120	0.3300	0.35		**Sheet Flow, Slope Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
2.8	284	0.0125	1.68		**Shallow Concentrated Flow, Ditch Flow** Grassed Waterway Kv= 15.0 fps
8.5	404	Total			

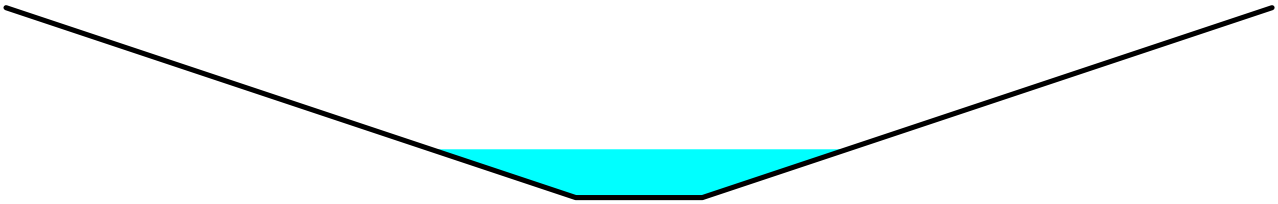
Summary for Reach B-E1: E Channel 1

Inflow Area = 1.900 ac, 0.00% Impervious, Inflow Depth = 5.54" for 10 year - 24 hour event
Inflow = 15.74 cfs @ 11.98 hrs, Volume= 0.877 af
Outflow = 14.27 cfs @ 12.01 hrs, Volume= 0.877 af, Atten= 9%, Lag= 2.3 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 4.35 fps, Min. Travel Time= 3.6 min
Avg. Velocity = 1.43 fps, Avg. Travel Time= 10.8 min

Peak Storage= 3,047 cf @ 12.01 hrs
Average Depth at Peak Storage= 0.76'
Bank-Full Depth= 3.00' Flow Area= 33.0 sf, Capacity= 317.10 cfs

2.00' x 3.00' deep channel, n= 0.040 Mountain streams
Side Slope Z-value= 3.0 '/' Top Width= 20.00'
Length= 930.0' Slope= 0.0366 '/'
Inlet Invert= 748.00', Outlet Invert= 714.00'



Summary for Reach CH-E5: E Channel 5

Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 0.00 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 0.00 fps, Avg. Travel Time= 0.0 min

Peak Storage= 0 cf @ 0.00 hrs
Average Depth at Peak Storage= 0.00'
Bank-Full Depth= 2.00' Flow Area= 34.0 sf, Capacity= 470.34 cfs

12.00' x 2.00' deep channel, n= 0.022 Earth, clean & straight
Side Slope Z-value= 3.0 2.0 '/' Top Width= 22.00'
Length= 650.0' Slope= 0.0246 '/'
Inlet Invert= 742.00', Outlet Invert= 726.00'

‡

Summary for Reach CH-E7: E Channel 7

[62] Hint: Exceeded Reach CH-E8 OUTLET depth by 0.17' @ 11.98 hrs

Inflow Area = 3.724 ac, 0.00% Impervious, Inflow Depth = 1.54" for 10 year - 24 hour event
Inflow = 8.45 cfs @ 12.00 hrs, Volume= 0.478 af
Outflow = 8.41 cfs @ 12.01 hrs, Volume= 0.478 af, Atten= 0%, Lag= 0.6 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 5.70 fps, Min. Travel Time= 0.9 min
Avg. Velocity = 1.61 fps, Avg. Travel Time= 3.0 min

Peak Storage= 432 cf @ 12.01 hrs
Average Depth at Peak Storage= 0.43'
Bank-Full Depth= 2.50' Flow Area= 13.8 sf, Capacity= 194.34 cfs

3.00' x 2.50' deep channel, n= 0.040 Earth, cobble bottom, clean sides
Side Slope Z-value= 1.0 '/' Top Width= 8.00'
Length= 293.0' Slope= 0.0956 '/'
Inlet Invert= 782.00', Outlet Invert= 754.00'

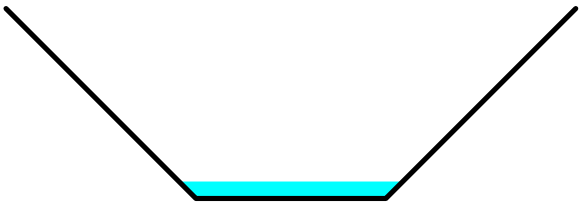
Summary for Reach CH-E8: E Channel 8

Inflow Area = 2.829 ac, 0.00% Impervious, Inflow Depth = 1.54" for 10 year - 24 hour event
Inflow = 6.64 cfs @ 12.03 hrs, Volume= 0.363 af
Outflow = 6.64 cfs @ 12.03 hrs, Volume= 0.363 af, Atten= 0%, Lag= 0.1 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 7.58 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 2.24 fps, Avg. Travel Time= 0.5 min

Peak Storage= 54 cf @ 12.03 hrs
Average Depth at Peak Storage= 0.27'
Bank-Full Depth= 3.00' Flow Area= 18.0 sf, Capacity= 486.14 cfs

3.00' x 3.00' deep channel, n= 0.040 Earth, cobble bottom, clean sides
Side Slope Z-value= 1.0 '/' Top Width= 9.00'
Length= 62.0' Slope= 0.2903 '/'
Inlet Invert= 800.00', Outlet Invert= 782.00'



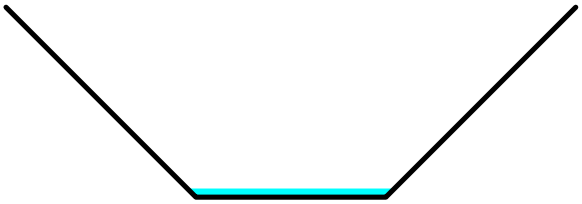
Summary for Reach CH-E9: E Channel 9

Inflow Area = 0.934 ac, 0.00% Impervious, Inflow Depth = 1.54" for 10 year - 24 hour event
Inflow = 2.23 cfs @ 12.02 hrs, Volume= 0.120 af
Outflow = 2.23 cfs @ 12.03 hrs, Volume= 0.120 af, Atten= 0%, Lag= 0.2 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 5.24 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 2.07 fps, Avg. Travel Time= 0.8 min

Peak Storage= 41 cf @ 12.03 hrs
Average Depth at Peak Storage= 0.14'
Bank-Full Depth= 3.00' Flow Area= 18.0 sf, Capacity= 504.36 cfs

3.00' x 3.00' deep channel, n= 0.040 Earth, cobble bottom, clean sides
Side Slope Z-value= 1.0 '/' Top Width= 9.00'
Length= 96.0' Slope= 0.3125 '/'
Inlet Invert= 830.00', Outlet Invert= 800.00'



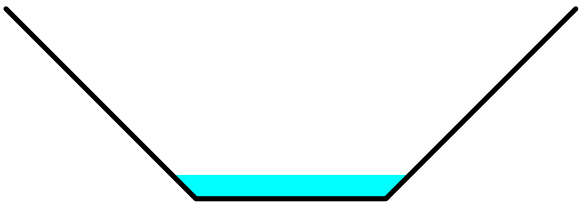
Summary for Reach CH-SE1: SE Channel 1

Inflow Area = 5.808 ac, 0.00% Impervious, Inflow Depth = 1.54" for 10 year - 24 hour event
Inflow = 12.58 cfs @ 12.06 hrs, Volume= 0.745 af
Outflow = 12.58 cfs @ 12.06 hrs, Volume= 0.745 af, Atten= 0%, Lag= 0.1 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 9.91 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 2.86 fps, Avg. Travel Time= 0.6 min

Peak Storage= 127 cf @ 12.06 hrs
Average Depth at Peak Storage= 0.38'
Bank-Full Depth= 3.00' Flow Area= 18.0 sf, Capacity= 522.20 cfs

3.00' x 3.00' deep channel, n= 0.040 Earth, cobble bottom, clean sides
Side Slope Z-value= 1.0 '/' Top Width= 9.00'
Length= 100.0' Slope= 0.3350 '/'
Inlet Invert= 745.50', Outlet Invert= 712.00'



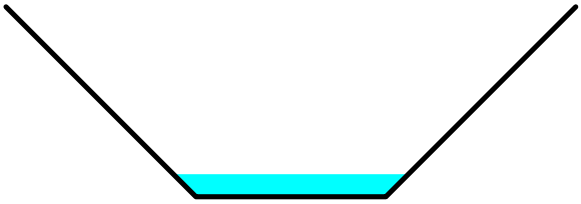
Summary for Reach CH-SE2: SE Channel 2

Inflow Area = 5.063 ac, 0.00% Impervious, Inflow Depth = 1.54" for 10 year - 24 hour event
Inflow = 11.17 cfs @ 12.05 hrs, Volume= 0.650 af
Outflow = 11.16 cfs @ 12.06 hrs, Volume= 0.650 af, Atten= 0%, Lag= 0.1 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 9.33 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 2.67 fps, Avg. Travel Time= 0.4 min

Peak Storage= 72 cf @ 12.06 hrs
Average Depth at Peak Storage= 0.36'
Bank-Full Depth= 3.00' Flow Area= 18.0 sf, Capacity= 507.71 cfs

3.00' x 3.00' deep channel, n= 0.040 Earth, cobble bottom, clean sides
Side Slope Z-value= 1.0 '/' Top Width= 9.00'
Length= 60.0' Slope= 0.3167 '/'
Inlet Invert= 764.50', Outlet Invert= 745.50'



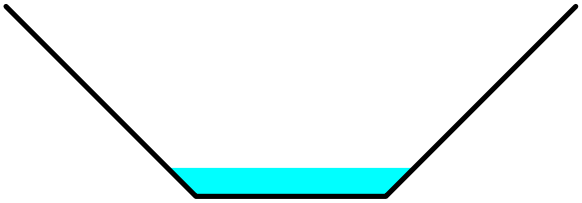
Summary for Reach CH-SE3: SE Channel 3

Inflow Area = 9.526 ac, 0.00% Impervious, Inflow Depth = 1.54" for 10 year - 24 hour event
Inflow = 15.93 cfs @ 12.13 hrs, Volume= 1.222 af
Outflow = 15.93 cfs @ 12.13 hrs, Volume= 1.222 af, Atten= 0%, Lag= 0.1 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 10.24 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 2.96 fps, Avg. Travel Time= 0.7 min

Peak Storage= 202 cf @ 12.13 hrs
Average Depth at Peak Storage= 0.45'
Bank-Full Depth= 3.00' Flow Area= 18.0 sf, Capacity= 487.80 cfs

3.00' x 3.00' deep channel, n= 0.040 Earth, cobble bottom, clean sides
Side Slope Z-value= 1.0 '/' Top Width= 9.00'
Length= 130.0' Slope= 0.2923 '/'
Inlet Invert= 750.00', Outlet Invert= 712.00'



Summary for Reach CH-SE3B: SE Bench 3

[62] Hint: Exceeded Reach CH-SE4B OUTLET depth by 0.18' @ 12.20 hrs

Inflow Area = 7.631 ac, 0.00% Impervious, Inflow Depth = 1.54" for 10 year - 24 hour event
Inflow = 15.55 cfs @ 12.09 hrs, Volume= 0.979 af
Outflow = 14.06 cfs @ 12.14 hrs, Volume= 0.979 af, Atten= 10%, Lag= 3.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 2.52 fps, Min. Travel Time= 4.9 min
Avg. Velocity = 0.60 fps, Avg. Travel Time= 20.7 min

Peak Storage= 4,144 cf @ 12.14 hrs
Average Depth at Peak Storage= 0.43'
Bank-Full Depth= 1.50' Flow Area= 23.6 sf, Capacity= 124.24 cfs

12.00' x 1.50' deep channel, n= 0.040
Side Slope Z-value= 2.0 3.0 '/' Top Width= 19.50'
Length= 743.0' Slope= 0.0162 '/'
Inlet Invert= 762.00', Outlet Invert= 750.00'

‡

Summary for Reach CH-SE4B: SE Channel 4B

[62] Hint: Exceeded Reach CH-SEB OUTLET depth by 0.01' @ 24.34 hrs

Inflow Area = 7.631 ac, 0.00% Impervious, Inflow Depth = 1.54" for 10 year - 24 hour event
Inflow = 15.66 cfs @ 12.08 hrs, Volume= 0.979 af
Outflow = 15.55 cfs @ 12.09 hrs, Volume= 0.979 af, Atten= 1%, Lag= 0.7 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 2.65 fps, Min. Travel Time= 1.2 min
Avg. Velocity = 0.72 fps, Avg. Travel Time= 4.4 min

Peak Storage= 1,121 cf @ 12.09 hrs
Average Depth at Peak Storage= 0.28'
Bank-Full Depth= 2.00' Flow Area= 50.0 sf, Capacity= 435.42 cfs

20.00' x 2.00' deep channel, n= 0.040 Earth, cobble bottom, clean sides
Side Slope Z-value= 3.0 2.0 '/' Top Width= 30.00'
Length= 191.0' Slope= 0.0288 '/'
Inlet Invert= 767.50', Outlet Invert= 762.00'

‡

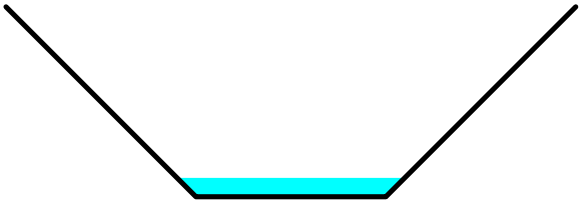
Summary for Reach CH-SE5: SE Channel 5

Inflow Area = 3.569 ac, 0.00% Impervious, Inflow Depth = 1.54" for 10 year - 24 hour event
Inflow = 7.39 cfs @ 12.07 hrs, Volume= 0.458 af
Outflow = 7.39 cfs @ 12.07 hrs, Volume= 0.458 af, Atten= 0%, Lag= 0.2 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 7.50 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 2.23 fps, Avg. Travel Time= 1.0 min

Peak Storage= 138 cf @ 12.07 hrs
Average Depth at Peak Storage= 0.30'
Bank-Full Depth= 3.00' Flow Area= 18.0 sf, Capacity= 451.12 cfs

3.00' x 3.00' deep channel, n= 0.040 Earth, cobble bottom, clean sides
Side Slope Z-value= 1.0 '/' Top Width= 9.00'
Length= 140.0' Slope= 0.2500 '/'
Inlet Invert= 833.00', Outlet Invert= 798.00'



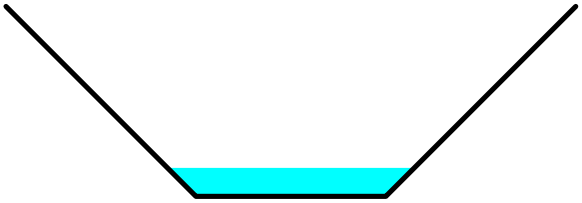
Summary for Reach CH-SEB: SE Channel 4

Inflow Area = 7.631 ac, 0.00% Impervious, Inflow Depth = 1.54" for 10 year - 24 hour event
Inflow = 15.66 cfs @ 12.07 hrs, Volume= 0.979 af
Outflow = 15.66 cfs @ 12.08 hrs, Volume= 0.979 af, Atten= 0%, Lag= 0.1 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 10.06 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 2.99 fps, Avg. Travel Time= 0.6 min

Peak Storage= 168 cf @ 12.08 hrs
Average Depth at Peak Storage= 0.45'
Bank-Full Depth= 3.00' Flow Area= 18.0 sf, Capacity= 479.46 cfs

3.00' x 3.00' deep channel, n= 0.040 Earth, cobble bottom, clean sides
Side Slope Z-value= 1.0 '/' Top Width= 9.00'
Length= 108.0' Slope= 0.2824 '/'
Inlet Invert= 798.00', Outlet Invert= 767.50'



Summary for Reach CH-SW1: SW Channel 1

Inflow Area = 21.264 ac, 0.00% Impervious, Inflow Depth = 1.53" for 10 year - 24 hour event
Inflow = 40.92 cfs @ 12.12 hrs, Volume= 2.717 af
Outflow = 40.91 cfs @ 12.12 hrs, Volume= 2.717 af, Atten= 0%, Lag= 0.1 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 10.61 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 2.64 fps, Avg. Travel Time= 0.7 min

Peak Storage= 424 cf @ 12.12 hrs
Average Depth at Peak Storage= 0.46'
Bank-Full Depth= 2.00' Flow Area= 20.0 sf, Capacity= 491.98 cfs

8.00' x 2.00' deep channel, n= 0.040 Earth, cobble bottom, clean sides
Side Slope Z-value= 1.0 '/' Top Width= 12.00'
Length= 110.0' Slope= 0.2636 '/'
Inlet Invert= 744.00', Outlet Invert= 715.00'

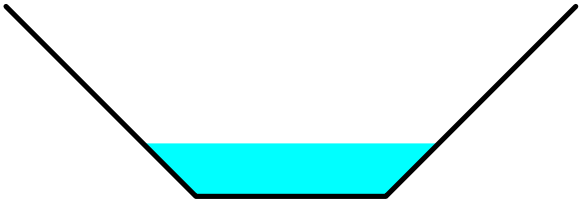
Summary for Reach CH-SW2: SW Channel 2

Inflow Area = 18.110 ac, 0.00% Impervious, Inflow Depth = 1.53" for 10 year - 24 hour event
Inflow = 35.12 cfs @ 12.12 hrs, Volume= 2.312 af
Outflow = 35.11 cfs @ 12.12 hrs, Volume= 2.312 af, Atten= 0%, Lag= 0.1 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 10.94 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 3.04 fps, Avg. Travel Time= 0.7 min

Peak Storage= 392 cf @ 12.12 hrs
Average Depth at Peak Storage= 0.84'
Bank-Full Depth= 3.00' Flow Area= 18.0 sf, Capacity= 374.32 cfs

3.00' x 3.00' deep channel, n= 0.040 Earth, cobble bottom, clean sides
Side Slope Z-value= 1.0 '/' Top Width= 9.00'
Length= 122.0' Slope= 0.1721 '/'
Inlet Invert= 766.00', Outlet Invert= 745.00'



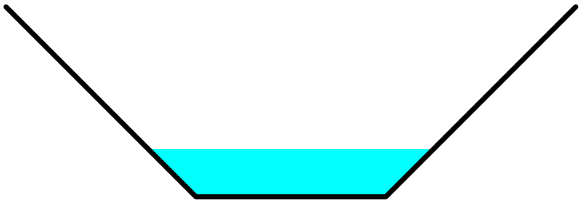
Summary for Reach CH-SW3: SW Channel 3

Inflow Area = 11.899 ac, 0.00% Impervious, Inflow Depth = 1.53" for 10 year - 24 hour event
Inflow = 25.88 cfs @ 12.06 hrs, Volume= 1.515 af
Outflow = 25.87 cfs @ 12.07 hrs, Volume= 1.515 af, Atten= 0%, Lag= 0.1 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 9.13 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 2.66 fps, Avg. Travel Time= 0.7 min

Peak Storage= 294 cf @ 12.07 hrs
Average Depth at Peak Storage= 0.75'
Bank-Full Depth= 3.00' Flow Area= 18.0 sf, Capacity= 329.84 cfs

3.00' x 3.00' deep channel, n= 0.040
Side Slope Z-value= 1.0 '/' Top Width= 9.00'
Length= 104.0' Slope= 0.1337 '/'
Inlet Invert= 798.00', Outlet Invert= 784.10'



Summary for Reach CH-SW3B: SW Bench 3B

[62] Hint: Exceeded Reach CH-SW3 OUTLET depth by 0.02' @ 24.60 hrs

Inflow Area = 11.899 ac, 0.00% Impervious, Inflow Depth = 1.53" for 10 year - 24 hour event
Inflow = 25.87 cfs @ 12.07 hrs, Volume= 1.515 af
Outflow = 23.96 cfs @ 12.11 hrs, Volume= 1.515 af, Atten= 7%, Lag= 2.4 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 3.99 fps, Min. Travel Time= 3.9 min
Avg. Velocity = 1.00 fps, Avg. Travel Time= 15.6 min

Peak Storage= 5,602 cf @ 12.11 hrs
Average Depth at Peak Storage= 0.49'
Bank-Full Depth= 2.00' Flow Area= 32.0 sf, Capacity= 285.18 cfs

11.00' x 2.00' deep channel, n= 0.030 Earth, dense weeds
Side Slope Z-value= 2.0 3.0 '/' Top Width= 21.00'
Length= 933.0' Slope= 0.0194 '/'
Inlet Invert= 784.10', Outlet Invert= 766.00'

‡

Summary for Reach CH-SW4: SW Chnl 4 - 8' FlxM

Inflow Area = 7.363 ac, 0.00% Impervious, Inflow Depth = 1.54" for 10 year - 24 hour event
Inflow = 17.21 cfs @ 12.03 hrs, Volume= 0.945 af
Outflow = 17.19 cfs @ 12.03 hrs, Volume= 0.945 af, Atten= 0%, Lag= 0.3 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 7.11 fps, Min. Travel Time= 0.4 min
Avg. Velocity = 1.92 fps, Avg. Travel Time= 1.5 min

Peak Storage= 411 cf @ 12.03 hrs
Average Depth at Peak Storage= 0.56'
Bank-Full Depth= 1.50' Flow Area= 7.9 sf, Capacity= 93.94 cfs

3.75' x 1.50' deep channel, n= 0.055
Side Slope Z-value= 1.0 '/' Top Width= 6.75'
Length= 170.0' Slope= 0.1988 '/'
Inlet Invert= 831.80', Outlet Invert= 798.00'

Summary for Reach CH-SW5: SW Chnl 5 - 8' FlxM

Inflow Area = 4.490 ac, 0.00% Impervious, Inflow Depth = 1.54" for 10 year - 24 hour event
Inflow = 10.87 cfs @ 12.02 hrs, Volume= 0.576 af
Outflow = 10.86 cfs @ 12.02 hrs, Volume= 0.576 af, Atten= 0%, Lag= 0.2 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 6.63 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 1.74 fps, Avg. Travel Time= 1.2 min

Peak Storage= 201 cf @ 12.02 hrs
Average Depth at Peak Storage= 0.39'
Bank-Full Depth= 1.50' Flow Area= 7.9 sf, Capacity= 106.96 cfs

3.75' x 1.50' deep channel, n= 0.061
Side Slope Z-value= 1.0 '/' Top Width= 6.75'
Length= 123.0' Slope= 0.3171 '/'
Inlet Invert= 870.80', Outlet Invert= 831.80'

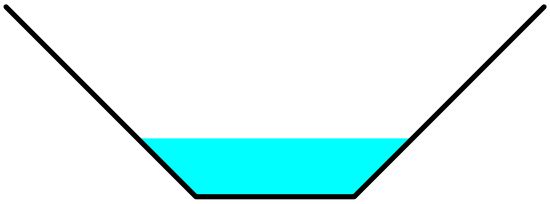
Summary for Reach CH-SW6: SW Chnl 6 - 5.5' FlxM

Inflow Area = 2.052 ac, 0.00% Impervious, Inflow Depth = 1.54" for 10 year - 24 hour event
Inflow = 5.11 cfs @ 12.01 hrs, Volume= 0.263 af
Outflow = 5.10 cfs @ 12.01 hrs, Volume= 0.263 af, Atten= 0%, Lag= 0.2 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 6.48 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 1.93 fps, Avg. Travel Time= 1.1 min

Peak Storage= 97 cf @ 12.01 hrs
Average Depth at Peak Storage= 0.46'
Bank-Full Depth= 1.50' Flow Area= 4.1 sf, Capacity= 48.34 cfs

1.25' x 1.50' deep channel, n= 0.059
Side Slope Z-value= 1.0 '/' Top Width= 4.25'
Length= 123.0' Slope= 0.3171 '/'
Inlet Invert= 909.80', Outlet Invert= 870.80'



Summary for Pond B-E11: E Berm 11

Inflow Area = 2.539 ac, 0.00% Impervious, Inflow Depth = 1.54" for 10 year - 24 hour event
Inflow = 5.59 cfs @ 12.04 hrs, Volume= 0.326 af
Outflow = 5.58 cfs @ 12.05 hrs, Volume= 0.326 af, Atten= 0%, Lag= 0.2 min
Primary = 5.58 cfs @ 12.05 hrs, Volume= 0.326 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 750.51' @ 12.05 hrs Surf.Area= 247 sf Storage= 63 cf
Flood Elev= 753.00' Surf.Area= 4,316 sf Storage= 4,566 cf

Plug-Flow detention time= 0.1 min calculated for 0.326 af (100% of inflow)
Center-of-Mass det. time= 0.1 min (856.6 - 856.5)

Volume	Invert	Avail.Storage	Storage Description
#1	750.00'	87,134 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
750.00	0	0	0
751.00	485	243	243
752.00	1,923	1,204	1,447
753.00	4,316	3,120	4,566
754.00	4,800	4,558	9,124
756.00	8,955	13,755	22,879
758.00	15,400	24,355	47,234
760.00	24,500	39,900	87,134

Device	Routing	Invert	Outlet Devices
#1	Primary	750.00'	**18.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Secondary	753.00'	**120.0' long x 2.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32

Primary OutFlow Max=5.58 cfs @ 12.05 hrs HW=750.51' TW=749.37' (Dynamic Tailwater)
1=Orifice/Grate (Weir Controls 5.58 cfs @ 2.33 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=750.00' TW=742.00' (Dynamic Tailwater)
2=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Summary for Pond B-E12: E Berm 12

Inflow Area = 2.603 ac, 0.00% Impervious, Inflow Depth = 1.54" for 10 year - 24 hour event
Inflow = 5.36 cfs @ 12.06 hrs, Volume= 0.334 af
Outflow = 5.36 cfs @ 12.07 hrs, Volume= 0.334 af, Atten= 0%, Lag= 0.2 min
Primary = 5.36 cfs @ 12.07 hrs, Volume= 0.334 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 773.49' @ 12.07 hrs Surf.Area= 240 sf Storage= 59 cf
Flood Elev= 776.00' Surf.Area= 4,316 sf Storage= 4,566 cf

Plug-Flow detention time= 0.1 min calculated for 0.334 af (100% of inflow)
Center-of-Mass det. time= 0.1 min (858.3 - 858.2)

Volume	Invert	Avail.Storage	Storage Description
#1	773.00'	14,292 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
773.00	0	0	0
774.00	485	243	243
775.00	1,923	1,204	1,447
776.00	4,316	3,120	4,566
778.00	5,410	9,726	14,292

Device	Routing	Invert	Outlet Devices
#1	Primary	773.00'	**18.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Secondary	776.00'	**120.0' long x 2.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32

Primary OutFlow Max=5.35 cfs @ 12.07 hrs HW=773.49' TW=771.16' (Dynamic Tailwater)
└**1=Orifice/Grate** (Weir Controls 5.35 cfs @ 2.30 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=773.00' TW=750.00' (Dynamic Tailwater)
└**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond B-E8: E Berm 8

[62] Hint: Exceeded Reach CH-E9 OUTLET depth by 0.48' @ 12.03 hrs

Inflow Area = 2.829 ac, 0.00% Impervious, Inflow Depth = 1.54" for 10 year - 24 hour event
Inflow = 6.65 cfs @ 12.03 hrs, Volume= 0.363 af
Outflow = 6.64 cfs @ 12.03 hrs, Volume= 0.363 af, Atten= 0%, Lag= 0.2 min
Primary = 6.64 cfs @ 12.03 hrs, Volume= 0.363 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 800.62' @ 12.03 hrs Surf.Area= 148 sf Storage= 46 cf
Flood Elev= 803.00' Surf.Area= 2,160 sf Storage= 2,280 cf

Plug-Flow detention time= 0.1 min calculated for 0.363 af (100% of inflow)
Center-of-Mass det. time= 0.1 min (855.2 - 855.2)

Volume	Invert	Avail.Storage	Storage Description
#1	800.00'	2,280 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
800.00	0	0	0
801.00	240	120	120
802.00	960	600	720
803.00	2,160	1,560	2,280

Device	Routing	Invert	Outlet Devices
#1	Primary	800.00'	**6.0' long x 2.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32

Primary OutFlow Max=6.64 cfs @ 12.03 hrs HW=800.62' TW=800.27' (Dynamic Tailwater)
└**1=Broad-Crested Rectangular Weir** (Weir Controls 6.64 cfs @ 1.80 fps)

Summary for Pond B-E9: E Berm 9

Inflow Area = 0.934 ac, 0.00% Impervious, Inflow Depth = 1.54" for 10 year - 24 hour event
Inflow = 2.23 cfs @ 12.02 hrs, Volume= 0.120 af
Outflow = 2.23 cfs @ 12.02 hrs, Volume= 0.120 af, Atten= 0%, Lag= 0.2 min
Primary = 2.23 cfs @ 12.02 hrs, Volume= 0.120 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 830.30' @ 12.02 hrs Surf.Area= 145 sf Storage= 22 cf
Flood Elev= 833.00' Surf.Area= 4,320 sf Storage= 4,560 cf

Plug-Flow detention time= 0.1 min calculated for 0.120 af (100% of inflow)
Center-of-Mass det. time= 0.1 min (854.7 - 854.6)

Volume	Invert	Avail.Storage	Storage Description
#1	830.00'	4,560 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
830.00	0	0	0
831.00	480	240	240
832.00	1,920	1,200	1,440
833.00	4,320	3,120	4,560

Device	Routing	Invert	Outlet Devices
#1	Primary	830.00'	**6.0' long x 2.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32

Primary OutFlow Max=2.22 cfs @ 12.02 hrs HW=830.30' TW=830.14' (Dynamic Tailwater)
└**1=Broad-Crested Rectangular Weir** (Weir Controls 2.22 cfs @ 1.23 fps)

Summary for Pond B-SE1: SE Bench 1

[62] Hint: Exceeded Reach CH-SE2 OUTLET depth by 1.02' @ 12.06 hrs

Inflow Area = 5.808 ac, 0.00% Impervious, Inflow Depth = 1.54" for 10 year - 24 hour event
Inflow = 12.69 cfs @ 12.04 hrs, Volume= 0.745 af
Outflow = 12.58 cfs @ 12.06 hrs, Volume= 0.745 af, Atten= 1%, Lag= 0.8 min
Primary = 12.58 cfs @ 12.06 hrs, Volume= 0.745 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 746.87' @ 12.06 hrs Surf.Area= 752 sf Storage= 371 cf
Flood Elev= 748.00' Surf.Area= 1,641 sf Storage= 1,717 cf

Plug-Flow detention time= 0.2 min calculated for 0.745 af (100% of inflow)
Center-of-Mass det. time= 0.2 min (856.5 - 856.3)

Volume	Invert	Avail.Storage	Storage Description
#1	745.50'	10,578 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
745.50	0	0	0
746.00	61	15	15
748.00	1,641	1,702	1,717
750.00	7,220	8,861	10,578

Device	Routing	Invert	Outlet Devices
#1	Primary	745.50'	**3.0' long x 2.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32
#2	Secondary	748.00'	**20.0' long x 2.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32

Primary OutFlow Max=12.57 cfs @ 12.06 hrs HW=746.87' TW=745.88' (Dynamic Tailwater)
↑**1=Broad-Crested Rectangular Weir** (Weir Controls 12.57 cfs @ 3.05 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=745.50' TW=712.00' (Dynamic Tailwater)
↑**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond B-SE2: SE Bench 1

Inflow Area = 5.063 ac, 0.00% Impervious, Inflow Depth = 1.54" for 10 year - 24 hour event
Inflow = 11.36 cfs @ 12.04 hrs, Volume= 0.650 af
Outflow = 11.17 cfs @ 12.05 hrs, Volume= 0.650 af, Atten= 2%, Lag= 1.1 min
Primary = 11.17 cfs @ 12.05 hrs, Volume= 0.650 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 765.78' @ 12.05 hrs Surf.Area= 954 sf Storage= 582 cf
Flood Elev= 767.00' Surf.Area= 2,766 sf Storage= 2,760 cf

Plug-Flow detention time= 0.5 min calculated for 0.650 af (100% of inflow)
Center-of-Mass det. time= 0.5 min (856.5 - 856.0)

Volume	Invert	Avail.Storage	Storage Description
#1	764.50'	8,191 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
764.50	0	0	0
765.00	330	83	83
765.50	725	264	346
766.00	1,133	465	811
767.00	2,766	1,950	2,760
768.00	8,095	5,431	8,191

Device	Routing	Invert	Outlet Devices
#1	Primary	764.50'	**3.0' long x 2.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32
#2	Secondary	767.00'	**50.0' long x 2.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32

Primary OutFlow Max=11.15 cfs @ 12.05 hrs HW=765.78' TW=764.86' (Dynamic Tailwater)
↑—**1=Broad-Crested Rectangular Weir** (Weir Controls 11.15 cfs @ 2.90 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=764.50' TW=745.50' (Dynamic Tailwater)
↑—**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond B-SE3: SE Bench 3

[62] Hint: Exceeded Reach CH-SE3B OUTLET depth by 0.65' @ 12.11 hrs

Inflow Area = 9.526 ac, 0.00% Impervious, Inflow Depth = 1.54" for 10 year - 24 hour event
Inflow = 15.98 cfs @ 12.12 hrs, Volume= 1.222 af
Outflow = 15.93 cfs @ 12.13 hrs, Volume= 1.222 af, Atten= 0%, Lag= 0.6 min
Primary = 15.93 cfs @ 12.13 hrs, Volume= 1.222 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 751.08' @ 12.13 hrs Surf.Area= 895 sf Storage= 471 cf
Flood Elev= 752.00' Surf.Area= 2,890 sf Storage= 2,215 cf

Plug-Flow detention time= 0.5 min calculated for 1.222 af (100% of inflow)
Center-of-Mass det. time= 0.5 min (870.5 - 870.0)

Volume	Invert	Avail.Storage	Storage Description
#1	750.00'	13,455 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
750.00	90	0	0
751.00	725	408	408
752.00	2,890	1,808	2,215
754.00	8,350	11,240	13,455

Device	Routing	Invert	Outlet Devices
#1	Primary	750.00'	**6.0' long x 2.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32
#2	Secondary	752.00'	**10.0' long x 60.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=15.92 cfs @ 12.13 hrs HW=751.08' TW=750.45' (Dynamic Tailwater)
└**1=Broad-Crested Rectangular Weir** (Weir Controls 15.92 cfs @ 2.46 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=750.00' TW=745.50' (Dynamic Tailwater)
└**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond B-SE4: SE Berm 4

[62] Hint: Exceeded Reach CH-SE5 OUTLET depth by 0.77' @ 12.08 hrs

Inflow Area = 7.631 ac, 0.00% Impervious, Inflow Depth = 1.54" for 10 year - 24 hour event
Inflow = 15.70 cfs @ 12.07 hrs, Volume= 0.979 af
Outflow = 15.66 cfs @ 12.07 hrs, Volume= 0.979 af, Atten= 0%, Lag= 0.4 min
Primary = 15.66 cfs @ 12.07 hrs, Volume= 0.979 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 799.07' @ 12.07 hrs Surf.Area= 583 sf Storage= 279 cf
Flood Elev= 801.00' Surf.Area= 4,316 sf Storage= 4,566 cf

Plug-Flow detention time= 0.2 min calculated for 0.979 af (100% of inflow)
Center-of-Mass det. time= 0.2 min (858.8 - 858.6)

Volume	Invert	Avail.Storage	Storage Description
#1	798.00'	4,566 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
798.00	0	0	0
799.00	485	243	243
800.00	1,923	1,204	1,447
801.00	4,316	3,120	4,566

Device	Routing	Invert	Outlet Devices
#1	Primary	798.00'	**6.0' long x 2.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32

Primary OutFlow Max=15.64 cfs @ 12.07 hrs HW=799.07' TW=798.45' (Dynamic Tailwater)
└**1=Broad-Crested Rectangular Weir** (Weir Controls 15.64 cfs @ 2.44 fps)

Summary for Pond B-SE5: SE Berm 5

Inflow Area = 3.569 ac, 0.00% Impervious, Inflow Depth = 1.54" for 10 year - 24 hour event
Inflow = 7.40 cfs @ 12.06 hrs, Volume= 0.458 af
Outflow = 7.39 cfs @ 12.07 hrs, Volume= 0.458 af, Atten= 0%, Lag= 0.3 min
Primary = 7.39 cfs @ 12.07 hrs, Volume= 0.458 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 833.67' @ 12.07 hrs Surf.Area= 323 sf Storage= 107 cf
Flood Elev= 836.00' Surf.Area= 4,316 sf Storage= 4,566 cf

Plug-Flow detention time= 0.1 min calculated for 0.458 af (100% of inflow)
Center-of-Mass det. time= 0.1 min (858.1 - 858.0)

Volume	Invert	Avail.Storage	Storage Description
#1	833.00'	4,566 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
833.00	0	0	0
834.00	485	243	243
835.00	1,923	1,204	1,447
836.00	4,316	3,120	4,566

Device	Routing	Invert	Outlet Devices
#1	Primary	833.00'	**6.0' long x 2.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32

Primary OutFlow Max=7.38 cfs @ 12.07 hrs HW=833.66' TW=833.30' (Dynamic Tailwater)
└**1=Broad-Crested Rectangular Weir** (Weir Controls 7.38 cfs @ 1.85 fps)

Summary for Pond B-SW1: SW Bench 1

[62] Hint: Exceeded Reach CH-SW2 OUTLET depth by 0.03' @ 12.11 hrs

Inflow Area = 21.264 ac, 0.00% Impervious, Inflow Depth = 1.53" for 10 year - 24 hour event
Inflow = 40.92 cfs @ 12.12 hrs, Volume= 2.717 af
Outflow = 40.92 cfs @ 12.12 hrs, Volume= 2.717 af, Atten= 0%, Lag= 0.0 min
Primary = 40.92 cfs @ 12.12 hrs, Volume= 2.717 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 745.86' @ 12.12 hrs Surf.Area= 54 sf Storage= 37 cf
Flood Elev= 746.00' Surf.Area= 59 sf Storage= 44 cf

Plug-Flow detention time= 0.0 min calculated for 2.717 af (100% of inflow)
Center-of-Mass det. time= 0.0 min (866.7 - 866.7)

Volume	Invert	Avail.Storage	Storage Description
#1	744.50'	1,235 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
744.50	0	0	0
746.00	59	44	44
748.00	1,132	1,191	1,235

Device	Routing	Invert	Outlet Devices
#1	Primary	744.50'	**96.0" W x 36.0" H Box Culvert** L= 46.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 744.50' / 744.00' S= 0.0109 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 24.00 sf
#2	Primary	746.00'	**120.0' long x 2.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32

Primary OutFlow Max=40.88 cfs @ 12.12 hrs HW=745.86' TW=744.46' (Dynamic Tailwater)
1=Culvert (Inlet Controls 40.88 cfs @ 3.75 fps)
2=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Summary for Pond B-SW2: SW Bench 2

[62] Hint: Exceeded Reach CH-SW3B OUTLET depth by 1.28' @ 12.13 hrs

Inflow Area = 18.110 ac, 0.00% Impervious, Inflow Depth = 1.53" for 10 year - 24 hour event
Inflow = 35.95 cfs @ 12.10 hrs, Volume= 2.312 af
Outflow = 35.12 cfs @ 12.12 hrs, Volume= 2.312 af, Atten= 2%, Lag= 1.4 min
Primary = 35.12 cfs @ 12.12 hrs, Volume= 2.312 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 767.77' @ 12.12 hrs Surf.Area= 2,755 sf Storage= 2,214 cf
Flood Elev= 769.00' Surf.Area= 5,770 sf Storage= 7,375 cf

Plug-Flow detention time= 0.6 min calculated for 2.312 af (100% of inflow)
Center-of-Mass det. time= 0.6 min (867.6 - 867.0)

Volume	Invert	Avail.Storage	Storage Description
#1	766.00'	13,760 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
766.00	0	0	0
766.50	611	153	153
767.00	1,350	490	643
767.50	2,214	891	1,534
768.00	3,203	1,354	2,888
769.00	5,770	4,487	7,375
770.00	7,000	6,385	13,760

Device	Routing	Invert	Outlet Devices
#1	Primary	766.00'	**6.0' long x 2.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00

3.50
Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32

#2 Secondary 769.00' **120.0' long x 2.0' breadth Broad-Crested Rectangular Weir**
Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50
Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32

Primary OutFlow Max=35.12 cfs @ 12.12 hrs HW=767.77' TW=766.84' (Dynamic Tailwater)
↑—**1=Broad-Crested Rectangular Weir** (Weir Controls 35.12 cfs @ 3.30 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=766.00' TW=744.50' (Dynamic Tailwater)
↑—**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond B-SW3: SW Bench 3

[62] Hint: Exceeded Reach CH-SW4 OUTLET depth by 0.96' @ 12.09 hrs

Inflow Area = 11.899 ac, 0.00% Impervious, Inflow Depth = 1.54" for 10 year - 24 hour event
Inflow = 27.10 cfs @ 12.04 hrs, Volume= 1.527 af
Outflow = 25.88 cfs @ 12.06 hrs, Volume= 1.515 af, Atten= 5%, Lag= 1.7 min
Primary = 25.88 cfs @ 12.06 hrs, Volume= 1.515 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 799.49' @ 12.06 hrs Surf.Area= 3,510 sf Storage= 3,445 cf
Flood Elev= 800.00' Surf.Area= 5,126 sf Storage= 5,654 cf

Plug-Flow detention time= 8.8 min calculated for 1.515 af (99% of inflow)
Center-of-Mass det. time= 4.2 min (861.2 - 856.9)

Volume	Invert	Avail.Storage	Storage Description
#1	797.00'	23,170 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
797.00	0	0	0
798.00	980	490	490
799.00	2,161	1,571	2,061
799.50	3,543	1,426	3,487
800.00	5,126	2,167	5,654
802.00	12,390	17,516	23,170

Device	Routing	Invert	Outlet Devices
#1	Primary	798.00'	**6.0' long x 2.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32
#2	Secondary	800.00'	**150.0' long x 2.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32

Primary OutFlow Max=25.85 cfs @ 12.06 hrs HW=799.49' TW=798.75' (Dynamic Tailwater)
↑—**1=Broad-Crested Rectangular Weir** (Weir Controls 25.85 cfs @ 2.90 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=797.00' TW=784.10' (Dynamic Tailwater)
↑—**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond B-SW4: SW Bench 4

[62] Hint: Exceeded Reach CH-SW5 OUTLET depth by 0.76' @ 12.03 hrs

Inflow Area = 7.363 ac, 0.00% Impervious, Inflow Depth = 1.54" for 10 year - 24 hour event
Inflow = 17.22 cfs @ 12.03 hrs, Volume= 0.945 af
Outflow = 17.21 cfs @ 12.03 hrs, Volume= 0.945 af, Atten= 0%, Lag= 0.1 min
Primary = 17.21 cfs @ 12.03 hrs, Volume= 0.945 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 832.96' @ 12.03 hrs Surf.Area= 148 sf Storage= 121 cf
Flood Elev= 835.80' Surf.Area= 4,335 sf Storage= 4,821 cf

Plug-Flow detention time= 0.2 min calculated for 0.945 af (100% of inflow)
Center-of-Mass det. time= 0.2 min (856.2 - 855.9)

Volume	Invert	Avail.Storage	Storage Description
#1	831.80'	4,821 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
831.80	60	0	0
833.80	213	273	273
835.80	4,335	4,548	4,821

Device	Routing	Invert	Outlet Devices
#1	Primary	831.80'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 4.00 Width (feet) 3.75 11.75

Primary OutFlow Max=17.20 cfs @ 12.03 hrs HW=832.96' TW=832.36' (Dynamic Tailwater)
↑—**1=Custom Weir/Orifice** (Weir Controls 17.20 cfs @ 3.03 fps)

Summary for Pond B-SW5: SW Bench 5

[62] Hint: Exceeded Reach CH-SW6 OUTLET depth by 0.41' @ 12.03 hrs

Inflow Area = 4.490 ac, 0.00% Impervious, Inflow Depth = 1.54" for 10 year - 24 hour event
Inflow = 10.87 cfs @ 12.02 hrs, Volume= 0.576 af
Outflow = 10.87 cfs @ 12.02 hrs, Volume= 0.576 af, Atten= 0%, Lag= 0.1 min
Primary = 10.87 cfs @ 12.02 hrs, Volume= 0.576 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 871.67' @ 12.02 hrs Surf.Area= 110 sf Storage= 74 cf
Flood Elev= 874.80' Surf.Area= 3,893 sf Storage= 4,303 cf

Plug-Flow detention time= 0.2 min calculated for 0.576 af (100% of inflow)
Center-of-Mass det. time= 0.2 min (855.0 - 854.8)

Volume	Invert	Avail.Storage	Storage Description
#1	870.80'	4,303 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
870.80	60	0	0
872.80	175	235	235
874.80	3,893	4,068	4,303

Device	Routing	Invert	Outlet Devices
#1	Primary	870.80'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 4.00 Width (feet) 3.75 11.75

Primary OutFlow Max=10.86 cfs @ 12.02 hrs HW=871.67' TW=871.19' (Dynamic Tailwater)
↑**1=Custom Weir/Orifice** (Weir Controls 10.86 cfs @ 2.70 fps)

Summary for Pond B-SW6: SW Bench 6

Inflow Area = 2.052 ac, 0.00% Impervious, Inflow Depth = 1.54" for 10 year - 24 hour event
Inflow = 5.11 cfs @ 12.01 hrs, Volume= 0.263 af
Outflow = 5.11 cfs @ 12.01 hrs, Volume= 0.263 af, Atten= 0%, Lag= 0.2 min
Primary = 5.11 cfs @ 12.01 hrs, Volume= 0.263 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 910.71' @ 12.01 hrs Surf.Area= 112 sf Storage= 79 cf
Flood Elev= 913.80' Surf.Area= 3,893 sf Storage= 4,303 cf

Plug-Flow detention time= 0.8 min calculated for 0.263 af (100% of inflow)
Center-of-Mass det. time= 0.6 min (854.1 - 853.5)

Volume	Invert	Avail.Storage	Storage Description
#1	909.80'	4,303 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
909.80	60	0	0
911.80	175	235	235
913.80	3,893	4,068	4,303

Device	Routing	Invert	Outlet Devices
#1	Primary	909.80'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 4.00 Width (feet) 1.25 9.25

Primary OutFlow Max=5.11 cfs @ 12.01 hrs HW=910.71' TW=910.26' (Dynamic Tailwater)
↑**1=Custom Weir/Orifice** (Weir Controls 5.11 cfs @ 2.59 fps)

Summary for Pond CB-E5: E CB 5

Inflow Area = 2.194 ac, 0.00% Impervious, Inflow Depth = 1.54" for 10 year - 24 hour event
Inflow = 5.18 cfs @ 12.02 hrs, Volume= 0.281 af
Outflow = 5.18 cfs @ 12.02 hrs, Volume= 0.281 af, Atten= 0%, Lag= 0.0 min
Primary = 5.18 cfs @ 12.02 hrs, Volume= 0.281 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 725.94' @ 12.02 hrs Surf.Area= 38 sf Storage= 8 cf
Flood Elev= 728.00' Surf.Area= 1,300 sf Storage= 1,048 cf

Plug-Flow detention time= 0.0 min calculated for 0.281 af (100% of inflow)
Center-of-Mass det. time= 0.0 min (854.9 - 854.8)

Volume	Invert	Avail.Storage	Storage Description
#1	725.50'	5,463 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
725.50	0	0	0
726.00	43	11	11
727.00	366	205	215
728.00	1,300	833	1,048
730.00	3,115	4,415	5,463

Device	Routing	Invert	Outlet Devices
#1	Primary	725.50'	**20.5" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Secondary	728.00'	**60.0' long x 2.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32

Primary OutFlow Max=5.17 cfs @ 12.02 hrs HW=725.94' TW=723.68' (Dynamic Tailwater)
└**1=Orifice/Grate** (Weir Controls 5.17 cfs @ 2.18 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=725.50' TW=709.00' (Dynamic Tailwater)
└**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond CB-E6: E CB 6

Inflow Area = 1.900 ac, 0.00% Impervious, Inflow Depth = 1.54" for 10 year - 24 hour event
Inflow = 5.23 cfs @ 11.98 hrs, Volume= 0.244 af
Outflow = 5.23 cfs @ 11.98 hrs, Volume= 0.244 af, Atten= 0%, Lag= 0.0 min
Primary = 4.77 cfs @ 11.98 hrs, Volume= 0.231 af
Secondary = 0.46 cfs @ 11.98 hrs, Volume= 0.013 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 752.34' @ 11.98 hrs
Flood Elev= 755.50'

Device	Routing	Invert	Outlet Devices
#1	Primary	752.00'	**10.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88
#2	Secondary	752.00'	**18.0" Round Culvert** L= 123.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 752.00' / 722.50' S= 0.2398 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf

Primary OutFlow Max=4.76 cfs @ 11.98 hrs HW=752.34' TW=748.74' (Dynamic Tailwater)
1=Broad-Crested Rectangular Weir (Weir Controls 4.76 cfs @ 1.42 fps)

Secondary OutFlow Max=0.46 cfs @ 11.98 hrs HW=752.34' TW=723.61' (Dynamic Tailwater)
2=Culvert (Inlet Controls 0.46 cfs @ 1.56 fps)

Summary for Pond CB-E7: E CB 3

Inflow Area = 5.357 ac, 0.00% Impervious, Inflow Depth = 1.54" for 10 year - 24 hour event
Inflow = 12.15 cfs @ 11.97 hrs, Volume= 0.687 af
Outflow = 12.15 cfs @ 11.97 hrs, Volume= 0.687 af, Atten= 0%, Lag= 0.0 min
Primary = 1.17 cfs @ 11.97 hrs, Volume= 0.041 af
Secondary = 10.98 cfs @ 11.97 hrs, Volume= 0.646 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 752.55' @ 11.97 hrs
Flood Elev= 756.50'

Device	Routing	Invert	Outlet Devices
#1	Primary	752.00'	**18.0" Round Culvert** L= 157.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 752.00' / 712.20' S= 0.2535 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf
#2	Secondary	752.00'	**10.0' long x 140.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=1.17 cfs @ 11.97 hrs HW=752.55' TW=712.71' (Dynamic Tailwater)
1=Culvert (Inlet Controls 1.17 cfs @ 1.99 fps)

Secondary OutFlow Max=10.97 cfs @ 11.97 hrs HW=752.55' TW=748.73' (Dynamic Tailwater)
2=Broad-Crested Rectangular Weir (Weir Controls 10.97 cfs @ 2.00 fps)

Summary for Pond DP-E11: 18" Pipe

Inflow Area = 5.142 ac, 0.00% Impervious, Inflow Depth = 1.54" for 10 year - 24 hour event
Inflow = 10.89 cfs @ 12.05 hrs, Volume= 0.660 af
Outflow = 10.89 cfs @ 12.05 hrs, Volume= 0.660 af, Atten= 0%, Lag= 0.0 min
Primary = 10.89 cfs @ 12.05 hrs, Volume= 0.660 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 749.39' @ 12.05 hrs
Flood Elev= 750.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	747.00'	**18.0" Round Culvert** L= 150.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 747.00' / 713.75' S= 0.2217 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf

Primary OutFlow Max=10.88 cfs @ 12.05 hrs HW=749.38' TW=716.13' (Dynamic Tailwater)
1=Culvert (Inlet Controls 10.88 cfs @ 6.15 fps)

Summary for Pond DP-E12: 18" Pipe

Inflow Area = 2.603 ac, 0.00% Impervious, Inflow Depth = 1.54" for 10 year - 24 hour event
Inflow = 5.36 cfs @ 12.07 hrs, Volume= 0.334 af
Outflow = 5.36 cfs @ 12.07 hrs, Volume= 0.334 af, Atten= 0%, Lag= 0.0 min
Primary = 5.36 cfs @ 12.07 hrs, Volume= 0.334 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 771.16' @ 12.07 hrs
Flood Elev= 776.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	770.00'	**18.0" Round Culvert** L= 110.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 770.00' / 747.00' S= 0.2091 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf

Primary OutFlow Max=5.35 cfs @ 12.07 hrs HW=771.16' TW=749.36' (Dynamic Tailwater)
1=Culvert (Inlet Controls 5.35 cfs @ 3.66 fps)

Summary for Pond DP-E5: 18" Pipe

Inflow Area = 2.194 ac, 0.00% Impervious, Inflow Depth = 1.61" for 10 year - 24 hour event
Inflow = 5.55 cfs @ 12.02 hrs, Volume= 0.294 af
Outflow = 5.55 cfs @ 12.02 hrs, Volume= 0.294 af, Atten= 0%, Lag= 0.0 min
Primary = 5.55 cfs @ 12.02 hrs, Volume= 0.294 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 723.69' @ 12.02 hrs
Flood Elev= 725.50'

Device	Routing	Invert	Outlet Devices
#1	Primary	722.50'	**18.0" Round Culvert** L= 60.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 722.50' / 712.00' S= 0.1750 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 1.77 sf

Primary OutFlow Max=5.55 cfs @ 12.02 hrs HW=723.68' TW=713.26' (Dynamic Tailwater)
1=Culvert (Inlet Controls 5.55 cfs @ 3.71 fps)

Summary for Pond MH-E1: Drop Structure 1

Inflow Area = 2.194 ac, 0.00% Impervious, Inflow Depth = 1.61" for 10 year - 24 hour event
Inflow = 5.55 cfs @ 12.02 hrs, Volume= 0.294 af
Outflow = 5.55 cfs @ 12.02 hrs, Volume= 0.294 af, Atten= 0%, Lag= 0.0 min
Primary = 5.55 cfs @ 12.02 hrs, Volume= 0.294 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 713.26' @ 12.02 hrs
Flood Elev= 716.50'

Device	Routing	Invert	Outlet Devices
#1	Primary	712.00'	**18.0" Round Culvert** L= 30.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 712.00' / 711.70' S= 0.0100 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 1.77 sf

Primary OutFlow Max=5.55 cfs @ 12.02 hrs HW=713.26' TW=712.25' (Dynamic Tailwater)
1=Culvert (Barrel Controls 5.55 cfs @ 4.73 fps)

Summary for Pond MH-E2: Drop Structure 2

Inflow Area = 5.357 ac, 0.00% Impervious, Inflow Depth = 0.09" for 10 year - 24 hour event
Inflow = 1.17 cfs @ 11.97 hrs, Volume= 0.041 af
Outflow = 1.17 cfs @ 11.97 hrs, Volume= 0.041 af, Atten= 0%, Lag= 0.0 min
Primary = 1.17 cfs @ 11.97 hrs, Volume= 0.041 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 712.96' @ 12.32 hrs
Flood Elev= 716.50'

Device	Routing	Invert	Outlet Devices
#1	Primary	712.20'	**18.0" Round Culvert** L= 20.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 712.20' / 712.00' S= 0.0100 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 1.77 sf

Primary OutFlow Max=1.17 cfs @ 11.97 hrs HW=712.71' TW=711.77' (Dynamic Tailwater)
1=Culvert (Barrel Controls 1.17 cfs @ 3.30 fps)

Summary for Pond MH-E3: Drop Structure 3

Inflow Area = 5.142 ac, 0.00% Impervious, Inflow Depth = 1.54" for 10 year - 24 hour event
Inflow = 10.89 cfs @ 12.05 hrs, Volume= 0.660 af
Outflow = 10.89 cfs @ 12.05 hrs, Volume= 0.660 af, Atten= 0%, Lag= 0.0 min
Primary = 10.89 cfs @ 12.05 hrs, Volume= 0.660 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 716.14' @ 12.05 hrs
Flood Elev= 720.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	713.75'	**18.0" Round Culvert** L= 25.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 713.75' / 713.50' S= 0.0100 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 1.77 sf

Primary OutFlow Max=10.88 cfs @ 12.05 hrs HW=716.13' TW=712.48' (Dynamic Tailwater)
1=Culvert (Inlet Controls 10.88 cfs @ 6.15 fps)

Summary for Pond P-E1: East Ditch 1

[58] Hint: Peaked 0.11' above defined flood level
[62] Hint: Exceeded Reach B-E1 OUTLET depth by 0.52' @ 12.22 hrs

Inflow Area = 6.659 ac, 0.00% Impervious, Inflow Depth = 2.68" for 10 year - 24 hour event
Inflow = 25.97 cfs @ 11.96 hrs, Volume= 1.488 af
Outflow = 20.34 cfs @ 12.02 hrs, Volume= 1.481 af, Atten= 22%, Lag= 3.9 min
Primary = 9.96 cfs @ 12.01 hrs, Volume= 1.409 af
Secondary = 10.48 cfs @ 12.02 hrs, Volume= 0.072 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 715.11' @ 12.02 hrs Surf.Area= 4,811 sf Storage= 10,041 cf
Flood Elev= 715.00' Surf.Area= 4,659 sf Storage= 9,544 cf

Plug-Flow detention time= 15.5 min calculated for 1.481 af (100% of inflow)
Center-of-Mass det. time= 12.9 min (870.5 - 857.6)

Volume	Invert	Avail.Storage	Storage Description
#1	711.00'	14,929 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
711.00	254	0	0
712.00	1,520	887	887
714.00	3,205	4,725	5,612
716.00	6,112	9,317	14,929

Device	Routing	Invert	Outlet Devices
#1	Primary	711.50'	**16.0" Round Culvert** L= 230.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 711.50' / 709.00' S= 0.0109 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 1.40 sf
#2	Secondary	715.00'	**115.0' long x 30.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=9.96 cfs @ 12.01 hrs HW=715.05' TW=711.57' (Dynamic Tailwater)
└**1=Culvert** (Outlet Controls 9.96 cfs @ 7.13 fps)

Secondary OutFlow Max=10.10 cfs @ 12.02 hrs HW=715.10' (Free Discharge)
└**2=Broad-Crested Rectangular Weir** (Weir Controls 10.10 cfs @ 0.86 fps)

Summary for Pond P-E2: East Ditch 2

Inflow Area = 7.064 ac, 0.00% Impervious, Inflow Depth = 2.48" for 10 year - 24 hour event
Inflow = 10.94 cfs @ 11.98 hrs, Volume= 1.461 af
Outflow = 6.36 cfs @ 12.33 hrs, Volume= 1.457 af, Atten= 42%, Lag= 21.0 min
Primary = 6.36 cfs @ 12.33 hrs, Volume= 1.457 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 712.75' @ 12.57 hrs Surf.Area= 4,451 sf Storage= 8,472 cf
Flood Elev= 713.80' Surf.Area= 6,136 sf Storage= 14,023 cf

Plug-Flow detention time= 18.7 min calculated for 1.457 af (100% of inflow)
Center-of-Mass det. time= 16.6 min (893.5 - 877.0)

Volume	Invert	Avail.Storage	Storage Description
#1	709.00'	15,282 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
709.00	0	0	0
710.00	1,558	779	779
712.00	3,244	4,802	5,581
714.00	6,457	9,701	15,282

Device	Routing	Invert	Outlet Devices
#1	Primary	709.50'	**16.0" Round Culvert** L= 90.0' RCP, end-section conforming to fill, Ke= 0.500 Inlet / Outlet Invert= 709.50' / 708.50' S= 0.0111 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 1.40 sf
#2	Secondary	713.80'	**115.0' long x 30.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=6.36 cfs @ 12.33 hrs HW=712.60' TW=711.67' (Dynamic Tailwater)
1=Culvert (Outlet Controls 6.36 cfs @ 4.56 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=709.00' (Free Discharge)
2=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Summary for Pond P-E3: East Ditch 3

Inflow Area = 26.944 ac, 0.00% Impervious, Inflow Depth = 1.50" for 10 year - 24 hour event
Inflow = 17.29 cfs @ 12.00 hrs, Volume= 3.365 af
Outflow = 11.83 cfs @ 12.79 hrs, Volume= 3.365 af, Atten= 32%, Lag= 47.6 min
Primary = 11.83 cfs @ 12.79 hrs, Volume= 3.365 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 711.95' @ 12.79 hrs Surf.Area= 9,714 sf Storage= 13,047 cf
Flood Elev= 713.80' Surf.Area= 20,308 sf Storage= 40,715 cf

Plug-Flow detention time= 9.8 min calculated for 3.365 af (100% of inflow)
Center-of-Mass det. time= 9.5 min (893.9 - 884.4)

Volume	Invert	Avail.Storage	Storage Description
#1	708.00'	44,892 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
708.00	0	0	0
710.00	1,805	1,805	1,805
712.00	9,909	11,714	13,519
714.00	21,464	31,373	44,892

Device	Routing	Invert	Outlet Devices
#1	Primary	708.19'	**16.0" Round Culvert** L= 75.0' RCP, end-section conforming to fill, Ke= 0.500 Inlet / Outlet Invert= 708.19' / 707.50' S= 0.0092 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 1.40 sf
#2	Secondary	713.80'	**300.0' long x 30.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=11.83 cfs @ 12.79 hrs HW=711.95' (Free Discharge)
1=Culvert (Inlet Controls 11.83 cfs @ 8.47 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=708.00' (Free Discharge)
2=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Summary for Pond P-E4: Exist Ditch 4

Inflow Area = 18.316 ac, 0.00% Impervious, Inflow Depth = 1.12" for 10 year - 24 hour event
Inflow = 27.44 cfs @ 12.05 hrs, Volume= 1.717 af
Outflow = 8.22 cfs @ 12.14 hrs, Volume= 1.708 af, Atten= 70%, Lag= 5.3 min
Primary = 8.22 cfs @ 12.14 hrs, Volume= 1.708 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2

Peak Elev= 712.96' @ 12.32 hrs Surf.Area= 21,180 sf Storage= 19,026 cf
Flood Elev= 713.80' Surf.Area= 35,801 sf Storage= 42,961 cf

Plug-Flow detention time= 27.7 min calculated for 1.708 af (99% of inflow)
Center-of-Mass det. time= 24.5 min (880.5 - 856.0)

Volume	Invert	Avail.Storage	Storage Description
#1	709.00'	106,611 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
709.00	0	0	0
712.00	4,475	6,713	6,713
714.00	39,282	43,757	50,470
715.00	73,000	56,141	106,611

Device	Routing	Invert	Outlet Devices
#1	Primary	709.72'	**16.0" Round Culvert** L= 65.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 709.72' / 709.24' S= 0.0074 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 1.40 sf
#2	Secondary	713.80'	**510.0' long x 30.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=8.22 cfs @ 12.14 hrs HW=712.81' TW=711.31' (Dynamic Tailwater)
1=Culvert (Inlet Controls 8.22 cfs @ 5.89 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=709.00' (Free Discharge)
2=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Summary for Pond P-S1: South Pond

[58] Hint: Peaked 0.03' above defined flood level

Inflow Area = 9.142 ac, 15.15% Impervious, Inflow Depth = 1.88" for 10 year - 24 hour event
Inflow = 22.60 cfs @ 11.98 hrs, Volume= 1.431 af
Outflow = 1.40 cfs @ 13.44 hrs, Volume= 0.781 af, Atten= 94%, Lag= 88.1 min
Discarded = 0.08 cfs @ 13.44 hrs, Volume= 0.321 af
Secondary = 1.32 cfs @ 13.44 hrs, Volume= 0.460 af
Tertiary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 720.03' @ 13.44 hrs Surf.Area= 22,234 sf Storage= 38,906 cf
Flood Elev= 720.00' Surf.Area= 22,003 sf Storage= 38,164 cf

Plug-Flow detention time= 752.1 min calculated for 0.781 af (55% of inflow)
Center-of-Mass det. time= 626.0 min (1,459.2 - 833.2)

Volume	Invert	Avail.Storage	Storage Description
#1	716.50'	95,942 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
716.50	0	0	0
718.00	9,235	6,926	6,926
720.00	22,003	31,238	38,164
722.00	35,775	57,778	95,942

Device	Routing	Invert	Outlet Devices
#1	Discarded	716.50'	**0.150 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 700.00'
#2	Secondary	720.00'	**80.0' long x 30.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63
#3	Tertiary	720.50'	**100.0' long x 30.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Discarded OutFlow Max=0.08 cfs @ 13.44 hrs HW=720.03' (Free Discharge)
└**1=Exfiltration** (Controls 0.08 cfs)

Secondary OutFlow Max=1.32 cfs @ 13.44 hrs HW=720.03' (Free Discharge)
└**2=Broad-Crested Rectangular Weir** (Weir Controls 1.32 cfs @ 0.49 fps)

Tertiary OutFlow Max=0.00 cfs @ 0.00 hrs HW=716.50' (Free Discharge)
└**3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond P-SE1: Southeast Pond

[62] Hint: Exceeded Reach CH-SE1 OUTLET depth by 1.54' @ 12.25 hrs
[62] Hint: Exceeded Reach CH-SE3 OUTLET depth by 1.36' @ 12.27 hrs

Inflow Area = 17.499 ac, 3.87% Impervious, Inflow Depth = 1.63" for 10 year - 24 hour event
Inflow = 28.91 cfs @ 12.08 hrs, Volume= 2.383 af
Outflow = 19.11 cfs @ 12.22 hrs, Volume= 2.378 af, Atten= 34%, Lag= 8.5 min
Primary = 19.11 cfs @ 12.22 hrs, Volume= 2.378 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Starting Elev= 712.00' Surf.Area= 11,817 sf Storage= 33,961 cf
Peak Elev= 713.74' @ 12.22 hrs Surf.Area= 14,864 sf Storage= 57,580 cf (23,619 cf above start)
Flood Elev= 718.00' Surf.Area= 22,487 sf Storage= 136,385 cf (102,424 cf above start)

Plug-Flow detention time= 263.8 min calculated for 1.598 af (67% of inflow)
Center-of-Mass det. time= 57.6 min (910.2 - 852.6)

Volume	Invert	Avail.Storage	Storage Description
#1	708.00'	187,373 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
708.00	5,158	0	0
710.00	8,493	13,651	13,651
712.00	11,817	20,310	33,961
714.00	15,317	27,134	61,095
716.00	18,743	34,060	95,155
718.00	22,487	41,230	136,385
720.00	28,501	50,988	187,373

Device	Routing	Invert	Outlet Devices
#1	Primary	712.00'	**36.0" Round Culvert** L= 73.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 712.00' / 710.90' S= 0.0151 '/' Cc= 0.900 n= 0.015 Concrete sewer w/manholes & inlets, Flow Area= 7.07 sf
#2	Secondary	718.00'	**600.0' long x 60.0' breadth Broad-Crested Rectangular Weir**

Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60
Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=19.11 cfs @ 12.22 hrs HW=713.74' (Free Discharge)
└**1=Culvert** (Inlet Controls 19.11 cfs @ 4.49 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=712.00' (Free Discharge)
└**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond P-SW1: Southwest Pond

[62] Hint: Exceeded Reach CH-SW1 OUTLET depth by 5.18' @ 12.69 hrs

Inflow Area = 24.187 ac, 3.46% Impervious, Inflow Depth = 1.62" for 10 year - 24 hour event
Inflow = 42.65 cfs @ 12.11 hrs, Volume= 3.262 af
Outflow = 7.98 cfs @ 12.59 hrs, Volume= 1.961 af, Atten= 81%, Lag= 28.2 min
Primary = 7.98 cfs @ 12.59 hrs, Volume= 1.961 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 720.34' @ 12.59 hrs Surf.Area= 24,756 sf Storage= 65,764 cf
Flood Elev= 723.00' Surf.Area= 40,614 sf Storage= 151,443 cf

Plug-Flow detention time= 254.1 min calculated for 1.961 af (60% of inflow)
Center-of-Mass det. time= 125.7 min (980.8 - 855.1)

Volume	Invert	Avail.Storage	Storage Description
#1	715.00'	192,056 cf	**Custom Stage Data (Prismatic)** Listed below

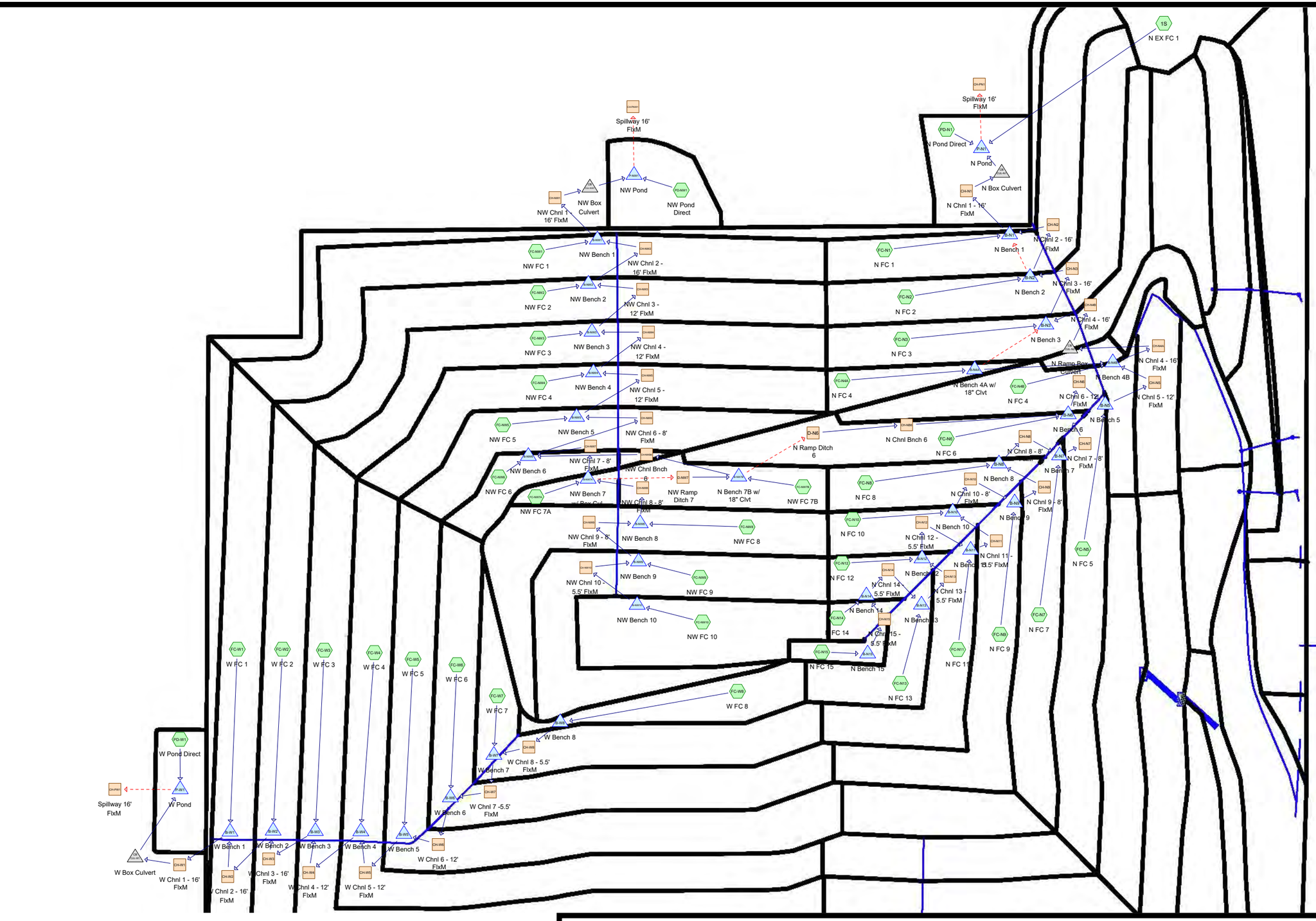
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
715.00	0	0	0
716.00	950	475	475
718.00	15,835	16,785	17,260
720.00	23,586	39,421	56,681
722.00	30,562	54,148	110,829
724.00	50,665	81,227	192,056

Device	Routing	Invert	Outlet Devices
#1	Primary	715.05'	**18.0" Round Culvert** L= 134.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 715.05' / 714.37' S= 0.0051 '/' Cc= 0.900 n= 0.015 Concrete sewer w/manholes & inlets, Flow Area= 1.77 sf
#2	Device 1	720.00'	**48.0" Horiz. Orifice/Grate** C= 0.600 in 48.0" Grate (100% open area) Limited to weir flow at low heads
#3	Secondary	723.00'	**300.0' long x 60.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=7.98 cfs @ 12.59 hrs HW=720.34' (Free Discharge)
└**1=Culvert** (Passes 7.98 cfs of 13.73 cfs potential flow)
└**2=Orifice/Grate** (Weir Controls 7.98 cfs @ 1.89 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=715.00' (Free Discharge)
└**3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Post-Project 500-Year Storm HydroCAD Analysis



Routing Diagram for BSLI Permit Expansion 2019 N & W

Prepared by Carlson McCain, Inc., Printed 12/18/2019

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Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
135.354	71	Meadow, non-grazed, HSG C (1S, FC-N1, FC-N10, FC-N11, FC-N12, FC-N13, FC-N14, FC-N15, FC-N2, FC-N3, FC-N4A, FC-N4B, FC-N5, FC-N6, FC-N7, FC-N8, FC-N9, FC-NW1, FC-NW10, FC-NW2, FC-NW3, FC-NW4, FC-NW5, FC-NW6, FC-NW7A, FC-NW7B, FC-NW8, FC-NW9, FC-W1, FC-W2, FC-W3, FC-W4, FC-W5, FC-W6, FC-W7, FC-W8)
1.497	98	Paved parking, HSG B (FC-N4B, FC-N6, FC-NW7A, FC-NW7B, FC-NW8, FC-NW9)
5.877	98	Water Surface, 0% imp, HSG B (PD-N1, PD-NW1, PD-W1)
142.727	**72**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
7.374	HSG B	FC-N4B, FC-N6, FC-NW7A, FC-NW7B, FC-NW8, FC-NW9, PD-N1, PD-NW1, PD-W1
135.354	HSG C	1S, FC-N1, FC-N10, FC-N11, FC-N12, FC-N13, FC-N14, FC-N15, FC-N2, FC-N3, FC-N4A, FC-N4B, FC-N5, FC-N6, FC-N7, FC-N8, FC-N9, FC-NW1, FC-NW10, FC-NW2, FC-NW3, FC-NW4, FC-NW5, FC-NW6, FC-NW7A, FC-NW7B, FC-NW8, FC-NW9, FC-W1, FC-W2, FC-W3, FC-W4, FC-W5, FC-W6, FC-W7, FC-W8
0.000	HSG D	
0.000	Other	
142.727		**TOTAL AREA**

Pipe Listing (all nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Diam/Width (inches)	Height (inches)	Inside-Fill (inches)
1	B-N4A	842.30	842.00	50.0	0.0060	0.010	15.8	0.0	0.0
2	B-NW7A	931.00	930.83	35.0	0.0049	0.012	96.0	48.0	0.0
3	B-NW7B	920.50	920.00	50.0	0.0100	0.010	15.8	0.0	0.0
4	CUL-N1	717.00	716.50	50.0	0.0100	0.012	120.0	48.0	0.0
5	CUL-N2	830.00	829.83	35.0	0.0049	0.010	96.0	48.0	0.0
6	CUL-NW1	717.00	716.60	40.0	0.0100	0.012	120.0	48.0	0.0
7	CUL-W1	717.00	716.60	40.0	0.0100	0.012	120.0	48.0	0.0
8	P-N1	701.00	700.50	50.0	0.0100	0.013	9.4	0.0	0.0
9	P-NW1	699.00	698.50	50.0	0.0100	0.013	10.0	0.0	0.0
10	P-W1	713.00	712.50	50.0	0.0100	0.013	10.0	0.0	0.0

Time span=0.00-60.00 hrs, dt=0.01 hrs, 6001 points x 2
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: N EX FC 1 Runoff Area=189,400 sf 0.00% Impervious Runoff Depth=6.81"
Flow Length=1,060' Tc=14.1 min CN=71 Runoff=39.11 cfs 2.468 af

Subcatchment FC-N1: N FC 1 Runoff Area=206,346 sf 0.00% Impervious Runoff Depth=6.81"
Flow Length=963' Tc=14.3 min CN=71 Runoff=42.40 cfs 2.688 af

Subcatchment FC-N10: N FC 10 Runoff Area=63,734 sf 0.00% Impervious Runoff Depth=6.81"
Flow Length=628' Tc=10.9 min CN=71 Runoff=14.63 cfs 0.830 af

Subcatchment FC-N11: N FC 11 Runoff Area=122,568 sf 0.00% Impervious Runoff Depth=6.81"
Flow Length=1,222' Tc=16.3 min CN=71 Runoff=23.67 cfs 1.597 af

Subcatchment FC-N12: N FC 12 Runoff Area=43,115 sf 0.00% Impervious Runoff Depth=6.81"
Flow Length=481' Tc=9.4 min CN=71 Runoff=10.42 cfs 0.562 af

Subcatchment FC-N13: N FC 13 Runoff Area=77,429 sf 0.00% Impervious Runoff Depth=6.81"
Flow Length=863' Tc=12.8 min CN=71 Runoff=16.69 cfs 1.009 af

Subcatchment FC-N14: N FC 14 Runoff Area=20,870 sf 0.00% Impervious Runoff Depth=6.81"
Flow Length=321' Tc=7.5 min CN=71 Runoff=5.39 cfs 0.272 af

Subcatchment FC-N15: N FC 15 Runoff Area=23,198 sf 0.00% Impervious Runoff Depth=6.81"
Flow Length=453' Tc=6.5 min CN=71 Runoff=6.20 cfs 0.302 af

Subcatchment FC-N2: N FC 2 Runoff Area=215,322 sf 0.00% Impervious Runoff Depth=6.81"
Flow Length=985' Tc=14.3 min CN=71 Runoff=44.24 cfs 2.805 af

Subcatchment FC-N3: N FC 3 Runoff Area=177,256 sf 0.00% Impervious Runoff Depth=6.81"
Flow Length=870' Tc=14.6 min CN=71 Runoff=36.01 cfs 2.309 af

Subcatchment FC-N4A: N FC 4 Runoff Area=45,986 sf 0.00% Impervious Runoff Depth=6.81"
Flow Length=706' Tc=11.6 min CN=71 Runoff=10.31 cfs 0.599 af

Subcatchment FC-N4B: N FC 4 Runoff Area=89,094 sf 15.79% Impervious Runoff Depth=7.34"
Flow Length=752' Tc=4.9 min CN=75 Runoff=26.71 cfs 1.252 af

Subcatchment FC-N5: N FC 5 Runoff Area=183,015 sf 0.00% Impervious Runoff Depth=6.81"
Flow Length=1,591' Tc=20.3 min CN=71 Runoff=31.39 cfs 2.384 af

Subcatchment FC-N6: N FC 6 Runoff Area=144,191 sf 6.48% Impervious Runoff Depth=7.08"
Flow Length=875' Tc=13.2 min CN=73 Runoff=31.70 cfs 1.952 af

Subcatchment FC-N7: N FC 7 Runoff Area=146,829 sf 0.00% Impervious Runoff Depth=6.81"
Flow Length=1,209' Tc=16.3 min CN=71 Runoff=28.36 cfs 1.913 af

Subcatchment FC-N8: N FC 8 Runoff Area=84,345 sf 0.00% Impervious Runoff Depth=6.81"
Flow Length=775' Tc=12.3 min CN=71 Runoff=18.49 cfs 1.099 af

Subcatchment FC-N9: N FC 9 Runoff Area=171,400 sf 0.00% Impervious Runoff Depth=6.81"
Flow Length=1,580' Tc=19.8 min CN=71 Runoff=29.88 cfs 2.233 af

Subcatchment FC-NW1: NW FC 1 Runoff Area=278,073 sf 0.00% Impervious Runoff Depth=6.81"
Flow Length=1,327' Tc=17.7 min CN=71 Runoff=51.46 cfs 3.623 af

Subcatchment FC-NW10: NW FC 10 Runoff Area=152,624 sf 0.00% Impervious Runoff Depth=6.81"
Flow Length=772' Tc=12.3 min CN=71 Runoff=33.46 cfs 1.988 af

Subcatchment FC-NW2: NW FC 2 Runoff Area=253,669 sf 0.00% Impervious Runoff Depth=6.81"
Flow Length=1,445' Tc=19.2 min CN=71 Runoff=44.88 cfs 3.305 af

Subcatchment FC-NW3: NW FC 3 Runoff Area=220,927 sf 0.00% Impervious Runoff Depth=6.81"
Flow Length=1,265' Tc=16.8 min CN=71 Runoff=41.98 cfs 2.878 af

Subcatchment FC-NW4: NW FC 4 Runoff Area=206,398 sf 0.00% Impervious Runoff Depth=6.81"
Flow Length=1,089' Tc=14.4 min CN=71 Runoff=42.19 cfs 2.689 af

Subcatchment FC-NW5: NW FC 5 Runoff Area=156,508 sf 0.00% Impervious Runoff Depth=6.81"
Flow Length=924' Tc=12.5 min CN=71 Runoff=34.09 cfs 2.039 af

Subcatchment FC-NW6: NW FC 6 Runoff Area=61,906 sf 0.00% Impervious Runoff Depth=6.81"
Flow Length=763' Tc=12.2 min CN=71 Runoff=13.60 cfs 0.807 af

Subcatchment FC-NW7A: NW FC 7A Runoff Area=26,678 sf 34.64% Impervious Runoff Depth=8.00"
Flow Length=294' Tc=2.2 min CN=80 Runoff=9.29 cfs 0.408 af

Subcatchment FC-NW7B: NW FC 7B Runoff Area=92,091 sf 4.67% Impervious Runoff Depth=6.94"
Flow Length=765' Tc=12.2 min CN=72 Runoff=20.57 cfs 1.223 af

Subcatchment FC-NW8: NW FC 8 Runoff Area=198,885 sf 6.07% Impervious Runoff Depth=7.08"
Flow Length=765' Tc=12.2 min CN=73 Runoff=45.16 cfs 2.693 af

Subcatchment FC-NW9: NW FC 9 Runoff Area=217,535 sf 7.43% Impervious Runoff Depth=7.08"
Flow Length=767' Tc=12.3 min CN=73 Runoff=49.32 cfs 2.946 af

Subcatchment FC-W1: W FC 1 Runoff Area=261,734 sf 0.00% Impervious Runoff Depth=6.81"
Flow Length=1,589' Tc=20.0 min CN=71 Runoff=45.27 cfs 3.410 af

Subcatchment FC-W2: W FC 2 Runoff Area=227,154 sf 0.00% Impervious Runoff Depth=6.81"
Flow Length=1,468' Tc=18.9 min CN=71 Runoff=40.56 cfs 2.960 af

Subcatchment FC-W3: W FC 3 Runoff Area=388,269 sf 0.00% Impervious Runoff Depth=6.81"
Flow Length=1,865' Tc=22.7 min CN=71 Runoff=62.42 cfs 5.059 af

Subcatchment FC-W4: W FC 4 Runoff Area=333,000 sf 0.00% Impervious Runoff Depth=6.81"
Flow Length=1,817' Tc=22.2 min CN=71 Runoff=54.29 cfs 4.339 af

Subcatchment FC-W5: W FC 5 Runoff Area=330,928 sf 0.00% Impervious Runoff Depth=6.81"
Flow Length=1,612' Tc=19.2 min CN=71 Runoff=58.55 cfs 4.312 af

Subcatchment FC-W6: W FC 6 Runoff Area=274,510 sf 0.00% Impervious Runoff Depth=6.81"
Flow Length=1,371' Tc=16.4 min CN=71 Runoff=52.85 cfs 3.577 af

Subcatchment FC-W7: W FC 7 Runoff Area=190,046 sf 0.00% Impervious Runoff Depth=6.81"
Flow Length=1,193' Tc=14.2 min CN=71 Runoff=39.10 cfs 2.476 af

Subcatchment FC-W8: W FC 8 Runoff Area=86,180 sf 0.00% Impervious Runoff Depth=6.81"
Flow Length=1,001' Tc=13.8 min CN=71 Runoff=17.96 cfs 1.123 af

Subcatchment PD-N1: N Pond Direct Runoff Area=104,271 sf 0.00% Impervious Runoff Depth=10.26"
Tc=0.0 min CN=98 Runoff=42.71 cfs 2.046 af

Subcatchment PD-NW1: NW Pond Direct Runoff Area=89,015 sf 0.00% Impervious Runoff Depth=10.26"
Tc=0.0 min CN=98 Runoff=36.46 cfs 1.747 af

Subcatchment PD-W1: W Pond Direct Runoff Area=62,704 sf 0.00% Impervious Runoff Depth=10.26"
Tc=0.0 min CN=98 Runoff=25.68 cfs 1.231 af

Reach CH-N1: N Chnl 1 - 16' FlxM Avg. Flow Depth=1.56' Max Vel=18.63 fps Inflow=386.10 cfs 25.452 af
n=0.052 L=28.8' S=0.3056 '/' Capacity=362.90 cfs Outflow=386.09 cfs 25.452 af

Reach CH-N10: N Chnl 10 - 8' FlxM Avg. Flow Depth=1.26' Max Vel=11.56 fps Inflow=73.13 cfs 4.572 af
n=0.056 L=85.7' S=0.2305 '/' Capacity=99.33 cfs Outflow=73.12 cfs 4.572 af

Reach CH-N11: N Chnl 11 - 5.5' FlxM Avg. Flow Depth=1.71' Max Vel=11.77 fps Inflow=58.99 cfs 3.742 af
n=0.053 L=96.5' S=0.2306 '/' Capacity=45.88 cfs Outflow=58.98 cfs 3.742 af

Reach CH-N12: N Chnl 12 - 5.5' FlxM Avg. Flow Depth=1.38' Max Vel=10.27 fps Inflow=37.35 cfs 2.145 af
n=0.055 L=84.5' S=0.2308 '/' Capacity=44.23 cfs Outflow=37.34 cfs 2.145 af

Reach CH-N13: N Chnl 13 - 5.5' FlxM Avg. Flow Depth=1.19' Max Vel=9.31 fps Inflow=27.09 cfs 1.583 af
n=0.057 L=86.7' S=0.2364 '/' Capacity=43.20 cfs Outflow=27.08 cfs 1.583 af

Reach CH-N14: N Chnl 14 - 5.5' FlxM Avg. Flow Depth=0.83' Max Vel=6.73 fps Inflow=11.55 cfs 0.574 af
n=0.066 L=92.2' S=0.2386 '/' Capacity=37.48 cfs Outflow=11.55 cfs 0.574 af

Reach CH-N15: N Chnl 15 - 5.5' FlxM Avg. Flow Depth=0.61' Max Vel=5.45 fps Inflow=6.19 cfs 0.302 af
n=0.074 L=60.0' S=0.2667 '/' Capacity=35.34 cfs Outflow=6.19 cfs 0.302 af

Reach CH-N2: N Chnl 2 - 16' FlxM Avg. Flow Depth=1.37' Max Vel=16.99 fps Inflow=306.22 cfs 22.412 af
n=0.053 L=119.1' S=0.3039 '/' Capacity=355.12 cfs Outflow=306.21 cfs 22.412 af

Reach CH-N3: N Chnl 3 - 16' FlxM Avg. Flow Depth=1.39' Max Vel=16.62 fps Inflow=303.88 cfs 19.958 af
n=0.055 L=122.8' S=0.3086 '/' Capacity=344.83 cfs Outflow=303.86 cfs 19.958 af

Reach CH-N4A: N Chnl 4 - 16' FlxM Avg. Flow Depth=1.29' Max Vel=15.87 fps Inflow=266.14 cfs 17.615 af
n=0.057 L=24.2' S=0.3306 '/' Capacity=344.36 cfs Outflow=266.13 cfs 17.615 af

Reach CH-N4B: N Chnl 4 - 16' FlxM Avg. Flow Depth=1.30' Max Vel=15.71 fps Inflow=266.13 cfs 17.615 af
n=0.057 L=87.0' S=0.3207 '/' Capacity=339.17 cfs Outflow=266.13 cfs 17.615 af

Reach CH-N5: N Chnl 5 - 12' FlxM Avg. Flow Depth=1.49' Max Vel=18.45 fps Inflow=254.03 cfs 15.798 af
n=0.051 L=61.6' S=0.3328 '/' Capacity=257.03 cfs Outflow=254.03 cfs 15.798 af

Reach CH-N6: N Chnl 6 - 12' FlxM Avg. Flow Depth=1.53' Max Vel=15.76 fps Inflow=224.13 cfs 13.414 af
n=0.051 L=71.7' S=0.2357 '/' Capacity=216.31 cfs Outflow=224.12 cfs 13.414 af

Reach CH-N7: N Chnl 7 - 8' FlxM Avg. Flow Depth=1.75' Max Vel=15.26 fps Inflow=145.80 cfs 9.817 af
n=0.051 L=89.3' S=0.2452 '/' Capacity=112.51 cfs Outflow=145.79 cfs 9.817 af

Reach CH-N8: N Chnl 8 - 8' FlxM Avg. Flow Depth=1.55' Max Vel=14.28 fps Inflow=117.55 cfs 7.904 af
n=0.052 L=73.4' S=0.2466 '/' Capacity=110.65 cfs Outflow=117.54 cfs 7.904 af

Reach CH-N9: N Chnl 9 - 8' FlxM Avg. Flow Depth=1.46' Max Vel=13.14 fps Inflow=99.93 cfs 6.805 af
n=0.053 L=93.3' S=0.2304 '/' Capacity=104.95 cfs Outflow=99.93 cfs 6.805 af

Reach CH-NB6: N Chnl Bnch 6 Avg. Flow Depth=1.01' Max Vel=4.62 fps Inflow=51.74 cfs 1.644 af
n=0.030 L=793.3' S=0.0120 '/' Capacity=174.96 cfs Outflow=48.98 cfs 1.644 af

Reach CH-NW1: NW Chnl 1 - 16' FlxM Avg. Flow Depth=1.43' Max Vel=16.94 fps Inflow=319.70 cfs 22.956 af
n=0.057 L=26.7' S=0.3333 '/' Capacity=345.79 cfs Outflow=319.70 cfs 22.956 af

Reach CH-NW10: NW Chnl 10 - 5.5' FlxM Avg. Flow Depth=1.30' Max Vel=10.05 fps Inflow=33.35 cfs 1.988 af
n=0.063 L=130.0' S=0.3077 '/' Capacity=44.59 cfs Outflow=33.33 cfs 1.988 af

Reach CH-NW2: NW Chnl 2 - 16' FlxM Avg. Flow Depth=1.27' Max Vel=16.27 fps Inflow=268.63 cfs 19.333 af
n=0.054 L=120.0' S=0.3167 '/' Capacity=355.76 cfs Outflow=268.61 cfs 19.333 af

Reach CH-NW3: NW Chnl 3 - 12' FlxM Avg. Flow Depth=1.49' Max Vel=16.38 fps Inflow=224.99 cfs 16.028 af
n=0.056 L=120.0' S=0.3167 '/' Capacity=228.34 cfs Outflow=224.97 cfs 16.028 af

Reach CH-NW4: NW Chnl 4 - 12' FlxM Avg. Flow Depth=1.30' Max Vel=15.53 fps Inflow=183.57 cfs 13.149 af
n=0.055 L=120.0' S=0.3167 '/' Capacity=232.49 cfs Outflow=183.57 cfs 13.149 af

Reach CH-NW5: NW Chnl 5 - 12' FlxM Avg. Flow Depth=1.14' Max Vel=13.94 fps Inflow=141.74 cfs 10.460 af
n=0.057 L=120.0' S=0.3167 '/' Capacity=224.33 cfs Outflow=141.73 cfs 10.460 af

Reach CH-NW6: NW Chnl 6 - 8' FlxM Avg. Flow Depth=1.39' Max Vel=15.30 fps Inflow=108.90 cfs 8.421 af
n=0.052 L=120.0' S=0.3167 '/' Capacity=125.39 cfs Outflow=108.90 cfs 8.421 af

Reach CH-NW7: NW Chnl 7 - 8' FlxM Avg. Flow Depth=1.27' Max Vel=14.19 fps Inflow=90.40 cfs 7.321 af
n=0.055 L=44.0' S=0.3330 '/' Capacity=121.56 cfs Outflow=90.40 cfs 7.321 af

Reach CH-NW8: NW Chnl 8 - 8' FlxM Avg. Flow Depth=1.50' Max Vel=16.12 fps Inflow=126.52 cfs 7.627 af
n=0.051 L=83.0' S=0.3133 '/' Capacity=127.16 cfs Outflow=126.51 cfs 7.627 af

Reach CH-NW9: NW Chnl 9 - 8' FlxM Avg. Flow Depth=1.24' Max Vel=13.25 fps Inflow=82.28 cfs 4.934 af
n=0.056 L=130.0' S=0.3077 '/' Capacity=114.77 cfs Outflow=82.26 cfs 4.934 af

Reach CH-NWB6: NW Chnl Bnch 6 Avg. Flow Depth=0.28' Max Vel=2.29 fps Inflow=5.49 cfs 0.294 af
n=0.030 L=150.0' S=0.0133 '/' Capacity=184.62 cfs Outflow=5.48 cfs 0.294 af

Reach CH-PN1: Spillway 16' FlxM Avg. Flow Depth=0.83' Max Vel=13.08 fps Inflow=120.13 cfs 13.576 af
n=0.053 L=21.0' S=0.3333 '/' Capacity=531.43 cfs Outflow=120.12 cfs 13.576 af

Reach CH-PNW1: Spillway 16' FlxM Avg. Flow Depth=0.75' Max Vel=12.14 fps Inflow=100.99 cfs 8.740 af
n=0.053 L=25.0' S=0.3200 '/' Capacity=520.69 cfs Outflow=100.99 cfs 8.740 af

Reach CH-PW1: Spillway 16' FlxM Avg. Flow Depth=0.82' Max Vel=12.87 fps Inflow=117.97 cfs 12.194 af
n=0.053 L=30.0' S=0.3233 '/' Capacity=523.39 cfs Outflow=118.00 cfs 12.194 af

Reach CH-W1: W Chnl 1 - 16' FlxM Avg. Flow Depth=1.48' Max Vel=18.58 fps Inflow=364.14 cfs 27.254 af
n=0.053 L=27.0' S=0.3333 '/' Capacity=371.89 cfs Outflow=364.14 cfs 27.254 af

Reach CH-W2: W Chnl 2 - 16' FlxM Avg. Flow Depth=1.37' Max Vel=17.77 fps Inflow=319.23 cfs 23.844 af
n=0.053 L=120.0' S=0.3333 '/' Capacity=371.89 cfs Outflow=319.22 cfs 23.844 af

Reach CH-W3: W Chnl 3 - 16' FlxM Avg. Flow Depth=1.30' Max Vel=16.46 fps Inflow=279.07 cfs 20.884 af
n=0.054 L=120.5' S=0.3154 '/' Capacity=355.02 cfs Outflow=279.06 cfs 20.884 af

Reach CH-W4: W Chnl 4 - 12' FlxM Avg. Flow Depth=1.45' Max Vel=16.43 fps Inflow=218.42 cfs 15.825 af
n=0.055 L=120.0' S=0.3167 '/' Capacity=232.49 cfs Outflow=218.40 cfs 15.825 af

Reach CH-W5: W Chnl 5 - 12' FlxM Avg. Flow Depth=1.21' Max Vel=15.44 fps Inflow=166.79 cfs 11.487 af
n=0.053 L=120.0' S=0.3167 '/' Capacity=241.26 cfs Outflow=166.78 cfs 11.487 af

Reach CH-W6: W Chnl 6 - 12' FlxM Avg. Flow Depth=0.96' Max Vel=13.02 fps Inflow=109.48 cfs 7.175 af
n=0.054 L=130.0' S=0.3000 '/' Capacity=230.48 cfs Outflow=109.44 cfs 7.175 af

Reach CH-W7: W Chnl 7 -5.5' FlxM Avg. Flow Depth=1.67' Max Vel=11.66 fps Inflow=56.75 cfs 3.599 af
n=0.053 L=174.0' S=0.2299 '/' Capacity=45.82 cfs Outflow=56.71 cfs 3.599 af

Reach CH-W8: W Chnl 8 - 5.5' FlxM Avg. Flow Depth=0.97' Max Vel=8.31 fps Inflow=17.86 cfs 1.123 af
n=0.058 L=179.0' S=0.2402 '/' Capacity=42.80 cfs Outflow=17.84 cfs 1.123 af

Reach D-N6: N Ramp Ditch 6 Avg. Flow Depth=0.77' Max Vel=15.60 fps Inflow=51.84 cfs 1.644 af
n=0.016 L=436.5' S=0.0745 '/' Capacity=430.04 cfs Outflow=51.74 cfs 1.644 af

Reach D-NW7: NW Ramp Ditch 7 Avg. Flow Depth=0.69' Max Vel=13.22 fps Inflow=37.34 cfs 0.715 af
n=0.016 L=163.0' S=0.0601 '/' Capacity=386.44 cfs Outflow=37.32 cfs 0.715 af

Pond B-N1: N Bench 1 Peak Elev=729.91' Storage=6,057 cf Inflow=387.22 cfs 25.452 af
Outflow=386.10 cfs 25.452 af

Pond B-N10: N Bench 10 Peak Elev=960.35' Storage=664 cf Inflow=73.19 cfs 4.572 af
Outflow=73.13 cfs 4.572 af

Pond B-N11: N Bench 11 Peak Elev=983.07' Storage=1,179 cf Inflow=59.21 cfs 3.742 af
Outflow=58.99 cfs 3.742 af

Pond B-N12: N Bench 12 Peak Elev=1,001.98' Storage=573 cf Inflow=37.44 cfs 2.145 af
Outflow=37.35 cfs 2.145 af

Pond B-N13: N Bench 13 Peak Elev=1,022.14' Storage=378 cf Inflow=27.12 cfs 1.583 af
Outflow=27.09 cfs 1.583 af

Pond B-N14: N Bench 14 Peak Elev=1,043.42' Storage=206 cf Inflow=11.57 cfs 0.574 af
Outflow=11.55 cfs 0.574 af

Pond B-N15: N Bench 15 Peak Elev=1,059.04' Storage=135 cf Inflow=6.20 cfs 0.302 af
Outflow=6.19 cfs 0.302 af

Pond B-N2: N Bench 2 Peak Elev=766.29' Storage=3,654 cf Inflow=346.45 cfs 22.764 af
Primary=306.22 cfs 22.412 af Secondary=40.10 cfs 0.352 af Outflow=346.32 cfs 22.764 af

Pond B-N3: N Bench 3 Peak Elev=804.67' Storage=1,966 cf Inflow=304.02 cfs 19.958 af
Outflow=303.88 cfs 19.958 af

Pond B-N4A: N Bench 4A w/ 18" Clvt Peak Elev=844.43' Storage=2,229 cf Inflow=10.31 cfs 0.599 af
Primary=6.29 cfs 0.565 af Secondary=2.98 cfs 0.034 af Outflow=9.27 cfs 0.599 af

Pond B-N4B: N Bench 4B Peak Elev=841.30' Storage=2,295 cf Inflow=266.39 cfs 17.615 af
Outflow=266.14 cfs 17.615 af

Pond B-N5: N Bench 5 Peak Elev=862.45' Storage=2,526 cf Inflow=254.28 cfs 15.798 af
Outflow=254.03 cfs 15.798 af

Pond B-N6: N Bench 6 Peak Elev=880.00' Storage=1,834 cf Inflow=224.30 cfs 13.414 af
Outflow=224.13 cfs 13.414 af

Pond B-N7: N Bench 7 Peak Elev=902.11' Storage=602 cf Inflow=145.78 cfs 9.817 af
Outflow=145.80 cfs 9.817 af

Pond B-N8: N Bench 8 Peak Elev=919.82' Storage=1,544 cf Inflow=117.73 cfs 7.904 af
Outflow=117.55 cfs 7.904 af

Pond B-N9: N Bench 9 Peak Elev=941.06' Storage=1,163 cf Inflow=100.07 cfs 6.805 af
Outflow=99.93 cfs 6.805 af

Pond B-NW1: NW Bench 1 Peak Elev=729.58' Storage=2,837 cf Inflow=320.04 cfs 22.956 af
Outflow=319.70 cfs 22.956 af

Pond B-NW10: NW Bench 10 Peak Elev=1,038.35' Storage=413 cf Inflow=33.46 cfs 1.988 af
Outflow=33.35 cfs 1.988 af

Pond B-NW2: NW Bench 2 Peak Elev=767.93' Storage=4,049 cf Inflow=269.21 cfs 19.333 af
Outflow=268.63 cfs 19.333 af

Pond B-NW3: NW Bench 3 Peak Elev=805.62' Storage=2,951 cf Inflow=225.45 cfs 16.028 af
Outflow=224.99 cfs 16.028 af

Pond B-NW4: NW Bench 4 Peak Elev=843.22' Storage=1,836 cf Inflow=183.81 cfs 13.149 af
Outflow=183.57 cfs 13.149 af

Pond B-NW5: NW Bench 5 Peak Elev=881.57' Storage=2,810 cf Inflow=142.22 cfs 10.460 af
Outflow=141.74 cfs 10.460 af

Pond B-NW6: NW Bench 6 Peak Elev=919.17' Storage=1,720 cf Inflow=109.20 cfs 8.421 af
Outflow=108.90 cfs 8.421 af

Pond B-NW7A: NW Bench 7 w/ Box Cul Peak Elev=933.62' Storage=1,400 cf Inflow=127.79 cfs 8.035 af
Primary=90.40 cfs 7.321 af Secondary=37.34 cfs 0.715 af Outflow=127.74 cfs 8.035 af

Pond B-NW7B: N Bench 7B w/ 18" Clvt Peak Elev=922.28' Storage=1,867 cf Inflow=57.46 cfs 1.938 af
Primary=5.49 cfs 0.294 af Secondary=51.84 cfs 1.644 af Outflow=57.33 cfs 1.938 af

Pond B-NW8: NW Bench 8 Peak Elev=959.43' Storage=2,385 cf Inflow=127.20 cfs 7.627 af
Outflow=126.52 cfs 7.627 af

Pond B-NW9: NW Bench 9 Peak Elev=998.75' Storage=886 cf Inflow=82.53 cfs 4.934 af
Outflow=82.28 cfs 4.934 af

Pond B-W1: W Bench 1 Peak Elev=729.96' Storage=3,333 cf Inflow=364.45 cfs 27.254 af
Outflow=364.14 cfs 27.254 af

Pond B-W2: W Bench 2 Peak Elev=767.66' Storage=2,352 cf Inflow=319.46 cfs 23.844 af
Outflow=319.23 cfs 23.844 af

Pond B-W3: W Bench 3 Peak Elev=805.39' Storage=1,653 cf Inflow=279.16 cfs 20.884 af
Outflow=279.07 cfs 20.884 af

Pond B-W4: W Bench 4 Peak Elev=843.55' Storage=2,017 cf Inflow=218.68 cfs 15.825 af
Outflow=218.42 cfs 15.825 af

Pond B-W5: W Bench 5 Peak Elev=881.04' Storage=1,043 cf Inflow=166.90 cfs 11.487 af
Outflow=166.79 cfs 11.487 af

Pond B-W6: W Bench 6 Peak Elev=919.39' Storage=514 cf Inflow=109.51 cfs 7.175 af
Outflow=109.48 cfs 7.175 af

Pond B-W7: W Bench 7 Peak Elev=960.02' Storage=1,293 cf Inflow=56.89 cfs 3.599 af
Outflow=56.75 cfs 3.599 af

Pond B-W8: W Bench 8 Peak Elev=1,001.75' Storage=695 cf Inflow=17.96 cfs 1.123 af
Outflow=17.86 cfs 1.123 af

Pond CUL-N1: N Box Culvert Peak Elev=723.10' Inflow=386.09 cfs 25.452 af
120.0" x 48.0" Box Culvert n=0.012 L=50.0' S=0.0100 '/' Outflow=386.09 cfs 25.452 af

Pond CUL-N2: N Ramp Box Culvert Peak Elev=835.52' Inflow=266.13 cfs 17.615 af
96.0" x 48.0" Box Culvert n=0.010 L=35.0' S=0.0049 '/' Outflow=266.13 cfs 17.615 af

Pond CUL-NW1: NW Box Culvert Peak Elev=722.12' Inflow=319.70 cfs 22.956 af
120.0" x 48.0" Box Culvert n=0.012 L=40.0' S=0.0100 '/' Outflow=319.70 cfs 22.956 af

Pond CUL-W1: W Box Culvert Peak Elev=725.54' Inflow=364.14 cfs 27.254 af
120.0" x 48.0" Box Culvert n=0.012 L=40.0' S=0.0100 '/' Outflow=364.14 cfs 27.254 af

Pond P-N1: N Pond Peak Elev=709.33' Storage=633,940 cf Inflow=427.54 cfs 29.966 af
Primary=5.72 cfs 13.201 af Secondary=120.13 cfs 13.576 af Tertiary=232.29 cfs 2.854 af Outflow=358.14 cfs 29.631 af

Pond P-NW1: NW Pond Peak Elev=710.02' Storage=578,420 cf Inflow=323.52 cfs 24.703 af
Primary=7.65 cfs 15.838 af Secondary=100.99 cfs 8.740 af Tertiary=5.46 cfs 0.020 af Outflow=114.10 cfs 24.598 af

Pond P-W1: W Pond Peak Elev=721.99' Storage=461,481 cf Inflow=366.74 cfs 28.484 af
Primary=6.88 cfs 12.734 af Secondary=117.97 cfs 12.194 af Tertiary=233.60 cfs 3.464 af Outflow=358.45 cfs 28.393 af

Total Runoff Area = 142.727 ac Runoff Volume = 83.153 af Average Runoff Depth = 6.99"
98.95% Pervious = 141.230 ac 1.05% Impervious = 1.497 ac

Summary for Subcatchment 1S: N EX FC 1

Runoff = 39.11 cfs @ 12.06 hrs, Volume= 2.468 af, Depth= 6.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 500 year - 24 hour Rainfall=10.50"

Area (sf)	CN	Description
189,400	71	Meadow, non-grazed, HSG C
189,400		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	120	0.3300	0.35		**Sheet Flow, 3:1 Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
1.8	230	0.0200	2.12		**Shallow Concentrated Flow, Ditch Flow** Grassed Waterway Kv= 15.0 fps
0.3	140	0.2000	6.71		**Shallow Concentrated Flow, Concentrated Flow** Grassed Waterway Kv= 15.0 fps
6.3	570	0.0100	1.50		**Shallow Concentrated Flow, Ditch Flow** Grassed Waterway Kv= 15.0 fps
14.1	1,060	Total			

Summary for Subcatchment FC-N1: N FC 1

Runoff = 42.40 cfs @ 12.06 hrs, Volume= 2.688 af, Depth= 6.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 500 year - 24 hour Rainfall=10.50"

Area (sf)	CN	Description
206,346	71	Meadow, non-grazed, HSG C
206,346		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	120	0.3300	0.35		**Sheet Flow, Slope Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
8.6	843	0.0120	1.64		**Shallow Concentrated Flow, Ditch Flow** Grassed Waterway Kv= 15.0 fps
14.3	963	Total			

Summary for Subcatchment FC-N10: N FC 10

Runoff = 14.63 cfs @ 12.02 hrs, Volume= 0.830 af, Depth= 6.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 500 year - 24 hour Rainfall=10.50"

Area (sf)	CN	Description
63,734	71	Meadow, non-grazed, HSG C
63,734		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	120	0.3300	0.35		**Sheet Flow, Slope Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
5.2	508	0.0120	1.64		**Shallow Concentrated Flow, Ditch Flow** Grassed Waterway Kv= 15.0 fps
10.9	628	Total			

Summary for Subcatchment FC-N11: N FC 11

Runoff = 23.67 cfs @ 12.08 hrs, Volume= 1.597 af, Depth= 6.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 500 year - 24 hour Rainfall=10.50"

Area (sf)	CN	Description
122,568	71	Meadow, non-grazed, HSG C
122,568		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.5	114	0.3300	0.35		**Sheet Flow, Slope Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
10.8	1,108	0.0130	1.71		**Shallow Concentrated Flow, Ditch Flow** Grassed Waterway Kv= 15.0 fps
16.3	1,222	Total			

Summary for Subcatchment FC-N12: N FC 12

Runoff = 10.42 cfs @ 12.01 hrs, Volume= 0.562 af, Depth= 6.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 500 year - 24 hour Rainfall=10.50"

Area (sf)	CN	Description
43,115	71	Meadow, non-grazed, HSG C
43,115		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	120	0.3300	0.35		**Sheet Flow, Slope Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
3.7	361	0.0120	1.64		**Shallow Concentrated Flow, Ditch Flow** Grassed Waterway Kv= 15.0 fps
9.4	481	Total			

Summary for Subcatchment FC-N13: N FC 13

Runoff = 16.69 cfs @ 12.05 hrs, Volume= 1.009 af, Depth= 6.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 500 year - 24 hour Rainfall=10.50"

Area (sf)	CN	Description
77,429	71	Meadow, non-grazed, HSG C
77,429		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.5	116	0.3330	0.35		**Sheet Flow, SlopeSheet Flow** Grass: Dense n= 0.240 P2= 2.83"
7.3	747	0.0130	1.71		**Shallow Concentrated Flow, Ditch Flow** Grassed Waterway Kv= 15.0 fps
12.8	863	Total			

Summary for Subcatchment FC-N14: N FC 14

Runoff = 5.39 cfs @ 11.99 hrs, Volume= 0.272 af, Depth= 6.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 500 year - 24 hour Rainfall=10.50"

Area (sf)	CN	Description
20,870	71	Meadow, non-grazed, HSG C
20,870		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.3	108	0.3300	0.34		**Sheet Flow, Slope Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
2.2	213	0.0115	1.61		**Shallow Concentrated Flow, Ditch Flow** Grassed Waterway Kv= 15.0 fps
7.5	321	Total			

Summary for Subcatchment FC-N15: N FC 15

Runoff = 6.20 cfs @ 11.98 hrs, Volume= 0.302 af, Depth= 6.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 500 year - 24 hour Rainfall=10.50"

Area (sf)	CN	Description
23,198	71	Meadow, non-grazed, HSG C
23,198		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.6	44	0.3300	0.29		**Sheet Flow, Slope Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
3.9	409	0.0137	1.76		**Shallow Concentrated Flow, Ditch Flow** Grassed Waterway Kv= 15.0 fps
6.5	453	Total			

Summary for Subcatchment FC-N2: N FC 2

Runoff = 44.24 cfs @ 12.06 hrs, Volume= 2.805 af, Depth= 6.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 500 year - 24 hour Rainfall=10.50"

Area (sf)	CN	Description
215,322	71	Meadow, non-grazed, HSG C
215,322		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	120	0.3300	0.35		**Sheet Flow, Slope Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
8.6	865	0.0125	1.68		**Shallow Concentrated Flow, Ditch Flow** Grassed Waterway Kv= 15.0 fps
14.3	985	Total			

Summary for Subcatchment FC-N3: N FC 3

Runoff = 36.01 cfs @ 12.06 hrs, Volume= 2.309 af, Depth= 6.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 500 year - 24 hour Rainfall=10.50"

Area (sf)	CN	Description
177,256	71	Meadow, non-grazed, HSG C
177,256		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.0	60	0.0500	0.14		**Sheet Flow, Top Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
7.6	810	0.0140	1.77		**Shallow Concentrated Flow, Ditch Flow** Grassed Waterway Kv= 15.0 fps
14.6	870	Total			

Summary for Subcatchment FC-N4A: N FC 4

Runoff = 10.31 cfs @ 12.03 hrs, Volume= 0.599 af, Depth= 6.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 500 year - 24 hour Rainfall=10.50"

Area (sf)	CN	Description
45,986	71	Meadow, non-grazed, HSG C
45,986		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	120	0.3300	0.35		**Sheet Flow, Slope Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
5.9	586	0.0120	1.64		**Shallow Concentrated Flow, Ditch Flow** Grassed Waterway Kv= 15.0 fps
11.6	706	Total			

Summary for Subcatchment FC-N4B: N FC 4

Runoff = 26.71 cfs @ 11.96 hrs, Volume= 1.252 af, Depth= 7.34"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 500 year - 24 hour Rainfall=10.50"

Area (sf)	CN	Description
75,024	71	Meadow, non-grazed, HSG C
14,070	98	Paved parking, HSG B
89,094	75	Weighted Average
75,024		84.21% Pervious Area
14,070		15.79% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.4	20	0.3300	0.24		**Sheet Flow, Slope Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
1.6	540	0.0800	5.74		**Shallow Concentrated Flow, Ditch Flow** Paved Kv= 20.3 fps
1.9	192	0.0120	1.64		**Shallow Concentrated Flow, Ditch Flow** Grassed Waterway Kv= 15.0 fps
4.9	752	Total			

Summary for Subcatchment FC-N5: N FC 5

Runoff = 31.39 cfs @ 12.12 hrs, Volume= 2.384 af, Depth= 6.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 500 year - 24 hour Rainfall=10.50"

Area (sf)	CN	Description
183,015	71	Meadow, non-grazed, HSG C
183,015		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	120	0.3300	0.35		**Sheet Flow, Slope Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
14.6	1,471	0.0125	1.68		**Shallow Concentrated Flow, Ditch Flow** Grassed Waterway Kv= 15.0 fps
20.3	1,591	Total			

Summary for Subcatchment FC-N6: N FC 6

Runoff = 31.70 cfs @ 12.05 hrs, Volume= 1.952 af, Depth= 7.08"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 500 year - 24 hour Rainfall=10.50"

Area (sf)	CN	Description
134,846	71	Meadow, non-grazed, HSG C
9,345	98	Paved parking, HSG B
144,191	73	Weighted Average
134,846		93.52% Pervious Area
9,345		6.48% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	120	0.3300	0.35		**Sheet Flow, Slope Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
7.5	755	0.0125	1.68		**Shallow Concentrated Flow, Ditch Flow** Grassed Waterway Kv= 15.0 fps
13.2	875	Total			

Summary for Subcatchment FC-N7: N FC 7

Runoff = 28.36 cfs @ 12.08 hrs, Volume= 1.913 af, Depth= 6.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 500 year - 24 hour Rainfall=10.50"

Area (sf)	CN	Description
146,829	71	Meadow, non-grazed, HSG C
146,829		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	120	0.3300	0.35		**Sheet Flow, Slope Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
10.6	1,089	0.0130	1.71		**Shallow Concentrated Flow, Ditch Flow** Grassed Waterway Kv= 15.0 fps
16.3	1,209	Total			

Summary for Subcatchment FC-N8: N FC 8

Runoff = 18.49 cfs @ 12.04 hrs, Volume= 1.099 af, Depth= 6.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 500 year - 24 hour Rainfall=10.50"

Area (sf)	CN	Description
84,345	71	Meadow, non-grazed, HSG C
84,345		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	120	0.3300	0.35		**Sheet Flow, Slope Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
6.6	655	0.0120	1.64		**Shallow Concentrated Flow, Ditch Flow** Grassed Waterway Kv= 15.0 fps
12.3	775	Total			

Summary for Subcatchment FC-N9: N FC 9

Runoff = 29.88 cfs @ 12.12 hrs, Volume= 2.233 af, Depth= 6.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 500 year - 24 hour Rainfall=10.50"

Area (sf)	CN	Description
171,400	71	Meadow, non-grazed, HSG C
171,400		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.5	114	0.3300	0.35		**Sheet Flow, Slope Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
14.3	1,466	0.0130	1.71		**Shallow Concentrated Flow, Ditch Flow** Grassed Waterway Kv= 15.0 fps
19.8	1,580	Total			

Summary for Subcatchment FC-NW1: NW FC 1

Runoff = 51.46 cfs @ 12.10 hrs, Volume= 3.623 af, Depth= 6.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 500 year - 24 hour Rainfall=10.50"

Area (sf)	CN	Description
278,073	71	Meadow, non-grazed, HSG C
278,073		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	120	0.3300	0.35		**Sheet Flow, Slope Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
12.0	1,207	0.0125	1.68		**Shallow Concentrated Flow, Ditch Flow** Grassed Waterway Kv= 15.0 fps
17.7	1,327	Total			

Summary for Subcatchment FC-NW10: NW FC 10

Runoff = 33.46 cfs @ 12.04 hrs, Volume= 1.988 af, Depth= 6.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 500 year - 24 hour Rainfall=10.50"

Area (sf)	CN	Description
152,624	71	Meadow, non-grazed, HSG C
152,624		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	120	0.3300	0.35		**Sheet Flow, Slope Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
6.6	652	0.0120	1.64		**Shallow Concentrated Flow, Ditch Flow** Grassed Waterway Kv= 15.0 fps
12.3	772	Total			

Summary for Subcatchment FC-NW2: NW FC 2

Runoff = 44.88 cfs @ 12.12 hrs, Volume= 3.305 af, Depth= 6.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 500 year - 24 hour Rainfall=10.50"

Area (sf)	CN	Description
253,669	71	Meadow, non-grazed, HSG C
253,669		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	120	0.3300	0.35		**Sheet Flow, Slope Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
6.8	545	0.0080	1.34		**Shallow Concentrated Flow, Ditch Flow** Grassed Waterway Kv= 15.0 fps
6.7	780	0.0166	1.93		**Shallow Concentrated Flow, Ditch Flow** Grassed Waterway Kv= 15.0 fps
19.2	1,445	Total			

Summary for Subcatchment FC-NW3: NW FC 3

Runoff = 41.98 cfs @ 12.08 hrs, Volume= 2.878 af, Depth= 6.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 500 year - 24 hour Rainfall=10.50"

Area (sf)	CN	Description
220,927	71	Meadow, non-grazed, HSG C
220,927		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	120	0.3300	0.35		**Sheet Flow, Slope Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
5.6	502	0.0100	1.50		**Shallow Concentrated Flow, 1% Shallow Flow** Grassed Waterway Kv= 15.0 fps
5.5	643	0.0170	1.96		**Shallow Concentrated Flow, Ditch Flow** Grassed Waterway Kv= 15.0 fps
16.8	1,265	Total			

Summary for Subcatchment FC-NW4: NW FC 4

Runoff = 42.19 cfs @ 12.06 hrs, Volume= 2.689 af, Depth= 6.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 500 year - 24 hour Rainfall=10.50"

Area (sf)	CN	Description
206,398	71	Meadow, non-grazed, HSG C
206,398		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	120	0.3300	0.35		**Sheet Flow, Slope Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
3.4	440	0.0210	2.17		**Shallow Concentrated Flow, 2% Shallow Flow** Grassed Waterway Kv= 15.0 fps
5.3	529	0.0125	1.68		**Shallow Concentrated Flow, Ditch Flow** Grassed Waterway Kv= 15.0 fps
14.4	1,089	Total			

Summary for Subcatchment FC-NW5: NW FC 5

Runoff = 34.09 cfs @ 12.04 hrs, Volume= 2.039 af, Depth= 6.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 500 year - 24 hour Rainfall=10.50"

Area (sf)	CN	Description
156,508	71	Meadow, non-grazed, HSG C
156,508		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	120	0.3300	0.35		**Sheet Flow, Slope Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
2.3	362	0.0300	2.60		**Shallow Concentrated Flow, 3% Shallow Flow** Grassed Waterway Kv= 15.0 fps
4.5	442	0.0120	1.64		**Shallow Concentrated Flow, Ditch Flow** Grassed Waterway Kv= 15.0 fps
12.5	924	Total			

Summary for Subcatchment FC-NW6: NW FC 6

Runoff = 13.60 cfs @ 12.04 hrs, Volume= 0.807 af, Depth= 6.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 500 year - 24 hour Rainfall=10.50"

Area (sf)	CN	Description
61,906	71	Meadow, non-grazed, HSG C
61,906		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	120	0.3300	0.35		**Sheet Flow, Slope Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
6.5	643	0.0120	1.64		**Shallow Concentrated Flow, Ditch Flow** Grassed Waterway Kv= 15.0 fps
12.2	763	Total			

Summary for Subcatchment FC-NW7A: NW FC 7A

Runoff = 9.29 cfs @ 11.93 hrs, Volume= 0.408 af, Depth= 8.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 500 year - 24 hour Rainfall=10.50"

Area (sf)	CN	Description
17,438	71	Meadow, non-grazed, HSG C
9,240	98	Paved parking, HSG B
26,678	80	Weighted Average
17,438		65.36% Pervious Area
9,240		34.64% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.4	20	0.3300	0.24		**Sheet Flow, Slope Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
0.8	274	0.0800	5.74		**Shallow Concentrated Flow, Ditch Flow** Paved Kv= 20.3 fps
2.2	294	Total			

Summary for Subcatchment FC-NW7B: NW FC 7B

Runoff = 20.57 cfs @ 12.04 hrs, Volume= 1.223 af, Depth= 6.94"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 500 year - 24 hour Rainfall=10.50"

Area (sf)	CN	Description
87,786	71	Meadow, non-grazed, HSG C
4,305	98	Paved parking, HSG B
92,091	72	Weighted Average
87,786		95.33% Pervious Area
4,305		4.67% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	120	0.3300	0.35		**Sheet Flow, Slope Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
6.5	645	0.0120	1.64		**Shallow Concentrated Flow, Ditch Flow** Grassed Waterway Kv= 15.0 fps
12.2	765	Total			

Summary for Subcatchment FC-NW8: NW FC 8

Runoff = 45.16 cfs @ 12.04 hrs, Volume= 2.693 af, Depth= 7.08"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 500 year - 24 hour Rainfall=10.50"

Area (sf)	CN	Description
186,810	71	Meadow, non-grazed, HSG C
12,075	98	Paved parking, HSG B
198,885	73	Weighted Average
186,810		93.93% Pervious Area
12,075		6.07% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	120	0.3300	0.35		**Sheet Flow, Slope Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
6.5	645	0.0120	1.64		**Shallow Concentrated Flow, Ditch Flow** Grassed Waterway Kv= 15.0 fps
12.2	765	Total			

Summary for Subcatchment FC-NW9: NW FC 9

Runoff = 49.32 cfs @ 12.04 hrs, Volume= 2.946 af, Depth= 7.08"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 500 year - 24 hour Rainfall=10.50"

Area (sf)	CN	Description
201,365	71	Meadow, non-grazed, HSG C
16,170	98	Paved parking, HSG B
217,535	73	Weighted Average
201,365		92.57% Pervious Area
16,170		7.43% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	120	0.3300	0.35		**Sheet Flow, Slope Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
6.6	647	0.0120	1.64		**Shallow Concentrated Flow, Ditch Flow** Grassed Waterway Kv= 15.0 fps
12.3	767	Total			

Summary for Subcatchment FC-W1: W FC 1

Runoff = 45.27 cfs @ 12.12 hrs, Volume= 3.410 af, Depth= 6.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 500 year - 24 hour Rainfall=10.50"

Area (sf)	CN	Description
261,734	71	Meadow, non-grazed, HSG C
261,734		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	120	0.3300	0.35		**Sheet Flow, Slope Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
14.3	1,469	0.0130	1.71		**Shallow Concentrated Flow, Ditch Flow** Grassed Waterway Kv= 15.0 fps
20.0	1,589	Total			

Summary for Subcatchment FC-W2: W FC 2

Runoff = 40.56 cfs @ 12.11 hrs, Volume= 2.960 af, Depth= 6.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 500 year - 24 hour Rainfall=10.50"

Area (sf)	CN	Description
227,154	71	Meadow, non-grazed, HSG C
227,154		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	120	0.3300	0.35		**Sheet Flow, Slope Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
13.2	1,348	0.0129	1.70		**Shallow Concentrated Flow, Ditch Flow** Grassed Waterway Kv= 15.0 fps
18.9	1,468	Total			

Summary for Subcatchment FC-W3: W FC 3

Runoff = 62.42 cfs @ 12.15 hrs, Volume= 5.059 af, Depth= 6.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 500 year - 24 hour Rainfall=10.50"

Area (sf)	CN	Description
388,269	71	Meadow, non-grazed, HSG C
388,269		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	120	0.3300	0.35		**Sheet Flow, Slope Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
17.0	1,745	0.0130	1.71		**Shallow Concentrated Flow, Ditch Flow** Grassed Waterway Kv= 15.0 fps
22.7	1,865	Total			

Summary for Subcatchment FC-W4: W FC 4

Runoff = 54.29 cfs @ 12.15 hrs, Volume= 4.339 af, Depth= 6.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 500 year - 24 hour Rainfall=10.50"

Area (sf)	CN	Description
333,000	71	Meadow, non-grazed, HSG C
333,000		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	120	0.3300	0.35		**Sheet Flow, Slope Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
16.5	1,697	0.0130	1.71		**Shallow Concentrated Flow, Ditch Flow** Grassed Waterway Kv= 15.0 fps
22.2	1,817	Total			

Summary for Subcatchment FC-W5: W FC 5

Runoff = 58.55 cfs @ 12.12 hrs, Volume= 4.312 af, Depth= 6.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 500 year - 24 hour Rainfall=10.50"

Area (sf)	CN	Description
330,928	71	Meadow, non-grazed, HSG C
330,928		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	120	0.3300	0.35		**Sheet Flow, Slope Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
0.6	167	0.1000	4.74		**Shallow Concentrated Flow, 10% Shallow Flow** Grassed Waterway Kv= 15.0 fps
12.9	1,325	0.0130	1.71		**Shallow Concentrated Flow, Ditch Flow** Grassed Waterway Kv= 15.0 fps
19.2	1,612	Total			

Summary for Subcatchment FC-W6: W FC 6

Runoff = 52.85 cfs @ 12.08 hrs, Volume= 3.577 af, Depth= 6.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 500 year - 24 hour Rainfall=10.50"

Area (sf)	CN	Description
274,510	71	Meadow, non-grazed, HSG C
274,510		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	120	0.3300	0.35		**Sheet Flow, Slope Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
0.9	266	0.1000	4.74		**Shallow Concentrated Flow, 10% Shallow Flow** Grassed Waterway Kv= 15.0 fps
9.8	985	0.0125	1.68		**Shallow Concentrated Flow, Ditch Flow** Grassed Waterway Kv= 15.0 fps
16.4	1,371	Total			

Summary for Subcatchment FC-W7: W FC 7

Runoff = 39.10 cfs @ 12.06 hrs, Volume= 2.476 af, Depth= 6.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 500 year - 24 hour Rainfall=10.50"

Area (sf)	CN	Description
190,046	71	Meadow, non-grazed, HSG C
190,046		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	120	0.3300	0.35		**Sheet Flow, Slope Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
0.8	233	0.1000	4.74		**Shallow Concentrated Flow, 10% Shallow Flow** Grassed Waterway Kv= 15.0 fps
7.7	840	0.0146	1.81		**Shallow Concentrated Flow, Ditch Flow** Grassed Waterway Kv= 15.0 fps
14.2	1,193	Total			

Summary for Subcatchment FC-W8: W FC 8

Runoff = 17.96 cfs @ 12.06 hrs, Volume= 1.123 af, Depth= 6.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 500 year - 24 hour Rainfall=10.50"

Area (sf)	CN	Description
86,180	71	Meadow, non-grazed, HSG C
86,180		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	120	0.3300	0.35		**Sheet Flow, Slope Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
0.7	211	0.1000	4.74		**Shallow Concentrated Flow, 10% Shallow Flow** Grassed Waterway Kv= 15.0 fps
7.4	670	0.0100	1.50		**Shallow Concentrated Flow, Ditch Flow** Grassed Waterway Kv= 15.0 fps
13.8	1,001	Total			

Summary for Subcatchment PD-N1: N Pond Direct

[46] Hint: Tc=0 (Instant runoff peak depends on dt)

Runoff = 42.71 cfs @ 11.90 hrs, Volume= 2.046 af, Depth=10.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 500 year - 24 hour Rainfall=10.50"

Area (sf)	CN	Description
104,271	98	Water Surface, 0% imp, HSG B
104,271		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0					**Direct Entry, Direct Entry**

Summary for Subcatchment PD-NW1: NW Pond Direct

[46] Hint: Tc=0 (Instant runoff peak depends on dt)

Runoff = 36.46 cfs @ 11.90 hrs, Volume= 1.747 af, Depth=10.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 500 year - 24 hour Rainfall=10.50"

Area (sf)	CN	Description
89,015	98	Water Surface, 0% imp, HSG B
89,015		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0					**Direct Entry, Direct Entry**

Summary for Subcatchment PD-W1: W Pond Direct

[46] Hint: Tc=0 (Instant runoff peak depends on dt)

Runoff = 25.68 cfs @ 11.90 hrs, Volume= 1.231 af, Depth=10.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 500 year - 24 hour Rainfall=10.50"

Area (sf)	CN	Description
62,704	98	Water Surface, 0% imp, HSG B
62,704		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0					**Direct Entry, Direct Entry**

Summary for Reach CH-N1: N Chnl 1 - 16' FlxM

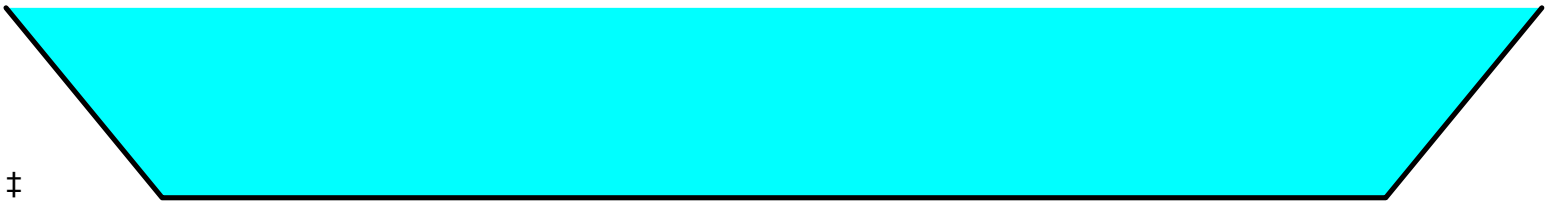
[91] Warning: Storage range exceeded by 0.06'
[55] Hint: Peak inflow is 106% of Manning's capacity

Inflow Area = 41.660 ac, 1.29% Impervious, Inflow Depth = 7.33" for 500 year - 24 hour event
Inflow = 386.10 cfs @ 12.10 hrs, Volume= 25.452 af
Outflow = 386.09 cfs @ 12.10 hrs, Volume= 25.452 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 18.63 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 3.84 fps, Avg. Travel Time= 0.1 min

Peak Storage= 597 cf @ 12.10 hrs
Average Depth at Peak Storage= 1.56'
Bank-Full Depth= 1.50' Flow Area= 19.9 sf, Capacity= 362.90 cfs

11.75' x 1.50' deep channel, n= 0.052
Side Slope Z-value= 1.0 '/' Top Width= 14.75'
Length= 28.8' Slope= 0.3056 '/'
Inlet Invert= 725.80', Outlet Invert= 717.00'



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Summary for Reach CH-N10: N Chnl 10 - 8' FlxM

Inflow Area = 8.056 ac, 0.00% Impervious, Inflow Depth = 6.81" for 500 year - 24 hour event
Inflow = 73.13 cfs @ 12.05 hrs, Volume= 4.572 af
Outflow = 73.12 cfs @ 12.05 hrs, Volume= 4.572 af, Atten= 0%, Lag= 0.1 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 11.56 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 2.98 fps, Avg. Travel Time= 0.5 min

Peak Storage= 542 cf @ 12.05 hrs
Average Depth at Peak Storage= 1.26'
Bank-Full Depth= 1.50' Flow Area= 7.9 sf, Capacity= 99.33 cfs

3.75' x 1.50' deep channel, n= 0.056
Side Slope Z-value= 1.0 '/' Top Width= 6.75'
Length= 85.7' Slope= 0.2305 '/'
Inlet Invert= 957.75', Outlet Invert= 938.00'

Summary for Reach CH-N11: N Chnl 11 - 5.5' FlxM

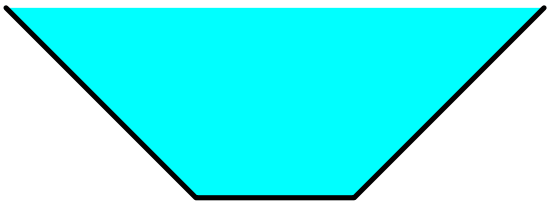
[91] Warning: Storage range exceeded by 0.21'
[55] Hint: Peak inflow is 129% of Manning's capacity

Inflow Area = 6.593 ac, 0.00% Impervious, Inflow Depth = 6.81" for 500 year - 24 hour event
Inflow = 58.99 cfs @ 12.05 hrs, Volume= 3.742 af
Outflow = 58.98 cfs @ 12.05 hrs, Volume= 3.742 af, Atten= 0%, Lag= 0.1 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 11.77 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 3.82 fps, Avg. Travel Time= 0.4 min

Peak Storage= 483 cf @ 12.05 hrs
Average Depth at Peak Storage= 1.71'
Bank-Full Depth= 1.50' Flow Area= 4.1 sf, Capacity= 45.88 cfs

1.25' x 1.50' deep channel, n= 0.053
Side Slope Z-value= 1.0 '/' Top Width= 4.25'
Length= 96.5' Slope= 0.2306 '/'
Inlet Invert= 980.00', Outlet Invert= 957.75'



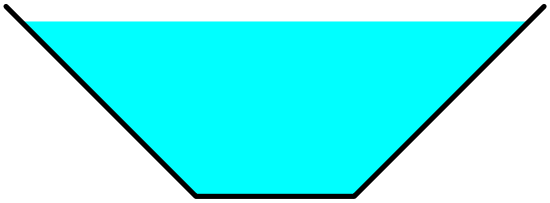
Summary for Reach CH-N12: N Chnl 12 - 5.5' FlxM

Inflow Area = 3.779 ac, 0.00% Impervious, Inflow Depth = 6.81" for 500 year - 24 hour event
Inflow = 37.35 cfs @ 12.02 hrs, Volume= 2.145 af
Outflow = 37.34 cfs @ 12.02 hrs, Volume= 2.145 af, Atten= 0%, Lag= 0.1 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 10.27 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 3.14 fps, Avg. Travel Time= 0.4 min

Peak Storage= 307 cf @ 12.02 hrs
Average Depth at Peak Storage= 1.38'
Bank-Full Depth= 1.50' Flow Area= 4.1 sf, Capacity= 44.23 cfs

1.25' x 1.50' deep channel, n= 0.055
Side Slope Z-value= 1.0 '/' Top Width= 4.25'
Length= 84.5' Slope= 0.2308 '/'
Inlet Invert= 999.50', Outlet Invert= 980.00'



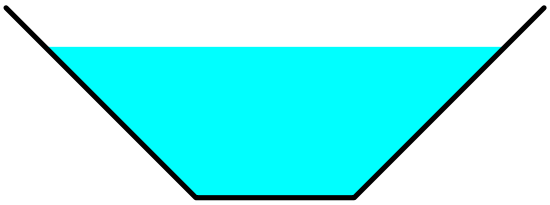
Summary for Reach CH-N13: N Chnl 13 - 5.5' FlxM

Inflow Area = 2.789 ac, 0.00% Impervious, Inflow Depth = 6.81" for 500 year - 24 hour event
Inflow = 27.09 cfs @ 12.02 hrs, Volume= 1.583 af
Outflow = 27.08 cfs @ 12.02 hrs, Volume= 1.583 af, Atten= 0%, Lag= 0.1 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 9.31 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 2.83 fps, Avg. Travel Time= 0.5 min

Peak Storage= 252 cf @ 12.02 hrs
Average Depth at Peak Storage= 1.19'
Bank-Full Depth= 1.50' Flow Area= 4.1 sf, Capacity= 43.20 cfs

1.25' x 1.50' deep channel, n= 0.057
Side Slope Z-value= 1.0 '/' Top Width= 4.25'
Length= 86.7' Slope= 0.2364 '/'
Inlet Invert= 1,020.00', Outlet Invert= 999.50'



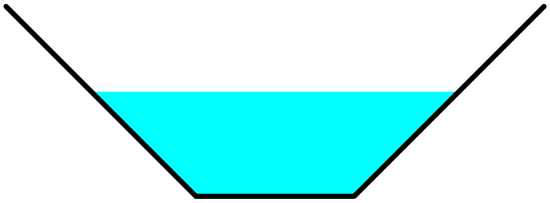
Summary for Reach CH-N14: N Chnl 14 - 5.5' FlxM

Inflow Area = 1.012 ac, 0.00% Impervious, Inflow Depth = 6.81" for 500 year - 24 hour event
Inflow = 11.55 cfs @ 11.99 hrs, Volume= 0.574 af
Outflow = 11.55 cfs @ 11.99 hrs, Volume= 0.574 af, Atten= 0%, Lag= 0.2 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 6.73 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 1.84 fps, Avg. Travel Time= 0.8 min

Peak Storage= 158 cf @ 11.99 hrs
Average Depth at Peak Storage= 0.83'
Bank-Full Depth= 1.50' Flow Area= 4.1 sf, Capacity= 37.48 cfs

1.25' x 1.50' deep channel, n= 0.066
Side Slope Z-value= 1.0 '/' Top Width= 4.25'
Length= 92.2' Slope= 0.2386 '/'
Inlet Invert= 1,042.00', Outlet Invert= 1,020.00'



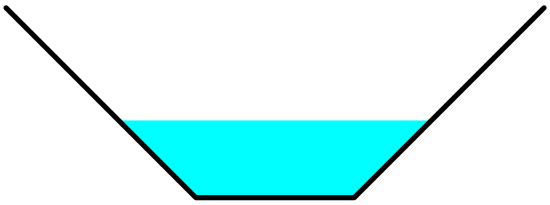
Summary for Reach CH-N15: N Chnl 15 - 5.5' FlxM

Inflow Area = 0.533 ac, 0.00% Impervious, Inflow Depth = 6.81" for 500 year - 24 hour event
Inflow = 6.19 cfs @ 11.98 hrs, Volume= 0.302 af
Outflow = 6.19 cfs @ 11.98 hrs, Volume= 0.302 af, Atten= 0%, Lag= 0.1 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 5.45 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 1.43 fps, Avg. Travel Time= 0.7 min

Peak Storage= 68 cf @ 11.98 hrs
Average Depth at Peak Storage= 0.61'
Bank-Full Depth= 1.50' Flow Area= 4.1 sf, Capacity= 35.34 cfs

1.25' x 1.50' deep channel, n= 0.074
Side Slope Z-value= 1.0 '/' Top Width= 4.25'
Length= 60.0' Slope= 0.2667 '/'
Inlet Invert= 1,058.00', Outlet Invert= 1,042.00'



Summary for Reach CH-N2: N Chnl 2 - 16' FlxM

Inflow Area = 36.923 ac, 1.46% Impervious, Inflow Depth = 7.28" for 500 year - 24 hour event
Inflow = 306.22 cfs @ 12.09 hrs, Volume= 22.412 af
Outflow = 306.21 cfs @ 12.09 hrs, Volume= 22.412 af, Atten= 0%, Lag= 0.1 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 16.99 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 3.63 fps, Avg. Travel Time= 0.5 min

Peak Storage= 2,146 cf @ 12.09 hrs
Average Depth at Peak Storage= 1.37'
Bank-Full Depth= 1.50' Flow Area= 19.9 sf, Capacity= 355.12 cfs

11.75' x 1.50' deep channel, n= 0.053
Side Slope Z-value= 1.0 '/' Top Width= 14.75'
Length= 119.1' Slope= 0.3039 '/'
Inlet Invert= 762.00', Outlet Invert= 725.80'

‡

Summary for Reach CH-N3: N Chnl 3 - 16' FlxM

Inflow Area = 31.980 ac, 1.68% Impervious, Inflow Depth = 7.49" for 500 year - 24 hour event
Inflow = 303.88 cfs @ 12.09 hrs, Volume= 19.958 af
Outflow = 303.86 cfs @ 12.09 hrs, Volume= 19.958 af, Atten= 0%, Lag= 0.1 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 16.62 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 3.40 fps, Avg. Travel Time= 0.6 min

Peak Storage= 2,245 cf @ 12.09 hrs
Average Depth at Peak Storage= 1.39'
Bank-Full Depth= 1.50' Flow Area= 19.9 sf, Capacity= 344.83 cfs

11.75' x 1.50' deep channel, n= 0.055
Side Slope Z-value= 1.0 '/' Top Width= 14.75'
Length= 122.8' Slope= 0.3086 '/'
Inlet Invert= 801.10', Outlet Invert= 763.20'

‡

Summary for Reach CH-N4A: N Chnl 4 - 16' FlxM

Inflow Area = 27.910 ac, 1.93% Impervious, Inflow Depth = 7.57" for 500 year - 24 hour event
Inflow = 266.14 cfs @ 12.09 hrs, Volume= 17.615 af
Outflow = 266.13 cfs @ 12.09 hrs, Volume= 17.615 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 15.87 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 3.25 fps, Avg. Travel Time= 0.1 min

Peak Storage= 406 cf @ 12.09 hrs
Average Depth at Peak Storage= 1.29'
Bank-Full Depth= 1.50' Flow Area= 19.9 sf, Capacity= 344.36 cfs

11.75' x 1.50' deep channel, n= 0.057
Side Slope Z-value= 1.0 '/' Top Width= 14.75'
Length= 24.2' Slope= 0.3306 '/'
Inlet Invert= 838.00', Outlet Invert= 830.00'

‡

Summary for Reach CH-N4B: N Chnl 4 - 16' FlxM

Inflow Area = 27.910 ac, 1.93% Impervious, Inflow Depth = 7.57" for 500 year - 24 hour event
Inflow = 266.13 cfs @ 12.09 hrs, Volume= 17.615 af
Outflow = 266.13 cfs @ 12.09 hrs, Volume= 17.615 af, Atten= 0%, Lag= 0.1 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 15.71 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 3.22 fps, Avg. Travel Time= 0.5 min

Peak Storage= 1,473 cf @ 12.09 hrs
Average Depth at Peak Storage= 1.30'
Bank-Full Depth= 1.50' Flow Area= 19.9 sf, Capacity= 339.17 cfs

11.75' x 1.50' deep channel, n= 0.057
Side Slope Z-value= 1.0 '/' Top Width= 14.75'
Length= 87.0' Slope= 0.3207 '/'
Inlet Invert= 829.00', Outlet Invert= 801.10'

‡

Summary for Reach CH-N5: N Chnl 5 - 12' FlxM

Inflow Area = 24.809 ac, 0.86% Impervious, Inflow Depth = 7.64" for 500 year - 24 hour event
Inflow = 254.03 cfs @ 12.09 hrs, Volume= 15.798 af
Outflow = 254.03 cfs @ 12.09 hrs, Volume= 15.798 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 18.45 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 3.94 fps, Avg. Travel Time= 0.3 min

Peak Storage= 848 cf @ 12.09 hrs
Average Depth at Peak Storage= 1.49'
Bank-Full Depth= 1.50' Flow Area= 13.9 sf, Capacity= 257.03 cfs

7.75' x 1.50' deep channel, n= 0.051
Side Slope Z-value= 1.0 '/' Top Width= 10.75'
Length= 61.6' Slope= 0.3328 '/'
Inlet Invert= 858.60', Outlet Invert= 838.10'

Summary for Reach CH-N6: N Chnl 6 - 12' FlxM

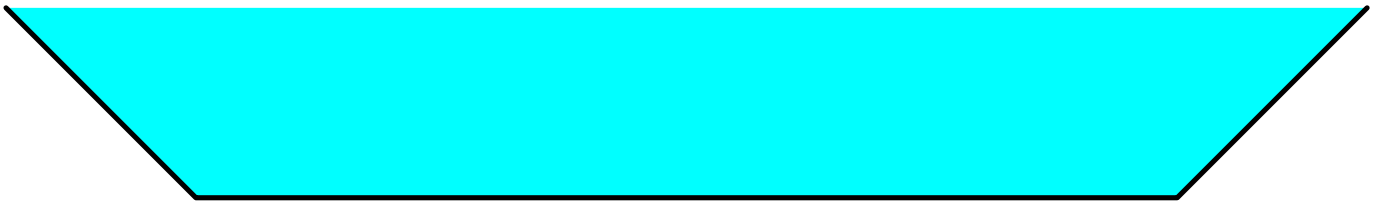
[91] Warning: Storage range exceeded by 0.03'
[55] Hint: Peak inflow is 104% of Manning's capacity

Inflow Area = 20.608 ac, 1.04% Impervious, Inflow Depth = 7.81" for 500 year - 24 hour event
Inflow = 224.13 cfs @ 12.08 hrs, Volume= 13.414 af
Outflow = 224.12 cfs @ 12.08 hrs, Volume= 13.414 af, Atten= 0%, Lag= 0.1 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 15.76 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 3.30 fps, Avg. Travel Time= 0.4 min

Peak Storage= 1,019 cf @ 12.08 hrs
Average Depth at Peak Storage= 1.53'
Bank-Full Depth= 1.50' Flow Area= 13.9 sf, Capacity= 216.31 cfs

7.75' x 1.50' deep channel, n= 0.051
Side Slope Z-value= 1.0 '/' Top Width= 10.75'
Length= 71.7' Slope= 0.2357 '/'
Inlet Invert= 875.50', Outlet Invert= 858.60'



Summary for Reach CH-N7: N Chnl 7 - 8' FlxM

[91] Warning: Storage range exceeded by 0.25'
[55] Hint: Peak inflow is 130% of Manning's capacity

Inflow Area = 17.298 ac, 0.00% Impervious, Inflow Depth = 6.81" for 500 year - 24 hour event
Inflow = 145.80 cfs @ 12.08 hrs, Volume= 9.817 af
Outflow = 145.79 cfs @ 12.08 hrs, Volume= 9.817 af, Atten= 0%, Lag= 0.1 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 15.26 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 4.21 fps, Avg. Travel Time= 0.4 min

Peak Storage= 853 cf @ 12.08 hrs
Average Depth at Peak Storage= 1.75'
Bank-Full Depth= 1.50' Flow Area= 7.9 sf, Capacity= 112.51 cfs

3.75' x 1.50' deep channel, n= 0.051
Side Slope Z-value= 1.0 '/' Top Width= 6.75'
Length= 89.3' Slope= 0.2452 '/'
Inlet Invert= 898.40', Outlet Invert= 876.50'

Summary for Reach CH-N8: N Chnl 8 - 8' FlxM

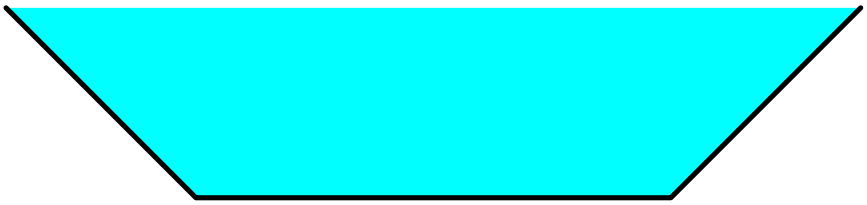
[91] Warning: Storage range exceeded by 0.05'
[55] Hint: Peak inflow is 106% of Manning's capacity

Inflow Area = 13.927 ac, 0.00% Impervious, Inflow Depth = 6.81" for 500 year - 24 hour event
Inflow = 117.55 cfs @ 12.07 hrs, Volume= 7.904 af
Outflow = 117.54 cfs @ 12.07 hrs, Volume= 7.904 af, Atten= 0%, Lag= 0.1 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 14.28 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 3.87 fps, Avg. Travel Time= 0.3 min

Peak Storage= 604 cf @ 12.07 hrs
Average Depth at Peak Storage= 1.55'
Bank-Full Depth= 1.50' Flow Area= 7.9 sf, Capacity= 110.65 cfs

3.75' x 1.50' deep channel, n= 0.052
Side Slope Z-value= 1.0 '/' Top Width= 6.75'
Length= 73.4' Slope= 0.2466 '/'
Inlet Invert= 916.50', Outlet Invert= 898.40'



Summary for Reach CH-N9: N Chnl 9 - 8' FlxM

Inflow Area = 11.991 ac, 0.00% Impervious, Inflow Depth = 6.81" for 500 year - 24 hour event
Inflow = 99.93 cfs @ 12.07 hrs, Volume= 6.805 af
Outflow = 99.93 cfs @ 12.07 hrs, Volume= 6.805 af, Atten= 0%, Lag= 0.1 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 13.14 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 3.56 fps, Avg. Travel Time= 0.4 min

Peak Storage= 709 cf @ 12.07 hrs
Average Depth at Peak Storage= 1.46'
Bank-Full Depth= 1.50' Flow Area= 7.9 sf, Capacity= 104.95 cfs

3.75' x 1.50' deep channel, n= 0.053
Side Slope Z-value= 1.0 '/' Top Width= 6.75'
Length= 93.3' Slope= 0.2304 '/'
Inlet Invert= 938.00', Outlet Invert= 916.50'

Summary for Reach CH-NB6: N Chnl Bnch 6

[62] Hint: Exceeded Reach D-N6 OUTLET depth by 0.30' @ 12.15 hrs

Inflow = 51.74 cfs @ 12.07 hrs, Volume= 1.644 af
Outflow = 48.98 cfs @ 12.10 hrs, Volume= 1.644 af, Atten= 5%, Lag= 1.8 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 4.62 fps, Min. Travel Time= 2.9 min
Avg. Velocity = 0.74 fps, Avg. Travel Time= 17.8 min

Peak Storage= 8,400 cf @ 12.10 hrs
Average Depth at Peak Storage= 1.01'
Bank-Full Depth= 2.00' Flow Area= 26.0 sf, Capacity= 174.96 cfs

8.00' x 2.00' deep channel, n= 0.030 Earth, dense weeds
Side Slope Z-value= 2.0 3.0 '/' Top Width= 18.00'
Length= 793.3' Slope= 0.0120 '/'
Inlet Invert= 888.00', Outlet Invert= 878.50'

‡

Summary for Reach CH-NW1: NW Chnl 1 - 16' FlxM

Inflow Area = 42.821 ac, 2.24% Impervious, Inflow Depth = 6.43" for 500 year - 24 hour event
Inflow = 319.70 cfs @ 12.11 hrs, Volume= 22.956 af
Outflow = 319.70 cfs @ 12.11 hrs, Volume= 22.956 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 16.94 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 3.91 fps, Avg. Travel Time= 0.1 min

Peak Storage= 504 cf @ 12.11 hrs
Average Depth at Peak Storage= 1.43'
Bank-Full Depth= 1.50' Flow Area= 19.9 sf, Capacity= 345.79 cfs

11.75' x 1.50' deep channel, n= 0.057
Side Slope Z-value= 1.0 '/' Top Width= 14.75'
Length= 26.7' Slope= 0.3333 '/'
Inlet Invert= 725.90', Outlet Invert= 717.00'

‡

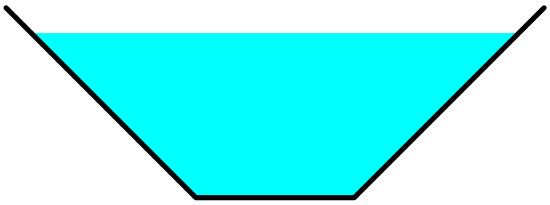
Summary for Reach CH-NW10: NW Chnl 10 - 5.5' FlxM

Inflow Area = 3.504 ac, 0.00% Impervious, Inflow Depth = 6.81" for 500 year - 24 hour event
Inflow = 33.35 cfs @ 12.05 hrs, Volume= 1.988 af
Outflow = 33.33 cfs @ 12.05 hrs, Volume= 1.988 af, Atten= 0%, Lag= 0.2 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 10.05 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 3.14 fps, Avg. Travel Time= 0.7 min

Peak Storage= 431 cf @ 12.05 hrs
Average Depth at Peak Storage= 1.30'
Bank-Full Depth= 1.50' Flow Area= 4.1 sf, Capacity= 44.59 cfs

1.25' x 1.50' deep channel, n= 0.063
Side Slope Z-value= 1.0 '/' Top Width= 4.25'
Length= 130.0' Slope= 0.3077 '/'
Inlet Invert= 1,036.00', Outlet Invert= 996.00'



Summary for Reach CH-NW2: NW Chnl 2 - 16' FlxM

Inflow Area = 36.438 ac, 2.63% Impervious, Inflow Depth = 6.37" for 500 year - 24 hour event
Inflow = 268.63 cfs @ 12.10 hrs, Volume= 19.333 af
Outflow = 268.61 cfs @ 12.10 hrs, Volume= 19.333 af, Atten= 0%, Lag= 0.1 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 16.27 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 3.74 fps, Avg. Travel Time= 0.5 min

Peak Storage= 1,982 cf @ 12.10 hrs
Average Depth at Peak Storage= 1.27'
Bank-Full Depth= 1.50' Flow Area= 19.9 sf, Capacity= 355.76 cfs

11.75' x 1.50' deep channel, n= 0.054
Side Slope Z-value= 1.0 '/' Top Width= 14.75'
Length= 120.0' Slope= 0.3167 '/'
Inlet Invert= 764.00', Outlet Invert= 726.00'

‡

Summary for Reach CH-NW3: NW Chnl 3 - 12' FlxM

Inflow Area = 30.614 ac, 3.13% Impervious, Inflow Depth = 6.28" for 500 year - 24 hour event
Inflow = 224.99 cfs @ 12.09 hrs, Volume= 16.028 af
Outflow = 224.97 cfs @ 12.09 hrs, Volume= 16.028 af, Atten= 0%, Lag= 0.1 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 16.38 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 3.95 fps, Avg. Travel Time= 0.5 min

Peak Storage= 1,648 cf @ 12.09 hrs
Average Depth at Peak Storage= 1.49'
Bank-Full Depth= 1.50' Flow Area= 13.9 sf, Capacity= 228.34 cfs

7.75' x 1.50' deep channel, n= 0.056
Side Slope Z-value= 1.0 '/' Top Width= 10.75'
Length= 120.0' Slope= 0.3167 '/'
Inlet Invert= 802.00', Outlet Invert= 764.00'

Summary for Reach CH-NW4: NW Chnl 4 - 12' FlxM

[90] Warning: Qout>Qin may require smaller dt or Finer Routing

Inflow Area = 25.542 ac, 3.76% Impervious, Inflow Depth = 6.18" for 500 year - 24 hour event
Inflow = 183.57 cfs @ 12.07 hrs, Volume= 13.149 af
Outflow = 183.57 cfs @ 12.08 hrs, Volume= 13.149 af, Atten= 0%, Lag= 0.1 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 15.53 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 3.73 fps, Avg. Travel Time= 0.5 min

Peak Storage= 1,418 cf @ 12.08 hrs
Average Depth at Peak Storage= 1.30'
Bank-Full Depth= 1.50' Flow Area= 13.9 sf, Capacity= 232.49 cfs

7.75' x 1.50' deep channel, n= 0.055
Side Slope Z-value= 1.0 '/' Top Width= 10.75'
Length= 120.0' Slope= 0.3167 '/'
Inlet Invert= 840.00', Outlet Invert= 802.00'

Summary for Reach CH-NW5: NW Chnl 5 - 12' FlxM

Inflow Area = 20.804 ac, 4.61% Impervious, Inflow Depth = 6.03" for 500 year - 24 hour event
Inflow = 141.74 cfs @ 12.07 hrs, Volume= 10.460 af
Outflow = 141.73 cfs @ 12.07 hrs, Volume= 10.460 af, Atten= 0%, Lag= 0.1 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 13.94 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 3.37 fps, Avg. Travel Time= 0.6 min

Peak Storage= 1,220 cf @ 12.07 hrs
Average Depth at Peak Storage= 1.14'
Bank-Full Depth= 1.50' Flow Area= 13.9 sf, Capacity= 224.33 cfs

7.75' x 1.50' deep channel, n= 0.057
Side Slope Z-value= 1.0 '/' Top Width= 10.75'
Length= 120.0' Slope= 0.3167 '/'
Inlet Invert= 878.00', Outlet Invert= 840.00'

Summary for Reach CH-NW6: NW Chnl 6 - 8' FlxM

Inflow Area = 17.211 ac, 5.57% Impervious, Inflow Depth = 5.87" for 500 year - 24 hour event
Inflow = 108.90 cfs @ 12.07 hrs, Volume= 8.421 af
Outflow = 108.90 cfs @ 12.07 hrs, Volume= 8.421 af, Atten= 0%, Lag= 0.1 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 15.30 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 4.19 fps, Avg. Travel Time= 0.5 min

Peak Storage= 854 cf @ 12.07 hrs
Average Depth at Peak Storage= 1.39'
Bank-Full Depth= 1.50' Flow Area= 7.9 sf, Capacity= 125.39 cfs

3.75' x 1.50' deep channel, n= 0.052
Side Slope Z-value= 1.0 '/' Top Width= 6.75'
Length= 120.0' Slope= 0.3167 '/'
Inlet Invert= 916.00', Outlet Invert= 878.00'

Summary for Reach CH-NW7: NW Chnl 7 - 8' FlxM

Inflow Area = 13.676 ac, 6.29% Impervious, Inflow Depth = 6.42" for 500 year - 24 hour event
Inflow = 90.40 cfs @ 12.06 hrs, Volume= 7.321 af
Outflow = 90.40 cfs @ 12.06 hrs, Volume= 7.321 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 14.19 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 3.95 fps, Avg. Travel Time= 0.2 min

Peak Storage= 280 cf @ 12.06 hrs
Average Depth at Peak Storage= 1.27'
Bank-Full Depth= 1.50' Flow Area= 7.9 sf, Capacity= 121.56 cfs

3.75' x 1.50' deep channel, n= 0.055
Side Slope Z-value= 1.0 '/' Top Width= 6.75'
Length= 44.0' Slope= 0.3330 '/'
Inlet Invert= 930.65', Outlet Invert= 916.00'

Summary for Reach CH-NW8: NW Chnl 8 - 8' FlxM

Inflow Area = 13.063 ac, 4.96% Impervious, Inflow Depth = 7.01" for 500 year - 24 hour event
Inflow = 126.52 cfs @ 12.06 hrs, Volume= 7.627 af
Outflow = 126.51 cfs @ 12.06 hrs, Volume= 7.627 af, Atten= 0%, Lag= 0.1 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 16.12 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 4.24 fps, Avg. Travel Time= 0.3 min

Peak Storage= 651 cf @ 12.06 hrs
Average Depth at Peak Storage= 1.50'
Bank-Full Depth= 1.50' Flow Area= 7.9 sf, Capacity= 127.16 cfs

3.75' x 1.50' deep channel, n= 0.051
Side Slope Z-value= 1.0 '/' Top Width= 6.75'
Length= 83.0' Slope= 0.3133 '/'
Inlet Invert= 956.00', Outlet Invert= 930.00'

Summary for Reach CH-NW9: NW Chnl 9 - 8' FlxM

Inflow Area = 8.498 ac, 4.37% Impervious, Inflow Depth = 6.97" for 500 year - 24 hour event
Inflow = 82.28 cfs @ 12.05 hrs, Volume= 4.934 af
Outflow = 82.26 cfs @ 12.05 hrs, Volume= 4.934 af, Atten= 0%, Lag= 0.1 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 13.25 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 3.40 fps, Avg. Travel Time= 0.6 min

Peak Storage= 807 cf @ 12.05 hrs
Average Depth at Peak Storage= 1.24'
Bank-Full Depth= 1.50' Flow Area= 7.9 sf, Capacity= 114.77 cfs

3.75' x 1.50' deep channel, n= 0.056
Side Slope Z-value= 1.0 '/' Top Width= 6.75'
Length= 130.0' Slope= 0.3077 '/'
Inlet Invert= 996.00', Outlet Invert= 956.00'

Summary for Reach CH-NWB6: NW Chnl Bnch 6

Inflow Area = 2.114 ac, 4.67% Impervious, Inflow Depth = 1.67" for 500 year - 24 hour event
Inflow = 5.49 cfs @ 12.06 hrs, Volume= 0.294 af
Outflow = 5.48 cfs @ 12.07 hrs, Volume= 0.294 af, Atten= 0%, Lag= 0.7 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 2.29 fps, Min. Travel Time= 1.1 min
Avg. Velocity = 0.52 fps, Avg. Travel Time= 4.8 min

Peak Storage= 360 cf @ 12.07 hrs
Average Depth at Peak Storage= 0.28'
Bank-Full Depth= 2.00' Flow Area= 26.0 sf, Capacity= 184.62 cfs

8.00' x 2.00' deep channel, n= 0.030 Earth, dense weeds
Side Slope Z-value= 2.0 3.0 '/' Top Width= 18.00'
Length= 150.0' Slope= 0.0133 '/'
Inlet Invert= 920.00', Outlet Invert= 918.00'

‡

Summary for Reach CH-PN1: Spillway 16' FlxM

Inflow = 120.13 cfs @ 12.17 hrs, Volume= 13.576 af
Outflow = 120.12 cfs @ 12.17 hrs, Volume= 13.576 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 13.08 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 4.49 fps, Avg. Travel Time= 0.1 min

Peak Storage= 193 cf @ 12.17 hrs
Average Depth at Peak Storage= 0.83'
Bank-Full Depth= 2.00' Flow Area= 24.6 sf, Capacity= 531.43 cfs

10.30' x 2.00' deep channel, n= 0.053
Side Slope Z-value= 1.0 '/' Top Width= 14.30'
Length= 21.0' Slope= 0.3333 '/'
Inlet Invert= 707.00', Outlet Invert= 700.00'

Summary for Reach CH-PNW1: Spillway 16' FlxM

[90] Warning: Qout>Qin may require smaller dt or Finer Routing
[80] Warning: Exceeded Pond P-NW1 by 0.01' @ 20.24 hrs (0.00 cfs 0.000 af)

Inflow = 100.99 cfs @ 12.33 hrs, Volume= 8.740 af
Outflow = 100.99 cfs @ 12.33 hrs, Volume= 8.740 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 12.14 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 4.39 fps, Avg. Travel Time= 0.1 min

Peak Storage= 208 cf @ 12.33 hrs
Average Depth at Peak Storage= 0.75'
Bank-Full Depth= 2.00' Flow Area= 24.6 sf, Capacity= 520.69 cfs

10.30' x 2.00' deep channel, n= 0.053
Side Slope Z-value= 1.0 '/' Top Width= 14.30'
Length= 25.0' Slope= 0.3200 '/'
Inlet Invert= 708.00', Outlet Invert= 700.00'

Summary for Reach CH-PW1: Spillway 16' FlxM

[90] Warning: Qout>Qin may require smaller dt or Finer Routing

Inflow = 117.97 cfs @ 12.17 hrs, Volume= 12.194 af
Outflow = 118.00 cfs @ 12.16 hrs, Volume= 12.194 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 12.87 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 4.17 fps, Avg. Travel Time= 0.1 min

Peak Storage= 275 cf @ 12.16 hrs
Average Depth at Peak Storage= 0.82'
Bank-Full Depth= 2.00' Flow Area= 24.6 sf, Capacity= 523.39 cfs

10.30' x 2.00' deep channel, n= 0.053
Side Slope Z-value= 1.0 '/' Top Width= 14.30'
Length= 30.0' Slope= 0.3233 '/'
Inlet Invert= 719.70', Outlet Invert= 710.00'

Summary for Reach CH-W1: W Chnl 1 - 16' FlxM

Inflow Area = 48.022 ac, 0.00% Impervious, Inflow Depth = 6.81" for 500 year - 24 hour event
Inflow = 364.14 cfs @ 12.13 hrs, Volume= 27.254 af
Outflow = 364.14 cfs @ 12.13 hrs, Volume= 27.254 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 18.58 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 4.53 fps, Avg. Travel Time= 0.1 min

Peak Storage= 529 cf @ 12.13 hrs
Average Depth at Peak Storage= 1.48'
Bank-Full Depth= 1.50' Flow Area= 19.9 sf, Capacity= 371.89 cfs

11.75' x 1.50' deep channel, n= 0.053
Side Slope Z-value= 1.0 '/' Top Width= 14.75'
Length= 27.0' Slope= 0.3333 '/'
Inlet Invert= 726.00', Outlet Invert= 717.00'

‡

Summary for Reach CH-W2: W Chnl 2 - 16' FlxM

Inflow Area = 42.013 ac, 0.00% Impervious, Inflow Depth = 6.81" for 500 year - 24 hour event
Inflow = 319.23 cfs @ 12.13 hrs, Volume= 23.844 af
Outflow = 319.22 cfs @ 12.13 hrs, Volume= 23.844 af, Atten= 0%, Lag= 0.1 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 17.77 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 4.32 fps, Avg. Travel Time= 0.5 min

Peak Storage= 2,156 cf @ 12.13 hrs
Average Depth at Peak Storage= 1.37'
Bank-Full Depth= 1.50' Flow Area= 19.9 sf, Capacity= 371.89 cfs

11.75' x 1.50' deep channel, n= 0.053
Side Slope Z-value= 1.0 '/' Top Width= 14.75'
Length= 120.0' Slope= 0.3333 '/'
Inlet Invert= 764.00', Outlet Invert= 724.00'

‡

Summary for Reach CH-W3: W Chnl 3 - 16' FlxM

Inflow Area = 36.798 ac, 0.00% Impervious, Inflow Depth = 6.81" for 500 year - 24 hour event
Inflow = 279.07 cfs @ 12.12 hrs, Volume= 20.884 af
Outflow = 279.06 cfs @ 12.13 hrs, Volume= 20.884 af, Atten= 0%, Lag= 0.1 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 16.46 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 4.00 fps, Avg. Travel Time= 0.5 min

Peak Storage= 2,043 cf @ 12.13 hrs
Average Depth at Peak Storage= 1.30'
Bank-Full Depth= 1.50' Flow Area= 19.9 sf, Capacity= 355.02 cfs

11.75' x 1.50' deep channel, n= 0.054
Side Slope Z-value= 1.0 '/' Top Width= 14.75'
Length= 120.5' Slope= 0.3154 '/'
Inlet Invert= 802.00', Outlet Invert= 764.00'

‡

Summary for Reach CH-W4: W Chnl 4 - 12' FlxM

Inflow Area = 27.885 ac, 0.00% Impervious, Inflow Depth = 6.81" for 500 year - 24 hour event
Inflow = 218.42 cfs @ 12.11 hrs, Volume= 15.825 af
Outflow = 218.40 cfs @ 12.11 hrs, Volume= 15.825 af, Atten= 0%, Lag= 0.1 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 16.43 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 4.13 fps, Avg. Travel Time= 0.5 min

Peak Storage= 1,595 cf @ 12.11 hrs
Average Depth at Peak Storage= 1.45'
Bank-Full Depth= 1.50' Flow Area= 13.9 sf, Capacity= 232.49 cfs

7.75' x 1.50' deep channel, n= 0.055
Side Slope Z-value= 1.0 '/' Top Width= 10.75'
Length= 120.0' Slope= 0.3167 '/'
Inlet Invert= 840.00', Outlet Invert= 802.00'

Summary for Reach CH-W5: W Chnl 5 - 12' FlxM

Inflow Area = 20.240 ac, 0.00% Impervious, Inflow Depth = 6.81" for 500 year - 24 hour event
Inflow = 166.79 cfs @ 12.09 hrs, Volume= 11.487 af
Outflow = 166.78 cfs @ 12.10 hrs, Volume= 11.487 af, Atten= 0%, Lag= 0.1 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 15.44 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 3.76 fps, Avg. Travel Time= 0.5 min

Peak Storage= 1,296 cf @ 12.10 hrs
Average Depth at Peak Storage= 1.21'
Bank-Full Depth= 1.50' Flow Area= 13.9 sf, Capacity= 241.26 cfs

7.75' x 1.50' deep channel, n= 0.053
Side Slope Z-value= 1.0 '/' Top Width= 10.75'
Length= 120.0' Slope= 0.3167 '/'
Inlet Invert= 878.00', Outlet Invert= 840.00'

Summary for Reach CH-W6: W Chnl 6 - 12' FlxM

Inflow Area = 12.643 ac, 0.00% Impervious, Inflow Depth = 6.81" for 500 year - 24 hour event
Inflow = 109.48 cfs @ 12.08 hrs, Volume= 7.175 af
Outflow = 109.44 cfs @ 12.08 hrs, Volume= 7.175 af, Atten= 0%, Lag= 0.1 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 13.02 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 3.06 fps, Avg. Travel Time= 0.7 min

Peak Storage= 1,093 cf @ 12.08 hrs
Average Depth at Peak Storage= 0.96'
Bank-Full Depth= 1.50' Flow Area= 13.9 sf, Capacity= 230.48 cfs

7.75' x 1.50' deep channel, n= 0.054
Side Slope Z-value= 1.0 '/' Top Width= 10.75'
Length= 130.0' Slope= 0.3000 '/'
Inlet Invert= 917.00', Outlet Invert= 878.00'

Summary for Reach CH-W7: W Chnl 7 -5.5' FlxM

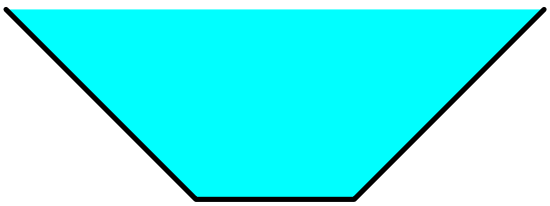
[91] Warning: Storage range exceeded by 0.17'
[55] Hint: Peak inflow is 124% of Manning's capacity

Inflow Area = 6.341 ac, 0.00% Impervious, Inflow Depth = 6.81" for 500 year - 24 hour event
Inflow = 56.75 cfs @ 12.07 hrs, Volume= 3.599 af
Outflow = 56.71 cfs @ 12.07 hrs, Volume= 3.599 af, Atten= 0%, Lag= 0.2 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 11.66 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 3.75 fps, Avg. Travel Time= 0.8 min

Peak Storage= 846 cf @ 12.07 hrs
Average Depth at Peak Storage= 1.67'
Bank-Full Depth= 1.50' Flow Area= 4.1 sf, Capacity= 45.82 cfs

1.25' x 1.50' deep channel, n= 0.053
Side Slope Z-value= 1.0 '/' Top Width= 4.25'
Length= 174.0' Slope= 0.2299 '/'
Inlet Invert= 957.00', Outlet Invert= 917.00'



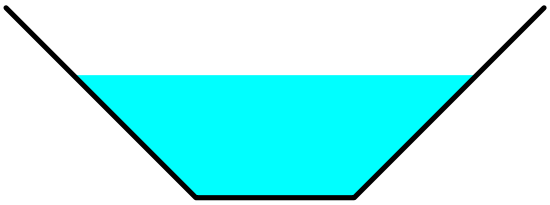
Summary for Reach CH-W8: W Chnl 8 - 5.5' FlxM

Inflow Area = 1.978 ac, 0.00% Impervious, Inflow Depth = 6.81" for 500 year - 24 hour event
Inflow = 17.86 cfs @ 12.07 hrs, Volume= 1.123 af
Outflow = 17.84 cfs @ 12.07 hrs, Volume= 1.123 af, Atten= 0%, Lag= 0.3 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 8.31 fps, Min. Travel Time= 0.4 min
Avg. Velocity = 2.49 fps, Avg. Travel Time= 1.2 min

Peak Storage= 384 cf @ 12.07 hrs
Average Depth at Peak Storage= 0.97'
Bank-Full Depth= 1.50' Flow Area= 4.1 sf, Capacity= 42.80 cfs

1.25' x 1.50' deep channel, n= 0.058
Side Slope Z-value= 1.0 '/' Top Width= 4.25'
Length= 179.0' Slope= 0.2402 '/'
Inlet Invert= 1,000.00', Outlet Invert= 957.00'



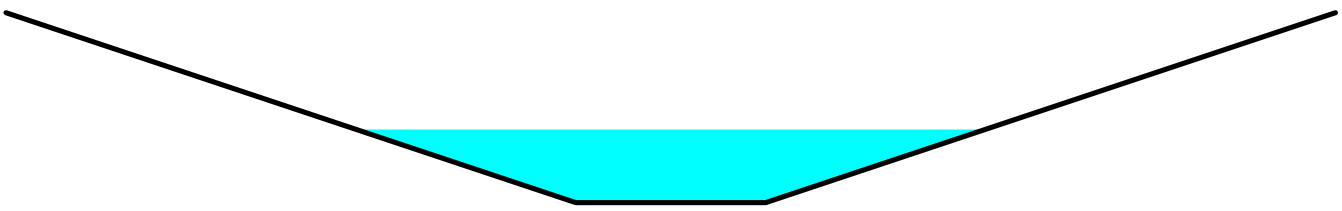
Summary for Reach D-N6: N Ramp Ditch 6

Inflow = 51.84 cfs @ 12.06 hrs, Volume= 1.644 af
Outflow = 51.74 cfs @ 12.07 hrs, Volume= 1.644 af, Atten= 0%, Lag= 0.3 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 15.60 fps, Min. Travel Time= 0.5 min
Avg. Velocity = 3.35 fps, Avg. Travel Time= 2.2 min

Peak Storage= 1,448 cf @ 12.07 hrs
Average Depth at Peak Storage= 0.77'
Bank-Full Depth= 2.00' Flow Area= 16.0 sf, Capacity= 430.04 cfs

2.00' x 2.00' deep channel, n= 0.016 Asphalt, rough
Side Slope Z-value= 3.0 '/' Top Width= 14.00'
Length= 436.5' Slope= 0.0745 '/'
Inlet Invert= 920.50', Outlet Invert= 888.00'



Summary for Reach D-NW7: NW Ramp Ditch 7

Inflow = 37.34 cfs @ 12.06 hrs, Volume= 0.715 af
Outflow = 37.32 cfs @ 12.06 hrs, Volume= 0.715 af, Atten= 0%, Lag= 0.2 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 13.22 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 6.93 fps, Avg. Travel Time= 0.4 min

Peak Storage= 460 cf @ 12.06 hrs
Average Depth at Peak Storage= 0.69'
Bank-Full Depth= 2.00' Flow Area= 16.0 sf, Capacity= 386.44 cfs

2.00' x 2.00' deep channel, n= 0.016 Asphalt, rough
Side Slope Z-value= 3.0 '/' Top Width= 14.00'
Length= 163.0' Slope= 0.0601 '/'
Inlet Invert= 930.00', Outlet Invert= 920.20'

Summary for Pond B-N1: N Bench 1

[95] Warning: Outlet Device #1 rise exceeded
[62] Hint: Exceeded Reach CH-N2 OUTLET depth by 2.74' @ 12.10 hrs

Inflow Area = 41.660 ac, 1.29% Impervious, Inflow Depth = 7.33" for 500 year - 24 hour event
Inflow = 387.22 cfs @ 12.09 hrs, Volume= 25.452 af
Outflow = 386.10 cfs @ 12.10 hrs, Volume= 25.452 af, Atten= 0%, Lag= 0.6 min
Primary = 386.10 cfs @ 12.10 hrs, Volume= 25.452 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 729.91' @ 12.10 hrs Surf.Area= 4,913 sf Storage= 6,057 cf
Flood Elev= 730.00' Surf.Area= 5,118 sf Storage= 6,508 cf

Plug-Flow detention time= 0.2 min calculated for 25.452 af (100% of inflow)
Center-of-Mass det. time= 0.2 min (815.8 - 815.6)

Volume	Invert	Avail.Storage	Storage Description
#1	725.80'	6,508 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
725.80	170	0	0
728.00	573	817	817
730.00	5,118	5,691	6,508

Device	Routing	Invert	Outlet Devices
#1	Primary	725.80'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 4.00 Width (feet) 11.75 19.75

Primary OutFlow Max=385.94 cfs @ 12.10 hrs HW=729.91' TW=727.36' (Dynamic Tailwater)
1=Custom Weir/Orifice (Orifice Controls 385.94 cfs @ 6.13 fps)

Summary for Pond B-N10: N Bench 10

[62] Hint: Exceeded Reach CH-N11 OUTLET depth by 0.89' @ 12.05 hrs

Inflow Area = 8.056 ac, 0.00% Impervious, Inflow Depth = 6.81" for 500 year - 24 hour event
Inflow = 73.19 cfs @ 12.04 hrs, Volume= 4.572 af
Outflow = 73.13 cfs @ 12.05 hrs, Volume= 4.572 af, Atten= 0%, Lag= 0.2 min
Primary = 73.13 cfs @ 12.05 hrs, Volume= 4.572 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 960.35' @ 12.05 hrs Surf.Area= 852 sf Storage= 664 cf
Flood Elev= 961.75' Surf.Area= 2,270 sf Storage= 2,850 cf

Plug-Flow detention time= 0.2 min calculated for 4.571 af (100% of inflow)
Center-of-Mass det. time= 0.2 min (816.0 - 815.8)

Volume	Invert	Avail.Storage	Storage Description
#1	957.75'	2,850 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
957.75	90	0	0
959.75	245	335	335
961.75	2,270	2,515	2,850

Device	Routing	Invert	Outlet Devices
#1	Primary	957.75'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 4.00 Width (feet) 3.75 11.75

Primary OutFlow Max=73.10 cfs @ 12.05 hrs HW=960.35' TW=959.01' (Dynamic Tailwater)
1=Custom Weir/Orifice (Weir Controls 73.10 cfs @ 4.43 fps)

Summary for Pond B-N11: N Bench 11

[62] Hint: Exceeded Reach CH-N12 OUTLET depth by 1.74' @ 12.08 hrs

Inflow Area = 6.593 ac, 0.00% Impervious, Inflow Depth = 6.81" for 500 year - 24 hour event
Inflow = 59.21 cfs @ 12.04 hrs, Volume= 3.742 af
Outflow = 58.99 cfs @ 12.05 hrs, Volume= 3.742 af, Atten= 0%, Lag= 0.5 min
Primary = 58.99 cfs @ 12.05 hrs, Volume= 3.742 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 983.07' @ 12.05 hrs Surf.Area= 1,330 sf Storage= 1,179 cf
Flood Elev= 984.00' Surf.Area= 2,270 sf Storage= 2,850 cf

Plug-Flow detention time= 0.4 min calculated for 3.742 af (100% of inflow)
Center-of-Mass det. time= 0.4 min (816.2 - 815.7)

Volume	Invert	Avail.Storage	Storage Description
#1	980.00'	2,850 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
980.00	90	0	0
982.00	245	335	335
984.00	2,270	2,515	2,850

Device	Routing	Invert	Outlet Devices
#1	Primary	980.00'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 4.00 Width (feet) 1.25 9.25

Primary OutFlow Max=58.96 cfs @ 12.05 hrs HW=983.07' TW=981.71' (Dynamic Tailwater)
↑**1=Custom Weir/Orifice** (Weir Controls 58.96 cfs @ 4.44 fps)

Summary for Pond B-N12: N Bench 12

[62] Hint: Exceeded Reach CH-N13 OUTLET depth by 1.29' @ 12.03 hrs

Inflow Area = 3.779 ac, 0.00% Impervious, Inflow Depth = 6.81" for 500 year - 24 hour event
Inflow = 37.44 cfs @ 12.02 hrs, Volume= 2.145 af
Outflow = 37.35 cfs @ 12.02 hrs, Volume= 2.145 af, Atten= 0%, Lag= 0.4 min
Primary = 37.35 cfs @ 12.02 hrs, Volume= 2.145 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 1,001.98' @ 12.02 hrs Surf.Area= 736 sf Storage= 573 cf
Flood Elev= 1,003.50' Surf.Area= 2,270 sf Storage= 2,850 cf

Plug-Flow detention time= 0.5 min calculated for 2.145 af (100% of inflow)
Center-of-Mass det. time= 0.5 min (813.9 - 813.4)

Volume	Invert	Avail.Storage	Storage Description
#1	999.50'	2,850 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
999.50	90	0	0
1,001.50	245	335	335
1,003.50	2,270	2,515	2,850

Device	Routing	Invert	Outlet Devices
#1	Primary	999.50'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 4.00 Width (feet) 1.25 9.25

Primary OutFlow Max=37.31 cfs @ 12.02 hrs HW=1,001.98' TW=1,000.88' (Dynamic Tailwater)
↑**1=Custom Weir/Orifice** (Weir Controls 37.31 cfs @ 4.02 fps)

Summary for Pond B-N13: N Bench 13

[62] Hint: Exceeded Reach CH-N14 OUTLET depth by 1.37' @ 12.05 hrs

Inflow Area = 2.789 ac, 0.00% Impervious, Inflow Depth = 6.81" for 500 year - 24 hour event
Inflow = 27.12 cfs @ 12.02 hrs, Volume= 1.583 af
Outflow = 27.09 cfs @ 12.02 hrs, Volume= 1.583 af, Atten= 0%, Lag= 0.2 min
Primary = 27.09 cfs @ 12.02 hrs, Volume= 1.583 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 1,022.14' @ 12.02 hrs Surf.Area= 383 sf Storage= 378 cf
Flood Elev= 1,024.00' Surf.Area= 2,270 sf Storage= 2,850 cf

Plug-Flow detention time= 0.5 min calculated for 1.583 af (100% of inflow)
Center-of-Mass det. time= 0.5 min (813.8 - 813.3)

Volume	Invert	Avail.Storage	Storage Description
#1	1,020.00'	2,850 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,020.00	90	0	0
1,022.00	245	335	335
1,024.00	2,270	2,515	2,850

Device	Routing	Invert	Outlet Devices
#1	Primary	1,020.00'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 4.00 Width (feet) 1.25 9.25

Primary OutFlow Max=27.07 cfs @ 12.02 hrs HW=1,022.14' TW=1,021.19' (Dynamic Tailwater)
↑—**1=Custom Weir/Orifice** (Weir Controls 27.07 cfs @ 3.74 fps)

Summary for Pond B-N14: N Bench 14

[62] Hint: Exceeded Reach CH-N15 OUTLET depth by 0.81' @ 11.99 hrs

Inflow Area = 1.012 ac, 0.00% Impervious, Inflow Depth = 6.81" for 500 year - 24 hour event
Inflow = 11.57 cfs @ 11.99 hrs, Volume= 0.574 af
Outflow = 11.55 cfs @ 11.99 hrs, Volume= 0.574 af, Atten= 0%, Lag= 0.2 min
Primary = 11.55 cfs @ 11.99 hrs, Volume= 0.574 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 1,043.42' @ 11.99 hrs Surf.Area= 200 sf Storage= 206 cf
Flood Elev= 1,046.00' Surf.Area= 2,270 sf Storage= 2,850 cf

Plug-Flow detention time= 0.8 min calculated for 0.574 af (100% of inflow)
Center-of-Mass det. time= 0.7 min (810.6 - 809.9)

Volume	Invert	Avail.Storage	Storage Description
#1	1,042.00'	2,850 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,042.00	90	0	0
1,044.00	245	335	335
1,046.00	2,270	2,515	2,850

Device	Routing	Invert	Outlet Devices
#1	Primary	1,042.00'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 4.00 Width (feet) 1.25 9.25

Primary OutFlow Max=11.54 cfs @ 11.99 hrs HW=1,043.42' TW=1,042.83' (Dynamic Tailwater)
└**1=Custom Weir/Orifice** (Weir Controls 11.54 cfs @ 3.05 fps)

Summary for Pond B-N15: N Bench 15

Inflow Area = 0.533 ac, 0.00% Impervious, Inflow Depth = 6.81" for 500 year - 24 hour event
Inflow = 6.20 cfs @ 11.98 hrs, Volume= 0.302 af
Outflow = 6.19 cfs @ 11.98 hrs, Volume= 0.302 af, Atten= 0%, Lag= 0.2 min
Primary = 6.19 cfs @ 11.98 hrs, Volume= 0.302 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 1,059.04' @ 11.98 hrs Surf.Area= 170 sf Storage= 135 cf
Flood Elev= 1,062.00' Surf.Area= 2,270 sf Storage= 2,850 cf

Plug-Flow detention time= 0.9 min calculated for 0.302 af (100% of inflow)
Center-of-Mass det. time= 0.9 min (809.6 - 808.8)

Volume	Invert	Avail.Storage	Storage Description
#1	1,058.00'	2,850 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,058.00	90	0	0
1,060.00	245	335	335
1,062.00	2,270	2,515	2,850

Device	Routing	Invert	Outlet Devices
#1	Primary	1,058.00'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 4.00 Width (feet) 1.25 9.25

Primary OutFlow Max=6.19 cfs @ 11.98 hrs HW=1,059.04' TW=1,058.61' (Dynamic Tailwater)
└**1=Custom Weir/Orifice** (Weir Controls 6.19 cfs @ 2.62 fps)

Summary for Pond B-N2: N Bench 2

[95] Warning: Outlet Device #1 rise exceeded
[58] Hint: Peaked 0.29' above defined flood level
[62] Hint: Exceeded Reach CH-N3 OUTLET depth by 1.70' @ 12.09 hrs

Inflow Area = 36.923 ac, 1.46% Impervious, Inflow Depth = 7.40" for 500 year - 24 hour event
Inflow = 346.45 cfs @ 12.09 hrs, Volume= 22.764 af
Outflow = 346.32 cfs @ 12.09 hrs, Volume= 22.764 af, Atten= 0%, Lag= 0.2 min
Primary = 306.22 cfs @ 12.09 hrs, Volume= 22.412 af
Secondary = 40.10 cfs @ 12.09 hrs, Volume= 0.352 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 766.29' @ 12.09 hrs Surf.Area= 3,278 sf Storage= 3,654 cf
Flood Elev= 766.00' Surf.Area= 2,270 sf Storage= 2,850 cf

Plug-Flow detention time= 0.1 min calculated for 22.760 af (100% of inflow)
Center-of-Mass det. time= 0.1 min (815.3 - 815.2)

Volume	Invert	Avail.Storage	Storage Description
#1	762.00'	14,348 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
762.00	90	0	0
764.00	245	335	335
766.00	2,270	2,515	2,850
768.00	9,228	11,498	14,348

Device	Routing	Invert	Outlet Devices
#1	Primary	762.00'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 4.00 Width (feet) 7.75 15.75
#2	Secondary	766.00'	**100.0' long x 2.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32

Primary OutFlow Max=306.16 cfs @ 12.09 hrs HW=766.29' TW=763.37' (Dynamic Tailwater)
↑—**1=Custom Weir/Orifice** (Orifice Controls 306.16 cfs @ 6.51 fps)

Secondary OutFlow Max=39.96 cfs @ 12.09 hrs HW=766.29' TW=729.91' (Dynamic Tailwater)
↑—**2=Broad-Crested Rectangular Weir** (Weir Controls 39.96 cfs @ 1.38 fps)

Summary for Pond B-N3: N Bench 3

[62] Hint: Exceeded Reach CH-N4B OUTLET depth by 2.27' @ 12.09 hrs

Inflow Area = 31.980 ac, 1.68% Impervious, Inflow Depth = 7.49" for 500 year - 24 hour event
Inflow = 304.02 cfs @ 12.09 hrs, Volume= 19.958 af
Outflow = 303.88 cfs @ 12.09 hrs, Volume= 19.958 af, Atten= 0%, Lag= 0.2 min
Primary = 303.88 cfs @ 12.09 hrs, Volume= 19.958 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 804.67' @ 12.09 hrs Surf.Area= 1,834 sf Storage= 1,966 cf
Flood Elev= 805.10' Surf.Area= 2,270 sf Storage= 2,850 cf

Plug-Flow detention time= 0.1 min calculated for 19.955 af (100% of inflow)
Center-of-Mass det. time= 0.1 min (814.7 - 814.7)

Volume	Invert	Avail.Storage	Storage Description
#1	801.10'	2,850 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
801.10	90	0	0
803.10	245	335	335
805.10	2,270	2,515	2,850

Device	Routing	Invert	Outlet Devices
#1	Primary	801.10'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 4.00 Width (feet) 11.75 19.75

Primary OutFlow Max=303.68 cfs @ 12.09 hrs HW=804.67' TW=802.49' (Dynamic Tailwater)
└**1=Custom Weir/Orifice** (Weir Controls 303.68 cfs @ 5.56 fps)

Summary for Pond B-N4A: N Bench 4A w/ 18" Clvt

[58] Hint: Peaked 0.43' above defined flood level

Inflow Area = 1.056 ac, 0.00% Impervious, Inflow Depth = 6.81" for 500 year - 24 hour event
Inflow = 10.31 cfs @ 12.03 hrs, Volume= 0.599 af
Outflow = 9.27 cfs @ 12.08 hrs, Volume= 0.599 af, Atten= 10%, Lag= 2.8 min
Primary = 6.29 cfs @ 12.08 hrs, Volume= 0.565 af
Secondary = 2.98 cfs @ 12.08 hrs, Volume= 0.034 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 844.43' @ 12.08 hrs Surf.Area= 2,192 sf Storage= 2,229 cf
Flood Elev= 844.00' Surf.Area= 1,545 sf Storage= 1,419 cf

Plug-Flow detention time= 3.1 min calculated for 0.599 af (100% of inflow)
Center-of-Mass det. time= 3.1 min (816.6 - 813.5)

Volume	Invert	Avail.Storage	Storage Description
#1	842.30'	7,494 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
842.30	0	0	0
843.00	760	266	266
844.00	1,545	1,153	1,419
846.00	4,530	6,075	7,494

Device	Routing	Invert	Outlet Devices
#1	Primary	842.30'	**15.8" Round 18" Dia PEP SDR 17** L= 50.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 842.30' / 842.00' S= 0.0060 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 1.36 sf
#2	Secondary	844.00'	**4.0' long x 2.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32

Primary OutFlow Max=6.29 cfs @ 12.08 hrs HW=844.43' TW=841.29' (Dynamic Tailwater)
└**1=18" Dia PEP SDR 17** (Inlet Controls 6.29 cfs @ 4.62 fps)

Secondary OutFlow Max=2.98 cfs @ 12.08 hrs HW=844.43' TW=804.65' (Dynamic Tailwater)
└**2=Broad-Crested Rectangular Weir** (Weir Controls 2.98 cfs @ 1.72 fps)

Summary for Pond B-N4B: N Bench 4B

[62] Hint: Exceeded Reach CH-N5 OUTLET depth by 1.71' @ 12.09 hrs

Inflow Area = 27.910 ac, 1.93% Impervious, Inflow Depth = 7.57" for 500 year - 24 hour event
Inflow = 266.39 cfs @ 12.09 hrs, Volume= 17.615 af
Outflow = 266.14 cfs @ 12.09 hrs, Volume= 17.615 af, Atten= 0%, Lag= 0.3 min
Primary = 266.14 cfs @ 12.09 hrs, Volume= 17.615 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 841.30' @ 12.09 hrs Surf.Area= 2,688 sf Storage= 2,295 cf
Flood Elev= 842.00' Surf.Area= 3,623 sf Storage= 4,501 cf

Plug-Flow detention time= 0.1 min calculated for 17.612 af (100% of inflow)
Center-of-Mass det. time= 0.1 min (814.3 - 814.3)

Volume	Invert	Avail.Storage	Storage Description
#1	838.00'	4,501 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
838.00	90	0	0
840.00	209	299	299
841.00	2,286	1,248	1,547
842.00	3,623	2,955	4,501

Device	Routing	Invert	Outlet Devices
#1	Primary	838.00'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 4.00 Width (feet) 11.75 19.75

Primary OutFlow Max=265.97 cfs @ 12.09 hrs HW=841.30' TW=839.29' (Dynamic Tailwater)
↑—**1=Custom Weir/Orifice** (Weir Controls 265.97 cfs @ 5.36 fps)

Summary for Pond B-N5: N Bench 5

[62] Hint: Exceeded Reach CH-N6 OUTLET depth by 2.32' @ 12.10 hrs

Inflow Area = 24.809 ac, 0.86% Impervious, Inflow Depth = 7.64" for 500 year - 24 hour event
Inflow = 254.28 cfs @ 12.09 hrs, Volume= 15.798 af
Outflow = 254.03 cfs @ 12.09 hrs, Volume= 15.798 af, Atten= 0%, Lag= 0.3 min
Primary = 254.03 cfs @ 12.09 hrs, Volume= 15.798 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 862.45' @ 12.09 hrs Surf.Area= 2,121 sf Storage= 2,526 cf
Flood Elev= 862.60' Surf.Area= 2,270 sf Storage= 2,850 cf

Plug-Flow detention time= 0.1 min calculated for 15.798 af (100% of inflow)
Center-of-Mass det. time= 0.1 min (815.0 - 814.9)

Volume	Invert	Avail.Storage	Storage Description
#1	858.60'	2,850 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
858.60	90	0	0
860.60	245	335	335
862.60	2,270	2,515	2,850

Device	Routing	Invert	Outlet Devices
#1	Primary	858.60'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 4.00 Width (feet) 7.75 15.75

Primary OutFlow Max=253.91 cfs @ 12.09 hrs HW=862.45' TW=860.09' (Dynamic Tailwater)
└**1=Custom Weir/Orifice** (Weir Controls 253.91 cfs @ 5.68 fps)

Summary for Pond B-N6: N Bench 6

[62] Hint: Exceeded Reach CH-N7 OUTLET depth by 1.75' @ 12.09 hrs
[62] Hint: Exceeded Reach CH-NB6 OUTLET depth by 0.50' @ 12.07 hrs

Inflow Area = 20.608 ac, 1.04% Impervious, Inflow Depth = 7.81" for 500 year - 24 hour event
Inflow = 224.30 cfs @ 12.08 hrs, Volume= 13.414 af
Outflow = 224.13 cfs @ 12.08 hrs, Volume= 13.414 af, Atten= 0%, Lag= 0.3 min
Primary = 224.13 cfs @ 12.08 hrs, Volume= 13.414 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 880.00' @ 12.08 hrs Surf.Area= 1,759 sf Storage= 1,834 cf
Flood Elev= 880.50' Surf.Area= 2,270 sf Storage= 2,850 cf

Plug-Flow detention time= 0.1 min calculated for 13.414 af (100% of inflow)
Center-of-Mass det. time= 0.1 min (813.5 - 813.4)

Volume	Invert	Avail.Storage	Storage Description
#1	876.50'	2,850 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
876.50	90	0	0
878.50	245	335	335
880.50	2,270	2,515	2,850

Device	Routing	Invert	Outlet Devices
#1	Primary	876.50'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 4.00 Width (feet) 7.75 15.75

Primary OutFlow Max=223.96 cfs @ 12.08 hrs HW=879.99' TW=877.03' (Dynamic Tailwater)
└**1=Custom Weir/Orifice** (Weir Controls 223.96 cfs @ 5.70 fps)

Summary for Pond B-N7: N Bench 7

[90] Warning: Qout>Qin may require smaller dt or Finer Routing
[62] Hint: Exceeded Reach CH-N8 OUTLET depth by 2.16' @ 12.08 hrs

Inflow Area = 17.298 ac, 0.00% Impervious, Inflow Depth = 6.81" for 500 year - 24 hour event
Inflow = 145.78 cfs @ 12.07 hrs, Volume= 9.817 af
Outflow = 145.80 cfs @ 12.08 hrs, Volume= 9.817 af, Atten= 0%, Lag= 0.0 min
Primary = 145.80 cfs @ 12.08 hrs, Volume= 9.817 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 902.11' @ 12.08 hrs Surf.Area= 234 sf Storage= 602 cf
Flood Elev= 902.40' Surf.Area= 245 sf Storage= 670 cf

Plug-Flow detention time= 0.1 min calculated for 9.815 af (100% of inflow)
Center-of-Mass det. time= 0.1 min (818.2 - 818.1)

Volume	Invert	Avail.Storage	Storage Description
#1	898.40'	3,185 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
898.40	90	0	0
902.40	245	670	670
904.40	2,270	2,515	3,185

Device	Routing	Invert	Outlet Devices
#1	Primary	898.40'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 4.00 Width (feet) 3.75 11.75

Primary OutFlow Max=145.66 cfs @ 12.08 hrs HW=902.11' TW=900.15' (Dynamic Tailwater)
↑**1=Custom Weir/Orifice** (Weir Controls 145.66 cfs @ 5.26 fps)

Summary for Pond B-N8: N Bench 8

[62] Hint: Exceeded Reach CH-N9 OUTLET depth by 1.86' @ 12.07 hrs

Inflow Area = 13.927 ac, 0.00% Impervious, Inflow Depth = 6.81" for 500 year - 24 hour event
Inflow = 117.73 cfs @ 12.06 hrs, Volume= 7.904 af
Outflow = 117.55 cfs @ 12.07 hrs, Volume= 7.904 af, Atten= 0%, Lag= 0.4 min
Primary = 117.55 cfs @ 12.07 hrs, Volume= 7.904 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 919.82' @ 12.07 hrs Surf.Area= 1,584 sf Storage= 1,544 cf
Flood Elev= 920.50' Surf.Area= 2,270 sf Storage= 2,850 cf

Plug-Flow detention time= 0.2 min calculated for 7.904 af (100% of inflow)
Center-of-Mass det. time= 0.2 min (817.9 - 817.7)

Volume	Invert	Avail.Storage	Storage Description
#1	916.50'	2,850 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
916.50	90	0	0
918.50	245	335	335
920.50	2,270	2,515	2,850

Device	Routing	Invert	Outlet Devices
#1	Primary	916.50'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)**

Head (feet) 0.00 4.00
Width (feet) 3.75 11.75

Primary OutFlow Max=117.51 cfs @ 12.07 hrs HW=919.82' TW=918.05' (Dynamic Tailwater)
1=Custom Weir/Orifice (Weir Controls 117.51 cfs @ 5.00 fps)

Summary for Pond B-N9: N Bench 9

[62] Hint: Exceeded Reach CH-N10 OUTLET depth by 1.82' @ 12.09 hrs

Inflow Area = 11.991 ac, 0.00% Impervious, Inflow Depth = 6.81" for 500 year - 24 hour event
Inflow = 100.07 cfs @ 12.06 hrs, Volume= 6.805 af
Outflow = 99.93 cfs @ 12.07 hrs, Volume= 6.805 af, Atten= 0%, Lag= 0.4 min
Primary = 99.93 cfs @ 12.07 hrs, Volume= 6.805 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 941.06' @ 12.07 hrs Surf.Area= 1,318 sf Storage= 1,163 cf
Flood Elev= 942.00' Surf.Area= 2,270 sf Storage= 2,850 cf

Plug-Flow detention time= 0.2 min calculated for 6.805 af (100% of inflow)
Center-of-Mass det. time= 0.2 min (818.0 - 817.8)

Volume	Invert	Avail.Storage	Storage Description
#1	938.00'	2,850 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
938.00	90	0	0
940.00	245	335	335
942.00	2,270	2,515	2,850

Device	Routing	Invert	Outlet Devices
#1	Primary	938.00'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)**
			Head (feet) 0.00 4.00
			Width (feet) 3.75 11.75

Primary OutFlow Max=99.90 cfs @ 12.07 hrs HW=941.06' TW=939.46' (Dynamic Tailwater)
1=Custom Weir/Orifice (Weir Controls 99.90 cfs @ 4.80 fps)

Summary for Pond B-NW1: NW Bench 1

[62] Hint: Exceeded Reach CH-NW2 OUTLET depth by 2.31' @ 12.11 hrs

Inflow Area = 42.821 ac, 2.24% Impervious, Inflow Depth = 6.43" for 500 year - 24 hour event
Inflow = 320.04 cfs @ 12.10 hrs, Volume= 22.956 af
Outflow = 319.70 cfs @ 12.11 hrs, Volume= 22.956 af, Atten= 0%, Lag= 0.3 min
Primary = 319.70 cfs @ 12.11 hrs, Volume= 22.956 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 729.58' @ 12.11 hrs Surf.Area= 3,106 sf Storage= 2,837 cf
Flood Elev= 729.90' Surf.Area= 3,707 sf Storage= 3,938 cf

Plug-Flow detention time= 0.1 min calculated for 22.956 af (100% of inflow)
Center-of-Mass det. time= 0.1 min (819.4 - 819.3)

Volume	Invert	Avail.Storage	Storage Description
#1	725.90'	4,318 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
725.90	63	0	0
728.00	175	250	250
730.00	3,893	4,068	4,318

Device	Routing	Invert	Outlet Devices
#1	Primary	725.90'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 4.00 Width (feet) 11.75 19.75

Primary OutFlow Max=319.48 cfs @ 12.11 hrs HW=729.58' TW=727.33' (Dynamic Tailwater)
└**1=Custom Weir/Orifice** (Weir Controls 319.48 cfs @ 5.64 fps)

Summary for Pond B-NW10: NW Bench 10

[58] Hint: Peaked 0.35' above defined flood level

Inflow Area = 3.504 ac, 0.00% Impervious, Inflow Depth = 6.81" for 500 year - 24 hour event
Inflow = 33.46 cfs @ 12.04 hrs, Volume= 1.988 af
Outflow = 33.35 cfs @ 12.05 hrs, Volume= 1.988 af, Atten= 0%, Lag= 0.4 min
Primary = 33.35 cfs @ 12.05 hrs, Volume= 1.988 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 1,038.35' @ 12.05 hrs Surf.Area= 833 sf Storage= 413 cf
Flood Elev= 1,038.00' Surf.Area= 175 sf Storage= 235 cf

Plug-Flow detention time= 0.5 min calculated for 1.988 af (100% of inflow)
Center-of-Mass det. time= 0.3 min (814.5 - 814.1)

Volume	Invert	Avail.Storage	Storage Description
#1	1,036.00'	4,303 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,036.00	60	0	0
1,038.00	175	235	235
1,040.00	3,893	4,068	4,303

Device	Routing	Invert	Outlet Devices
#1	Primary	1,036.00'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 1.00 2.00 4.00 Width (feet) 1.25 3.25 5.25 9.25

Primary OutFlow Max=33.31 cfs @ 12.05 hrs HW=1,038.35' TW=1,037.30' (Dynamic Tailwater)
└**1=Custom Weir/Orifice** (Weir Controls 33.31 cfs @ 3.93 fps)

Summary for Pond B-NW2: NW Bench 2

[62] Hint: Exceeded Reach CH-NW3 OUTLET depth by 2.45' @ 12.11 hrs

Inflow Area = 36.438 ac, 2.63% Impervious, Inflow Depth = 6.37" for 500 year - 24 hour event
Inflow = 269.21 cfs @ 12.09 hrs, Volume= 19.333 af
Outflow = 268.63 cfs @ 12.10 hrs, Volume= 19.333 af, Atten= 0%, Lag= 0.5 min
Primary = 268.63 cfs @ 12.10 hrs, Volume= 19.333 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 767.93' @ 12.10 hrs Surf.Area= 3,768 sf Storage= 4,049 cf
Flood Elev= 768.00' Surf.Area= 3,893 sf Storage= 4,306 cf

Plug-Flow detention time= 0.1 min calculated for 19.330 af (100% of inflow)
Center-of-Mass det. time= 0.1 min (819.1 - 819.0)

Volume	Invert	Avail.Storage	Storage Description
#1	764.00'	4,306 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
764.00	63	0	0
766.00	175	238	238
768.00	3,893	4,068	4,306

Device	Routing	Invert	Outlet Devices
#1	Primary	764.00'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 4.00 Width (feet) 7.75 15.75

Primary OutFlow Max=268.59 cfs @ 12.10 hrs HW=767.93' TW=765.27' (Dynamic Tailwater)
↑—**1=Custom Weir/Orifice** (Weir Controls 268.59 cfs @ 5.85 fps)

Summary for Pond B-NW3: NW Bench 3

[62] Hint: Exceeded Reach CH-NW4 OUTLET depth by 2.32' @ 12.09 hrs

Inflow Area = 30.614 ac, 3.13% Impervious, Inflow Depth = 6.28" for 500 year - 24 hour event
Inflow = 225.45 cfs @ 12.08 hrs, Volume= 16.028 af
Outflow = 224.99 cfs @ 12.09 hrs, Volume= 16.028 af, Atten= 0%, Lag= 0.5 min
Primary = 224.99 cfs @ 12.09 hrs, Volume= 16.028 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 805.62' @ 12.09 hrs Surf.Area= 3,181 sf Storage= 2,951 cf
Flood Elev= 806.00' Surf.Area= 3,893 sf Storage= 4,306 cf

Plug-Flow detention time= 0.1 min calculated for 16.025 af (100% of inflow)
Center-of-Mass det. time= 0.1 min (818.4 - 818.3)

Volume	Invert	Avail.Storage	Storage Description
#1	802.00'	4,306 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
802.00	63	0	0
804.00	175	238	238
806.00	3,893	4,068	4,306

Device	Routing	Invert	Outlet Devices
#1	Primary	802.00'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 4.00 Width (feet) 7.75 15.75

Primary OutFlow Max=224.82 cfs @ 12.09 hrs HW=805.62' TW=803.49' (Dynamic Tailwater)
└**1=Custom Weir/Orifice** (Weir Controls 224.82 cfs @ 5.47 fps)

Summary for Pond B-NW4: NW Bench 4

[62] Hint: Exceeded Reach CH-NW5 OUTLET depth by 2.08' @ 12.08 hrs

Inflow Area = 25.542 ac, 3.76% Impervious, Inflow Depth = 6.18" for 500 year - 24 hour event
Inflow = 183.81 cfs @ 12.07 hrs, Volume= 13.149 af
Outflow = 183.57 cfs @ 12.07 hrs, Volume= 13.149 af, Atten= 0%, Lag= 0.4 min
Primary = 183.57 cfs @ 12.07 hrs, Volume= 13.149 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 843.22' @ 12.08 hrs Surf.Area= 2,444 sf Storage= 1,836 cf
Flood Elev= 844.00' Surf.Area= 3,893 sf Storage= 4,306 cf

Plug-Flow detention time= 0.1 min calculated for 13.147 af (100% of inflow)
Center-of-Mass det. time= 0.1 min (817.9 - 817.8)

Volume	Invert	Avail.Storage	Storage Description
#1	840.00'	4,306 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
840.00	63	0	0
842.00	175	238	238
844.00	3,893	4,068	4,306

Device	Routing	Invert	Outlet Devices
#1	Primary	840.00'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 4.00 Width (feet) 7.75 15.75

Primary OutFlow Max=183.44 cfs @ 12.07 hrs HW=843.22' TW=841.30' (Dynamic Tailwater)
└**1=Custom Weir/Orifice** (Weir Controls 183.44 cfs @ 5.20 fps)

Summary for Pond B-NW5: NW Bench 5

[62] Hint: Exceeded Reach CH-NW6 OUTLET depth by 2.19' @ 12.07 hrs

Inflow Area = 20.804 ac, 4.61% Impervious, Inflow Depth = 6.03" for 500 year - 24 hour event
Inflow = 142.22 cfs @ 12.06 hrs, Volume= 10.460 af
Outflow = 141.74 cfs @ 12.07 hrs, Volume= 10.460 af, Atten= 0%, Lag= 0.6 min
Primary = 141.74 cfs @ 12.07 hrs, Volume= 10.460 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 881.57' @ 12.07 hrs Surf.Area= 3,097 sf Storage= 2,810 cf
Flood Elev= 882.00' Surf.Area= 3,893 sf Storage= 4,306 cf

Plug-Flow detention time= 0.2 min calculated for 10.459 af (100% of inflow)
Center-of-Mass det. time= 0.2 min (818.0 - 817.8)

Volume	Invert	Avail.Storage	Storage Description
#1	878.00'	4,306 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
878.00	63	0	0
880.00	175	238	238
882.00	3,893	4,068	4,306

Device	Routing	Invert	Outlet Devices
#1	Primary	878.00'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 4.00 Width (feet) 3.75 11.75

Primary OutFlow Max=141.71 cfs @ 12.07 hrs HW=881.57' TW=879.14' (Dynamic Tailwater)
↑—**1=Custom Weir/Orifice** (Weir Controls 141.71 cfs @ 5.42 fps)

Summary for Pond B-NW6: NW Bench 6

[62] Hint: Exceeded Reach CH-NW7 OUTLET depth by 1.90' @ 12.07 hrs
[62] Hint: Exceeded Reach CH-NWB6 OUTLET depth by 0.90' @ 12.07 hrs

Inflow Area = 17.211 ac, 5.57% Impervious, Inflow Depth = 5.87" for 500 year - 24 hour event
Inflow = 109.20 cfs @ 12.06 hrs, Volume= 8.421 af
Outflow = 108.90 cfs @ 12.07 hrs, Volume= 8.421 af, Atten= 0%, Lag= 0.6 min
Primary = 108.90 cfs @ 12.07 hrs, Volume= 8.421 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 919.17' @ 12.07 hrs Surf.Area= 2,354 sf Storage= 1,720 cf
Flood Elev= 920.00' Surf.Area= 3,893 sf Storage= 4,306 cf

Plug-Flow detention time= 0.2 min calculated for 8.420 af (100% of inflow)
Center-of-Mass det. time= 0.2 min (818.3 - 818.2)

Volume	Invert	Avail.Storage	Storage Description
#1	916.00'	4,306 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
916.00	63	0	0
918.00	175	238	238
920.00	3,893	4,068	4,306

Device	Routing	Invert	Outlet Devices
#1	Primary	916.00'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 4.00 Width (feet) 3.75 11.75

Primary OutFlow Max=108.83 cfs @ 12.07 hrs HW=919.17' TW=917.39' (Dynamic Tailwater)
1=Custom Weir/Orifice (Weir Controls 108.83 cfs @ 4.96 fps)

Summary for Pond B-NW7A: NW Bench 7 w/ Box Cul

[62] Hint: Exceeded Reach CH-NW8 OUTLET depth by 2.12' @ 12.06 hrs

Inflow Area =	13.676 ac,	6.29% Impervious,	Inflow Depth =	7.05"	for 500 year - 24 hour event
Inflow =	127.79 cfs @	12.06 hrs,	Volume=	8.035 af	
Outflow =	127.74 cfs @	12.06 hrs,	Volume=	8.035 af,	Atten= 0%, Lag= 0.2 min
Primary =	90.40 cfs @	12.06 hrs,	Volume=	7.321 af	
Secondary =	37.34 cfs @	12.06 hrs,	Volume=	0.715 af	

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 933.62' @ 12.06 hrs Surf.Area= 1,047 sf Storage= 1,400 cf
Flood Elev= 934.00' Surf.Area= 1,200 sf Storage= 1,830 cf

Plug-Flow detention time= 0.2 min calculated for 8.035 af (100% of inflow)
Center-of-Mass det. time= 0.2 min (811.0 - 810.8)

Volume	Invert	Avail.Storage	Storage Description
#1	931.00'	1,830 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
931.00	60	0	0
932.00	400	230	230
933.00	800	600	830
934.00	1,200	1,000	1,830

Device	Routing	Invert	Outlet Devices
#1	Primary	931.00'	**96.0" W x 48.0" H Box 4' x 8' Box Culvert** L= 35.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 931.00' / 930.83' S= 0.0049 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 32.00 sf
#2	Secondary	932.00'	**143.1 deg x 2.0' long x 2.00' rise Sharp-Crested Vee/Trap Weir** Cv= 2.47 (C= 3.09)

Primary OutFlow Max=90.40 cfs @ 12.06 hrs HW=933.62' TW=931.92' (Dynamic Tailwater)
1=4' x 8' Box Culvert (Barrel Controls 90.40 cfs @ 5.76 fps)

Secondary OutFlow Max=37.33 cfs @ 12.06 hrs HW=933.62' TW=930.69' (Dynamic Tailwater)
2=Sharp-Crested Vee/Trap Weir (Weir Controls 37.33 cfs @ 3.37 fps)

Summary for Pond B-NW7B: N Bench 7B w/ 18" Clvt

[58] Hint: Peaked 0.28' above defined flood level
[62] Hint: Exceeded Reach D-NW7 OUTLET depth by 1.39' @ 12.06 hrs

Inflow Area =	2.114 ac,	4.67% Impervious,	Inflow Depth =	11.00"	for 500 year - 24 hour event
Inflow =	57.46 cfs @	12.06 hrs,	Volume=	1.938 af	
Outflow =	57.33 cfs @	12.06 hrs,	Volume=	1.938 af,	Atten= 0%, Lag= 0.4 min
Primary =	5.49 cfs @	12.06 hrs,	Volume=	0.294 af	
Secondary =	51.84 cfs @	12.06 hrs,	Volume=	1.644 af	

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2

Peak Elev= 922.28' @ 12.06 hrs Surf.Area= 2,138 sf Storage= 1,867 cf
Flood Elev= 922.00' Surf.Area= 1,545 sf Storage= 1,343 cf

Plug-Flow detention time= 0.6 min calculated for 1.938 af (100% of inflow)
Center-of-Mass det. time= 0.6 min (779.7 - 779.1)

Volume	Invert	Avail.Storage	Storage Description
#1	920.50'	8,598 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
920.50	0	0	0
921.00	760	190	190
922.00	1,545	1,153	1,343
924.00	5,710	7,255	8,598

Device	Routing	Invert	Outlet Devices
#1	Primary	920.50'	**15.8" Round 18" Dia PEP SDR 17** L= 50.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 920.50' / 920.00' S= 0.0100 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 1.36 sf
#2	Secondary	920.50'	**143.1 deg x 2.0' long x 2.00' rise Sharp-Crested Vee/Trap Weir** Cv= 2.47 (C= 3.09)
#3	Secondary	922.00'	**20.0' long x 2.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32

Primary OutFlow Max=5.49 cfs @ 12.06 hrs HW=922.28' TW=920.28' (Dynamic Tailwater)
└**1=18" Dia PEP SDR 17** (Inlet Controls 5.49 cfs @ 4.03 fps)

Secondary OutFlow Max=51.80 cfs @ 12.06 hrs HW=922.28' TW=921.27' (Dynamic Tailwater)
├**2=Sharp-Crested Vee/Trap Weir** (Weir Controls 44.01 cfs @ 3.36 fps)
└**3=Broad-Crested Rectangular Weir** (Weir Controls 7.79 cfs @ 1.37 fps)

Summary for Pond B-NW8: NW Bench 8

[62] Hint: Exceeded Reach CH-NW9 OUTLET depth by 2.19' @ 12.06 hrs

Inflow Area = 13.063 ac, 4.96% Impervious, Inflow Depth = 7.01" for 500 year - 24 hour event
Inflow = 127.20 cfs @ 12.05 hrs, Volume= 7.627 af
Outflow = 126.52 cfs @ 12.06 hrs, Volume= 7.627 af, Atten= 1%, Lag= 0.6 min
Primary = 126.52 cfs @ 12.06 hrs, Volume= 7.627 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 959.43' @ 12.06 hrs Surf.Area= 2,831 sf Storage= 2,385 cf
Flood Elev= 960.00' Surf.Area= 3,893 sf Storage= 4,306 cf

Plug-Flow detention time= 0.2 min calculated for 7.626 af (100% of inflow)
Center-of-Mass det. time= 0.2 min (811.9 - 811.7)

Volume	Invert	Avail.Storage	Storage Description
#1	956.00'	4,306 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
956.00	63	0	0
958.00	175	238	238
960.00	3,893	4,068	4,306

Device	Routing	Invert	Outlet Devices
#1	Primary	956.00'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 4.00 Width (feet) 3.75 11.75

Primary OutFlow Max=126.41 cfs @ 12.06 hrs HW=959.43' TW=957.49' (Dynamic Tailwater)
└**1=Custom Weir/Orifice** (Weir Controls 126.41 cfs @ 5.14 fps)

Summary for Pond B-NW9: NW Bench 9

[62] Hint: Exceeded Reach CH-NW10 OUTLET depth by 1.45' @ 12.05 hrs

Inflow Area = 8.498 ac, 4.37% Impervious, Inflow Depth = 6.97" for 500 year - 24 hour event
Inflow = 82.53 cfs @ 12.04 hrs, Volume= 4.934 af
Outflow = 82.28 cfs @ 12.05 hrs, Volume= 4.934 af, Atten= 0%, Lag= 0.5 min
Primary = 82.28 cfs @ 12.05 hrs, Volume= 4.934 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 998.75' @ 12.05 hrs Surf.Area= 1,562 sf Storage= 886 cf
Flood Elev= 1,000.00' Surf.Area= 3,893 sf Storage= 4,306 cf

Plug-Flow detention time= 0.2 min calculated for 4.934 af (100% of inflow)
Center-of-Mass det. time= 0.2 min (812.3 - 812.1)

Volume	Invert	Avail.Storage	Storage Description
#1	996.00'	4,306 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
996.00	63	0	0
998.00	175	238	238
1,000.00	3,893	4,068	4,306

Device	Routing	Invert	Outlet Devices
#1	Primary	996.00'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 4.00 Width (feet) 3.75 11.75

Primary OutFlow Max=82.28 cfs @ 12.05 hrs HW=998.75' TW=997.24' (Dynamic Tailwater)
└**1=Custom Weir/Orifice** (Weir Controls 82.28 cfs @ 4.61 fps)

Summary for Pond B-W1: W Bench 1

[62] Hint: Exceeded Reach CH-W2 OUTLET depth by 4.59' @ 12.14 hrs

Inflow Area = 48.022 ac, 0.00% Impervious, Inflow Depth = 6.81" for 500 year - 24 hour event
Inflow = 364.45 cfs @ 12.13 hrs, Volume= 27.254 af
Outflow = 364.14 cfs @ 12.13 hrs, Volume= 27.254 af, Atten= 0%, Lag= 0.3 min
Primary = 364.14 cfs @ 12.13 hrs, Volume= 27.254 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 729.96' @ 12.13 hrs Surf.Area= 3,255 sf Storage= 3,333 cf
Flood Elev= 730.00' Surf.Area= 3,339 sf Storage= 3,481 cf

Plug-Flow detention time= 0.1 min calculated for 27.254 af (100% of inflow)
Center-of-Mass det. time= 0.1 min (822.1 - 822.0)

Volume	Invert	Avail.Storage	Storage Description
#1	726.00'	3,481 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
726.00	67	0	0
727.00	125	96	96
728.00	194	160	256
729.00	1,459	827	1,082
730.00	3,339	2,399	3,481

Device	Routing	Invert	Outlet Devices
#1	Primary	726.00'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 1.00 2.00 3.00 4.00 Width (feet) 11.75 13.75 15.75 17.75 19.75

Primary OutFlow Max=363.92 cfs @ 12.13 hrs HW=729.95' TW=727.48' (Dynamic Tailwater)
1=Custom Weir/Orifice (Weir Controls 363.92 cfs @ 5.86 fps)

Summary for Pond B-W2: W Bench 2

[62] Hint: Exceeded Reach CH-W3 OUTLET depth by 2.36' @ 12.13 hrs

Inflow Area = 42.013 ac, 0.00% Impervious, Inflow Depth = 6.81" for 500 year - 24 hour event
Inflow = 319.46 cfs @ 12.12 hrs, Volume= 23.844 af
Outflow = 319.23 cfs @ 12.13 hrs, Volume= 23.844 af, Atten= 0%, Lag= 0.3 min
Primary = 319.23 cfs @ 12.13 hrs, Volume= 23.844 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 767.66' @ 12.13 hrs Surf.Area= 2,621 sf Storage= 2,352 cf
Flood Elev= 768.00' Surf.Area= 3,245 sf Storage= 3,343 cf

Plug-Flow detention time= 0.1 min calculated for 23.840 af (100% of inflow)
Center-of-Mass det. time= 0.1 min (821.8 - 821.7)

Volume	Invert	Avail.Storage	Storage Description
#1	764.00'	3,343 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
764.00	63	0	0
765.00	115	89	89
766.00	176	146	235
767.00	1,398	787	1,022
768.00	3,245	2,322	3,343

Device	Routing	Invert	Outlet Devices
#1	Primary	764.00'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 1.00 2.00 3.00 4.00

Width (feet) 11.75 13.75 15.75 17.75 19.75

Primary OutFlow Max=319.09 cfs @ 12.13 hrs HW=767.66' TW=765.37' (Dynamic Tailwater)
1=Custom Weir/Orifice (Weir Controls 319.09 cfs @ 5.66 fps)

Summary for Pond B-W3: W Bench 3

[62] Hint: Exceeded Reach CH-W4 OUTLET depth by 1.95' @ 12.13 hrs

Inflow Area = 36.798 ac, 0.00% Impervious, Inflow Depth = 6.81" for 500 year - 24 hour event
Inflow = 279.16 cfs @ 12.12 hrs, Volume= 20.884 af
Outflow = 279.07 cfs @ 12.12 hrs, Volume= 20.884 af, Atten= 0%, Lag= 0.2 min
Primary = 279.07 cfs @ 12.12 hrs, Volume= 20.884 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 805.39' @ 12.12 hrs Surf.Area= 2,071 sf Storage= 1,653 cf
Flood Elev= 806.00' Surf.Area= 3,168 sf Storage= 3,251 cf

Plug-Flow detention time= 0.1 min calculated for 20.884 af (100% of inflow)
Center-of-Mass det. time= 0.1 min (821.7 - 821.6)

Volume	Invert	Avail.Storage	Storage Description
#1	802.00'	3,251 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
802.00	62	0	0
803.00	107	85	85
804.00	160	134	218
805.00	1,369	765	983
806.00	3,168	2,269	3,251

Device	Routing	Invert	Outlet Devices
#1	Primary	802.00'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 1.00 2.00 3.00 4.00 Width (feet) 11.75 13.75 15.75 17.75 19.75

Primary OutFlow Max=278.90 cfs @ 12.12 hrs HW=805.39' TW=803.30' (Dynamic Tailwater)
1=Custom Weir/Orifice (Weir Controls 278.90 cfs @ 5.44 fps)

Summary for Pond B-W4: W Bench 4

[62] Hint: Exceeded Reach CH-W5 OUTLET depth by 2.36' @ 12.12 hrs

Inflow Area = 27.885 ac, 0.00% Impervious, Inflow Depth = 6.81" for 500 year - 24 hour event
Inflow = 218.68 cfs @ 12.11 hrs, Volume= 15.825 af
Outflow = 218.42 cfs @ 12.11 hrs, Volume= 15.825 af, Atten= 0%, Lag= 0.3 min
Primary = 218.42 cfs @ 12.11 hrs, Volume= 15.825 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 843.55' @ 12.11 hrs Surf.Area= 2,366 sf Storage= 2,017 cf
Flood Elev= 844.00' Surf.Area= 3,168 sf Storage= 3,251 cf

Plug-Flow detention time= 0.1 min calculated for 15.823 af (100% of inflow)
Center-of-Mass det. time= 0.1 min (820.6 - 820.5)

Volume	Invert	Avail.Storage	Storage Description
#1	840.00'	3,251 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
840.00	62	0	0
841.00	107	85	85
842.00	160	134	218
843.00	1,369	765	983
844.00	3,168	2,269	3,251

Device	Routing	Invert	Outlet Devices
#1	Primary	840.00'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 1.00 2.00 3.00 4.00 Width (feet) 7.75 9.75 11.75 13.75 15.75

Primary OutFlow Max=218.35 cfs @ 12.11 hrs HW=843.55' TW=841.45' (Dynamic Tailwater)
1=Custom Weir/Orifice (Weir Controls 218.35 cfs @ 5.44 fps)

Summary for Pond B-W5: W Bench 5

[62] Hint: Exceeded Reach CH-W6 OUTLET depth by 2.08' @ 12.10 hrs

Inflow Area = 20.240 ac, 0.00% Impervious, Inflow Depth = 6.81" for 500 year - 24 hour event
Inflow = 166.90 cfs @ 12.09 hrs, Volume= 11.487 af
Outflow = 166.79 cfs @ 12.09 hrs, Volume= 11.487 af, Atten= 0%, Lag= 0.3 min
Primary = 166.79 cfs @ 12.09 hrs, Volume= 11.487 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 881.04' @ 12.09 hrs Surf.Area= 1,447 sf Storage= 1,043 cf
Flood Elev= 882.00' Surf.Area= 3,168 sf Storage= 3,251 cf

Plug-Flow detention time= 0.1 min calculated for 11.485 af (100% of inflow)
Center-of-Mass det. time= 0.1 min (819.2 - 819.1)

Volume	Invert	Avail.Storage	Storage Description
#1	878.00'	3,251 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
878.00	62	0	0
879.00	107	85	85
880.00	160	134	218
881.00	1,369	765	983
882.00	3,168	2,269	3,251

Device	Routing	Invert	Outlet Devices
#1	Primary	878.00'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 1.00 2.00 3.00 4.00 Width (feet) 7.75 9.75 11.75 13.75 15.75

Primary OutFlow Max=166.65 cfs @ 12.09 hrs HW=881.04' TW=879.21' (Dynamic Tailwater)
1=Custom Weir/Orifice (Weir Controls 166.65 cfs @ 5.08 fps)

Summary for Pond B-W6: W Bench 6

[62] Hint: Exceeded Reach CH-W7 OUTLET depth by 0.72' @ 12.09 hrs

Inflow Area = 12.643 ac, 0.00% Impervious, Inflow Depth = 6.81" for 500 year - 24 hour event
Inflow = 109.51 cfs @ 12.08 hrs, Volume= 7.175 af
Outflow = 109.48 cfs @ 12.08 hrs, Volume= 7.175 af, Atten= 0%, Lag= 0.1 min
Primary = 109.48 cfs @ 12.08 hrs, Volume= 7.175 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 919.39' @ 12.08 hrs Surf.Area= 336 sf Storage= 514 cf
Flood Elev= 921.00' Surf.Area= 1,413 sf Storage= 1,712 cf

Plug-Flow detention time= 0.2 min calculated for 7.175 af (100% of inflow)
Center-of-Mass det. time= 0.2 min (817.8 - 817.7)

Volume	Invert	Avail.Storage	Storage Description
#1	917.00'	1,712 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
917.00	158	0	0
919.00	243	401	401
920.00	483	363	764
921.00	1,413	948	1,712

Device	Routing	Invert	Outlet Devices
#1	Primary	917.00'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 1.00 2.00 3.00 4.00 Width (feet) 7.75 9.75 11.75 13.75 15.75

Primary OutFlow Max=109.47 cfs @ 12.08 hrs HW=919.39' TW=917.96' (Dynamic Tailwater)
↑—**1=Custom Weir/Orifice** (Weir Controls 109.47 cfs @ 4.52 fps)

Summary for Pond B-W7: W Bench 7

[62] Hint: Exceeded Reach CH-W8 OUTLET depth by 2.05' @ 12.07 hrs

Inflow Area = 6.341 ac, 0.00% Impervious, Inflow Depth = 6.81" for 500 year - 24 hour event
Inflow = 56.89 cfs @ 12.06 hrs, Volume= 3.599 af
Outflow = 56.75 cfs @ 12.07 hrs, Volume= 3.599 af, Atten= 0%, Lag= 0.4 min
Primary = 56.75 cfs @ 12.07 hrs, Volume= 3.599 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 960.02' @ 12.07 hrs Surf.Area= 1,186 sf Storage= 1,293 cf
Flood Elev= 961.00' Surf.Area= 2,467 sf Storage= 3,090 cf

Plug-Flow detention time= 0.6 min calculated for 3.599 af (100% of inflow)
Center-of-Mass det. time= 0.5 min (816.9 - 816.4)

Volume	Invert	Avail.Storage	Storage Description
#1	957.00'	3,090 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
957.00	102	0	0
958.00	268	185	185
959.00	372	320	505
960.00	1,165	769	1,274
961.00	2,467	1,816	3,090

Device	Routing	Invert	Outlet Devices
#1	Primary	957.00'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 1.00 2.00 3.00 4.00 Width (feet) 1.25 3.25 5.25 7.25 9.25

Primary OutFlow Max=56.72 cfs @ 12.07 hrs HW=960.02' TW=958.67' (Dynamic Tailwater)
└**1=Custom Weir/Orifice** (Weir Controls 56.72 cfs @ 4.41 fps)

Summary for Pond B-W8: W Bench 8

Inflow Area = 1.978 ac, 0.00% Impervious, Inflow Depth = 6.81" for 500 year - 24 hour event
Inflow = 17.96 cfs @ 12.06 hrs, Volume= 1.123 af
Outflow = 17.86 cfs @ 12.07 hrs, Volume= 1.123 af, Atten= 1%, Lag= 0.7 min
Primary = 17.86 cfs @ 12.07 hrs, Volume= 1.123 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 1,001.75' @ 12.07 hrs Surf.Area= 932 sf Storage= 695 cf
Flood Elev= 1,004.00' Surf.Area= 3,908 sf Storage= 3,489 cf

Plug-Flow detention time= 1.3 min calculated for 1.123 af (100% of inflow)
Center-of-Mass det. time= 1.2 min (816.7 - 815.5)

Volume	Invert	Avail.Storage	Storage Description
#1	1,000.00'	3,489 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,000.00	187	0	0
1,001.00	291	239	239
1,002.00	1,150	721	960
1,003.00	3,908	2,529	3,489

Device	Routing	Invert	Outlet Devices
#1	Primary	1,000.00'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 1.00 2.00 Width (feet) 1.25 3.25 5.25

Primary OutFlow Max=17.84 cfs @ 12.07 hrs HW=1,001.75' TW=1,000.97' (Dynamic Tailwater)
└**1=Custom Weir/Orifice** (Weir Controls 17.84 cfs @ 3.41 fps)

Summary for Pond CUL-N1: N Box Culvert

[58] Hint: Peaked 1.10' above defined flood level
[62] Hint: Exceeded Reach CH-N1 OUTLET depth by 4.55' @ 12.10 hrs

Inflow Area = 41.660 ac, 1.29% Impervious, Inflow Depth = 7.33" for 500 year - 24 hour event
Inflow = 386.09 cfs @ 12.10 hrs, Volume= 25.452 af
Outflow = 386.09 cfs @ 12.10 hrs, Volume= 25.452 af, Atten= 0%, Lag= 0.0 min
Primary = 386.09 cfs @ 12.10 hrs, Volume= 25.452 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 723.10' @ 12.10 hrs
Flood Elev= 722.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	717.00'	**120.0" W x 48.0" H Box Culvert** L= 50.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 717.00' / 716.50' S= 0.0100 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 40.00 sf

Primary OutFlow Max=385.94 cfs @ 12.10 hrs HW=723.10' TW=708.81' (Dynamic Tailwater)
1=Culvert (Inlet Controls 385.94 cfs @ 9.65 fps)

Summary for Pond CUL-N2: N Ramp Box Culvert

[58] Hint: Peaked 1.52' above defined flood level
[62] Hint: Exceeded Reach CH-N4A OUTLET depth by 4.23' @ 12.09 hrs

Inflow Area = 27.910 ac, 1.93% Impervious, Inflow Depth = 7.57" for 500 year - 24 hour event
Inflow = 266.13 cfs @ 12.09 hrs, Volume= 17.615 af
Outflow = 266.13 cfs @ 12.09 hrs, Volume= 17.615 af, Atten= 0%, Lag= 0.0 min
Primary = 266.13 cfs @ 12.09 hrs, Volume= 17.615 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 835.52' @ 12.09 hrs
Flood Elev= 834.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	830.00'	**96.0" W x 48.0" H Box Culvert** L= 35.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 830.00' / 829.83' S= 0.0049 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 32.00 sf

Primary OutFlow Max=265.95 cfs @ 12.09 hrs HW=835.51' TW=830.30' (Dynamic Tailwater)
1=Culvert (Barrel Controls 265.95 cfs @ 8.31 fps)

Summary for Pond CUL-NW1: NW Box Culvert

[58] Hint: Peaked 0.12' above defined flood level
[62] Hint: Exceeded Reach CH-NW1 OUTLET depth by 3.69' @ 12.11 hrs

Inflow Area = 42.821 ac, 2.24% Impervious, Inflow Depth = 6.43" for 500 year - 24 hour event
Inflow = 319.70 cfs @ 12.11 hrs, Volume= 22.956 af
Outflow = 319.70 cfs @ 12.11 hrs, Volume= 22.956 af, Atten= 0%, Lag= 0.0 min
Primary = 319.70 cfs @ 12.11 hrs, Volume= 22.956 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 722.12' @ 12.11 hrs
Flood Elev= 722.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	717.00'	**120.0" W x 48.0" H Box Culvert** L= 40.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 717.00' / 716.60' S= 0.0100 '/' Cc= 0.900

n= 0.012 Concrete pipe, finished, Flow Area= 40.00 sf

Primary OutFlow Max=319.48 cfs @ 12.11 hrs HW=722.12' TW=707.87' (Dynamic Tailwater)
1=Culvert (Barrel Controls 319.48 cfs @ 8.33 fps)

Summary for Pond CUL-W1: W Box Culvert

[58] Hint: Peaked 3.54' above defined flood level
[62] Hint: Exceeded Reach CH-W1 OUTLET depth by 7.06' @ 12.14 hrs

Inflow Area = 48.022 ac, 0.00% Impervious, Inflow Depth = 6.81" for 500 year - 24 hour event
Inflow = 364.14 cfs @ 12.13 hrs, Volume= 27.254 af
Outflow = 364.14 cfs @ 12.13 hrs, Volume= 27.254 af, Atten= 0%, Lag= 0.0 min
Primary = 364.14 cfs @ 12.13 hrs, Volume= 27.254 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 725.54' @ 12.14 hrs
Flood Elev= 722.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	717.00'	**120.0" W x 48.0" H Box Culvert** L= 40.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 717.00' / 716.60' S= 0.0100 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 40.00 sf

Primary OutFlow Max=363.91 cfs @ 12.13 hrs HW=725.51' TW=721.94' (Dynamic Tailwater)
1=Culvert (Inlet Controls 363.91 cfs @ 9.10 fps)

Summary for Pond P-N1: N Pond

[95] Warning: Outlet Device #2 rise exceeded
[58] Hint: Peaked 0.33' above defined flood level

Inflow Area = 48.401 ac, 1.11% Impervious, Inflow Depth = 7.43" for 500 year - 24 hour event
Inflow = 427.54 cfs @ 12.09 hrs, Volume= 29.966 af
Outflow = 358.14 cfs @ 12.17 hrs, Volume= 29.631 af, Atten= 16%, Lag= 4.6 min
Primary = 5.72 cfs @ 12.17 hrs, Volume= 13.201 af
Secondary = 120.13 cfs @ 12.17 hrs, Volume= 13.576 af
Tertiary = 232.29 cfs @ 12.17 hrs, Volume= 2.854 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Starting Elev= 701.00' Surf.Area= 48,455 sf Storage= 134,178 cf
Peak Elev= 709.33' @ 12.17 hrs Surf.Area= 87,619 sf Storage= 633,940 cf (499,762 cf above start)
Flood Elev= 709.00' Surf.Area= 70,530 sf Storage= 607,730 cf (473,553 cf above start)

Plug-Flow detention time= 517.3 min calculated for 26.551 af (89% of inflow)
Center-of-Mass det. time= 402.5 min (1,212.3 - 809.9)

Volume	Invert	Avail.Storage	Storage Description
#1	698.00'	669,733 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
698.00	41,070	0	0
700.00	45,920	86,990	86,990
702.00	50,990	96,910	183,900
704.00	56,290	107,280	291,180
706.00	61,820	118,110	409,290
708.00	67,570	129,390	538,680
709.00	70,530	69,050	607,730
709.70	106,620	62,003	669,733

Device	Routing	Invert	Outlet Devices
#1	Primary	701.00'	**9.4" Round Culvert** L= 50.0' CPP, end-section conforming to fill, Ke= 0.500 Inlet / Outlet Invert= 701.00' / 700.50' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.48 sf
#2	Secondary	707.00'	**90.0 deg x 10.3' long x 2.00' rise Sharp-Crested Vee/Trap Weir** Cv= 2.50 (C= 3.13)
#3	Tertiary	709.00'	**480.0' long x 10.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64

Primary OutFlow Max=5.72 cfs @ 12.17 hrs HW=709.33' (Free Discharge)
└**1=Culvert** (Barrel Controls 5.72 cfs @ 11.88 fps)

Secondary OutFlow Max=120.12 cfs @ 12.17 hrs HW=709.33' TW=707.83' (Dynamic Tailwater)
└**2=Sharp-Crested Vee/Trap Weir** (Orifice Controls 120.12 cfs @ 4.88 fps)

Tertiary OutFlow Max=232.16 cfs @ 12.17 hrs HW=709.33' (Free Discharge)
└**3=Broad-Crested Rectangular Weir** (Weir Controls 232.16 cfs @ 1.46 fps)

Summary for Pond P-NW1: NW Pond

[95] Warning: Outlet Device #2 rise exceeded
[58] Hint: Peaked 0.02' above defined flood level

Inflow Area = 44.865 ac, 2.14% Impervious, Inflow Depth = 6.61" for 500 year - 24 hour event
Inflow = 323.52 cfs @ 12.11 hrs, Volume= 24.703 af
Outflow = 114.10 cfs @ 12.33 hrs, Volume= 24.598 af, Atten= 65%, Lag= 13.5 min
Primary = 7.65 cfs @ 12.33 hrs, Volume= 15.838 af
Secondary = 100.99 cfs @ 12.33 hrs, Volume= 8.740 af
Tertiary = 5.46 cfs @ 12.33 hrs, Volume= 0.020 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Starting Elev= 699.00' Surf.Area= 31,396 sf Storage= 81,473 cf
Peak Elev= 710.02' @ 12.33 hrs Surf.Area= 61,049 sf Storage= 578,420 cf (496,947 cf above start)
Flood Elev= 710.00' Surf.Area= 60,211 sf Storage= 577,158 cf (495,685 cf above start)

Plug-Flow detention time= 555.8 min calculated for 22.724 af (92% of inflow)
Center-of-Mass det. time= 464.6 min (1,277.7 - 813.0)

Volume	Invert	Avail.Storage	Storage Description
#1	696.00'	612,293 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
696.00	22,005	0	0
698.00	29,180	51,185	51,185
700.00	33,612	62,792	113,977
702.00	38,339	71,951	185,928
704.00	43,362	81,701	267,629
706.00	48,680	92,042	359,671
708.00	54,298	102,978	462,649
710.00	60,211	114,509	577,158
710.50	80,330	35,135	612,293

Device	Routing	Invert	Outlet Devices
#1	Primary	699.00'	**10.0" Round 10" Dia PEP SDR 17** L= 50.0' CPP, end-section conforming to fill, Ke= 0.500 Inlet / Outlet Invert= 699.00' / 698.50' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.55 sf
#2	Secondary	708.00'	**90.0 deg x 10.3' long x 2.00' rise Sharp-Crested Vee/Trap Weir** Cv= 2.50 (C= 3.13)
#3	Tertiary	710.00'	**730.0' long x 10.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64

Primary OutFlow Max=7.65 cfs @ 12.33 hrs HW=710.02' (Free Discharge)
└**1=10" Dia PEP SDR 17** (Barrel Controls 7.65 cfs @ 14.02 fps)

Secondary OutFlow Max=100.98 cfs @ 12.33 hrs HW=710.02' TW=708.75' (Dynamic Tailwater)
└**2=Sharp-Crested Vee/Trap Weir** (Orifice Controls 100.98 cfs @ 4.11 fps)

Tertiary OutFlow Max=5.43 cfs @ 12.33 hrs HW=710.02' (Free Discharge)
└**3=Broad-Crested Rectangular Weir** (Weir Controls 5.43 cfs @ 0.36 fps)

Summary for Pond P-W1: W Pond

[95] Warning: Outlet Device #2 rise exceeded
[58] Hint: Peaked 0.29' above defined flood level
[80] Warning: Exceeded Pond CUL-W1 by 2.44' @ 24.80 hrs (116.25 cfs 12.265 af)

Inflow Area = 49.461 ac, 0.00% Impervious, Inflow Depth = 6.91" for 500 year - 24 hour event
Inflow = 366.74 cfs @ 12.13 hrs, Volume= 28.484 af
Outflow = 358.45 cfs @ 12.17 hrs, Volume= 28.393 af, Atten= 2%, Lag= 1.9 min
Primary = 6.88 cfs @ 12.17 hrs, Volume= 12.734 af
Secondary = 117.97 cfs @ 12.17 hrs, Volume= 12.194 af
Tertiary = 233.60 cfs @ 12.17 hrs, Volume= 3.464 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Starting Elev= 713.00' Surf.Area= 32,954 sf Storage= 91,190 cf
Peak Elev= 721.99' @ 12.17 hrs Surf.Area= 52,508 sf Storage= 461,481 cf (370,291 cf above start)
Flood Elev= 721.70' Surf.Area= 49,174 sf Storage= 446,853 cf (355,663 cf above start)

Plug-Flow detention time= 348.8 min calculated for 26.300 af (92% of inflow)
Center-of-Mass det. time= 275.6 min (1,093.6 - 818.1)

Volume	Invert	Avail.Storage	Storage Description
#1	710.00'	479,186 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

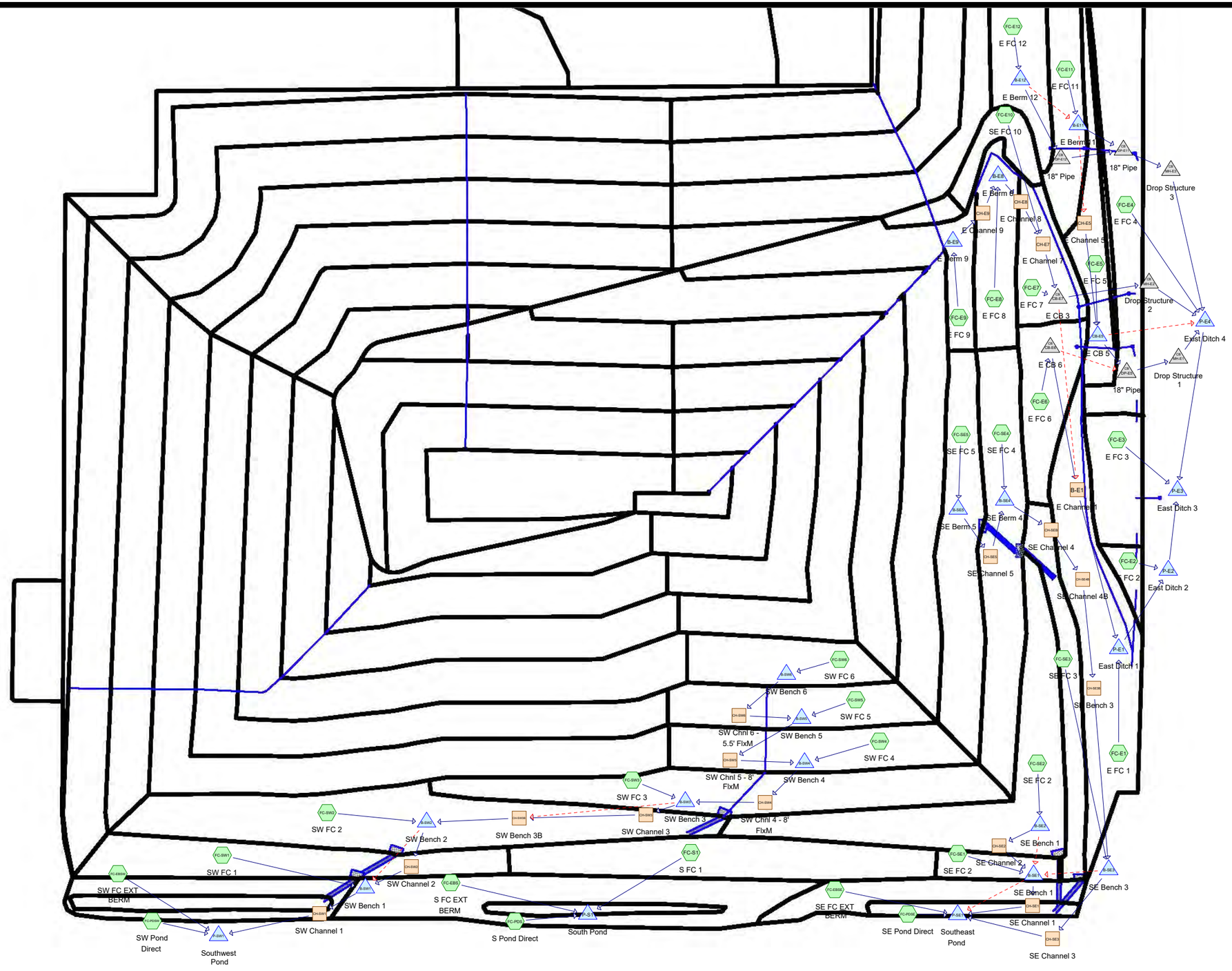
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
710.00	27,881	0	0
712.00	31,221	59,102	59,102
714.00	34,687	65,908	125,010
716.00	38,279	72,966	197,976
718.00	41,998	80,277	278,253
720.00	45,840	87,838	366,091
721.70	49,174	80,762	446,853
721.90	49,174	9,835	456,688
722.30	63,320	22,499	479,186

Device	Routing	Invert	Outlet Devices
#1	Primary	713.00'	**10.0" Round 10" Dia PEP SDR 17** L= 50.0' CMP, end-section conforming to fill, Ke= 0.500 Inlet / Outlet Invert= 713.00' / 712.50' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.55 sf
#2	Secondary	719.70'	**90.0 deg x 10.3' long x 2.00' rise Sharp-Crested Vee/Trap Weir** Cv= 2.50 (C= 3.13)
#3	Tertiary	721.70'	**580.0' long x 10.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64

Primary OutFlow Max=6.88 cfs @ 12.17 hrs HW=721.99' (Free Discharge)
↑—**1=10" Dia PEP SDR 17** (Barrel Controls 6.88 cfs @ 12.62 fps)

Secondary OutFlow Max=117.95 cfs @ 12.17 hrs HW=721.99' TW=720.52' (Dynamic Tailwater)
↑—**2=Sharp-Crested Vee/Trap Weir** (Orifice Controls 117.95 cfs @ 4.79 fps)

Tertiary OutFlow Max=233.15 cfs @ 12.17 hrs HW=721.99' (Free Discharge)
↑—**3=Broad-Crested Rectangular Weir** (Weir Controls 233.15 cfs @ 1.37 fps)



Subcat Reach Pond Link

Routing Diagram for BLSI Permit Expansion 2019_SE & Existing

Prepared by Carlson McCain, Inc., Printed 12/18/2019

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Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
74.539	71	Meadow, non-grazed, HSG C (FC-E1, FC-E10, FC-E11, FC-E12, FC-E2, FC-E3, FC-E4, FC-E5, FC-E6, FC-E7, FC-E8, FC-E9, FC-EBS, FC-EBSE, FC-EBSW, FC-S1, FC-SE1, FC-SE2, FC-SE3, FC-SE4, FC-SE5, FC-SW1, FC-SW2, FC-SW3, FC-SW4, FC-SW5, FC-SW6)
1.192	91	Urban industrial, 72% imp, HSG C (FC-EBS)
2.042	98	Water Surface, HSG C (FC-PDS, FC-PDSE, FC-PDSW)
77.773	**72**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
77.773	HSG C	FC-E1, FC-E10, FC-E11, FC-E12, FC-E2, FC-E3, FC-E4, FC-E5, FC-E6, FC-E7, FC-E8, FC-E9, FC-EBS, FC-EBSE, FC-EBSW, FC-PDS, FC-PDSE, FC-PDSW, FC-S1, FC-SE1, FC-SE2, FC-SE3, FC-SE4, FC-SE5, FC-SW1, FC-SW2, FC-SW3, FC-SW4, FC-SW5, FC-SW6
0.000	HSG D	
0.000	Other	
77.773		**TOTAL AREA**

Pipe Listing (all nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Diam/Width (inches)	Height (inches)	Inside-Fill (inches)
1	B-SW1	744.50	744.00	46.0	0.0109	0.011	96.0	36.0	0.0
2	CB-E6	752.00	722.50	123.0	0.2398	0.013	18.0	0.0	0.0
3	CB-E7	752.00	712.20	157.0	0.2535	0.013	18.0	0.0	0.0
4	DP-E11	747.00	713.75	150.0	0.2217	0.013	18.0	0.0	0.0
5	DP-E12	770.00	747.00	110.0	0.2091	0.013	18.0	0.0	0.0
6	DP-E5	722.50	712.00	60.0	0.1750	0.010	18.0	0.0	0.0
7	MH-E1	712.00	711.70	30.0	0.0100	0.010	18.0	0.0	0.0
8	MH-E2	712.20	712.00	20.0	0.0100	0.010	18.0	0.0	0.0
9	MH-E3	713.75	713.50	25.0	0.0100	0.010	18.0	0.0	0.0
10	P-E1	711.50	709.00	230.0	0.0109	0.010	16.0	0.0	0.0
11	P-E2	709.50	708.50	90.0	0.0111	0.011	16.0	0.0	0.0
12	P-E3	708.19	707.50	75.0	0.0092	0.011	16.0	0.0	0.0
13	P-E4	709.72	709.24	65.0	0.0074	0.010	16.0	0.0	0.0
14	P-SE1	712.00	710.90	73.0	0.0151	0.015	36.0	0.0	0.0
15	P-SW1	715.05	714.37	134.0	0.0051	0.015	18.0	0.0	0.0

Time span=0.00-60.00 hrs, dt=0.01 hrs, 6001 points x 2
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment FC-E1: E FC 1 Runoff Area=207,322 sf 0.00% Impervious Runoff Depth=6.81"
Flow Length=950' Tc=3.0 min CN=71 Runoff=62.48 cfs 2.701 af

Subcatchment FC-E10: SE FC 10 Runoff Area=38,960 sf 0.00% Impervious Runoff Depth=6.81"
Flow Length=540' Tc=4.4 min CN=71 Runoff=11.19 cfs 0.508 af

Subcatchment FC-E11: E FC 11 Runoff Area=110,581 sf 0.00% Impervious Runoff Depth=6.81"
Flow Length=815' Tc=11.7 min CN=71 Runoff=24.71 cfs 1.441 af

Subcatchment FC-E12: E FC 12 Runoff Area=113,402 sf 0.00% Impervious Runoff Depth=6.81"
Flow Length=840' Tc=13.5 min CN=71 Runoff=23.88 cfs 1.477 af

Subcatchment FC-E2: E FC 2 Runoff Area=17,645 sf 0.00% Impervious Runoff Depth=6.81"
Flow Length=80' Slope=0.3300 '/' Tc=4.1 min CN=71 Runoff=5.12 cfs 0.230 af

Subcatchment FC-E3: E FC 3 Runoff Area=68,100 sf 0.00% Impervious Runoff Depth=6.81"
Flow Length=126' Slope=0.3300 '/' Tc=5.9 min CN=71 Runoff=18.57 cfs 0.887 af

Subcatchment FC-E4: E FC 4 Runoff Area=244,950 sf 0.00% Impervious Runoff Depth=6.81"
Flow Length=660' Tc=15.1 min CN=71 Runoff=49.01 cfs 3.191 af

Subcatchment FC-E5: E FC 5 Runoff Area=95,558 sf 0.00% Impervious Runoff Depth=6.81"
Flow Length=1,290' Tc=9.9 min CN=71 Runoff=22.69 cfs 1.245 af

Subcatchment FC-E6: E FC 6 Runoff Area=82,761 sf 0.00% Impervious Runoff Depth=6.81"
Flow Length=353' Tc=6.0 min CN=71 Runoff=22.50 cfs 1.078 af

Subcatchment FC-E7: E FC 7 Runoff Area=71,155 sf 0.00% Impervious Runoff Depth=6.81"
Flow Length=240' Tc=3.2 min CN=71 Runoff=21.30 cfs 0.927 af

Subcatchment FC-E8: E FC 8 Runoff Area=82,564 sf 0.00% Impervious Runoff Depth=6.81"
Flow Length=630' Tc=10.2 min CN=71 Runoff=19.41 cfs 1.076 af

Subcatchment FC-E9: E FC 9 Runoff Area=40,680 sf 0.00% Impervious Runoff Depth=6.81"
Flow Length=590' Tc=9.6 min CN=71 Runoff=9.76 cfs 0.530 af

Subcatchment FC-EBS: S FC EXT BERM Runoff Area=218,410 sf 17.12% Impervious Runoff Depth=7.48"
Flow Length=440' Tc=6.0 min CN=76 Runoff=63.94 cfs 3.124 af

Subcatchment FC-EBSE: SE FC EXT BERM Runoff Area=64,817 sf 0.00% Impervious Runoff Depth=6.81"
Flow Length=80' Slope=0.3333 '/' Tc=4.1 min CN=71 Runoff=18.81 cfs 0.844 af

Subcatchment FC-EBSW: SW FC EXT BERM Runoff Area=90,866 sf 0.00% Impervious Runoff Depth=6.81"
Flow Length=80' Slope=0.2500 '/' Tc=4.6 min CN=71 Runoff=25.93 cfs 1.184 af

Subcatchment FC-PDS: S Pond Direct Runoff Area=22,956 sf 100.00% Impervious Runoff Depth=10.26"
Tc=0.0 min CN=98 Runoff=9.40 cfs 0.451 af

Subcatchment FC-PDSE: SE Pond Direct Runoff Area=29,534 sf 100.00% Impervious Runoff Depth=10.26"
Tc=0.0 min CN=98 Runoff=12.10 cfs 0.580 af

Subcatchment FC-PDSW: SW Pond Direct Runoff Area=0.837 ac 100.00% Impervious Runoff Depth=10.26"
Tc=0.0 min CN=98 Runoff=14.93 cfs 0.716 af

Subcatchment FC-S1: S FC 1 Runoff Area=156,870 sf 0.00% Impervious Runoff Depth=6.81"
Flow Length=1,258' Tc=16.0 min CN=71 Runoff=30.52 cfs 2.044 af

Subcatchment FC-SE1: SE FC 2 Runoff Area=32,441 sf 0.00% Impervious Runoff Depth=6.81"
Flow Length=471' Tc=7.6 min CN=71 Runoff=8.34 cfs 0.423 af

Subcatchment FC-SE2: SE FC 2 Runoff Area=220,544 sf 0.00% Impervious Runoff Depth=6.81"
Flow Length=935' Tc=11.2 min CN=71 Runoff=50.14 cfs 2.873 af

Subcatchment FC-SE3: SE FC 3 Runoff Area=82,514 sf 0.00% Impervious Runoff Depth=6.81"
Flow Length=948' Tc=8.3 min CN=71 Runoff=20.72 cfs 1.075 af

Subcatchment FC-SE4: SE FC 4 Runoff Area=176,950 sf 0.00% Impervious Runoff Depth=6.81"
Flow Length=890' Tc=13.7 min CN=71 Runoff=36.99 cfs 2.305 af

Subcatchment FC-SE5: SE FC 5 Runoff Area=155,474 sf 0.00% Impervious Runoff Depth=6.81"
Flow Length=880' Tc=13.3 min CN=71 Runoff=32.95 cfs 2.026 af

Subcatchment FC-SW1: SW FC 1 Runoff Area=137,408 sf 0.00% Impervious Runoff Depth=6.81"
Flow Length=920' Tc=14.6 min CN=71 Runoff=27.91 cfs 1.790 af

Subcatchment FC-SW2: SW FC 2 Runoff Area=270,545 sf 0.00% Impervious Runoff Depth=6.81"
Flow Length=915' Tc=14.5 min CN=71 Runoff=55.17 cfs 3.525 af

Subcatchment FC-SW3: SW FC 3 Runoff Area=197,591 sf 0.00% Impervious Runoff Depth=6.81"
Flow Length=971' Tc=11.8 min CN=71 Runoff=43.98 cfs 2.574 af

Subcatchment FC-SW4: SW FC 4 Runoff Area=125,118 sf 0.00% Impervious Runoff Depth=6.81"
Flow Length=671' Tc=11.3 min CN=71 Runoff=28.32 cfs 1.630 af

Subcatchment FC-SW5: SW FC 5 Runoff Area=106,215 sf 0.00% Impervious Runoff Depth=6.81"
Flow Length=527' Tc=9.8 min CN=71 Runoff=25.33 cfs 1.384 af

Subcatchment FC-SW6: SW FC 6 Runoff Area=89,383 sf 0.00% Impervious Runoff Depth=6.81"
Flow Length=404' Tc=8.5 min CN=71 Runoff=22.29 cfs 1.165 af

Reach B-E1: E Channel 1 Avg. Flow Depth=1.53' Max Vel=6.44 fps Inflow=68.24 cfs 3.791 af
n=0.040 L=930.0' S=0.0366 '/' Capacity=317.10 cfs Outflow=64.99 cfs 3.791 af

Reach CH-E5: E Channel 5 Avg. Flow Depth=0.25' Max Vel=4.05 fps Inflow=17.41 cfs 0.125 af
n=0.022 L=650.0' S=0.0246 '/' Capacity=470.34 cfs Outflow=12.84 cfs 0.125 af

Reach CH-E7: E Channel 7 Avg. Flow Depth=1.02' Max Vel=9.02 fps Inflow=37.05 cfs 2.113 af
n=0.040 L=293.0' S=0.0956 '/' Capacity=194.34 cfs Outflow=36.98 cfs 2.113 af

Reach CH-E8: E Channel 8 Avg. Flow Depth=0.64' Max Vel=12.39 fps Inflow=29.11 cfs 1.606 af
n=0.040 L=62.0' S=0.2903 '/' Capacity=486.14 cfs Outflow=29.10 cfs 1.606 af

Reach CH-E9: E Channel 9 Avg. Flow Depth=0.33' Max Vel=8.87 fps Inflow=9.74 cfs 0.530 af
n=0.040 L=96.0' S=0.3125 '/' Capacity=504.36 cfs Outflow=9.74 cfs 0.530 af

Reach CH-SE1: SE Channel 1 Avg. Flow Depth=0.81' Max Vel=15.04 fps Inflow=46.63 cfs 3.251 af
n=0.040 L=100.0' S=0.3350 '/' Capacity=522.20 cfs Outflow=46.63 cfs 3.251 af

Reach CH-SE2: SE Channel 2 Avg. Flow Depth=0.74' Max Vel=13.97 fps Inflow=38.98 cfs 2.779 af
n=0.040 L=60.0' S=0.3167 '/' Capacity=507.71 cfs Outflow=38.98 cfs 2.779 af

Reach CH-SE3: SE Channel 3 Avg. Flow Depth=1.03' Max Vel=15.87 fps Inflow=65.86 cfs 5.251 af
n=0.040 L=130.0' S=0.2923 '/' Capacity=487.80 cfs Outflow=65.86 cfs 5.251 af

Reach CH-SE3B: SE Bench 3 Avg. Flow Depth=1.05' Max Vel=4.31 fps Inflow=68.60 cfs 4.331 af
n=0.040 L=743.0' S=0.0162 '/' Capacity=124.24 cfs Outflow=66.35 cfs 4.331 af

Reach CH-SE4B: SE Channel 4B Avg. Flow Depth=0.68' Max Vel=4.62 fps Inflow=68.73 cfs 4.331 af
n=0.040 L=191.0' S=0.0288 '/' Capacity=435.42 cfs Outflow=68.60 cfs 4.331 af

Reach CH-SE5: SE Channel 5 Avg. Flow Depth=0.72' Max Vel=12.20 fps Inflow=32.72 cfs 2.026 af
n=0.040 L=140.0' S=0.2500 '/' Capacity=451.12 cfs Outflow=32.71 cfs 2.026 af

Reach CH-SEB: SE Channel 4 Avg. Flow Depth=1.07' Max Vel=15.87 fps Inflow=68.74 cfs 4.331 af
n=0.040 L=108.0' S=0.2824 '/' Capacity=479.46 cfs Outflow=68.73 cfs 4.331 af

Reach CH-SW1: SW Channel 1 Avg. Flow Depth=1.17' Max Vel=18.43 fps Inflow=198.25 cfs 12.057 af
n=0.040 L=110.0' S=0.2636 '/' Capacity=491.98 cfs Outflow=198.19 cfs 12.057 af

Reach CH-SW2: SW Channel 2 Avg. Flow Depth=1.54' Max Vel=14.92 fps Inflow=104.79 cfs 9.429 af
n=0.040 L=122.0' S=0.1721 '/' Capacity=374.32 cfs Outflow=104.78 cfs 9.429 af

Reach CH-SW3: SW Channel 3 Avg. Flow Depth=1.14' Max Vel=11.29 fps Inflow=53.26 cfs 5.744 af
n=0.040 L=104.0' S=0.1337 '/' Capacity=329.84 cfs Outflow=53.26 cfs 5.744 af

Reach CH-SW3B: SW Bench 3B Avg. Flow Depth=1.21' Max Vel=6.77 fps Inflow=119.04 cfs 6.742 af
n=0.030 L=933.0' S=0.0194 '/' Capacity=285.18 cfs Outflow=115.36 cfs 6.742 af

Reach CH-SW4: SW Chnl 4 - 8' FlxM Avg. Flow Depth=1.32' Max Vel=11.20 fps Inflow=75.27 cfs 4.179 af
n=0.055 L=170.0' S=0.1988 '/' Capacity=93.94 cfs Outflow=75.24 cfs 4.179 af

Reach CH-SW5: SW Chnl 5 - 8' FlxM Avg. Flow Depth=0.94' Max Vel=10.71 fps Inflow=47.51 cfs 2.548 af
n=0.061 L=123.0' S=0.3171 '/' Capacity=106.96 cfs Outflow=47.49 cfs 2.548 af

Reach CH-SW6: SW Chnl 6 - 5.5' FlxM Avg. Flow Depth=1.02' Max Vel=9.63 fps Inflow=22.28 cfs 1.165 af
n=0.059 L=123.0' S=0.3171 '/' Capacity=48.34 cfs Outflow=22.26 cfs 1.165 af

Pond B-E11: E Berm 11 Peak Elev=753.15' Storage=5,212 cf Inflow=31.11 cfs 1.503 af
Primary=13.52 cfs 1.389 af Secondary=17.41 cfs 0.125 af Outflow=30.46 cfs 1.503 af

Pond B-E12: E Berm 12 Peak Elev=776.10' Storage=4,999 cf Inflow=23.88 cfs 1.477 af
Primary=13.17 cfs 1.415 af Secondary=9.60 cfs 0.062 af Outflow=22.51 cfs 1.477 af

Pond B-E8: E Berm 8 Peak Elev=801.54' Storage=357 cf Inflow=29.16 cfs 1.606 af
Outflow=29.11 cfs 1.606 af

Pond B-E9: E Berm 9 Peak Elev=830.79' Storage=150 cf Inflow=9.76 cfs 0.530 af
Outflow=9.74 cfs 0.530 af

Pond B-SE1: SE Bench 1 Peak Elev=748.49' Storage=2,843 cf Inflow=64.64 cfs 3.452 af
Primary=46.63 cfs 3.251 af Secondary=17.66 cfs 0.201 af Outflow=64.30 cfs 3.452 af

Pond B-SE2: SE Bench 1 Peak Elev=767.19' Storage=3,399 cf Inflow=50.14 cfs 2.873 af
Primary=38.98 cfs 2.779 af Secondary=10.90 cfs 0.095 af Outflow=49.88 cfs 2.873 af

Pond B-SE3: SE Bench 3 Peak Elev=752.52' Storage=4,102 cf Inflow=76.50 cfs 5.406 af
Primary=65.86 cfs 5.251 af Secondary=10.23 cfs 0.156 af Outflow=76.09 cfs 5.406 af

Pond B-SE4: SE Berm 4 Peak Elev=800.59' Storage=2,996 cf Inflow=69.63 cfs 4.331 af
Outflow=68.74 cfs 4.331 af

Pond B-SE5: SE Berm 5 Peak Elev=834.67' Storage=883 cf Inflow=32.95 cfs 2.026 af
Outflow=32.72 cfs 2.026 af

Pond B-SW1: SW Bench 1 Peak Elev=746.55' Storage=157 cf Inflow=198.20 cfs 12.057 af
Outflow=198.25 cfs 12.057 af

Pond B-SW2: SW Bench 2 Peak Elev=769.35' Storage=9,493 cf Inflow=170.49 cfs 10.266 af
Primary=104.79 cfs 9.429 af Secondary=65.51 cfs 0.837 af Outflow=170.30 cfs 10.266 af

Pond B-SW3: SW Bench 3 Peak Elev=800.31' Storage=7,399 cf Inflow=119.18 cfs 6.753 af
Primary=53.26 cfs 5.744 af Secondary=65.79 cfs 0.998 af Outflow=119.05 cfs 6.742 af

Pond B-SW4: SW Bench 4 Peak Elev=834.45' Storage=846 cf Inflow=75.58 cfs 4.179 af
Outflow=75.27 cfs 4.179 af

Pond B-SW5: SW Bench 5 Peak Elev=872.85' Storage=245 cf Inflow=47.53 cfs 2.548 af
Outflow=47.51 cfs 2.548 af

Pond B-SW6: SW Bench 6 Peak Elev=911.73' Storage=223 cf Inflow=22.29 cfs 1.165 af
Outflow=22.28 cfs 1.165 af

Pond CB-E5: E CB 5 Peak Elev=728.14' Storage=1,233 cf Inflow=25.63 cfs 1.370 af
Primary=17.92 cfs 1.299 af Secondary=7.61 cfs 0.087 af Outflow=25.53 cfs 1.370 af

Pond CB-E6: E CB 6 Peak Elev=752.82' Inflow=22.50 cfs 1.078 af
Primary=20.07 cfs 0.999 af Secondary=2.43 cfs 0.079 af Outflow=22.50 cfs 1.078 af

Pond CB-E7: E CB 3 Peak Elev=753.50' Inflow=54.09 cfs 3.040 af
Primary=5.81 cfs 0.249 af Secondary=48.27 cfs 2.792 af Outflow=54.09 cfs 3.040 af

Pond DP-E11: 18" Pipe Peak Elev=757.30' Inflow=26.29 cfs 2.804 af
18.0" Round Culvert n=0.013 L=150.0' S=0.2217 '/' Outflow=26.29 cfs 2.804 af

Pond DP-E12: 18" Pipe Peak Elev=773.14' Inflow=13.17 cfs 1.415 af
18.0" Round Culvert n=0.013 L=110.0' S=0.2091 '/' Outflow=13.17 cfs 1.415 af

Pond DP-E5: 18" Pipe Peak Elev=728.85' Inflow=20.13 cfs 1.378 af
18.0" Round Culvert n=0.010 L=60.0' S=0.1750 '/' Outflow=20.13 cfs 1.378 af

Pond MH-E1: Drop Structure 1 Peak Elev=719.50' Inflow=20.13 cfs 1.378 af
18.0" Round Culvert n=0.010 L=30.0' S=0.0100 '/' Outflow=20.13 cfs 1.378 af

Pond MH-E2: Drop Structure 2 Peak Elev=714.37' Inflow=5.81 cfs 0.249 af
18.0" Round Culvert n=0.010 L=20.0' S=0.0100 '/' Outflow=5.81 cfs 0.249 af

Pond MH-E3: Drop Structure 3 Peak Elev=724.05' Inflow=26.29 cfs 2.804 af
18.0" Round Culvert n=0.010 L=25.0' S=0.0100 '/' Outflow=26.29 cfs 2.804 af

Pond P-E1: East Ditch 1 Peak Elev=715.50' Storage=12,068 cf Inflow=119.01 cfs 6.492 af
Primary=9.31 cfs 3.773 af Secondary=110.60 cfs 2.712 af Outflow=118.75 cfs 6.486 af

Pond P-E2: East Ditch 2 Peak Elev=713.81' Storage=14,086 cf Inflow=13.36 cfs 4.003 af
Primary=6.16 cfs 3.989 af Secondary=0.32 cfs 0.010 af Outflow=6.34 cfs 3.999 af

Pond P-E3: East Ditch 3 Peak Elev=712.98' Storage=25,987 cf Inflow=32.55 cfs 9.728 af
Primary=13.65 cfs 9.727 af Secondary=0.00 cfs 0.000 af Outflow=13.65 cfs 9.727 af

Pond P-E4: Exist Ditch 4 Peak Elev=713.97' Storage=49,228 cf Inflow=101.93 cfs 7.708 af
Primary=8.04 cfs 4.852 af Secondary=94.25 cfs 2.847 af Outflow=101.32 cfs 7.699 af

Pond P-S1: South Pond Peak Elev=720.53' Storage=50,889 cf Inflow=88.89 cfs 5.618 af
Discarded=0.10 cfs 0.338 af Secondary=84.22 cfs 4.622 af Tertiary=1.66 cfs 0.008 af Outflow=85.98 cfs 4.967 af

Pond P-SE1: Southeast Pond Peak Elev=718.01' Storage=136,715 cf Inflow=134.85 cfs 10.126 af
Primary=72.30 cfs 10.116 af Secondary=2.35 cfs 0.005 af Outflow=74.65 cfs 10.121 af

Pond P-SW1: Southwest Pond Peak Elev=723.37' Storage=166,666 cf Inflow=208.05 cfs 13.956 af
Primary=17.80 cfs 8.734 af Secondary=185.71 cfs 3.921 af Outflow=203.51 cfs 12.655 af

Total Runoff Area = 77.773 ac Runoff Volume = 45.003 af Average Runoff Depth = 6.94"
96.27% Pervious = 74.872 ac 3.73% Impervious = 2.900 ac

Summary for Subcatchment FC-E1: E FC 1

Runoff = 62.48 cfs @ 11.94 hrs, Volume= 2.701 af, Depth= 6.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 500 year - 24 hour Rainfall=10.50"

Area (sf)	CN	Description
207,322	71	Meadow, non-grazed, HSG C
207,322		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.4	20	0.3330	0.25		**Sheet Flow, Slope Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
1.6	930	0.0366	9.61	317.28	**Trap/Vee/Rect Channel Flow, Ditch Flow** Bot.W=2.00' D=3.00' Z= 3.0 '/' Top.W=20.00' n= 0.040 Mountain streams
3.0	950	Total			

Summary for Subcatchment FC-E10: SE FC 10

Runoff = 11.19 cfs @ 11.95 hrs, Volume= 0.508 af, Depth= 6.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 500 year - 24 hour Rainfall=10.50"

Area (sf)	CN	Description
38,960	71	Meadow, non-grazed, HSG C
38,960		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.4	40	0.3330	0.28		**Sheet Flow, Slope Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
2.0	500	0.0800	4.24		**Shallow Concentrated Flow, Ditch Flow** Grassed Waterway Kv= 15.0 fps
4.4	540	Total			

Summary for Subcatchment FC-E11: E FC 11

Runoff = 24.71 cfs @ 12.03 hrs, Volume= 1.441 af, Depth= 6.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 500 year - 24 hour Rainfall=10.50"

Area (sf)	CN	Description
110,581	71	Meadow, non-grazed, HSG C
110,581		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.5	90	0.3300	0.33		**Sheet Flow, Slope Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
7.2	725	0.0125	1.68		**Shallow Concentrated Flow, Ditch Flow** Grassed Waterway Kv= 15.0 fps
11.7	815	Total			

Summary for Subcatchment FC-E12: E FC 12

Runoff = 23.88 cfs @ 12.05 hrs, Volume= 1.477 af, Depth= 6.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 500 year - 24 hour Rainfall=10.50"

Area (sf)	CN	Description
113,402	71	Meadow, non-grazed, HSG C
113,402		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.5	140	0.3300	0.36		**Sheet Flow, Slope Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
7.0	700	0.0125	1.68		**Shallow Concentrated Flow, Ditch Flow** Grassed Waterway Kv= 15.0 fps
13.5	840	Total			

Summary for Subcatchment FC-E2: E FC 2

Runoff = 5.12 cfs @ 11.95 hrs, Volume= 0.230 af, Depth= 6.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 500 year - 24 hour Rainfall=10.50"

Area (sf)	CN	Description
17,645	71	Meadow, non-grazed, HSG C
17,645		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.1	80	0.3300	0.32		**Sheet Flow, 3:1 Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"

Summary for Subcatchment FC-E3: E FC 3

Runoff = 18.57 cfs @ 11.97 hrs, Volume= 0.887 af, Depth= 6.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 500 year - 24 hour Rainfall=10.50"

Area (sf)	CN	Description
68,100	71	Meadow, non-grazed, HSG C
68,100		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.9	126	0.3300	0.35		**Sheet Flow, 3:1 Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"

Summary for Subcatchment FC-E4: E FC 4

Runoff = 49.01 cfs @ 12.07 hrs, Volume= 3.191 af, Depth= 6.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 500 year - 24 hour Rainfall=10.50"

Area (sf)	CN	Description
244,950	71	Meadow, non-grazed, HSG C
244,950		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.2	160	0.3300	0.37		**Sheet Flow, Slope Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
7.9	500	0.0050	1.06		**Shallow Concentrated Flow, Ditch Flow** Grassed Waterway Kv= 15.0 fps
15.1	660	Total			

Summary for Subcatchment FC-E5: E FC 5

Runoff = 22.69 cfs @ 12.01 hrs, Volume= 1.245 af, Depth= 6.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 500 year - 24 hour Rainfall=10.50"

Area (sf)	CN	Description
95,558	71	Meadow, non-grazed, HSG C
95,558		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.4	40	0.3330	0.28		**Sheet Flow, Slope Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
7.5	1,250	0.0300	2.79		**Shallow Concentrated Flow, Ditch Flow** Unpaved Kv= 16.1 fps
9.9	1,290	Total			

Summary for Subcatchment FC-E6: E FC 6

Runoff = 22.50 cfs @ 11.97 hrs, Volume= 1.078 af, Depth= 6.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 500 year - 24 hour Rainfall=10.50"

Area (sf)	CN	Description
82,761	71	Meadow, non-grazed, HSG C
82,761		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0	103	0.3330	0.34		**Sheet Flow, Slope Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
1.0	250	0.0700	3.97		**Shallow Concentrated Flow, Ditch Flow** Grassed Waterway Kv= 15.0 fps
6.0	353	Total			

Summary for Subcatchment FC-E7: E FC 7

Runoff = 21.30 cfs @ 11.94 hrs, Volume= 0.927 af, Depth= 6.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 500 year - 24 hour Rainfall=10.50"

Area (sf)	CN	Description
71,155	71	Meadow, non-grazed, HSG C
71,155		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.4	40	0.3330	0.28		**Sheet Flow, Slope Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
0.8	200	0.0700	4.26		**Shallow Concentrated Flow, Ditch Flow** Unpaved Kv= 16.1 fps
3.2	240	Total			

Summary for Subcatchment FC-E8: E FC 8

Runoff = 19.41 cfs @ 12.02 hrs, Volume= 1.076 af, Depth= 6.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 500 year - 24 hour Rainfall=10.50"

Area (sf)	CN	Description
82,564	71	Meadow, non-grazed, HSG C
82,564		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.9	100	0.3330	0.34		**Sheet Flow, Slope Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
5.3	530	0.0125	1.68		**Shallow Concentrated Flow, Ditch Flow** Grassed Waterway Kv= 15.0 fps
10.2	630	Total			

Summary for Subcatchment FC-E9: E FC 9

Runoff = 9.76 cfs @ 12.01 hrs, Volume= 0.530 af, Depth= 6.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 500 year - 24 hour Rainfall=10.50"

Area (sf)	CN	Description
40,680	71	Meadow, non-grazed, HSG C
40,680		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.7	95	0.3330	0.33		**Sheet Flow, Slope Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
4.9	495	0.0125	1.68		**Shallow Concentrated Flow, Ditch Flow** Grassed Waterway Kv= 15.0 fps
9.6	590	Total			

Summary for Subcatchment FC-EBS: S FC EXT BERM

Runoff = 63.94 cfs @ 11.97 hrs, Volume= 3.124 af, Depth= 7.48"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 500 year - 24 hour Rainfall=10.50"

Area (sf)	CN	Description
166,486	71	Meadow, non-grazed, HSG C
51,924	91	Urban industrial, 72% imp, HSG C
218,410	76	Weighted Average
181,025		82.88% Pervious Area
37,385		17.12% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.8	50	0.3333	0.29		**Sheet Flow, 3:1 Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
3.2	390	0.0100	2.03		**Shallow Concentrated Flow, 1% Shallow Flow** Paved Kv= 20.3 fps
6.0	440	Total			

Summary for Subcatchment FC-EBSE: SE FC EXT BERM

Runoff = 18.81 cfs @ 11.95 hrs, Volume= 0.844 af, Depth= 6.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 500 year - 24 hour Rainfall=10.50"

Area (sf)	CN	Description
64,817	71	Meadow, non-grazed, HSG C
64,817		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.1	80	0.3333	0.32		**Sheet Flow, 3:1 Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"

Summary for Subcatchment FC-EBSW: SW FC EXT BERM

Runoff = 25.93 cfs @ 11.96 hrs, Volume= 1.184 af, Depth= 6.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 500 year - 24 hour Rainfall=10.50"

Area (sf)	CN	Description
90,866	71	Meadow, non-grazed, HSG C
90,866		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.6	80	0.2500	0.29		**Sheet Flow, 4:1 Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"

Summary for Subcatchment FC-PDS: S Pond Direct

[46] Hint: Tc=0 (Instant runoff peak depends on dt)

Runoff = 9.40 cfs @ 11.90 hrs, Volume= 0.451 af, Depth=10.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 500 year - 24 hour Rainfall=10.50"

Area (sf)	CN	Description
22,956	98	Water Surface, HSG C
22,956		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0					**Direct Entry, Direct Entry**

Summary for Subcatchment FC-PDSE: SE Pond Direct

[46] Hint: Tc=0 (Instant runoff peak depends on dt)

Runoff = 12.10 cfs @ 11.90 hrs, Volume= 0.580 af, Depth=10.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 500 year - 24 hour Rainfall=10.50"

Area (sf)	CN	Description
29,534	98	Water Surface, HSG C
29,534		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0					**Direct Entry, Direct Entry**

Summary for Subcatchment FC-PDSW: SW Pond Direct

[46] Hint: Tc=0 (Instant runoff peak depends on dt)

Runoff = 14.93 cfs @ 11.90 hrs, Volume= 0.716 af, Depth=10.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 500 year - 24 hour Rainfall=10.50"

Area (ac)	CN	Description
0.837	98	Water Surface, HSG C
0.837		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0					**Direct Entry, Direct Entry**

Summary for Subcatchment FC-S1: S FC 1

Runoff = 30.52 cfs @ 12.08 hrs, Volume= 2.044 af, Depth= 6.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 500 year - 24 hour Rainfall=10.50"

Area (sf)	CN	Description
156,870	71	Meadow, non-grazed, HSG C
156,870		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.5	90	0.3330	0.33		**Sheet Flow, Sheet Flow Slope** Grass: Dense n= 0.240 P2= 2.83"
10.8	968	0.0100	1.50		**Shallow Concentrated Flow, Ditch Flow** Grassed Waterway Kv= 15.0 fps
0.7	200	0.1000	5.09		**Shallow Concentrated Flow, Concentrated Flow** Unpaved Kv= 16.1 fps
16.0	1,258	Total			

Summary for Subcatchment FC-SE1: SE FC 2

Runoff = 8.34 cfs @ 11.99 hrs, Volume= 0.423 af, Depth= 6.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 500 year - 24 hour Rainfall=10.50"

Area (sf)	CN	Description
32,441	71	Meadow, non-grazed, HSG C
32,441		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.6	91	0.3330	0.33		**Sheet Flow, Slope Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
3.0	380	0.0200	2.12		**Shallow Concentrated Flow, Ditch Flow** Grassed Waterway Kv= 15.0 fps
7.6	471	Total			

Summary for Subcatchment FC-SE2: SE FC 2

Runoff = 50.14 cfs @ 12.03 hrs, Volume= 2.873 af, Depth= 6.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 500 year - 24 hour Rainfall=10.50"

Area (sf)	CN	Description
220,544	71	Meadow, non-grazed, HSG C
220,544		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.3	60	0.3330	0.31		**Sheet Flow, Slope Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
7.9	875	0.0150	1.84		**Shallow Concentrated Flow, Ditch Flow** Grassed Waterway Kv= 15.0 fps
11.2	935	Total			

Summary for Subcatchment FC-SE3: SE FC 3

Runoff = 20.72 cfs @ 12.00 hrs, Volume= 1.075 af, Depth= 6.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 500 year - 24 hour Rainfall=10.50"

Area (sf)	CN	Description
82,514	71	Meadow, non-grazed, HSG C
82,514		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.3	38	0.3330	0.28		**Sheet Flow, Slope Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
6.0	910	0.0280	2.51		**Shallow Concentrated Flow, Ditch Flow** Grassed Waterway Kv= 15.0 fps
8.3	948	Total			

Summary for Subcatchment FC-SE4: SE FC 4

Runoff = 36.99 cfs @ 12.05 hrs, Volume= 2.305 af, Depth= 6.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 500 year - 24 hour Rainfall=10.50"

Area (sf)	CN	Description
176,950	71	Meadow, non-grazed, HSG C
176,950		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.1	130	0.3330	0.36		**Sheet Flow, Slope Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
7.6	760	0.0125	1.68		**Shallow Concentrated Flow, Ditch Flow** Grassed Waterway Kv= 15.0 fps
13.7	890	Total			

Summary for Subcatchment FC-SE5: SE FC 5

Runoff = 32.95 cfs @ 12.05 hrs, Volume= 2.026 af, Depth= 6.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 500 year - 24 hour Rainfall=10.50"

Area (sf)	CN	Description
155,474	71	Meadow, non-grazed, HSG C
155,474		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	120	0.3330	0.35		**Sheet Flow, Slope Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
7.6	760	0.0125	1.68		**Shallow Concentrated Flow, Ditch Flow** Grassed Waterway Kv= 15.0 fps
13.3	880	Total			

Summary for Subcatchment FC-SW1: SW FC 1

Runoff = 27.91 cfs @ 12.06 hrs, Volume= 1.790 af, Depth= 6.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 500 year - 24 hour Rainfall=10.50"

Area (sf)	CN	Description
137,408	71	Meadow, non-grazed, HSG C
137,408		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	120	0.3330	0.35		**Sheet Flow, Slope Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
8.9	800	0.0100	1.50		**Shallow Concentrated Flow, Ditch Flow** Grassed Waterway Kv= 15.0 fps
14.6	920	Total			

Summary for Subcatchment FC-SW2: SW FC 2

Runoff = 55.17 cfs @ 12.06 hrs, Volume= 3.525 af, Depth= 6.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 500 year - 24 hour Rainfall=10.50"

Area (sf)	CN	Description
270,545	71	Meadow, non-grazed, HSG C
270,545		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	120	0.3330	0.35		**Sheet Flow, Slope Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
8.8	795	0.0100	1.50		**Shallow Concentrated Flow, Ditch Flow** Grassed Waterway Kv= 15.0 fps
14.5	915	Total			

Summary for Subcatchment FC-SW3: SW FC 3

Runoff = 43.98 cfs @ 12.03 hrs, Volume= 2.574 af, Depth= 6.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 500 year - 24 hour Rainfall=10.50"

Area (sf)	CN	Description
197,591	71	Meadow, non-grazed, HSG C
197,591		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.6	46	0.3330	0.29		**Sheet Flow, Slope Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
9.2	925	0.0125	1.68		**Shallow Concentrated Flow, Ditch Flow** Grassed Waterway Kv= 15.0 fps
11.8	971	Total			

Summary for Subcatchment FC-SW4: SW FC 4

Runoff = 28.32 cfs @ 12.03 hrs, Volume= 1.630 af, Depth= 6.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 500 year - 24 hour Rainfall=10.50"

Area (sf)	CN	Description
125,118	71	Meadow, non-grazed, HSG C
125,118		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	120	0.3300	0.35		**Sheet Flow, Slope Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
5.6	551	0.0120	1.64		**Shallow Concentrated Flow, Ditch Flow** Grassed Waterway Kv= 15.0 fps
11.3	671	Total			

Summary for Subcatchment FC-SW5: SW FC 5

Runoff = 25.33 cfs @ 12.01 hrs, Volume= 1.384 af, Depth= 6.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 500 year - 24 hour Rainfall=10.50"

Area (sf)	CN	Description
106,215	71	Meadow, non-grazed, HSG C
106,215		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	120	0.3300	0.35		**Sheet Flow, Slope Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
4.1	407	0.0120	1.64		**Shallow Concentrated Flow, Ditch Flow** Grassed Waterway Kv= 15.0 fps
9.8	527	Total			

Summary for Subcatchment FC-SW6: SW FC 6

Runoff = 22.29 cfs @ 12.00 hrs, Volume= 1.165 af, Depth= 6.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type II 24-hr 500 year - 24 hour Rainfall=10.50"

Area (sf)	CN	Description
89,383	71	Meadow, non-grazed, HSG C
89,383		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	120	0.3300	0.35		**Sheet Flow, Slope Sheet Flow** Grass: Dense n= 0.240 P2= 2.83"
2.8	284	0.0125	1.68		**Shallow Concentrated Flow, Ditch Flow** Grassed Waterway Kv= 15.0 fps
8.5	404	Total			

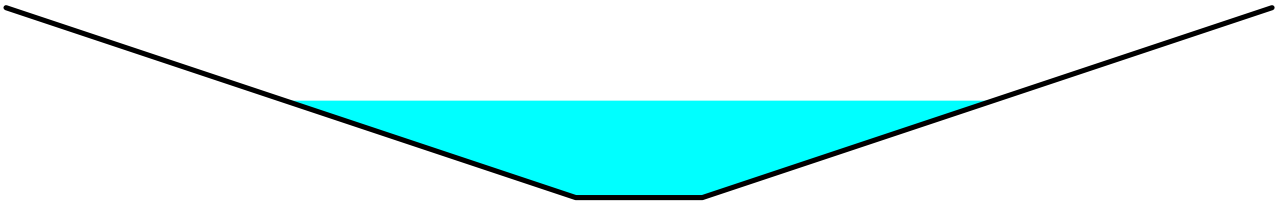
Summary for Reach B-E1: E Channel 1

Inflow Area = 1.900 ac, 0.00% Impervious, Inflow Depth = 23.94" for 500 year - 24 hour event
Inflow = 68.24 cfs @ 11.97 hrs, Volume= 3.791 af
Outflow = 64.99 cfs @ 11.99 hrs, Volume= 3.791 af, Atten= 5%, Lag= 1.7 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 6.44 fps, Min. Travel Time= 2.4 min
Avg. Velocity = 1.98 fps, Avg. Travel Time= 7.8 min

Peak Storage= 9,382 cf @ 11.99 hrs
Average Depth at Peak Storage= 1.53'
Bank-Full Depth= 3.00' Flow Area= 33.0 sf, Capacity= 317.10 cfs

2.00' x 3.00' deep channel, n= 0.040 Mountain streams
Side Slope Z-value= 3.0 '/' Top Width= 20.00'
Length= 930.0' Slope= 0.0366 '/'
Inlet Invert= 748.00', Outlet Invert= 714.00'



Summary for Reach CH-E5: E Channel 5

Inflow = 17.41 cfs @ 12.09 hrs, Volume= 0.125 af
Outflow = 12.84 cfs @ 12.12 hrs, Volume= 0.125 af, Atten= 26%, Lag= 1.8 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 4.05 fps, Min. Travel Time= 2.7 min
Avg. Velocity = 1.02 fps, Avg. Travel Time= 10.7 min

Peak Storage= 2,056 cf @ 12.12 hrs
Average Depth at Peak Storage= 0.25'
Bank-Full Depth= 2.00' Flow Area= 34.0 sf, Capacity= 470.34 cfs

12.00' x 2.00' deep channel, n= 0.022 Earth, clean & straight
Side Slope Z-value= 3.0 2.0 '/' Top Width= 22.00'
Length= 650.0' Slope= 0.0246 '/'
Inlet Invert= 742.00', Outlet Invert= 726.00'

‡

Summary for Reach CH-E7: E Channel 7

[62] Hint: Exceeded Reach CH-E8 OUTLET depth by 0.40' @ 11.97 hrs

Inflow Area = 3.724 ac, 0.00% Impervious, Inflow Depth = 6.81" for 500 year - 24 hour event
Inflow = 37.05 cfs @ 11.99 hrs, Volume= 2.113 af
Outflow = 36.98 cfs @ 12.00 hrs, Volume= 2.113 af, Atten= 0%, Lag= 0.4 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 9.02 fps, Min. Travel Time= 0.5 min
Avg. Velocity = 2.35 fps, Avg. Travel Time= 2.1 min

Peak Storage= 1,201 cf @ 12.00 hrs
Average Depth at Peak Storage= 1.02'
Bank-Full Depth= 2.50' Flow Area= 13.8 sf, Capacity= 194.34 cfs

3.00' x 2.50' deep channel, n= 0.040 Earth, cobble bottom, clean sides
Side Slope Z-value= 1.0 '/' Top Width= 8.00'
Length= 293.0' Slope= 0.0956 '/'
Inlet Invert= 782.00', Outlet Invert= 754.00'

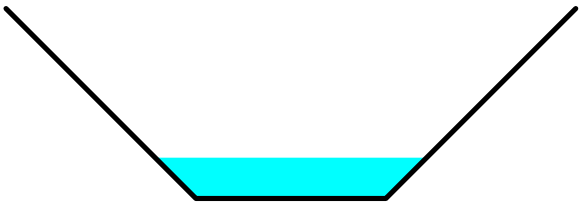
Summary for Reach CH-E8: E Channel 8

Inflow Area = 2.829 ac, 0.00% Impervious, Inflow Depth = 6.81" for 500 year - 24 hour event
Inflow = 29.11 cfs @ 12.02 hrs, Volume= 1.606 af
Outflow = 29.10 cfs @ 12.02 hrs, Volume= 1.606 af, Atten= 0%, Lag= 0.1 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 12.39 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 3.15 fps, Avg. Travel Time= 0.3 min

Peak Storage= 146 cf @ 12.02 hrs
Average Depth at Peak Storage= 0.64'
Bank-Full Depth= 3.00' Flow Area= 18.0 sf, Capacity= 486.14 cfs

3.00' x 3.00' deep channel, n= 0.040 Earth, cobble bottom, clean sides
Side Slope Z-value= 1.0 '/' Top Width= 9.00'
Length= 62.0' Slope= 0.2903 '/'
Inlet Invert= 800.00', Outlet Invert= 782.00'



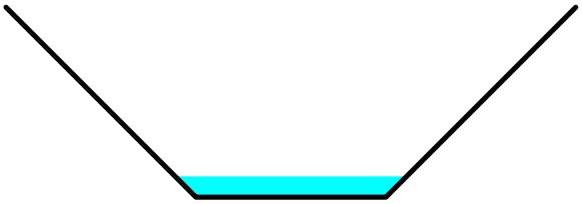
Summary for Reach CH-E9: E Channel 9

Inflow Area = 0.934 ac, 0.00% Impervious, Inflow Depth = 6.81" for 500 year - 24 hour event
Inflow = 9.74 cfs @ 12.02 hrs, Volume= 0.530 af
Outflow = 9.74 cfs @ 12.02 hrs, Volume= 0.530 af, Atten= 0%, Lag= 0.1 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 8.87 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 2.35 fps, Avg. Travel Time= 0.7 min

Peak Storage= 105 cf @ 12.02 hrs
Average Depth at Peak Storage= 0.33'
Bank-Full Depth= 3.00' Flow Area= 18.0 sf, Capacity= 504.36 cfs

3.00' x 3.00' deep channel, n= 0.040 Earth, cobble bottom, clean sides
Side Slope Z-value= 1.0 '/' Top Width= 9.00'
Length= 96.0' Slope= 0.3125 '/'
Inlet Invert= 830.00', Outlet Invert= 800.00'



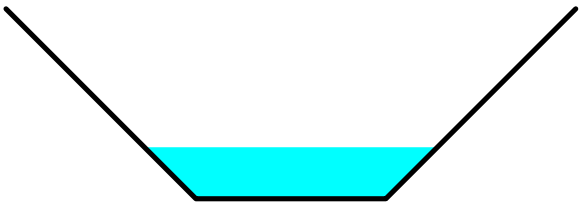
Summary for Reach CH-SE1: SE Channel 1

Inflow Area = 5.808 ac, 0.00% Impervious, Inflow Depth = 6.72" for 500 year - 24 hour event
Inflow = 46.63 cfs @ 12.05 hrs, Volume= 3.251 af
Outflow = 46.63 cfs @ 12.05 hrs, Volume= 3.251 af, Atten= 0%, Lag= 0.1 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 15.04 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 4.19 fps, Avg. Travel Time= 0.4 min

Peak Storage= 310 cf @ 12.05 hrs
Average Depth at Peak Storage= 0.81'
Bank-Full Depth= 3.00' Flow Area= 18.0 sf, Capacity= 522.20 cfs

3.00' x 3.00' deep channel, n= 0.040 Earth, cobble bottom, clean sides
Side Slope Z-value= 1.0 '/' Top Width= 9.00'
Length= 100.0' Slope= 0.3350 '/'
Inlet Invert= 745.50', Outlet Invert= 712.00'



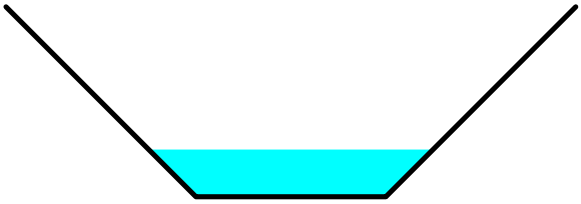
Summary for Reach CH-SE2: SE Channel 2

Inflow Area = 5.063 ac, 0.00% Impervious, Inflow Depth = 6.59" for 500 year - 24 hour event
Inflow = 38.98 cfs @ 12.04 hrs, Volume= 2.779 af
Outflow = 38.98 cfs @ 12.04 hrs, Volume= 2.779 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 13.97 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 3.92 fps, Avg. Travel Time= 0.3 min

Peak Storage= 167 cf @ 12.04 hrs
Average Depth at Peak Storage= 0.74'
Bank-Full Depth= 3.00' Flow Area= 18.0 sf, Capacity= 507.71 cfs

3.00' x 3.00' deep channel, n= 0.040 Earth, cobble bottom, clean sides
Side Slope Z-value= 1.0 '/' Top Width= 9.00'
Length= 60.0' Slope= 0.3167 '/'
Inlet Invert= 764.50', Outlet Invert= 745.50'



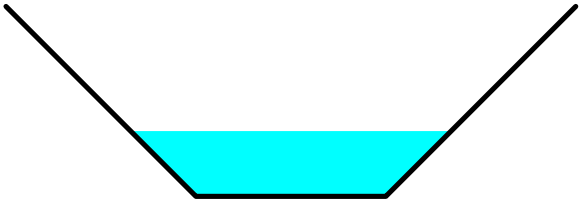
Summary for Reach CH-SE3: SE Channel 3

Inflow Area = 9.526 ac, 0.00% Impervious, Inflow Depth = 6.61" for 500 year - 24 hour event
Inflow = 65.86 cfs @ 12.10 hrs, Volume= 5.251 af
Outflow = 65.86 cfs @ 12.10 hrs, Volume= 5.251 af, Atten= 0%, Lag= 0.1 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 15.87 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 4.21 fps, Avg. Travel Time= 0.5 min

Peak Storage= 540 cf @ 12.10 hrs
Average Depth at Peak Storage= 1.03'
Bank-Full Depth= 3.00' Flow Area= 18.0 sf, Capacity= 487.80 cfs

3.00' x 3.00' deep channel, n= 0.040 Earth, cobble bottom, clean sides
Side Slope Z-value= 1.0 '/' Top Width= 9.00'
Length= 130.0' Slope= 0.2923 '/'
Inlet Invert= 750.00', Outlet Invert= 712.00'



Summary for Reach CH-SE3B: SE Bench 3

[62] Hint: Exceeded Reach CH-SE4B OUTLET depth by 0.41' @ 12.17 hrs

Inflow Area = 7.631 ac, 0.00% Impervious, Inflow Depth = 6.81" for 500 year - 24 hour event
Inflow = 68.60 cfs @ 12.09 hrs, Volume= 4.331 af
Outflow = 66.35 cfs @ 12.12 hrs, Volume= 4.331 af, Atten= 3%, Lag= 1.8 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 4.31 fps, Min. Travel Time= 2.9 min
Avg. Velocity = 0.89 fps, Avg. Travel Time= 13.9 min

Peak Storage= 11,447 cf @ 12.12 hrs
Average Depth at Peak Storage= 1.05'
Bank-Full Depth= 1.50' Flow Area= 23.6 sf, Capacity= 124.24 cfs

12.00' x 1.50' deep channel, n= 0.040
Side Slope Z-value= 2.0 3.0 '/' Top Width= 19.50'
Length= 743.0' Slope= 0.0162 '/'
Inlet Invert= 762.00', Outlet Invert= 750.00'

‡

Summary for Reach CH-SE4B: SE Channel 4B

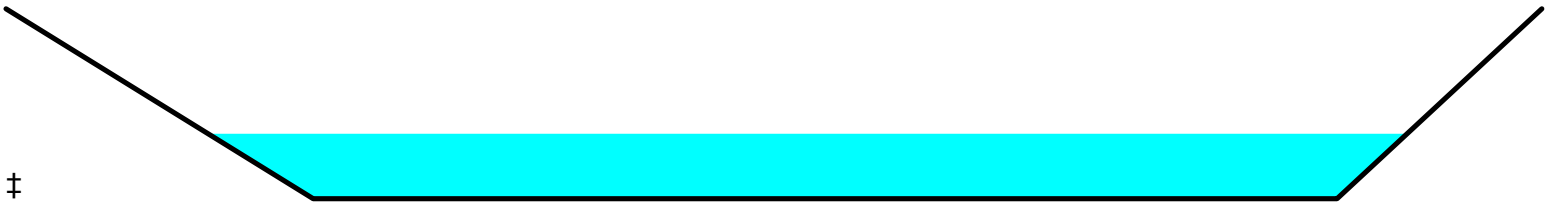
[62] Hint: Exceeded Reach CH-SEB OUTLET depth by 0.01' @ 24.44 hrs

Inflow Area = 7.631 ac, 0.00% Impervious, Inflow Depth = 6.81" for 500 year - 24 hour event
Inflow = 68.73 cfs @ 12.08 hrs, Volume= 4.331 af
Outflow = 68.60 cfs @ 12.09 hrs, Volume= 4.331 af, Atten= 0%, Lag= 0.4 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 4.62 fps, Min. Travel Time= 0.7 min
Avg. Velocity = 1.06 fps, Avg. Travel Time= 3.0 min

Peak Storage= 2,837 cf @ 12.09 hrs
Average Depth at Peak Storage= 0.68'
Bank-Full Depth= 2.00' Flow Area= 50.0 sf, Capacity= 435.42 cfs

20.00' x 2.00' deep channel, n= 0.040 Earth, cobble bottom, clean sides
Side Slope Z-value= 3.0 2.0 '/' Top Width= 30.00'
Length= 191.0' Slope= 0.0288 '/'
Inlet Invert= 767.50', Outlet Invert= 762.00'



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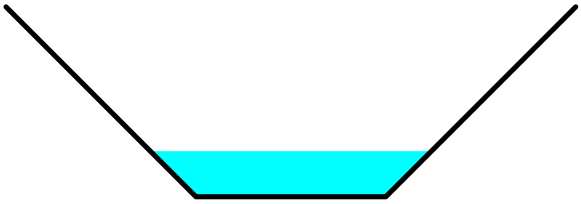
Summary for Reach CH-SE5: SE Channel 5

Inflow Area = 3.569 ac, 0.00% Impervious, Inflow Depth = 6.81" for 500 year - 24 hour event
Inflow = 32.72 cfs @ 12.06 hrs, Volume= 2.026 af
Outflow = 32.71 cfs @ 12.06 hrs, Volume= 2.026 af, Atten= 0%, Lag= 0.1 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 12.20 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 3.22 fps, Avg. Travel Time= 0.7 min

Peak Storage= 375 cf @ 12.06 hrs
Average Depth at Peak Storage= 0.72'
Bank-Full Depth= 3.00' Flow Area= 18.0 sf, Capacity= 451.12 cfs

3.00' x 3.00' deep channel, n= 0.040 Earth, cobble bottom, clean sides
Side Slope Z-value= 1.0 '/' Top Width= 9.00'
Length= 140.0' Slope= 0.2500 '/'
Inlet Invert= 833.00', Outlet Invert= 798.00'



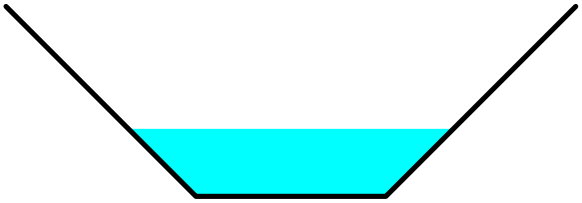
Summary for Reach CH-SEB: SE Channel 4

Inflow Area = 7.631 ac, 0.00% Impervious, Inflow Depth = 6.81" for 500 year - 24 hour event
Inflow = 68.74 cfs @ 12.08 hrs, Volume= 4.331 af
Outflow = 68.73 cfs @ 12.08 hrs, Volume= 4.331 af, Atten= 0%, Lag= 0.1 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 15.87 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 4.35 fps, Avg. Travel Time= 0.4 min

Peak Storage= 468 cf @ 12.08 hrs
Average Depth at Peak Storage= 1.07'
Bank-Full Depth= 3.00' Flow Area= 18.0 sf, Capacity= 479.46 cfs

3.00' x 3.00' deep channel, n= 0.040 Earth, cobble bottom, clean sides
Side Slope Z-value= 1.0 '/' Top Width= 9.00'
Length= 108.0' Slope= 0.2824 '/'
Inlet Invert= 798.00', Outlet Invert= 767.50'



Summary for Reach CH-SW1: SW Channel 1

Inflow Area = 21.264 ac, 0.00% Impervious, Inflow Depth = 6.80" for 500 year - 24 hour event
Inflow = 198.25 cfs @ 12.07 hrs, Volume= 12.057 af
Outflow = 198.19 cfs @ 12.07 hrs, Volume= 12.057 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 18.43 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 3.94 fps, Avg. Travel Time= 0.5 min

Peak Storage= 1,183 cf @ 12.07 hrs
Average Depth at Peak Storage= 1.17'
Bank-Full Depth= 2.00' Flow Area= 20.0 sf, Capacity= 491.98 cfs

8.00' x 2.00' deep channel, n= 0.040 Earth, cobble bottom, clean sides
Side Slope Z-value= 1.0 '/' Top Width= 12.00'
Length= 110.0' Slope= 0.2636 '/'
Inlet Invert= 744.00', Outlet Invert= 715.00'

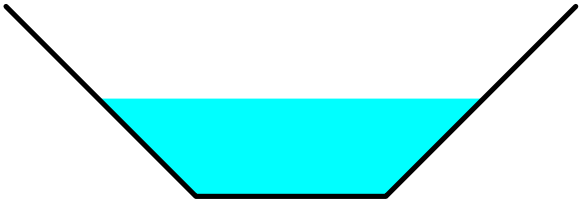
Summary for Reach CH-SW2: SW Channel 2

Inflow Area = 18.110 ac, 0.00% Impervious, Inflow Depth = 6.25" for 500 year - 24 hour event
Inflow = 104.79 cfs @ 12.06 hrs, Volume= 9.429 af
Outflow = 104.78 cfs @ 12.07 hrs, Volume= 9.429 af, Atten= 0%, Lag= 0.1 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 14.92 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 4.40 fps, Avg. Travel Time= 0.5 min

Peak Storage= 857 cf @ 12.07 hrs
Average Depth at Peak Storage= 1.54'
Bank-Full Depth= 3.00' Flow Area= 18.0 sf, Capacity= 374.32 cfs

3.00' x 3.00' deep channel, n= 0.040 Earth, cobble bottom, clean sides
Side Slope Z-value= 1.0 '/' Top Width= 9.00'
Length= 122.0' Slope= 0.1721 '/'
Inlet Invert= 766.00', Outlet Invert= 745.00'



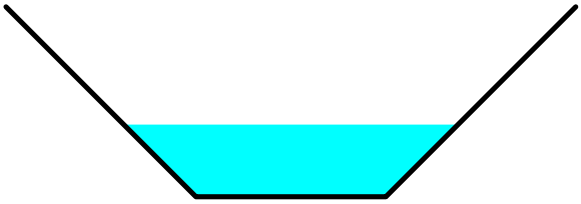
Summary for Reach CH-SW3: SW Channel 3

Inflow Area = 11.899 ac, 0.00% Impervious, Inflow Depth = 5.79" for 500 year - 24 hour event
Inflow = 53.26 cfs @ 12.03 hrs, Volume= 5.744 af
Outflow = 53.26 cfs @ 12.04 hrs, Volume= 5.744 af, Atten= 0%, Lag= 0.1 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 11.29 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 3.90 fps, Avg. Travel Time= 0.4 min

Peak Storage= 491 cf @ 12.04 hrs
Average Depth at Peak Storage= 1.14'
Bank-Full Depth= 3.00' Flow Area= 18.0 sf, Capacity= 329.84 cfs

3.00' x 3.00' deep channel, n= 0.040
Side Slope Z-value= 1.0 '/' Top Width= 9.00'
Length= 104.0' Slope= 0.1337 '/'
Inlet Invert= 798.00', Outlet Invert= 784.10'



Summary for Reach CH-SW3B: SW Bench 3B

[62] Hint: Exceeded Reach CH-SW3 OUTLET depth by 0.08' @ 12.07 hrs

Inflow Area = 11.899 ac, 0.00% Impervious, Inflow Depth = 6.80" for 500 year - 24 hour event
Inflow = 119.04 cfs @ 12.03 hrs, Volume= 6.742 af
Outflow = 115.36 cfs @ 12.06 hrs, Volume= 6.742 af, Atten= 3%, Lag= 1.5 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 6.77 fps, Min. Travel Time= 2.3 min
Avg. Velocity = 1.50 fps, Avg. Travel Time= 10.4 min

Peak Storage= 15,908 cf @ 12.06 hrs
Average Depth at Peak Storage= 1.21'
Bank-Full Depth= 2.00' Flow Area= 32.0 sf, Capacity= 285.18 cfs

11.00' x 2.00' deep channel, n= 0.030 Earth, dense weeds
Side Slope Z-value= 2.0 3.0 '/' Top Width= 21.00'
Length= 933.0' Slope= 0.0194 '/'
Inlet Invert= 784.10', Outlet Invert= 766.00'

‡

Summary for Reach CH-SW4: SW Chnl 4 - 8' FlxM

Inflow Area = 7.363 ac, 0.00% Impervious, Inflow Depth = 6.81" for 500 year - 24 hour event
Inflow = 75.27 cfs @ 12.02 hrs, Volume= 4.179 af
Outflow = 75.24 cfs @ 12.03 hrs, Volume= 4.179 af, Atten= 0%, Lag= 0.2 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 11.20 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 2.85 fps, Avg. Travel Time= 1.0 min

Peak Storage= 1,142 cf @ 12.03 hrs
Average Depth at Peak Storage= 1.32'
Bank-Full Depth= 1.50' Flow Area= 7.9 sf, Capacity= 93.94 cfs

3.75' x 1.50' deep channel, n= 0.055
Side Slope Z-value= 1.0 '/' Top Width= 6.75'
Length= 170.0' Slope= 0.1988 '/'
Inlet Invert= 831.80', Outlet Invert= 798.00'

Summary for Reach CH-SW5: SW Chnl 5 - 8' FlxM

Inflow Area = 4.490 ac, 0.00% Impervious, Inflow Depth = 6.81" for 500 year - 24 hour event
Inflow = 47.51 cfs @ 12.01 hrs, Volume= 2.548 af
Outflow = 47.49 cfs @ 12.01 hrs, Volume= 2.548 af, Atten= 0%, Lag= 0.1 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 10.71 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 2.60 fps, Avg. Travel Time= 0.8 min

Peak Storage= 545 cf @ 12.01 hrs
Average Depth at Peak Storage= 0.94'
Bank-Full Depth= 1.50' Flow Area= 7.9 sf, Capacity= 106.96 cfs

3.75' x 1.50' deep channel, n= 0.061
Side Slope Z-value= 1.0 '/' Top Width= 6.75'
Length= 123.0' Slope= 0.3171 '/'
Inlet Invert= 870.80', Outlet Invert= 831.80'

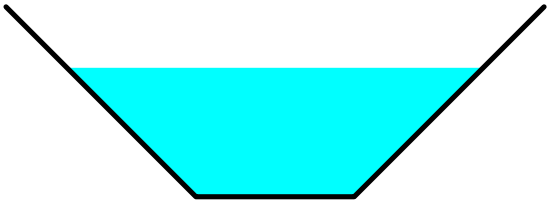
Summary for Reach CH-SW6: SW Chnl 6 - 5.5' FlxM

Inflow Area = 2.052 ac, 0.00% Impervious, Inflow Depth = 6.81" for 500 year - 24 hour event
Inflow = 22.28 cfs @ 12.00 hrs, Volume= 1.165 af
Outflow = 22.26 cfs @ 12.00 hrs, Volume= 1.165 af, Atten= 0%, Lag= 0.2 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 9.63 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 2.79 fps, Avg. Travel Time= 0.7 min

Peak Storage= 284 cf @ 12.00 hrs
Average Depth at Peak Storage= 1.02'
Bank-Full Depth= 1.50' Flow Area= 4.1 sf, Capacity= 48.34 cfs

1.25' x 1.50' deep channel, n= 0.059
Side Slope Z-value= 1.0 '/' Top Width= 4.25'
Length= 123.0' Slope= 0.3171 '/'
Inlet Invert= 909.80', Outlet Invert= 870.80'



Summary for Pond B-E11: E Berm 11

[58] Hint: Peaked 0.15' above defined flood level

Inflow Area = 2.539 ac, 0.00% Impervious, Inflow Depth = 7.11" for 500 year - 24 hour event
Inflow = 31.11 cfs @ 12.08 hrs, Volume= 1.503 af
Outflow = 30.46 cfs @ 12.09 hrs, Volume= 1.503 af, Atten= 2%, Lag= 0.5 min
Primary = 13.52 cfs @ 11.99 hrs, Volume= 1.389 af
Secondary = 17.41 cfs @ 12.09 hrs, Volume= 0.125 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 753.15' @ 12.09 hrs Surf.Area= 4,388 sf Storage= 5,212 cf
Flood Elev= 753.00' Surf.Area= 4,316 sf Storage= 4,566 cf

Plug-Flow detention time= 1.6 min calculated for 1.503 af (100% of inflow)
Center-of-Mass det. time= 1.6 min (811.6 - 810.0)

Volume	Invert	Avail.Storage	Storage Description
#1	750.00'	87,134 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
750.00	0	0	0
751.00	485	243	243
752.00	1,923	1,204	1,447
753.00	4,316	3,120	4,566
754.00	4,800	4,558	9,124
756.00	8,955	13,755	22,879
758.00	15,400	24,355	47,234
760.00	24,500	39,900	87,134

Device	Routing	Invert	Outlet Devices
#1	Primary	750.00'	**18.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Secondary	753.00'	**120.0' long x 2.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32

Primary OutFlow Max=0.00 cfs @ 11.99 hrs HW=752.53' TW=757.29' (Dynamic Tailwater)
↑—**1=Orifice/Grate** (Controls 0.00 cfs)

Secondary OutFlow Max=17.15 cfs @ 12.09 hrs HW=753.15' TW=742.20' (Dynamic Tailwater)
↑—**2=Broad-Crested Rectangular Weir** (Weir Controls 17.15 cfs @ 0.97 fps)

Summary for Pond B-E12: E Berm 12

[58] Hint: Peaked 0.10' above defined flood level

Inflow Area = 2.603 ac, 0.00% Impervious, Inflow Depth = 6.81" for 500 year - 24 hour event
Inflow = 23.88 cfs @ 12.05 hrs, Volume= 1.477 af
Outflow = 22.51 cfs @ 12.09 hrs, Volume= 1.477 af, Atten= 6%, Lag= 2.5 min
Primary = 13.17 cfs @ 12.30 hrs, Volume= 1.415 af
Secondary = 9.60 cfs @ 12.09 hrs, Volume= 0.062 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 776.10' @ 12.09 hrs Surf.Area= 4,371 sf Storage= 4,999 cf
Flood Elev= 776.00' Surf.Area= 4,316 sf Storage= 4,566 cf

Plug-Flow detention time= 1.6 min calculated for 1.477 af (100% of inflow)
Center-of-Mass det. time= 1.6 min (816.8 - 815.2)

Volume	Invert	Avail.Storage	Storage Description
#1	773.00'	14,292 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
773.00	0	0	0
774.00	485	243	243
775.00	1,923	1,204	1,447
776.00	4,316	3,120	4,566
778.00	5,410	9,726	14,292

Device	Routing	Invert	Outlet Devices
#1	Primary	773.00'	**18.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Secondary	776.00'	**120.0' long x 2.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32

Primary OutFlow Max=13.27 cfs @ 12.30 hrs HW=775.57' TW=773.14' (Dynamic Tailwater)
1=Orifice/Grate (Orifice Controls 13.27 cfs @ 7.51 fps)

Secondary OutFlow Max=9.48 cfs @ 12.09 hrs HW=776.10' TW=753.15' (Dynamic Tailwater)
2=Broad-Crested Rectangular Weir (Weir Controls 9.48 cfs @ 0.80 fps)

Summary for Pond B-E8: E Berm 8

[62] Hint: Exceeded Reach CH-E9 OUTLET depth by 1.21' @ 12.02 hrs

Inflow Area = 2.829 ac, 0.00% Impervious, Inflow Depth = 6.81" for 500 year - 24 hour event
Inflow = 29.16 cfs @ 12.02 hrs, Volume= 1.606 af
Outflow = 29.11 cfs @ 12.02 hrs, Volume= 1.606 af, Atten= 0%, Lag= 0.3 min
Primary = 29.11 cfs @ 12.02 hrs, Volume= 1.606 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 801.54' @ 12.02 hrs Surf.Area= 631 sf Storage= 357 cf
Flood Elev= 803.00' Surf.Area= 2,160 sf Storage= 2,280 cf

Plug-Flow detention time= 0.1 min calculated for 1.605 af (100% of inflow)
Center-of-Mass det. time= 0.1 min (812.3 - 812.2)

Volume	Invert	Avail.Storage	Storage Description
#1	800.00'	2,280 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
800.00	0	0	0
801.00	240	120	120
802.00	960	600	720
803.00	2,160	1,560	2,280

Device	Routing	Invert	Outlet Devices
#1	Primary	800.00'	**6.0' long x 2.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32

Primary OutFlow Max=29.08 cfs @ 12.02 hrs HW=801.54' TW=800.64' (Dynamic Tailwater)
1=Broad-Crested Rectangular Weir (Weir Controls 29.08 cfs @ 3.14 fps)

Summary for Pond B-E9: E Berm 9

Inflow Area = 0.934 ac, 0.00% Impervious, Inflow Depth = 6.81" for 500 year - 24 hour event
Inflow = 9.76 cfs @ 12.01 hrs, Volume= 0.530 af
Outflow = 9.74 cfs @ 12.02 hrs, Volume= 0.530 af, Atten= 0%, Lag= 0.3 min
Primary = 9.74 cfs @ 12.02 hrs, Volume= 0.530 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 830.79' @ 12.02 hrs Surf.Area= 380 sf Storage= 150 cf
Flood Elev= 833.00' Surf.Area= 4,320 sf Storage= 4,560 cf

Plug-Flow detention time= 0.1 min calculated for 0.530 af (100% of inflow)
Center-of-Mass det. time= 0.1 min (811.8 - 811.6)

Volume	Invert	Avail.Storage	Storage Description
#1	830.00'	4,560 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
830.00	0	0	0
831.00	480	240	240
832.00	1,920	1,200	1,440
833.00	4,320	3,120	4,560

Device	Routing	Invert	Outlet Devices
#1	Primary	830.00'	**6.0' long x 2.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32

Primary OutFlow Max=9.73 cfs @ 12.02 hrs HW=830.79' TW=830.33' (Dynamic Tailwater)
1=Broad-Crested Rectangular Weir (Weir Controls 9.73 cfs @ 2.05 fps)

Summary for Pond B-SE1: SE Bench 1

[58] Hint: Peaked 0.49' above defined flood level
[62] Hint: Exceeded Reach CH-SE2 OUTLET depth by 2.24' @ 12.05 hrs

Inflow Area = 5.808 ac, 0.00% Impervious, Inflow Depth = 7.13" for 500 year - 24 hour event
Inflow = 64.64 cfs @ 12.04 hrs, Volume= 3.452 af
Outflow = 64.30 cfs @ 12.05 hrs, Volume= 3.452 af, Atten= 1%, Lag= 0.6 min
Primary = 46.63 cfs @ 12.05 hrs, Volume= 3.251 af
Secondary = 17.66 cfs @ 12.05 hrs, Volume= 0.201 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 748.49' @ 12.05 hrs Surf.Area= 2,996 sf Storage= 2,843 cf
Flood Elev= 748.00' Surf.Area= 1,641 sf Storage= 1,717 cf

Plug-Flow detention time= 0.4 min calculated for 3.451 af (100% of inflow)
Center-of-Mass det. time= 0.4 min (810.0 - 809.6)

Volume	Invert	Avail.Storage	Storage Description
#1	745.50'	10,578 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
745.50	0	0	0
746.00	61	15	15
748.00	1,641	1,702	1,717
750.00	7,220	8,861	10,578

Device	Routing	Invert	Outlet Devices
#1	Primary	745.50'	**3.0' long x 2.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32
#2	Secondary	748.00'	**20.0' long x 2.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32

Primary OutFlow Max=46.62 cfs @ 12.05 hrs HW=748.49' TW=746.31' (Dynamic Tailwater)
↑—**1=Broad-Crested Rectangular Weir** (Weir Controls 46.62 cfs @ 5.21 fps)

Secondary OutFlow Max=17.64 cfs @ 12.05 hrs HW=748.49' TW=716.60' (Dynamic Tailwater)
↑—**2=Broad-Crested Rectangular Weir** (Weir Controls 17.64 cfs @ 1.82 fps)

Summary for Pond B-SE2: SE Bench 1

[58] Hint: Peaked 0.19' above defined flood level

Inflow Area = 5.063 ac, 0.00% Impervious, Inflow Depth = 6.81" for 500 year - 24 hour event
Inflow = 50.14 cfs @ 12.03 hrs, Volume= 2.873 af
Outflow = 49.88 cfs @ 12.04 hrs, Volume= 2.873 af, Atten= 1%, Lag= 0.6 min
Primary = 38.98 cfs @ 12.04 hrs, Volume= 2.779 af
Secondary = 10.90 cfs @ 12.04 hrs, Volume= 0.095 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2

Peak Elev= 767.19' @ 12.04 hrs Surf.Area= 3,803 sf Storage= 3,399 cf
Flood Elev= 767.00' Surf.Area= 2,766 sf Storage= 2,760 cf

Plug-Flow detention time= 0.8 min calculated for 2.873 af (100% of inflow)
Center-of-Mass det. time= 0.8 min (813.9 - 813.1)

Volume	Invert	Avail.Storage	Storage Description
#1	764.50'	8,191 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
764.50	0	0	0
765.00	330	83	83
765.50	725	264	346
766.00	1,133	465	811
767.00	2,766	1,950	2,760
768.00	8,095	5,431	8,191

Device	Routing	Invert	Outlet Devices
#1	Primary	764.50'	**3.0' long x 2.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32
#2	Secondary	767.00'	**50.0' long x 2.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32

Primary OutFlow Max=38.97 cfs @ 12.04 hrs HW=767.19' TW=765.24' (Dynamic Tailwater)
↑—**1=Broad-Crested Rectangular Weir** (Weir Controls 38.97 cfs @ 4.82 fps)

Secondary OutFlow Max=10.86 cfs @ 12.04 hrs HW=767.19' TW=748.48' (Dynamic Tailwater)
↑—**2=Broad-Crested Rectangular Weir** (Weir Controls 10.86 cfs @ 1.12 fps)

Summary for Pond B-SE3: SE Bench 3

[58] Hint: Peaked 0.52' above defined flood level
[62] Hint: Exceeded Reach CH-SE3B OUTLET depth by 1.50' @ 12.04 hrs

Inflow Area = 9.526 ac, 0.00% Impervious, Inflow Depth = 6.81" for 500 year - 24 hour event
Inflow = 76.50 cfs @ 12.09 hrs, Volume= 5.406 af
Outflow = 76.09 cfs @ 12.10 hrs, Volume= 5.406 af, Atten= 1%, Lag= 0.9 min
Primary = 65.86 cfs @ 12.10 hrs, Volume= 5.251 af
Secondary = 10.23 cfs @ 12.10 hrs, Volume= 0.156 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 752.52' @ 12.10 hrs Surf.Area= 4,319 sf Storage= 4,102 cf
Flood Elev= 752.00' Surf.Area= 2,890 sf Storage= 2,215 cf

Plug-Flow detention time= 0.6 min calculated for 5.405 af (100% of inflow)
Center-of-Mass det. time= 0.6 min (822.8 - 822.2)

Volume	Invert	Avail.Storage	Storage Description
#1	750.00'	13,455 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
750.00	90	0	0
751.00	725	408	408
752.00	2,890	1,808	2,215
754.00	8,350	11,240	13,455

Device	Routing	Invert	Outlet Devices
#1	Primary	750.00'	**6.0' long x 2.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32
#2	Secondary	752.00'	**10.0' long x 60.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=65.85 cfs @ 12.10 hrs HW=752.52' TW=751.03' (Dynamic Tailwater)
1=Broad-Crested Rectangular Weir (Weir Controls 65.85 cfs @ 4.35 fps)

Secondary OutFlow Max=10.22 cfs @ 12.10 hrs HW=752.52' TW=748.39' (Dynamic Tailwater)
2=Broad-Crested Rectangular Weir (Weir Controls 10.22 cfs @ 1.95 fps)

Summary for Pond B-SE4: SE Berm 4

[62] Hint: Exceeded Reach CH-SE5 OUTLET depth by 1.87' @ 12.08 hrs

Inflow Area = 7.631 ac, 0.00% Impervious, Inflow Depth = 6.81" for 500 year - 24 hour event
Inflow = 69.63 cfs @ 12.06 hrs, Volume= 4.331 af
Outflow = 68.74 cfs @ 12.08 hrs, Volume= 4.331 af, Atten= 1%, Lag= 1.1 min
Primary = 68.74 cfs @ 12.08 hrs, Volume= 4.331 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 800.59' @ 12.08 hrs Surf.Area= 3,334 sf Storage= 2,996 cf
Flood Elev= 801.00' Surf.Area= 4,316 sf Storage= 4,566 cf

Plug-Flow detention time= 0.4 min calculated for 4.330 af (100% of inflow)
Center-of-Mass det. time= 0.4 min (815.9 - 815.6)

Volume	Invert	Avail.Storage	Storage Description
#1	798.00'	4,566 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
798.00	0	0	0
799.00	485	243	243
800.00	1,923	1,204	1,447
801.00	4,316	3,120	4,566

Device	Routing	Invert	Outlet Devices
#1	Primary	798.00'	**6.0' long x 2.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50

Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32

Primary OutFlow Max=68.69 cfs @ 12.08 hrs HW=800.59' TW=799.07' (Dynamic Tailwater)
1=Broad-Crested Rectangular Weir (Weir Controls 68.69 cfs @ 4.42 fps)

Summary for Pond B-SE5: SE Berm 5

Inflow Area = 3.569 ac, 0.00% Impervious, Inflow Depth = 6.81" for 500 year - 24 hour event
Inflow = 32.95 cfs @ 12.05 hrs, Volume= 2.026 af
Outflow = 32.72 cfs @ 12.06 hrs, Volume= 2.026 af, Atten= 1%, Lag= 0.8 min
Primary = 32.72 cfs @ 12.06 hrs, Volume= 2.026 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 834.67' @ 12.06 hrs Surf.Area= 1,442 sf Storage= 883 cf
Flood Elev= 836.00' Surf.Area= 4,316 sf Storage= 4,566 cf

Plug-Flow detention time= 0.2 min calculated for 2.025 af (100% of inflow)
Center-of-Mass det. time= 0.2 min (815.3 - 815.1)

Volume	Invert	Avail.Storage	Storage Description
#1	833.00'	4,566 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
833.00	0	0	0
834.00	485	243	243
835.00	1,923	1,204	1,447
836.00	4,316	3,120	4,566

Device	Routing	Invert	Outlet Devices
#1	Primary	833.00'	**6.0' long x 2.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32

Primary OutFlow Max=32.70 cfs @ 12.06 hrs HW=834.66' TW=833.72' (Dynamic Tailwater)
1=Broad-Crested Rectangular Weir (Weir Controls 32.70 cfs @ 3.27 fps)

Summary for Pond B-SW1: SW Bench 1

[58] Hint: Peaked 0.55' above defined flood level
[90] Warning: Qout>Qin may require smaller dt or Finer Routing
[62] Hint: Exceeded Reach CH-SW2 OUTLET depth by 0.12' @ 11.84 hrs

Inflow Area = 21.264 ac, 0.00% Impervious, Inflow Depth = 6.80" for 500 year - 24 hour event
Inflow = 198.20 cfs @ 12.06 hrs, Volume= 12.057 af
Outflow = 198.25 cfs @ 12.07 hrs, Volume= 12.057 af, Atten= 0%, Lag= 0.0 min
Primary = 198.25 cfs @ 12.07 hrs, Volume= 12.057 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 746.55' @ 12.07 hrs Surf.Area= 352 sf Storage= 157 cf
Flood Elev= 746.00' Surf.Area= 59 sf Storage= 44 cf

Plug-Flow detention time= 0.0 min calculated for 12.055 af (100% of inflow)

Center-of-Mass det. time= 0.0 min (820.5 - 820.5)

Volume	Invert	Avail.Storage	Storage Description
#1	744.50'	1,235 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
744.50	0	0	0
746.00	59	44	44
748.00	1,132	1,191	1,235

Device	Routing	Invert	Outlet Devices
#1	Primary	744.50'	**96.0" W x 36.0" H Box Culvert** L= 46.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 744.50' / 744.00' S= 0.0109 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 24.00 sf
#2	Primary	746.00'	**120.0' long x 2.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32

Primary OutFlow Max=198.00 cfs @ 12.07 hrs HW=746.55' TW=745.17' (Dynamic Tailwater)
- **1=Culvert** (Inlet Controls 71.70 cfs @ 4.38 fps)
- **2=Broad-Crested Rectangular Weir** (Weir Controls 126.30 cfs @ 1.93 fps)

Summary for Pond B-SW2: SW Bench 2

[58] Hint: Peaked 0.35' above defined flood level
[62] Hint: Exceeded Reach CH-SW3B OUTLET depth by 2.25' @ 12.19 hrs

Inflow Area = 18.110 ac, 0.00% Impervious, Inflow Depth = 6.80" for 500 year - 24 hour event
Inflow = 170.49 cfs @ 12.06 hrs, Volume= 10.266 af
Outflow = 170.30 cfs @ 12.06 hrs, Volume= 10.266 af, Atten= 0%, Lag= 0.3 min
Primary = 104.79 cfs @ 12.06 hrs, Volume= 9.429 af
Secondary = 65.51 cfs @ 12.06 hrs, Volume= 0.837 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 769.35' @ 12.06 hrs Surf.Area= 6,205 sf Storage= 9,493 cf
Flood Elev= 769.00' Surf.Area= 5,770 sf Storage= 7,375 cf

Plug-Flow detention time= 0.8 min calculated for 10.265 af (100% of inflow)
Center-of-Mass det. time= 0.8 min (821.0 - 820.1)

Volume	Invert	Avail.Storage	Storage Description
#1	766.00'	13,760 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
766.00	0	0	0
766.50	611	153	153
767.00	1,350	490	643
767.50	2,214	891	1,534
768.00	3,203	1,354	2,888
769.00	5,770	4,487	7,375
770.00	7,000	6,385	13,760

Device	Routing	Invert	Outlet Devices
#1	Primary	766.00'	**6.0' long x 2.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32
#2	Secondary	769.00'	**120.0' long x 2.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32

Primary OutFlow Max=104.76 cfs @ 12.06 hrs HW=769.35' TW=767.54' (Dynamic Tailwater)
└**1=Broad-Crested Rectangular Weir** (Weir Controls 104.76 cfs @ 5.21 fps)

Secondary OutFlow Max=65.35 cfs @ 12.06 hrs HW=769.35' TW=746.55' (Dynamic Tailwater)
└**2=Broad-Crested Rectangular Weir** (Weir Controls 65.35 cfs @ 1.54 fps)

Summary for Pond B-SW3: SW Bench 3

[58] Hint: Peaked 0.31' above defined flood level
[62] Hint: Exceeded Reach CH-SW4 OUTLET depth by 1.36' @ 12.21 hrs

Inflow Area = 11.899 ac, 0.00% Impervious, Inflow Depth = 6.81" for 500 year - 24 hour event
Inflow = 119.18 cfs @ 12.03 hrs, Volume= 6.753 af
Outflow = 119.05 cfs @ 12.03 hrs, Volume= 6.742 af, Atten= 0%, Lag= 0.3 min
Primary = 53.26 cfs @ 12.03 hrs, Volume= 5.744 af
Secondary = 65.79 cfs @ 12.03 hrs, Volume= 0.998 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 800.31' @ 12.03 hrs Surf.Area= 6,241 sf Storage= 7,399 cf
Flood Elev= 800.00' Surf.Area= 5,126 sf Storage= 5,654 cf

Plug-Flow detention time= 3.7 min calculated for 6.740 af (100% of inflow)
Center-of-Mass det. time= 2.7 min (816.2 - 813.5)

Volume	Invert	Avail.Storage	Storage Description
#1	797.00'	23,170 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
797.00	0	0	0
798.00	980	490	490
799.00	2,161	1,571	2,061
799.50	3,543	1,426	3,487
800.00	5,126	2,167	5,654
802.00	12,390	17,516	23,170

Device	Routing	Invert	Outlet Devices
#1	Primary	798.00'	**6.0' long x 2.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32
#2	Secondary	800.00'	**150.0' long x 2.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50

Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32

Primary OutFlow Max=53.24 cfs @ 12.03 hrs HW=800.31' TW=799.14' (Dynamic Tailwater)
1=Broad-Crested Rectangular Weir (Weir Controls 53.24 cfs @ 3.85 fps)

Secondary OutFlow Max=65.65 cfs @ 12.03 hrs HW=800.31' TW=785.29' (Dynamic Tailwater)
2=Broad-Crested Rectangular Weir (Weir Controls 65.65 cfs @ 1.43 fps)

Summary for Pond B-SW4: SW Bench 4

[62] Hint: Exceeded Reach CH-SW5 OUTLET depth by 1.72' @ 12.04 hrs

Inflow Area = 7.363 ac, 0.00% Impervious, Inflow Depth = 6.81" for 500 year - 24 hour event
Inflow = 75.58 cfs @ 12.02 hrs, Volume= 4.179 af
Outflow = 75.27 cfs @ 12.02 hrs, Volume= 4.179 af, Atten= 0%, Lag= 0.5 min
Primary = 75.27 cfs @ 12.02 hrs, Volume= 4.179 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 834.45' @ 12.03 hrs Surf.Area= 1,552 sf Storage= 846 cf
Flood Elev= 835.80' Surf.Area= 4,335 sf Storage= 4,821 cf

Plug-Flow detention time= 0.2 min calculated for 4.179 af (100% of inflow)
Center-of-Mass det. time= 0.2 min (812.8 - 812.6)

Volume	Invert	Avail.Storage	Storage Description
#1	831.80'	4,821 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
831.80	60	0	0
833.80	213	273	273
835.80	4,335	4,548	4,821

Device	Routing	Invert	Outlet Devices
#1	Primary	831.80'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 4.00 Width (feet) 3.75 11.75

Primary OutFlow Max=75.17 cfs @ 12.02 hrs HW=834.45' TW=833.12' (Dynamic Tailwater)
1=Custom Weir/Orifice (Weir Controls 75.17 cfs @ 4.44 fps)

Summary for Pond B-SW5: SW Bench 5

[62] Hint: Exceeded Reach CH-SW6 OUTLET depth by 1.03' @ 12.02 hrs

Inflow Area = 4.490 ac, 0.00% Impervious, Inflow Depth = 6.81" for 500 year - 24 hour event
Inflow = 47.53 cfs @ 12.01 hrs, Volume= 2.548 af
Outflow = 47.51 cfs @ 12.01 hrs, Volume= 2.548 af, Atten= 0%, Lag= 0.1 min
Primary = 47.51 cfs @ 12.01 hrs, Volume= 2.548 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 872.85' @ 12.01 hrs Surf.Area= 259 sf Storage= 245 cf
Flood Elev= 874.80' Surf.Area= 3,893 sf Storage= 4,303 cf

Plug-Flow detention time= 0.2 min calculated for 2.548 af (100% of inflow)

Center-of-Mass det. time= 0.2 min (811.8 - 811.6)

Volume	Invert	Avail.Storage	Storage Description
#1	870.80'	4,303 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
870.80	60	0	0
872.80	175	235	235
874.80	3,893	4,068	4,303

Device	Routing	Invert	Outlet Devices
#1	Primary	870.80'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 4.00 Width (feet) 3.75 11.75

Primary OutFlow Max=47.50 cfs @ 12.01 hrs HW=872.84' TW=871.74' (Dynamic Tailwater)
1=Custom Weir/Orifice (Weir Controls 47.50 cfs @ 4.01 fps)

Summary for Pond B-SW6: SW Bench 6

Inflow Area = 2.052 ac, 0.00% Impervious, Inflow Depth = 6.81" for 500 year - 24 hour event
Inflow = 22.29 cfs @ 12.00 hrs, Volume= 1.165 af
Outflow = 22.28 cfs @ 12.00 hrs, Volume= 1.165 af, Atten= 0%, Lag= 0.1 min
Primary = 22.28 cfs @ 12.00 hrs, Volume= 1.165 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 911.73' @ 12.00 hrs Surf.Area= 171 sf Storage= 223 cf
Flood Elev= 913.80' Surf.Area= 3,893 sf Storage= 4,303 cf

Plug-Flow detention time= 0.5 min calculated for 1.165 af (100% of inflow)
Center-of-Mass det. time= 0.4 min (811.0 - 810.6)

Volume	Invert	Avail.Storage	Storage Description
#1	909.80'	4,303 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
909.80	60	0	0
911.80	175	235	235
913.80	3,893	4,068	4,303

Device	Routing	Invert	Outlet Devices
#1	Primary	909.80'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 4.00 Width (feet) 1.25 9.25

Primary OutFlow Max=22.27 cfs @ 12.00 hrs HW=911.73' TW=910.82' (Dynamic Tailwater)
1=Custom Weir/Orifice (Weir Controls 22.27 cfs @ 3.63 fps)

Summary for Pond CB-E5: E CB 5

[58] Hint: Peaked 0.14' above defined flood level
[87] Warning: Oscillations may require smaller dt or Finer Routing (severity=2)
[62] Hint: Exceeded Reach CH-E5 OUTLET depth by 2.13' @ 11.94 hrs

Inflow Area = 2.194 ac, 0.00% Impervious, Inflow Depth = 7.49" for 500 year - 24 hour event
Inflow = 25.63 cfs @ 12.11 hrs, Volume= 1.370 af
Outflow = 25.53 cfs @ 12.11 hrs, Volume= 1.370 af, Atten= 0%, Lag= 0.3 min
Primary = 17.92 cfs @ 12.11 hrs, Volume= 1.299 af
Secondary = 7.61 cfs @ 12.11 hrs, Volume= 0.087 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 728.14' @ 12.11 hrs Surf.Area= 1,423 sf Storage= 1,233 cf
Flood Elev= 728.00' Surf.Area= 1,300 sf Storage= 1,048 cf

Plug-Flow detention time= 0.4 min calculated for 1.370 af (100% of inflow)
Center-of-Mass det. time= 0.4 min (804.8 - 804.5)

Volume	Invert	Avail.Storage	Storage Description
#1	725.50'	5,463 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
725.50	0	0	0
726.00	43	11	11
727.00	366	205	215
728.00	1,300	833	1,048
730.00	3,115	4,415	5,463

Device	Routing	Invert	Outlet Devices
#1	Primary	725.50'	**20.5" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Secondary	728.00'	**60.0' long x 2.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32

Primary OutFlow Max=5.06 cfs @ 12.11 hrs HW=728.13' TW=727.92' (Dynamic Tailwater)
1=Orifice/Grate (Orifice Controls 5.06 cfs @ 2.21 fps)

Secondary OutFlow Max=7.51 cfs @ 12.11 hrs HW=728.13' TW=713.97' (Dynamic Tailwater)
2=Broad-Crested Rectangular Weir (Weir Controls 7.51 cfs @ 0.93 fps)

Summary for Pond CB-E6: E CB 6

Inflow Area = 1.900 ac, 0.00% Impervious, Inflow Depth = 6.81" for 500 year - 24 hour event
Inflow = 22.50 cfs @ 11.97 hrs, Volume= 1.078 af
Outflow = 22.50 cfs @ 11.97 hrs, Volume= 1.078 af, Atten= 0%, Lag= 0.0 min
Primary = 20.07 cfs @ 11.97 hrs, Volume= 0.999 af
Secondary = 2.43 cfs @ 11.97 hrs, Volume= 0.079 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 752.82' @ 11.97 hrs
Flood Elev= 755.50'

Device	Routing	Invert	Outlet Devices
#1	Primary	752.00'	**10.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88
#2	Secondary	752.00'	**18.0" Round Culvert** L= 123.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 752.00' / 722.50' S= 0.2398 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf

Primary OutFlow Max=20.05 cfs @ 11.97 hrs HW=752.82' TW=749.51' (Dynamic Tailwater)
└**1=Broad-Crested Rectangular Weir** (Weir Controls 20.05 cfs @ 2.43 fps)

Secondary OutFlow Max=2.43 cfs @ 11.97 hrs HW=752.82' TW=728.82' (Dynamic Tailwater)
└**2=Culvert** (Inlet Controls 2.43 cfs @ 2.44 fps)

Summary for Pond CB-E7: E CB 3

Inflow Area = 5.357 ac, 0.00% Impervious, Inflow Depth = 6.81" for 500 year - 24 hour event
Inflow = 54.09 cfs @ 11.96 hrs, Volume= 3.040 af
Outflow = 54.09 cfs @ 11.96 hrs, Volume= 3.040 af, Atten= 0%, Lag= 0.0 min
Primary = 5.81 cfs @ 11.96 hrs, Volume= 0.249 af
Secondary = 48.27 cfs @ 11.96 hrs, Volume= 2.792 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 753.50' @ 11.96 hrs
Flood Elev= 756.50'

Device	Routing	Invert	Outlet Devices
#1	Primary	752.00'	**18.0" Round Culvert** L= 157.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 752.00' / 712.20' S= 0.2535 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf
#2	Secondary	752.00'	**10.0' long x 140.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=5.81 cfs @ 11.96 hrs HW=753.50' TW=714.26' (Dynamic Tailwater)
└**1=Culvert** (Inlet Controls 5.81 cfs @ 3.29 fps)

Secondary OutFlow Max=48.22 cfs @ 11.96 hrs HW=753.50' TW=749.49' (Dynamic Tailwater)
└**2=Broad-Crested Rectangular Weir** (Weir Controls 48.22 cfs @ 3.22 fps)

Summary for Pond DP-E11: 18" Pipe

[58] Hint: Peaked 7.30' above defined flood level
[80] Warning: Exceeded Pond B-E11 by 4.77' @ 11.99 hrs (18.58 cfs 0.744 af)

Inflow Area = 5.142 ac, 0.00% Impervious, Inflow Depth = 6.54" for 500 year - 24 hour event
Inflow = 26.29 cfs @ 12.03 hrs, Volume= 2.804 af
Outflow = 26.29 cfs @ 12.03 hrs, Volume= 2.804 af, Atten= 0%, Lag= 0.0 min
Primary = 26.29 cfs @ 12.03 hrs, Volume= 2.804 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 757.30' @ 12.03 hrs
Flood Elev= 750.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	747.00'	**18.0" Round Culvert** L= 150.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 747.00' / 713.75' S= 0.2217 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf

Primary OutFlow Max=26.29 cfs @ 12.03 hrs HW=757.30' TW=724.05' (Dynamic Tailwater)
1=Culvert (Inlet Controls 26.29 cfs @ 14.88 fps)

Summary for Pond DP-E12: 18" Pipe

Inflow Area = 2.603 ac, 0.00% Impervious, Inflow Depth = 6.52" for 500 year - 24 hour event
Inflow = 13.17 cfs @ 12.30 hrs, Volume= 1.415 af
Outflow = 13.17 cfs @ 12.30 hrs, Volume= 1.415 af, Atten= 0%, Lag= 0.0 min
Primary = 13.17 cfs @ 12.30 hrs, Volume= 1.415 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 773.14' @ 12.30 hrs
Flood Elev= 776.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	770.00'	**18.0" Round Culvert** L= 110.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 770.00' / 747.00' S= 0.2091 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf

Primary OutFlow Max=13.16 cfs @ 12.30 hrs HW=773.14' TW=756.91' (Dynamic Tailwater)
1=Culvert (Inlet Controls 13.16 cfs @ 7.45 fps)

Summary for Pond DP-E5: 18" Pipe

[58] Hint: Peaked 3.35' above defined flood level
[80] Warning: Exceeded Pond CB-E5 by 0.77' @ 11.98 hrs (9.66 cfs 0.087 af)

Inflow Area = 2.194 ac, 0.00% Impervious, Inflow Depth = 7.54" for 500 year - 24 hour event
Inflow = 20.13 cfs @ 11.94 hrs, Volume= 1.378 af
Outflow = 20.13 cfs @ 11.94 hrs, Volume= 1.378 af, Atten= 0%, Lag= 0.0 min
Primary = 20.13 cfs @ 11.94 hrs, Volume= 1.378 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 728.85' @ 11.94 hrs
Flood Elev= 725.50'

Device	Routing	Invert	Outlet Devices
#1	Primary	722.50'	**18.0" Round Culvert** L= 60.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 722.50' / 712.00' S= 0.1750 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 1.77 sf

Primary OutFlow Max=20.13 cfs @ 11.94 hrs HW=728.85' TW=719.22' (Dynamic Tailwater)
1=Culvert (Inlet Controls 20.13 cfs @ 11.39 fps)

Summary for Pond MH-E1: Drop Structure 1

[58] Hint: Peaked 3.00' above defined flood level

Inflow Area = 2.194 ac, 0.00% Impervious, Inflow Depth = 7.54" for 500 year - 24 hour event
Inflow = 20.13 cfs @ 11.94 hrs, Volume= 1.378 af
Outflow = 20.13 cfs @ 11.94 hrs, Volume= 1.378 af, Atten= 0%, Lag= 0.0 min
Primary = 20.13 cfs @ 11.94 hrs, Volume= 1.378 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 719.50' @ 11.99 hrs
Flood Elev= 716.50'

Device	Routing	Invert	Outlet Devices
#1	Primary	712.00'	**18.0" Round Culvert** L= 30.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 712.00' / 711.70' S= 0.0100 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 1.77 sf

Primary OutFlow Max=20.11 cfs @ 11.94 hrs HW=719.22' TW=713.63' (Dynamic Tailwater)
1=Culvert (Inlet Controls 20.11 cfs @ 11.38 fps)

Summary for Pond MH-E2: Drop Structure 2

Inflow Area = 5.357 ac, 0.00% Impervious, Inflow Depth = 0.56" for 500 year - 24 hour event
Inflow = 5.81 cfs @ 11.96 hrs, Volume= 0.249 af
Outflow = 5.81 cfs @ 11.96 hrs, Volume= 0.249 af, Atten= 0%, Lag= 0.0 min
Primary = 5.81 cfs @ 11.96 hrs, Volume= 0.249 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 714.37' @ 11.99 hrs
Flood Elev= 716.50'

Device	Routing	Invert	Outlet Devices
#1	Primary	712.20'	**18.0" Round Culvert** L= 20.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 712.20' / 712.00' S= 0.0100 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 1.77 sf

Primary OutFlow Max=5.74 cfs @ 11.96 hrs HW=714.26' TW=713.81' (Dynamic Tailwater)
1=Culvert (Inlet Controls 5.74 cfs @ 3.25 fps)

Summary for Pond MH-E3: Drop Structure 3

[58] Hint: Peaked 4.05' above defined flood level

Inflow Area = 5.142 ac, 0.00% Impervious, Inflow Depth = 6.54" for 500 year - 24 hour event
Inflow = 26.29 cfs @ 12.03 hrs, Volume= 2.804 af
Outflow = 26.29 cfs @ 12.03 hrs, Volume= 2.804 af, Atten= 0%, Lag= 0.0 min
Primary = 26.29 cfs @ 12.03 hrs, Volume= 2.804 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 724.05' @ 12.03 hrs
Flood Elev= 720.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	713.75'	**18.0" Round Culvert** L= 25.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 713.75' / 713.50' S= 0.0100 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 1.77 sf

Primary OutFlow Max=26.29 cfs @ 12.03 hrs HW=724.05' TW=713.97' (Dynamic Tailwater)
1=Culvert (Inlet Controls 26.29 cfs @ 14.88 fps)

Summary for Pond P-E1: East Ditch 1

[58] Hint: Peaked 0.50' above defined flood level
[62] Hint: Exceeded Reach B-E1 OUTLET depth by 0.63' @ 13.38 hrs

Inflow Area = 6.659 ac, 0.00% Impervious, Inflow Depth = 11.70" for 500 year - 24 hour event
Inflow = 119.01 cfs @ 11.95 hrs, Volume= 6.492 af
Outflow = 118.75 cfs @ 11.96 hrs, Volume= 6.486 af, Atten= 0%, Lag= 0.3 min
Primary = 9.31 cfs @ 11.74 hrs, Volume= 3.773 af
Secondary = 110.60 cfs @ 11.96 hrs, Volume= 2.712 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 715.50' @ 11.96 hrs Surf.Area= 5,389 sf Storage= 12,068 cf
Flood Elev= 715.00' Surf.Area= 4,659 sf Storage= 9,544 cf

Plug-Flow detention time= 10.4 min calculated for 6.486 af (100% of inflow)
Center-of-Mass det. time= 9.6 min (822.3 - 812.6)

Volume	Invert	Avail.Storage	Storage Description
#1	711.00'	14,929 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
711.00	254	0	0
712.00	1,520	887	887
714.00	3,205	4,725	5,612
716.00	6,112	9,317	14,929

Device	Routing	Invert	Outlet Devices
#1	Primary	711.50'	**16.0" Round Culvert** L= 230.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 711.50' / 709.00' S= 0.0109 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 1.40 sf
#2	Secondary	715.00'	**115.0' long x 30.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=9.30 cfs @ 11.74 hrs HW=715.16' TW=712.12' (Dynamic Tailwater)
1=Culvert (Outlet Controls 9.30 cfs @ 6.66 fps)

Secondary OutFlow Max=110.41 cfs @ 11.96 hrs HW=715.50' (Free Discharge)
2=Broad-Crested Rectangular Weir (Weir Controls 110.41 cfs @ 1.91 fps)

Summary for Pond P-E2: East Ditch 2

[58] Hint: Peaked 0.01' above defined flood level
[87] Warning: Oscillations may require smaller dt or Finer Routing (severity=1)

Inflow Area = 7.064 ac, 0.00% Impervious, Inflow Depth = 6.80" for 500 year - 24 hour event
Inflow = 13.36 cfs @ 11.94 hrs, Volume= 4.003 af
Outflow = 6.34 cfs @ 12.52 hrs, Volume= 3.999 af, Atten= 53%, Lag= 34.5 min
Primary = 6.16 cfs @ 13.47 hrs, Volume= 3.989 af
Secondary = 0.32 cfs @ 12.52 hrs, Volume= 0.010 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 713.81' @ 12.52 hrs Surf.Area= 6,152 sf Storage= 14,086 cf
Flood Elev= 713.80' Surf.Area= 6,136 sf Storage= 14,023 cf

Plug-Flow detention time= 25.4 min calculated for 3.999 af (100% of inflow)
Center-of-Mass det. time= 24.5 min (913.5 - 889.0)

Volume	Invert	Avail.Storage	Storage Description
#1	709.00'	15,282 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
709.00	0	0	0
710.00	1,558	779	779
712.00	3,244	4,802	5,581
714.00	6,457	9,701	15,282

Device	Routing	Invert	Outlet Devices
#1	Primary	709.50'	**16.0" Round Culvert** L= 90.0' RCP, end-section conforming to fill, Ke= 0.500 Inlet / Outlet Invert= 709.50' / 708.50' S= 0.0111 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 1.40 sf
#2	Secondary	713.80'	**115.0' long x 30.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=6.16 cfs @ 13.47 hrs HW=713.79' TW=712.92' (Dynamic Tailwater)
└**1=Culvert** (Outlet Controls 6.16 cfs @ 4.41 fps)

Secondary OutFlow Max=0.32 cfs @ 12.52 hrs HW=713.81' (Free Discharge)
└**2=Broad-Crested Rectangular Weir** (Weir Controls 0.32 cfs @ 0.27 fps)

Summary for Pond P-E3: East Ditch 3

Inflow Area = 26.944 ac, 0.00% Impervious, Inflow Depth = 4.33" for 500 year - 24 hour event
Inflow = 32.55 cfs @ 11.97 hrs, Volume= 9.728 af
Outflow = 13.65 cfs @ 12.55 hrs, Volume= 9.727 af, Atten= 58%, Lag= 34.6 min
Primary = 13.65 cfs @ 12.55 hrs, Volume= 9.727 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 712.98' @ 12.55 hrs Surf.Area= 15,565 sf Storage= 25,987 cf
Flood Elev= 713.80' Surf.Area= 20,308 sf Storage= 40,715 cf

Plug-Flow detention time= 17.7 min calculated for 9.727 af (100% of inflow)
Center-of-Mass det. time= 17.6 min (923.3 - 905.7)

Volume	Invert	Avail.Storage	Storage Description
#1	708.00'	44,892 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
708.00	0	0	0
710.00	1,805	1,805	1,805
712.00	9,909	11,714	13,519
714.00	21,464	31,373	44,892

Device	Routing	Invert	Outlet Devices
#1	Primary	708.19'	**16.0" Round Culvert** L= 75.0' RCP, end-section conforming to fill, Ke= 0.500 Inlet / Outlet Invert= 708.19' / 707.50' S= 0.0092 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 1.40 sf

#2	Secondary	713.80'	**300.0' long x 30.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=13.65 cfs @ 12.55 hrs HW=712.98' (Free Discharge)
1=Culvert (Inlet Controls 13.65 cfs @ 9.78 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=708.00' (Free Discharge)
2=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Summary for Pond P-E4: Exist Ditch 4

[58] Hint: Peaked 0.17' above defined flood level

Inflow Area = 18.316 ac, 0.00% Impervious, Inflow Depth = 5.05" for 500 year - 24 hour event
Inflow = 101.93 cfs @ 12.04 hrs, Volume= 7.708 af
Outflow = 101.32 cfs @ 12.06 hrs, Volume= 7.699 af, Atten= 1%, Lag= 1.2 min
Primary = 8.04 cfs @ 11.97 hrs, Volume= 4.852 af
Secondary = 94.25 cfs @ 12.11 hrs, Volume= 2.847 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 713.97' @ 12.11 hrs Surf.Area= 38,728 sf Storage= 49,228 cf
Flood Elev= 713.80' Surf.Area= 35,801 sf Storage= 42,961 cf

Plug-Flow detention time= 36.6 min calculated for 7.699 af (100% of inflow)
Center-of-Mass det. time= 35.7 min (849.4 - 813.6)

Volume	Invert	Avail.Storage	Storage Description
#1	709.00'	106,611 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
709.00	0	0	0
712.00	4,475	6,713	6,713
714.00	39,282	43,757	50,470
715.00	73,000	56,141	106,611

Device	Routing	Invert	Outlet Devices
#1	Primary	709.72'	**16.0" Round Culvert** L= 65.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 709.72' / 709.24' S= 0.0074 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 1.40 sf
#2	Secondary	713.80'	**510.0' long x 30.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=8.04 cfs @ 11.97 hrs HW=713.86' TW=712.43' (Dynamic Tailwater)
1=Culvert (Inlet Controls 8.04 cfs @ 5.76 fps)

Secondary OutFlow Max=94.17 cfs @ 12.11 hrs HW=713.97' (Free Discharge)
2=Broad-Crested Rectangular Weir (Weir Controls 94.17 cfs @ 1.10 fps)

Summary for Pond P-S1: South Pond

[58] Hint: Peaked 0.53' above defined flood level

Inflow Area = 9.142 ac, 15.15% Impervious, Inflow Depth = 7.37" for 500 year - 24 hour event
Inflow = 88.89 cfs @ 11.97 hrs, Volume= 5.618 af
Outflow = 85.98 cfs @ 12.00 hrs, Volume= 4.967 af, Atten= 3%, Lag= 1.4 min
Discarded = 0.10 cfs @ 12.00 hrs, Volume= 0.338 af
Secondary = 84.22 cfs @ 12.00 hrs, Volume= 4.622 af
Tertiary = 1.66 cfs @ 12.00 hrs, Volume= 0.008 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 720.53' @ 12.00 hrs Surf.Area= 25,678 sf Storage= 50,889 cf
Flood Elev= 720.00' Surf.Area= 22,003 sf Storage= 38,164 cf

Plug-Flow detention time= 172.5 min calculated for 4.967 af (88% of inflow)
Center-of-Mass det. time= 115.2 min (914.9 - 799.7)

Volume	Invert	Avail.Storage	Storage Description
#1	716.50'	95,942 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
716.50	0	0	0
718.00	9,235	6,926	6,926
720.00	22,003	31,238	38,164
722.00	35,775	57,778	95,942

Device	Routing	Invert	Outlet Devices
#1	Discarded	716.50'	**0.150 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 700.00'
#2	Secondary	720.00'	**80.0' long x 30.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63
#3	Tertiary	720.50'	**100.0' long x 30.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Discarded OutFlow Max=0.10 cfs @ 12.00 hrs HW=720.53' (Free Discharge)
↑**1=Exfiltration** (Controls 0.10 cfs)

Secondary OutFlow Max=84.15 cfs @ 12.00 hrs HW=720.53' (Free Discharge)
↑**2=Broad-Crested Rectangular Weir** (Weir Controls 84.15 cfs @ 1.97 fps)

Tertiary OutFlow Max=1.64 cfs @ 12.00 hrs HW=720.53' (Free Discharge)
↑**3=Broad-Crested Rectangular Weir** (Weir Controls 1.64 cfs @ 0.49 fps)

Summary for Pond P-SE1: Southeast Pond

[58] Hint: Peaked 0.01' above defined flood level
[62] Hint: Exceeded Reach CH-SE1 OUTLET depth by 5.54' @ 12.28 hrs
[62] Hint: Exceeded Reach CH-SE3 OUTLET depth by 5.19' @ 12.28 hrs

Inflow Area = 17.499 ac, 3.87% Impervious, Inflow Depth = 6.94" for 500 year - 24 hour event
Inflow = 134.85 cfs @ 12.05 hrs, Volume= 10.126 af
Outflow = 74.65 cfs @ 12.24 hrs, Volume= 10.121 af, Atten= 45%, Lag= 11.6 min
Primary = 72.30 cfs @ 12.24 hrs, Volume= 10.116 af
Secondary = 2.35 cfs @ 12.24 hrs, Volume= 0.005 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Starting Elev= 712.00' Surf.Area= 11,817 sf Storage= 33,961 cf
Peak Elev= 718.01' @ 12.24 hrs Surf.Area= 22,526 sf Storage= 136,715 cf (102,754 cf above start)
Flood Elev= 718.00' Surf.Area= 22,487 sf Storage= 136,385 cf (102,424 cf above start)

Plug-Flow detention time= 92.8 min calculated for 9.342 af (92% of inflow)
Center-of-Mass det. time= 32.5 min (845.9 - 813.4)

Volume	Invert	Avail.Storage	Storage Description
#1	708.00'	187,373 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
708.00	5,158	0	0
710.00	8,493	13,651	13,651
712.00	11,817	20,310	33,961
714.00	15,317	27,134	61,095
716.00	18,743	34,060	95,155
718.00	22,487	41,230	136,385
720.00	28,501	50,988	187,373

Device	Routing	Invert	Outlet Devices
#1	Primary	712.00'	**36.0" Round Culvert** L= 73.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 712.00' / 710.90' S= 0.0151 '/' Cc= 0.900 n= 0.015 Concrete sewer w/manholes & inlets, Flow Area= 7.07 sf
#2	Secondary	718.00'	**600.0' long x 60.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=72.30 cfs @ 12.24 hrs HW=718.01' (Free Discharge)
↑—**1=Culvert** (Inlet Controls 72.30 cfs @ 10.23 fps)

Secondary OutFlow Max=2.17 cfs @ 12.24 hrs HW=718.01' (Free Discharge)
↑—**2=Broad-Crested Rectangular Weir** (Weir Controls 2.17 cfs @ 0.30 fps)

Summary for Pond P-SW1: Southwest Pond

[58] Hint: Peaked 0.37' above defined flood level
[62] Hint: Exceeded Reach CH-SW1 OUTLET depth by 7.76' @ 13.01 hrs

Inflow Area = 24.187 ac, 3.46% Impervious, Inflow Depth = 6.92" for 500 year - 24 hour event
Inflow = 208.05 cfs @ 12.06 hrs, Volume= 13.956 af
Outflow = 203.51 cfs @ 12.08 hrs, Volume= 12.655 af, Atten= 2%, Lag= 1.6 min
Primary = 17.80 cfs @ 12.08 hrs, Volume= 8.734 af
Secondary = 185.71 cfs @ 12.08 hrs, Volume= 3.921 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 723.37' @ 12.08 hrs Surf.Area= 44,381 sf Storage= 166,666 cf
Flood Elev= 723.00' Surf.Area= 40,614 sf Storage= 151,443 cf

Plug-Flow detention time= 108.5 min calculated for 12.653 af (91% of inflow)

Center-of-Mass det. time= 59.7 min (874.6 - 814.8)

Volume	Invert	Avail.Storage	Storage Description
#1	715.00'	192,056 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
715.00	0	0	0
716.00	950	475	475
718.00	15,835	16,785	17,260
720.00	23,586	39,421	56,681
722.00	30,562	54,148	110,829
724.00	50,665	81,227	192,056

Device	Routing	Invert	Outlet Devices
#1	Primary	715.05'	**18.0" Round Culvert** L= 134.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 715.05' / 714.37' S= 0.0051 '/' Cc= 0.900 n= 0.015 Concrete sewer w/manholes & inlets, Flow Area= 1.77 sf
#2	Device 1	720.00'	**48.0" Horiz. Orifice/Grate** C= 0.600 in 48.0" Grate (100% open area) Limited to weir flow at low heads
#3	Secondary	723.00'	**300.0' long x 60.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=17.80 cfs @ 12.08 hrs HW=723.37' (Free Discharge)
└**1=Culvert** (Barrel Controls 17.80 cfs @ 10.07 fps)
└**2=Orifice/Grate** (Passes 17.80 cfs of 111.15 cfs potential flow)

Secondary OutFlow Max=185.42 cfs @ 12.08 hrs HW=723.37' (Free Discharge)
└**3=Broad-Crested Rectangular Weir** (Weir Controls 185.42 cfs @ 1.65 fps)

Attachment C-3

HydroCAD Model of Wetland Impacts, Pre-Expansion vs. Post-Project for the 2-Year, 10-Year and 25-Year Storm Events

Attachment C-3: Impacts on BSL Wetland Watersheds from the 2-Year, 10-year and 25-year, 24-hour Storm Events

Pre-Expansion Wetland Watershed (as shown on Figure 6-4)	Square Feet	Acres
Impacted Wetland Area from North Development Area Landfill Footprint:	1,287,460	29.6
Remaining Wetland Area within BSL Property:	3,650,692	83.8
		113.4

Pre-Expansion Wetland Hydrology Evaluation

Wetland B

	2-Year, 24-hr Storm Event		10-Year, 24-hr Storm Event		25-Year, 24-hr Storm Event	
Contributing Source	**Peak Inflow (cfs)**	**Total Volume (acre-ft)**	**Peak Inflow (cfs)**	**Total Volume (acre-ft)**	**Peak Inflow (cfs)**	**Total Volume (acre-ft)**
Direct Rainfall	286.44	14.032	426.11	20.875	538.46	26.378
Upland Run-off	15.48	0.939	37.86	2.175	58.32	3.336
Discharge from Landfill Stormwater Ponds	25.87	6.026	24.13	5	32.17	6.961
Wetland Summary	296.94	20.998	462.32	36	605.55	49.711

Wetland C

	2-Year, 24-hr Storm Event		10-Year, 24-hr Storm Event		25-Year, 24-hr Storm Event	
Contributing Source	**Peak Inflow (cfs)**	**Total Volume (acre-ft)**	**Peak Inflow (cfs)**	**Total Volume (acre-ft)**	**Peak Inflow (cfs)**	**Total Volume (acre-ft)**
Direct Rainfall	15.4	0.755	22.92	1.123	28.96	1.419
Upland Run-off	9.72	0.475	19.06	0.961	27.01	1.395
Discharge from Landfill Stormwater Ponds	0.52	0.238	9.85	2.121	15.22	3.876
Wetland Summary	23.03	1.468	37.97	4.205	50.35	6.69

Post-Project Wetland Watershed (as shown on Figure 6-5)	Square Feet	Acres
Impacted Wetland Area from Annex Development Area Landfill Footprint:	1,264,990	29.0
Remaining Wetland Area within BSL Property:	3,678,558	84.4
		113.4

Post-Project Wetland Hydrology Evaluation

Wetland B

	2-Year, 24-hr Storm Event		10-Year, 24-hr Storm Event		25-Year, 24-hr Storm Event	
Contributing Source	**Peak Inflow (cfs)**	**Total Volume (acre-ft)**	**Peak Inflow (cfs)**	**Total Volume (acre-ft)**	**Peak Inflow (cfs)**	**Total Volume (acre-ft)**
Direct Rainfall	296.06	14.504	440.43	21.576	556.56	27.265
Upland Run-off	17.56	1.045	42.96	2.422	66.19	3.716
Discharge from Landfill Stormwater Ponds	4.97	5.878	8.14	12.863	10.16	19.091
Wetland Summary	307.37	21.427	472.12	36.861	606.61	50.071

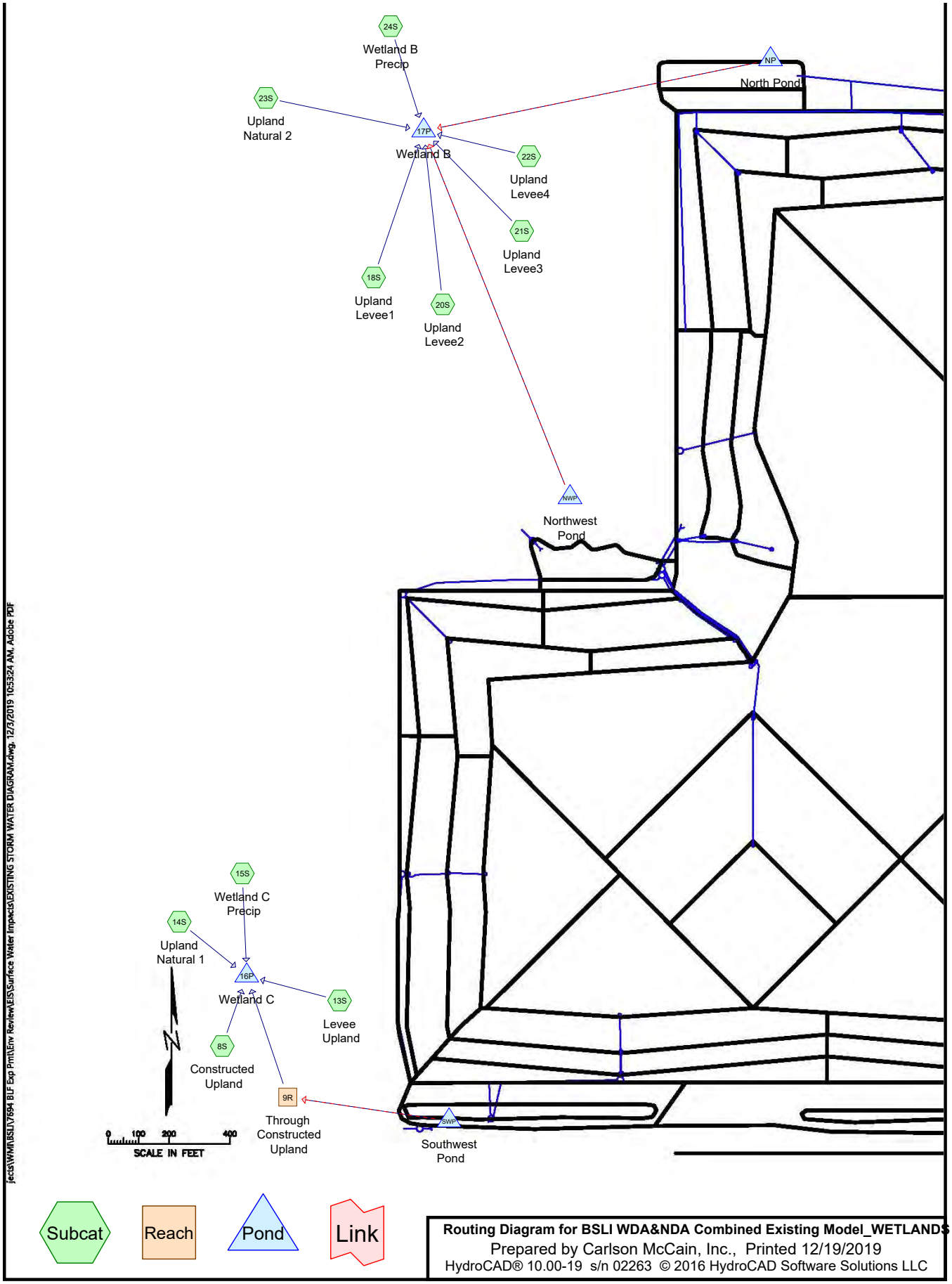
Wetland C-North

	2-Year, 24-hr Storm Event		10-Year, 24-hr Storm Event		25-Year, 24-hr Storm Event	
Contributing Source	**Peak Inflow (cfs)**	**Total Volume (acre-ft)**	**Peak Inflow (cfs)**	**Total Volume (acre-ft)**	**Peak Inflow (cfs)**	**Total Volume (acre-ft)**
Direct Rainfall	5.3	0.259	7.88	0.386	9.95	0.488
Upland Run-off	2.32	0.109	5.62	0.251	8.63	0.386
Discharge from Landfill Stormwater Ponds	2.78	2.92	4.68	6.575	5.9	9.981
Wetland Summary	7.01	3.288	13.17	7.212	18.65	10.855

Wetland C-South

	2-Year, 24-hr Storm Event		10-Year, 24-hr Storm Event		25-Year, 24-hr Storm Event	
Contributing Source	**Peak Inflow (cfs)**	**Total Volume (acre-ft)**	**Peak Inflow (cfs)**	**Total Volume (acre-ft)**	**Peak Inflow (cfs)**	**Total Volume (acre-ft)**
Direct Rainfall	3.37	0.165	5.01	0.246	6.33	0.31
Upland Run-off	2.62	0.18	6.45	0.417	9.95	0.638
Discharge from Landfill Stormwater Ponds	0.45	0.162	7.98	1.961	14.96	3.637
Wetland Summary	4.99	0.507	10.07	2.622	18.38	4.585

Pre-Expansion 2-Year HydroCAD Analysis of Wetland Inputs



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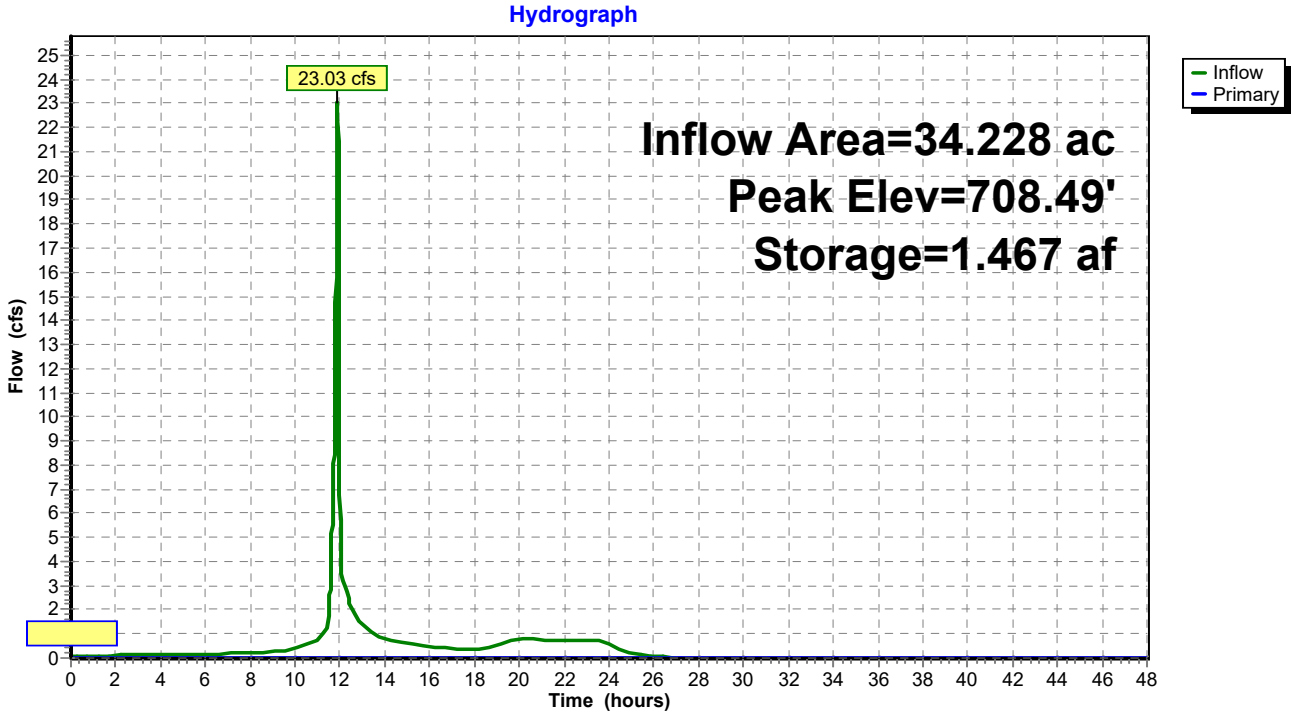
Pond 16P: Wetland C



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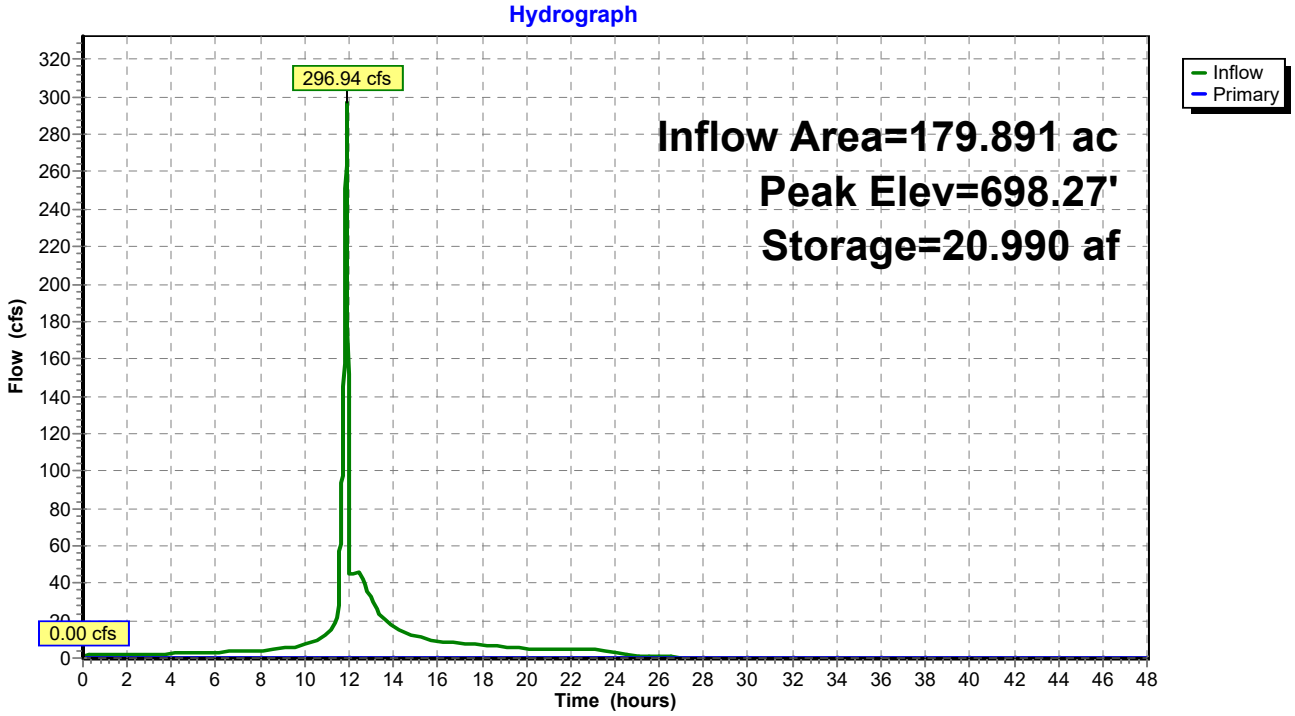

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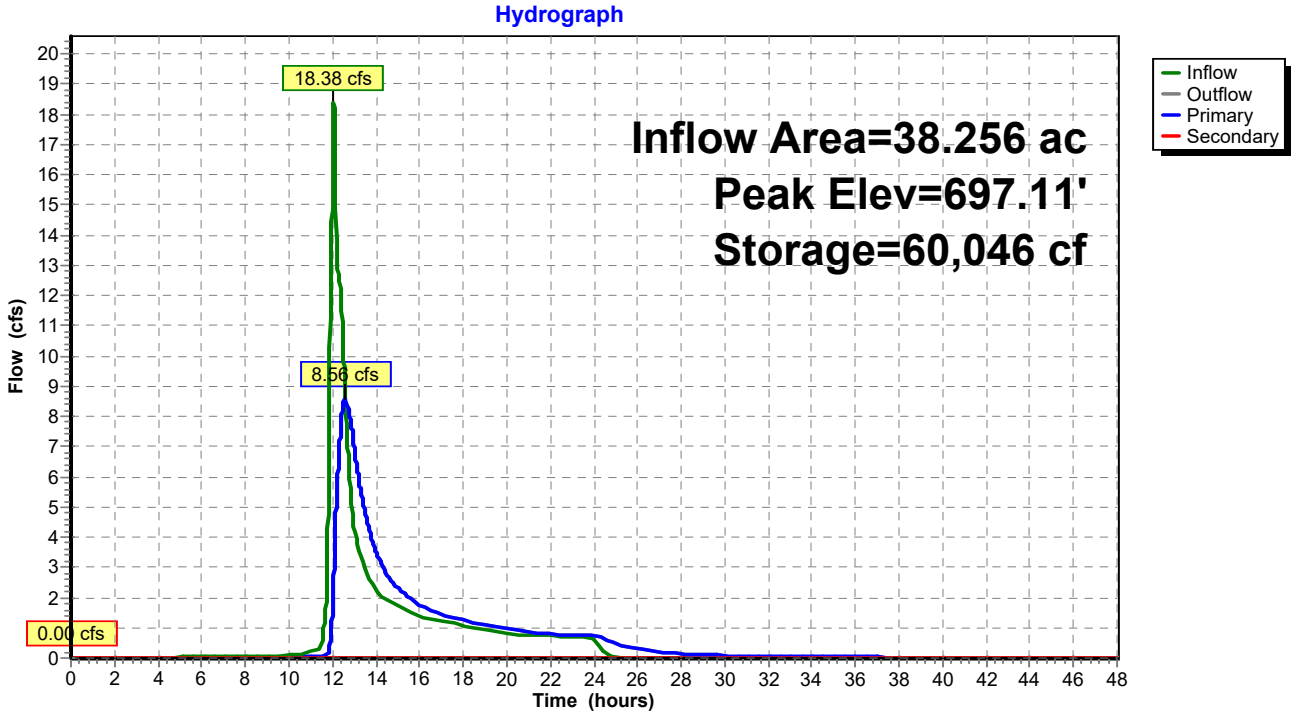

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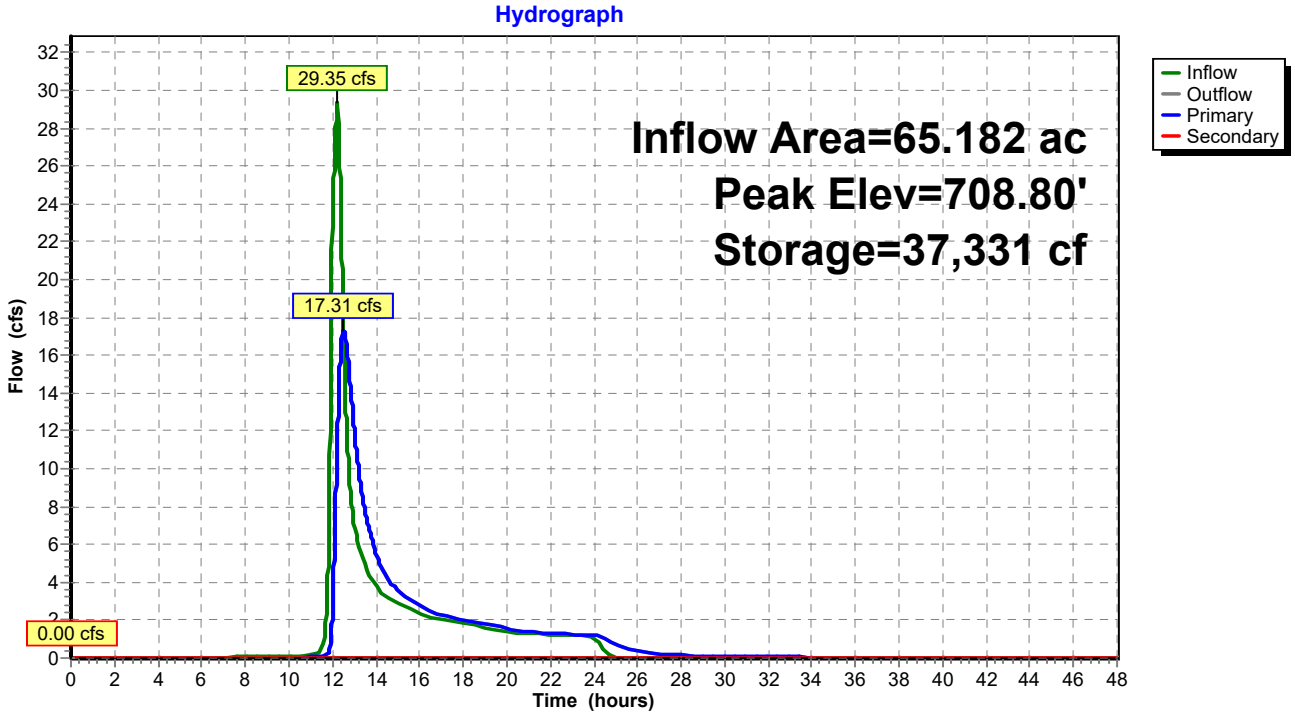

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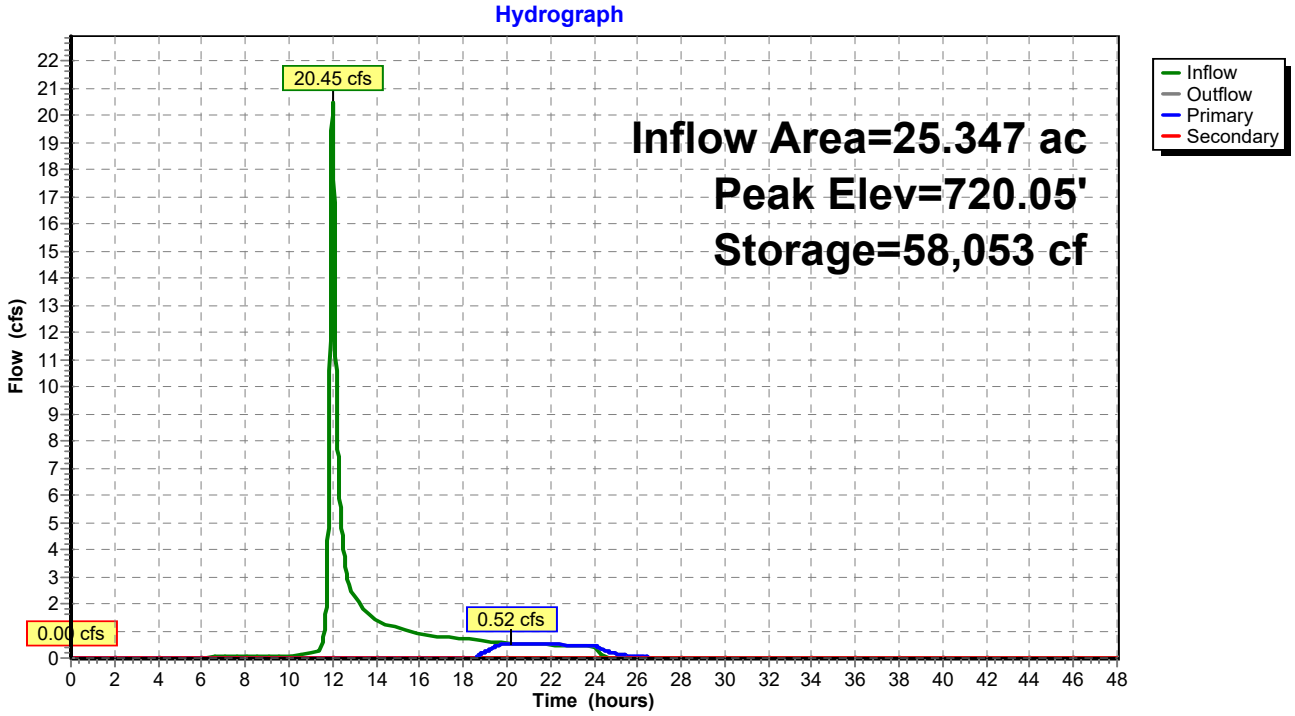
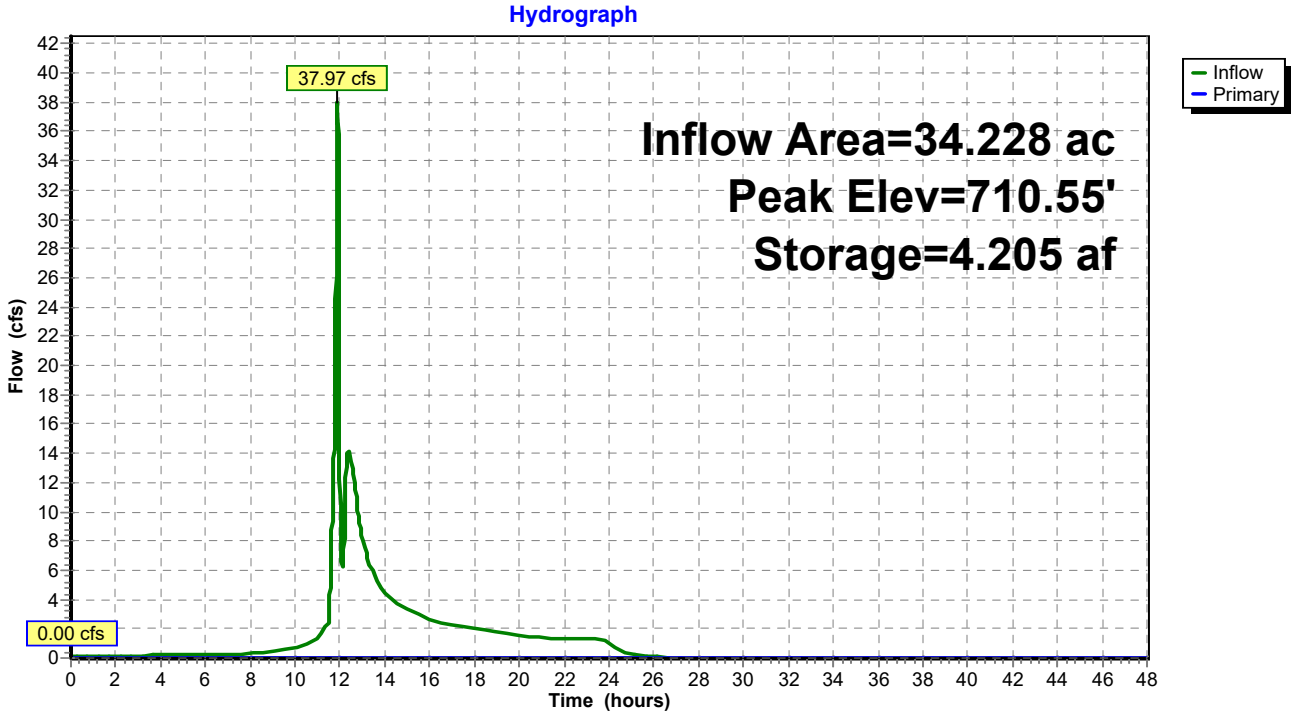


Pre-Expansion 10-Year HydroCAD Analysis of Wetland Inputs

Pond 16P: Wetland C



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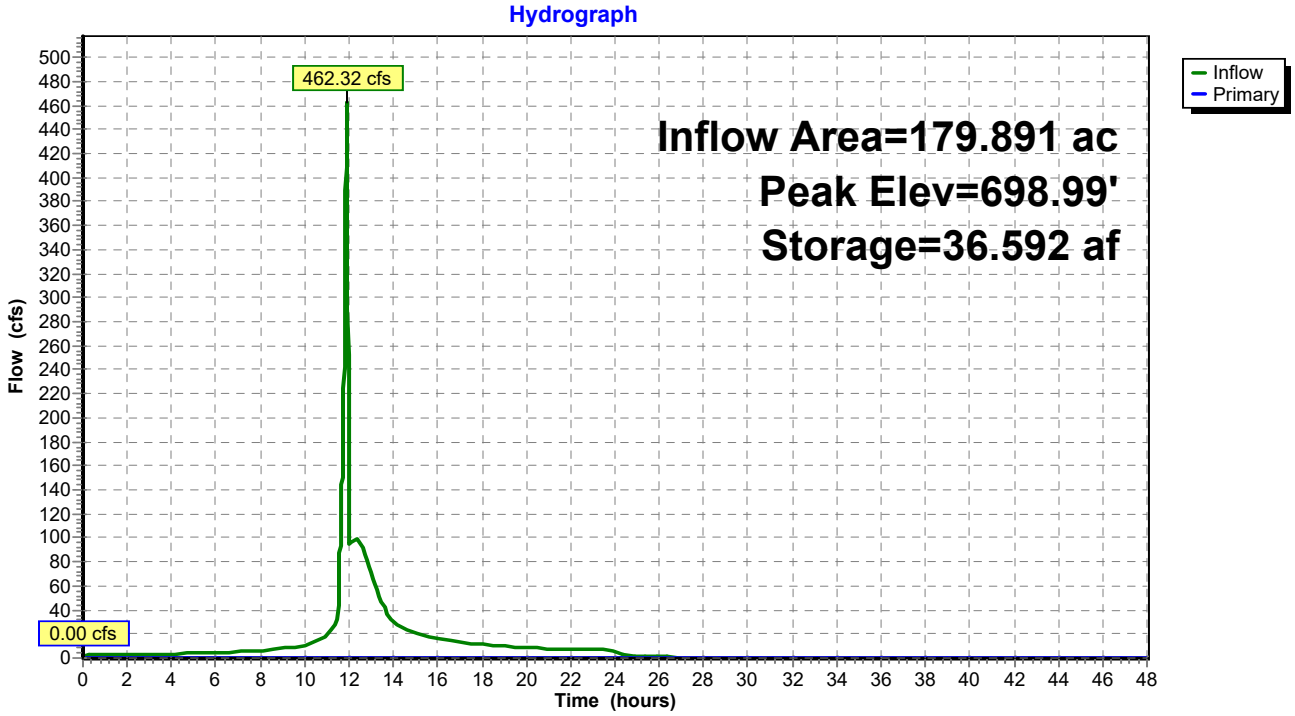

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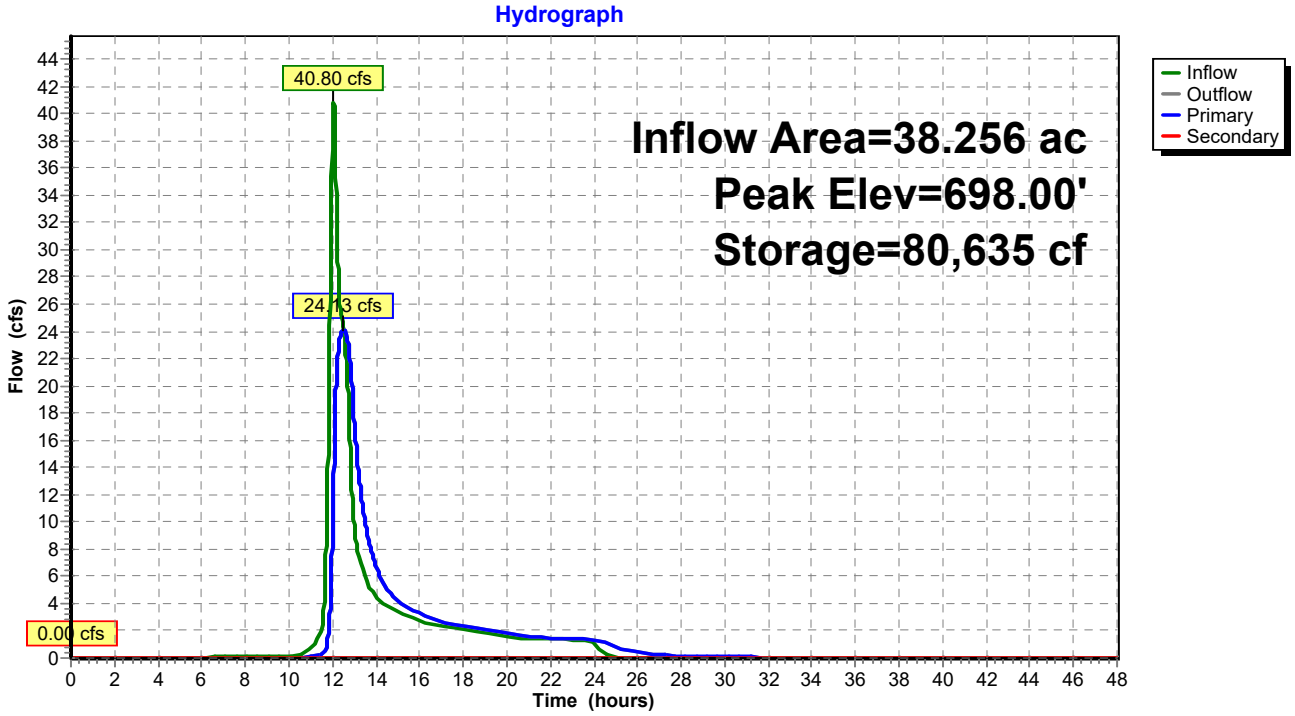

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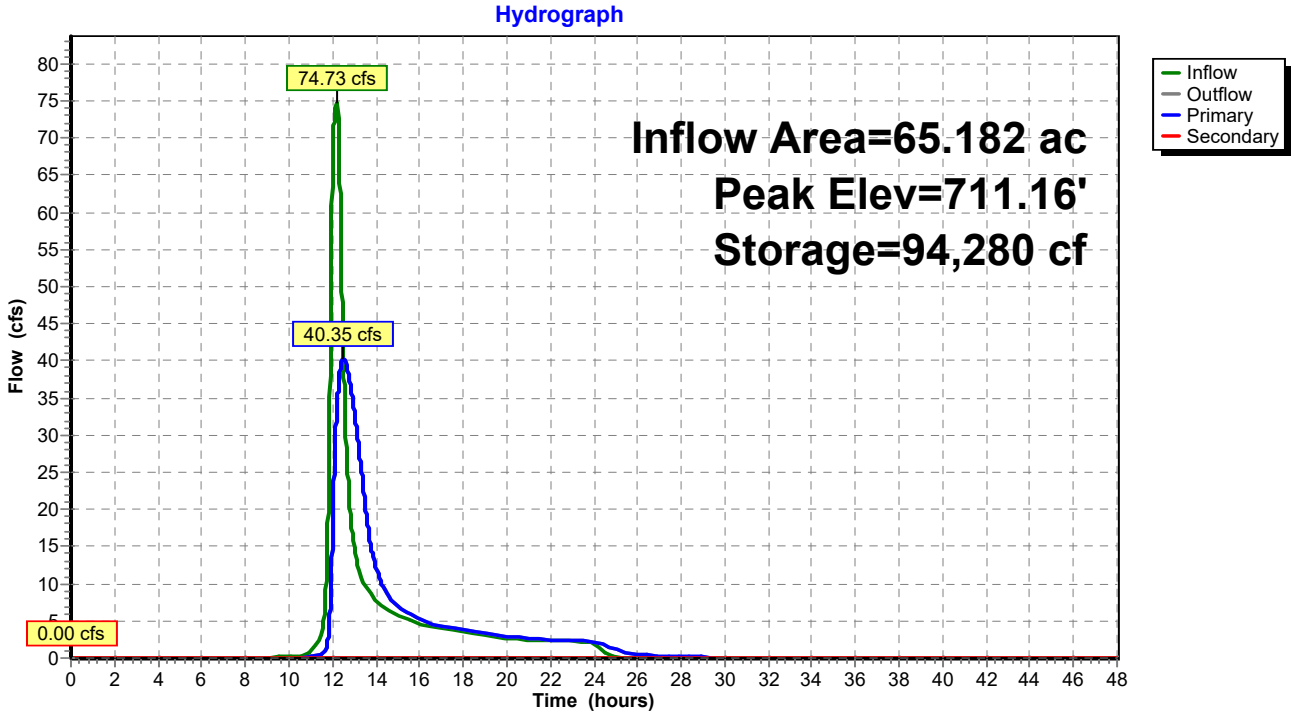
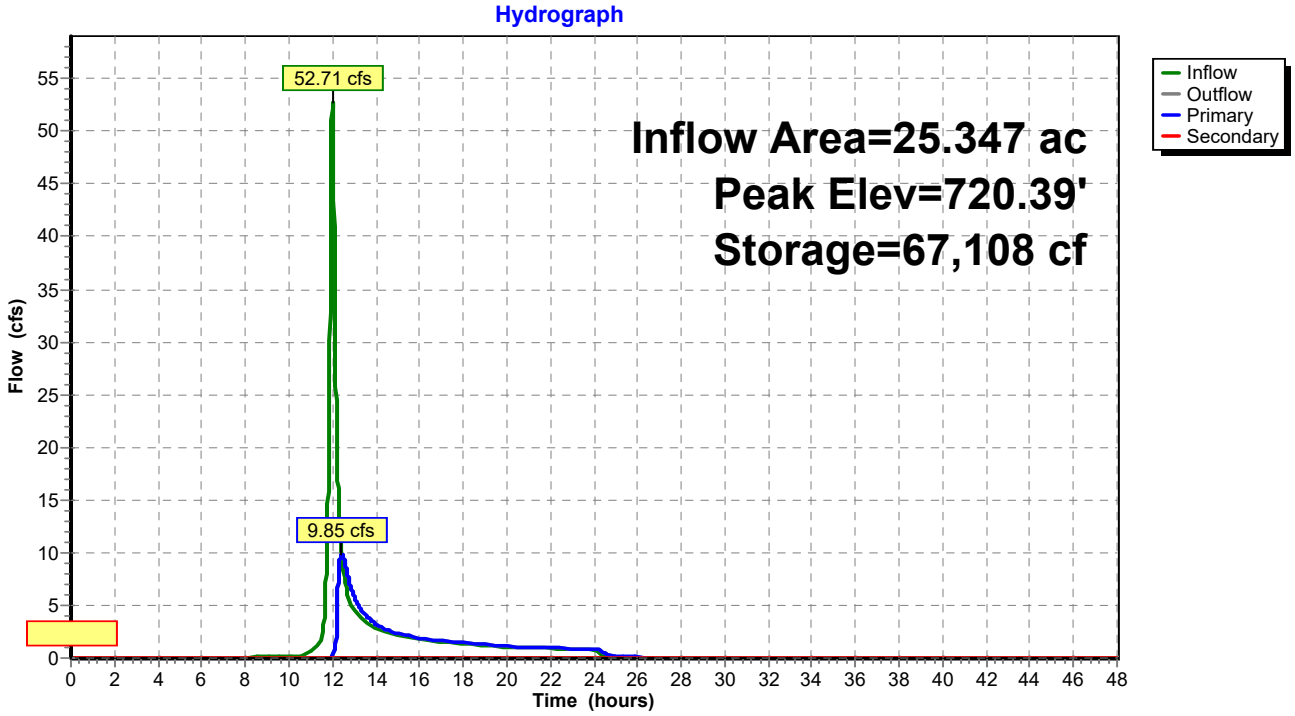
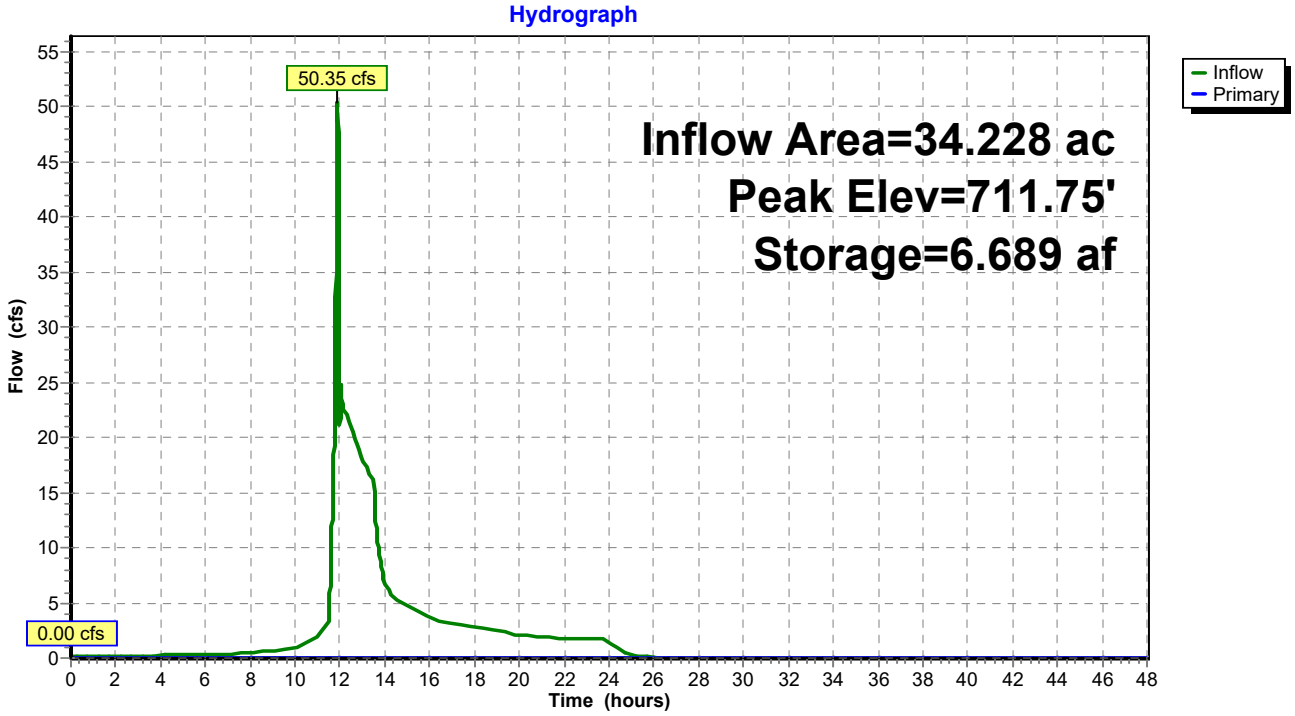


Pond SWP: Southwest Pond



Pre-Expansion 25-Year HydroCAD Analysis of Wetland Inputs

Pond 16P: Wetland C



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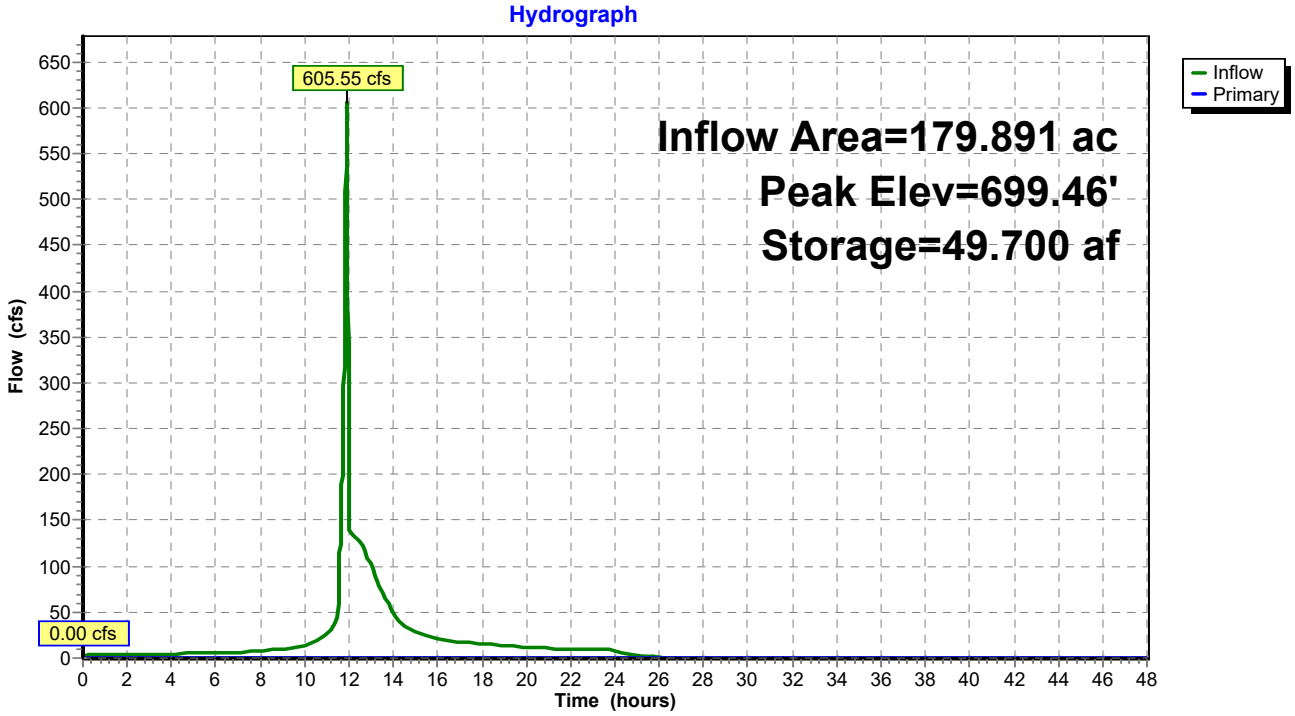

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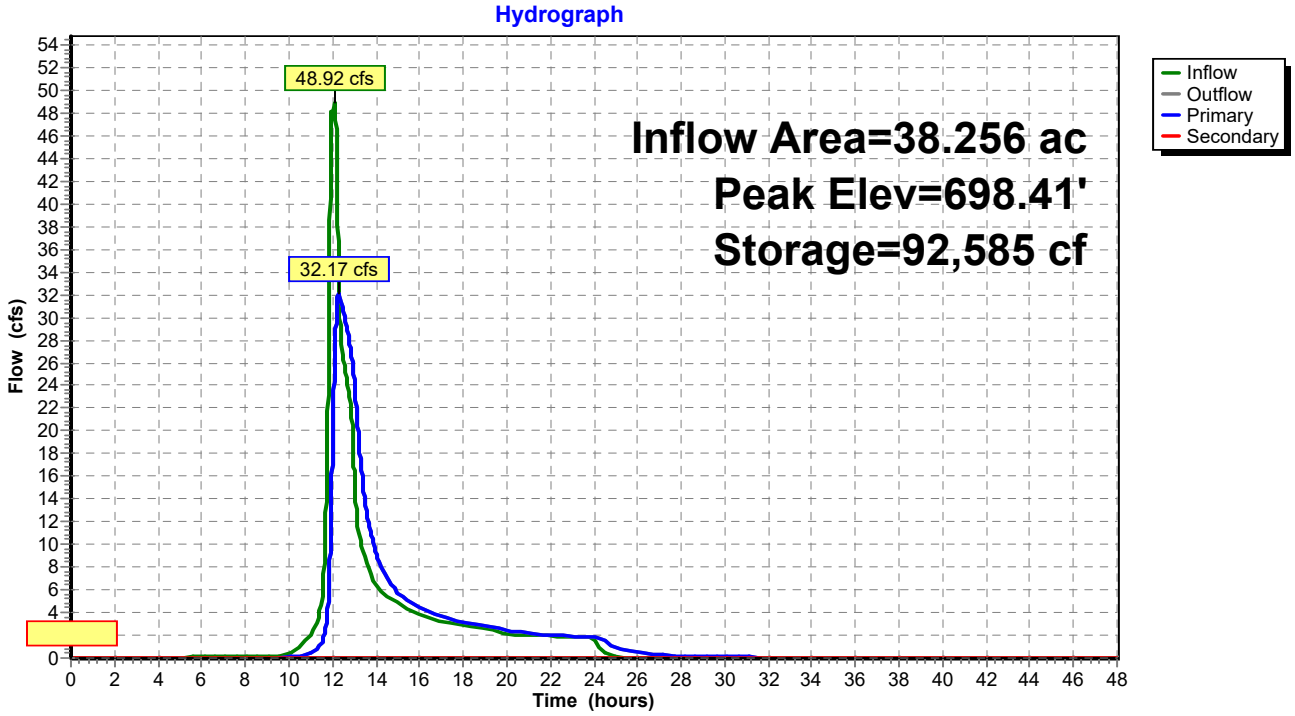

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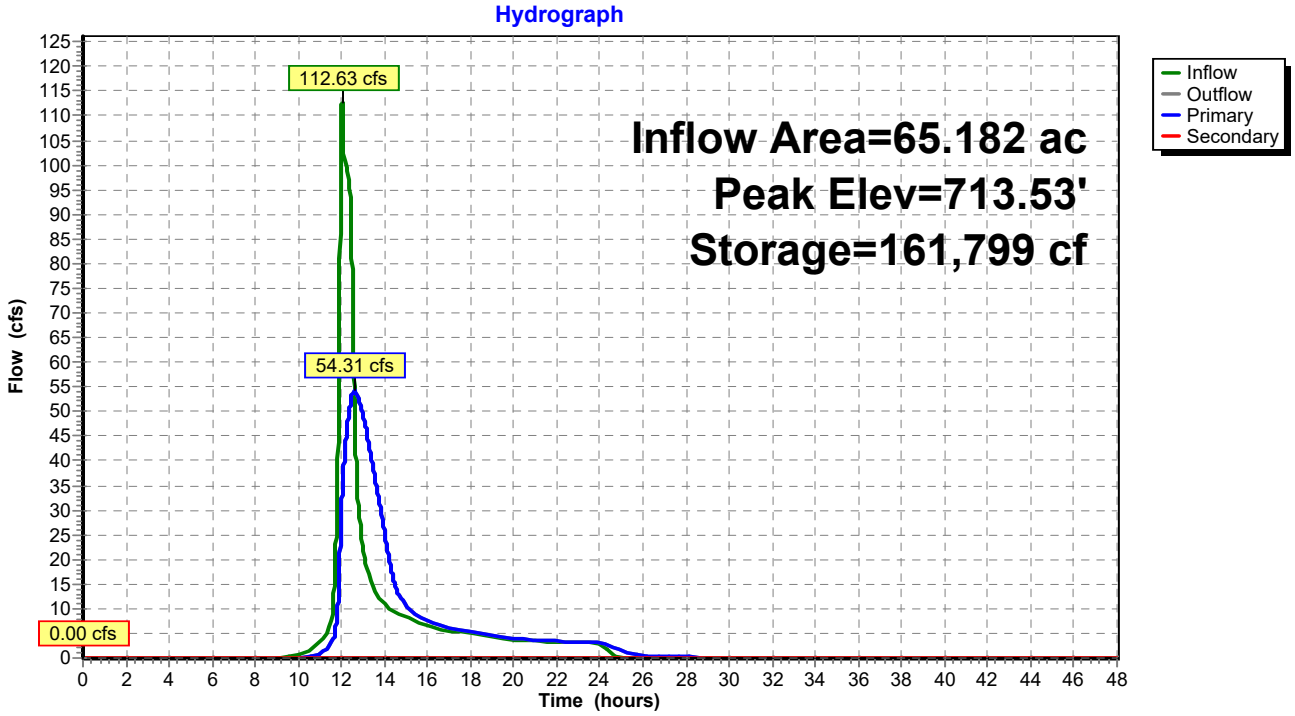
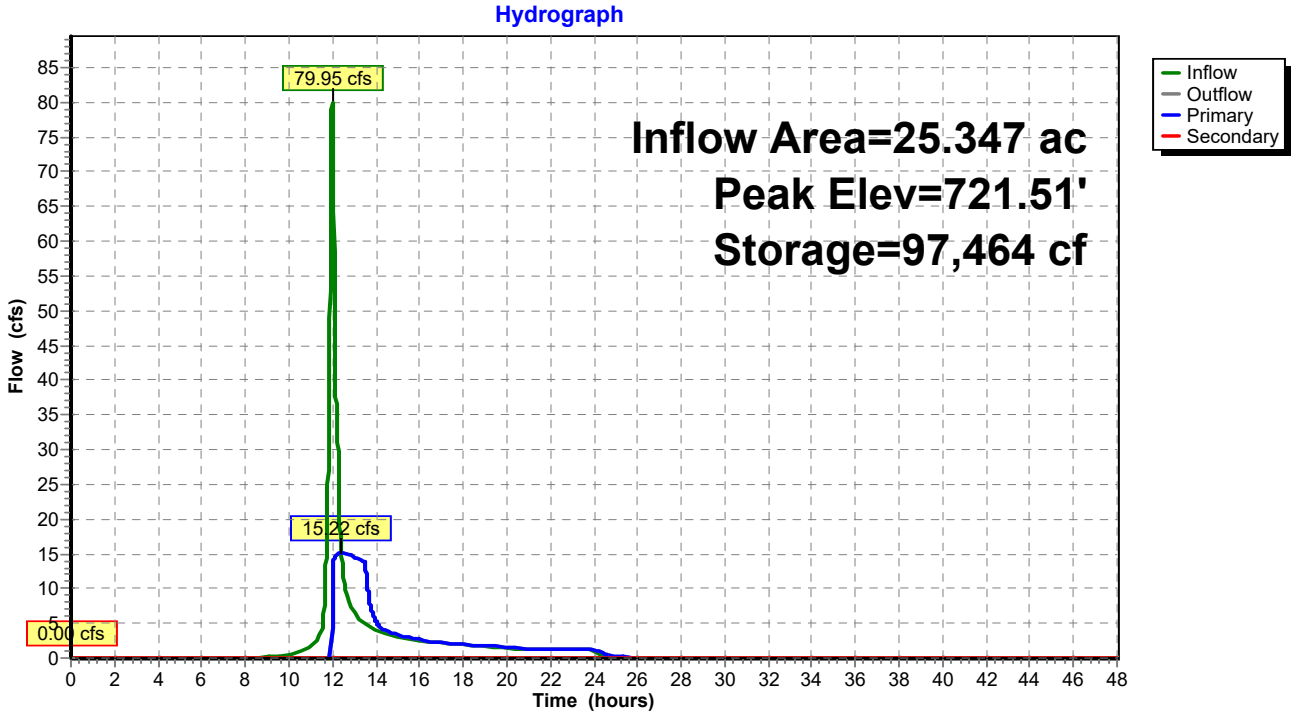
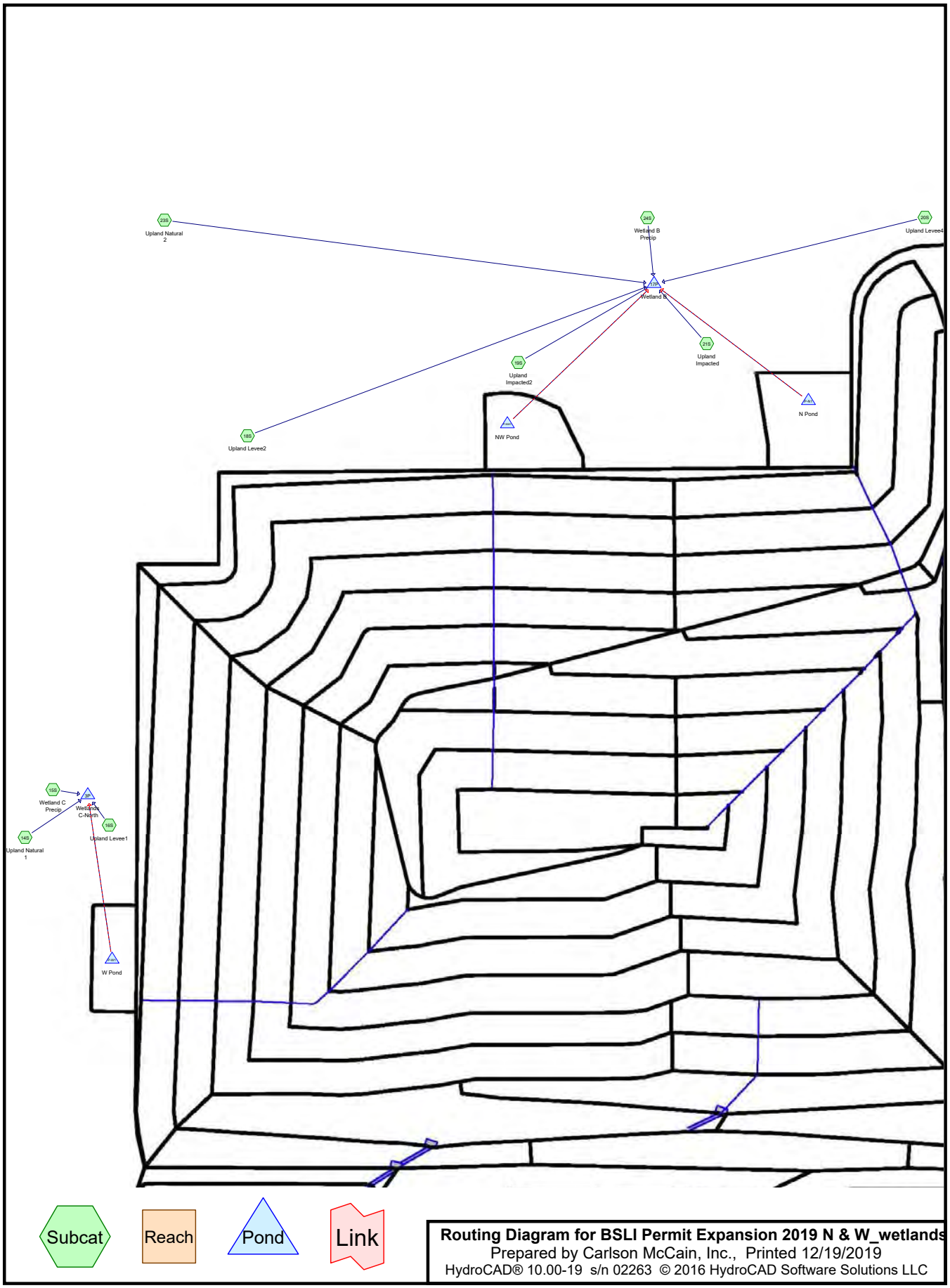


Pond SWP: Southwest Pond



Post-Project 2-Year HydroCAD Analysis of Wetland Inputs



Routing Diagram for BSLI Permit Expansion 2019 N & W_wetlands
Prepared by Carlson McCain, Inc., Printed 12/19/2019
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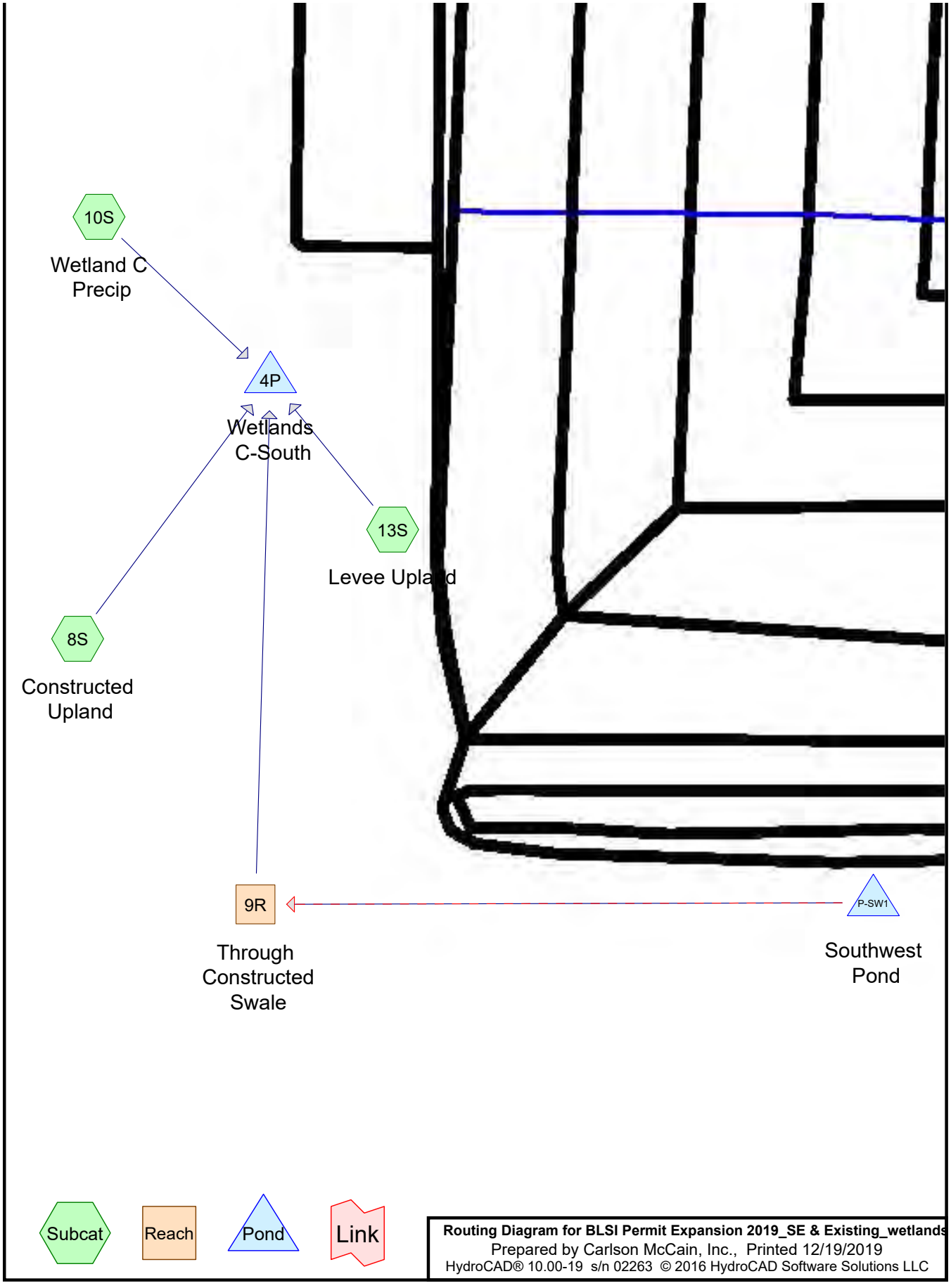
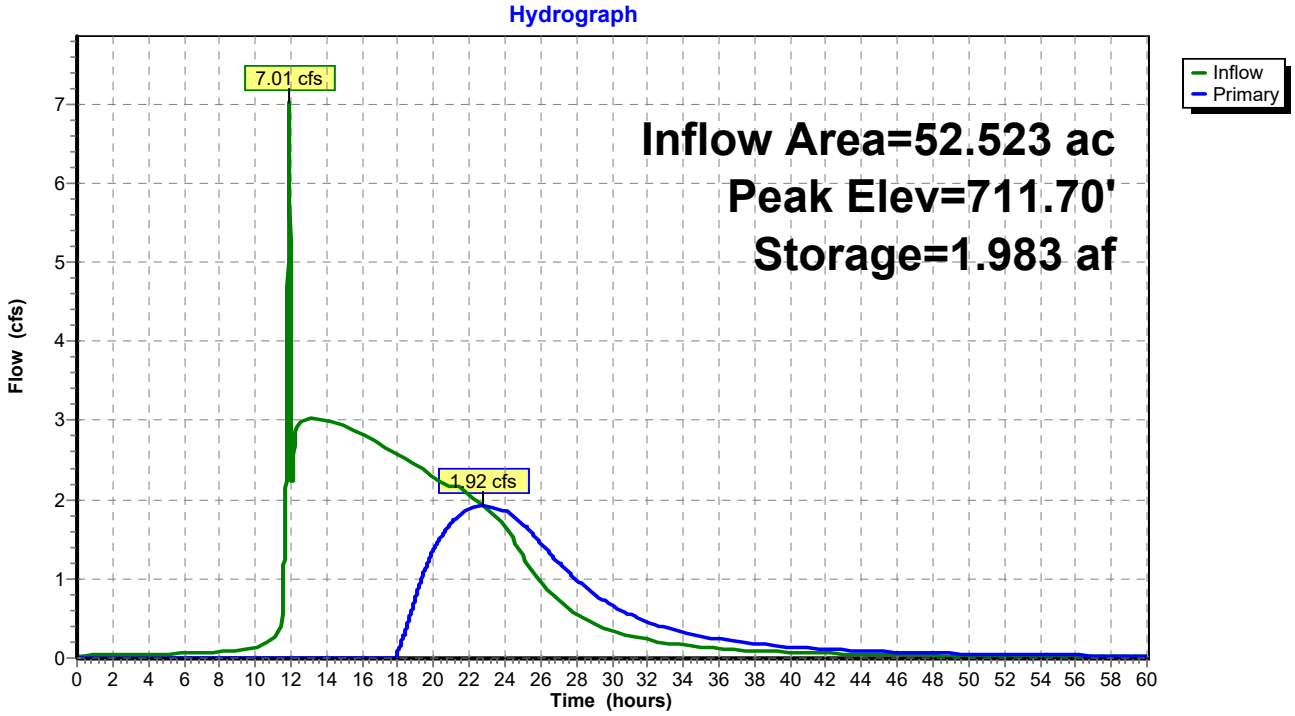
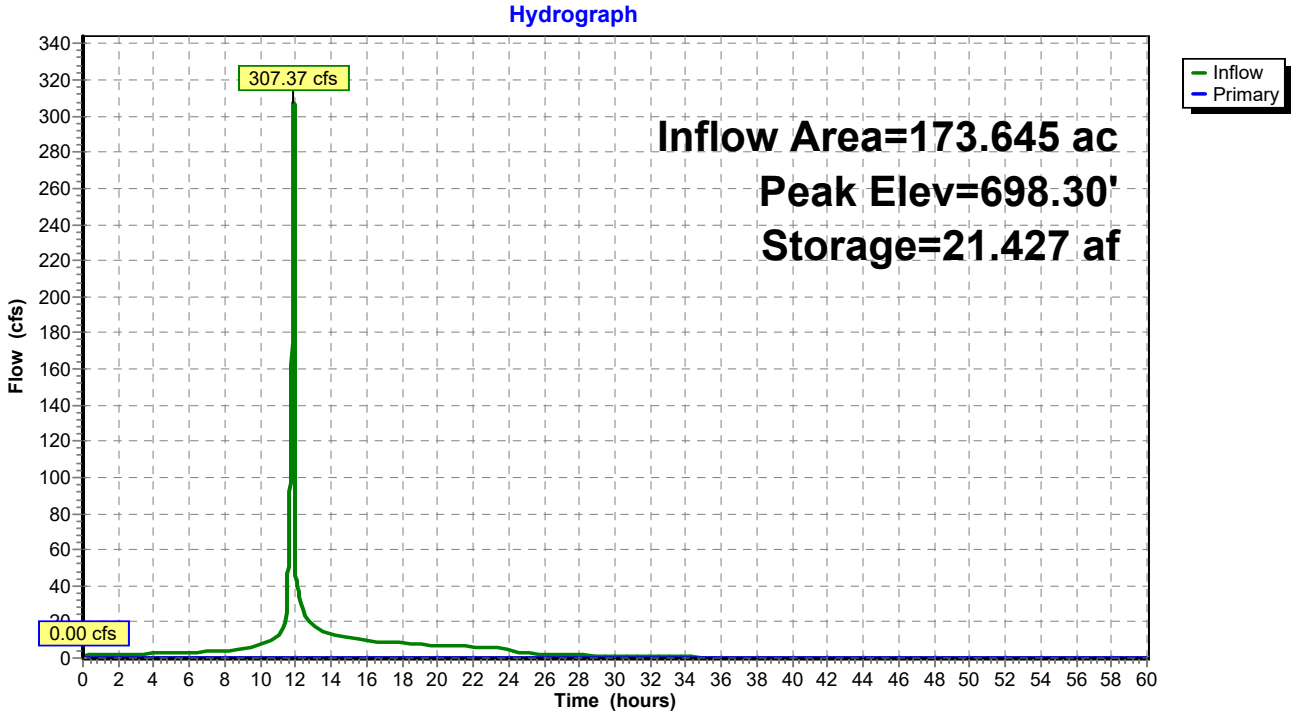


Routing Diagram for BLSI Permit Expansion 2019_SE & Existing_wetlands
Prepared by Carlson McCain, Inc., Printed 12/19/2019
HydroCAD® 10.00-19 s/n 02263 © 2016 HydroCAD Software Solutions LLC

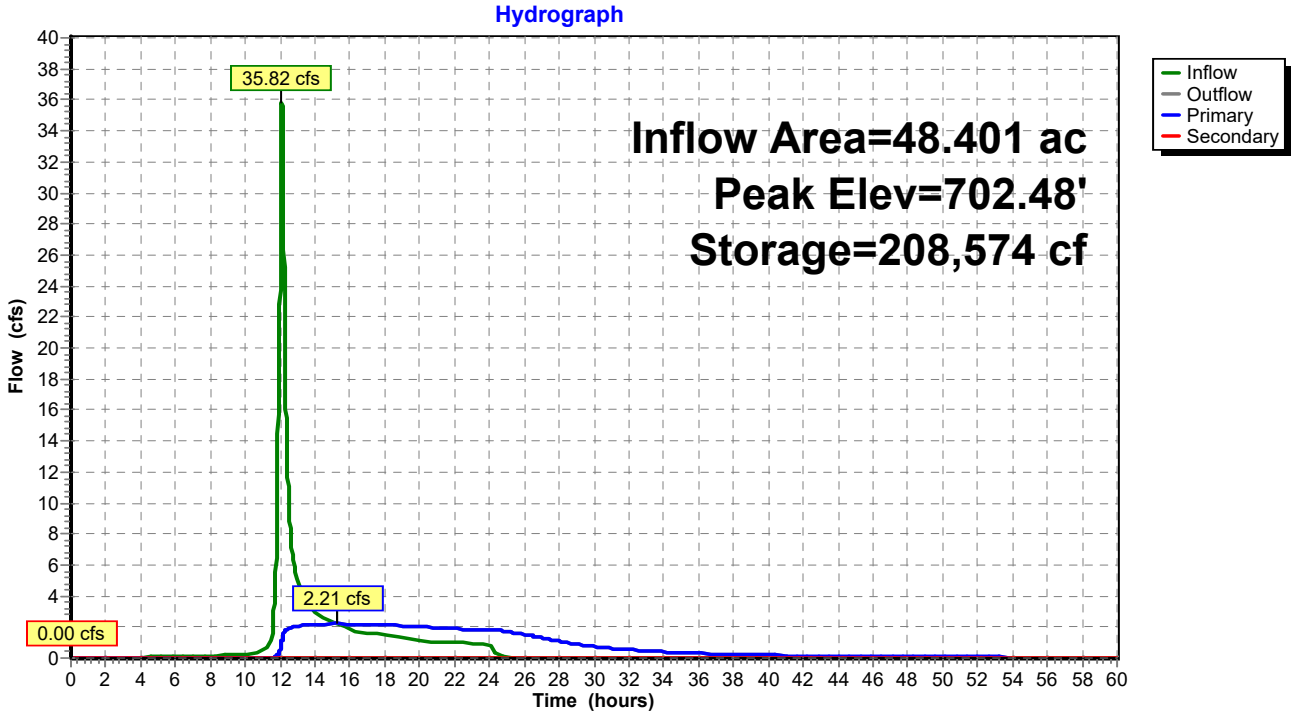
Pond 3P: Wetlands C-North



Pond 17P: Wetland B



Pond P-N1: N Pond



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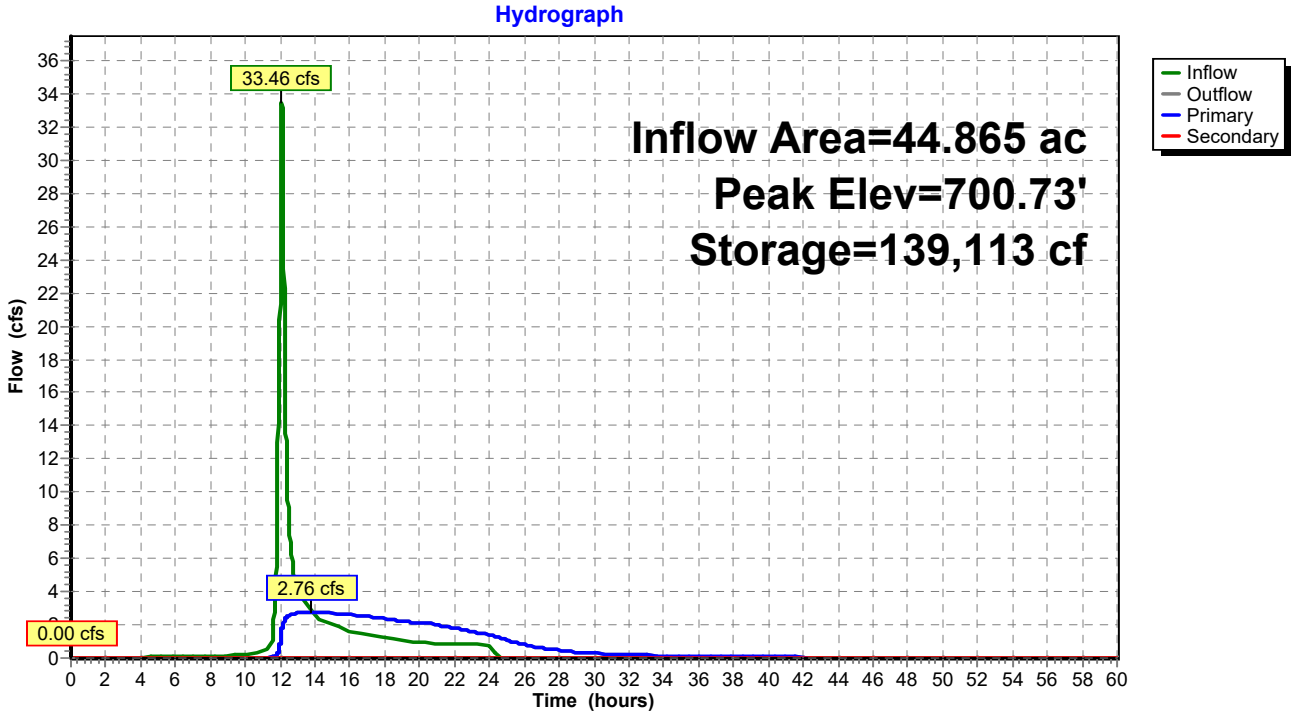

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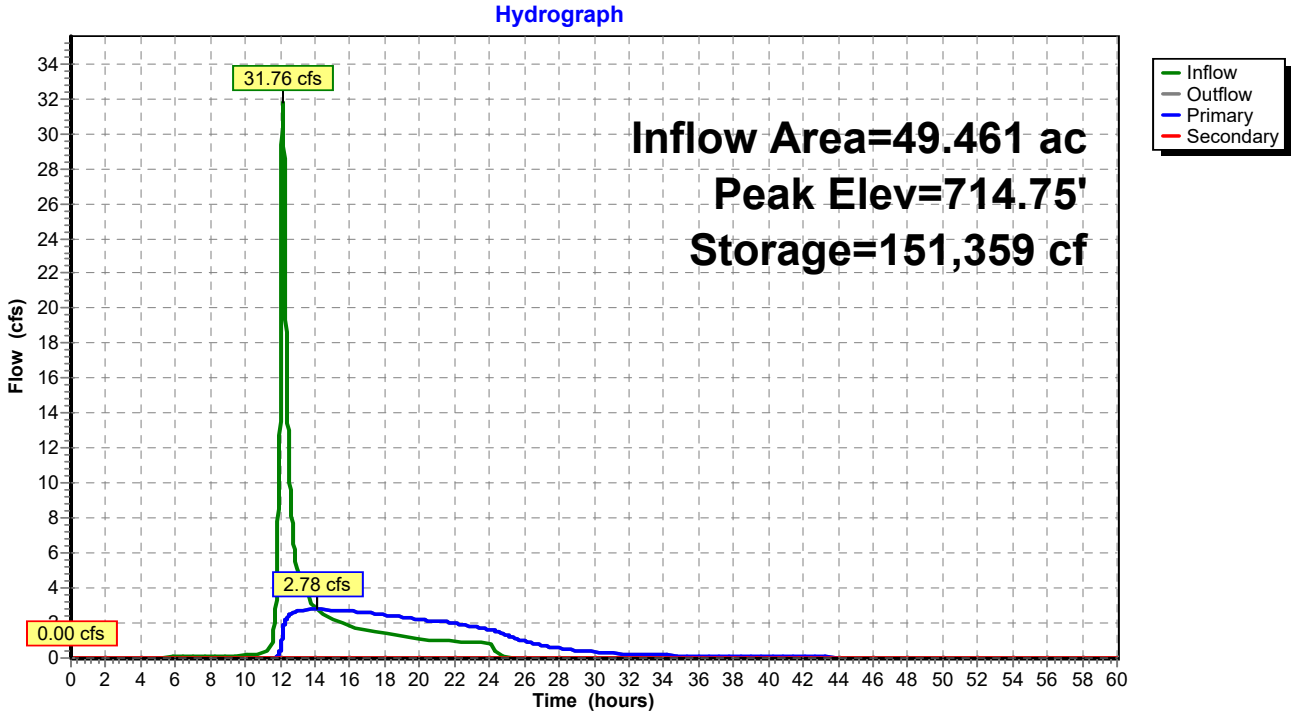
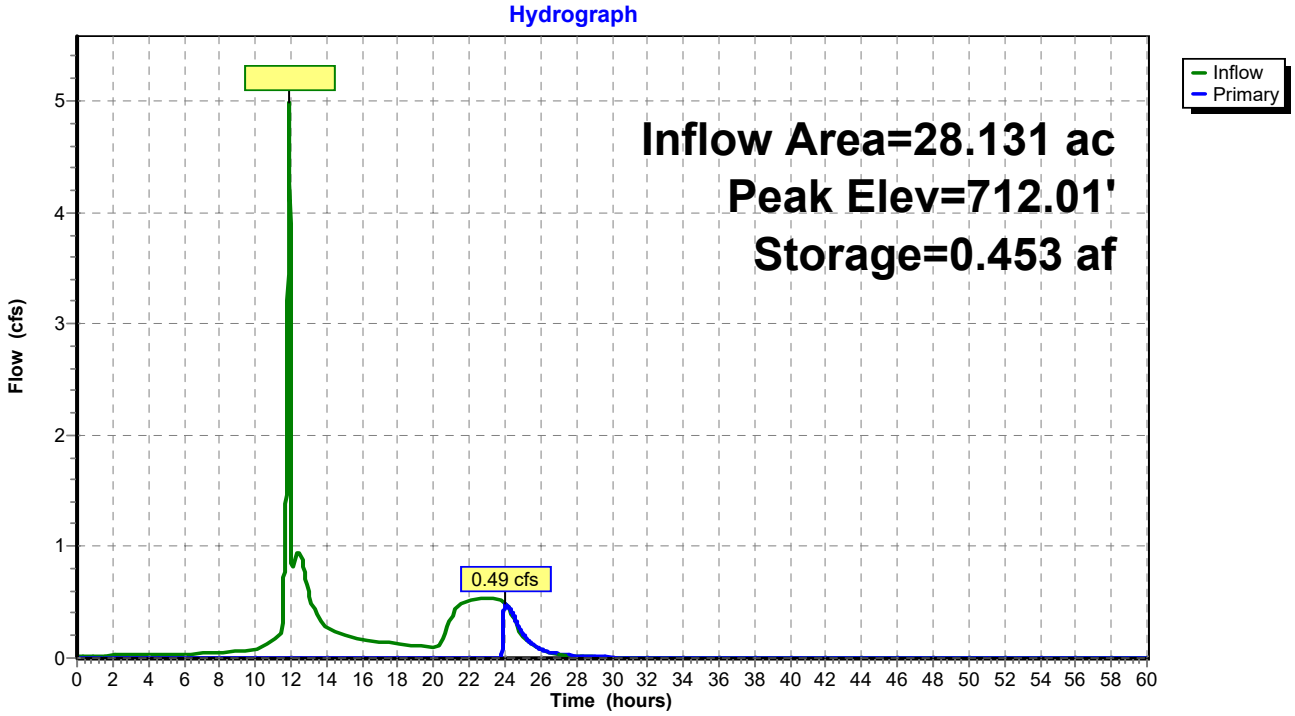


Pond 4P: Wetlands C-South



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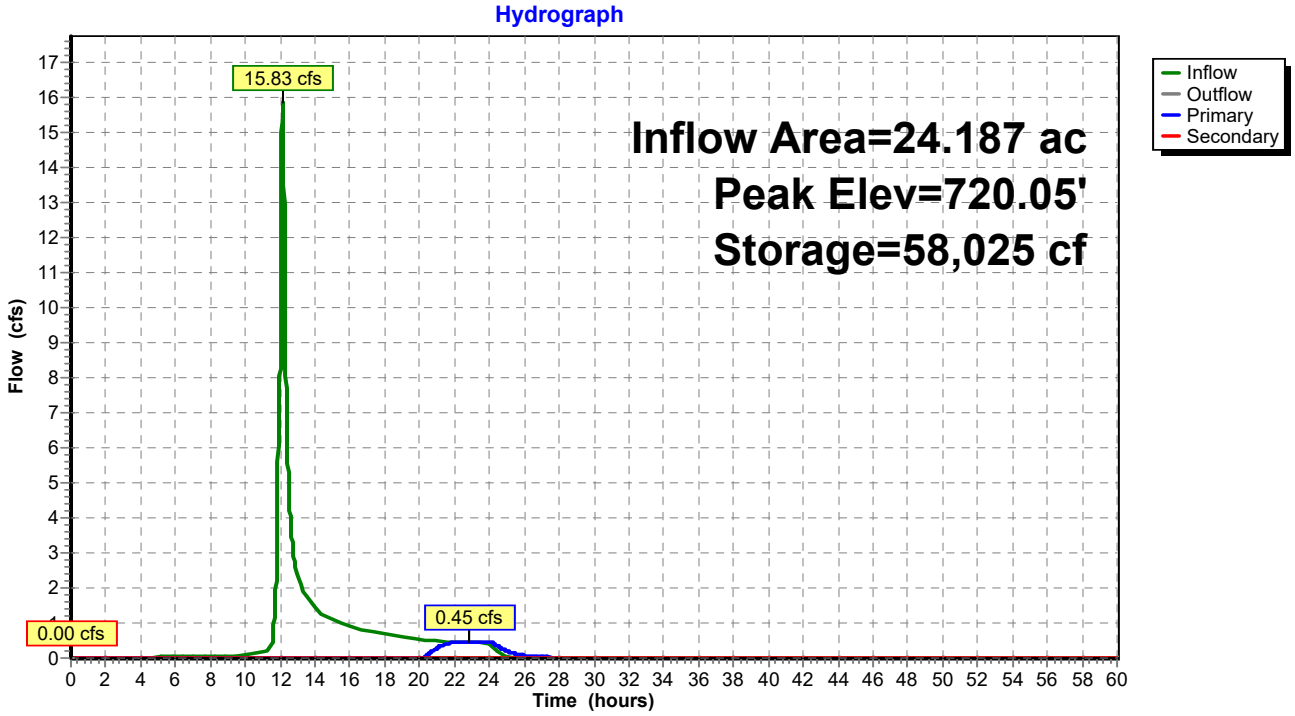
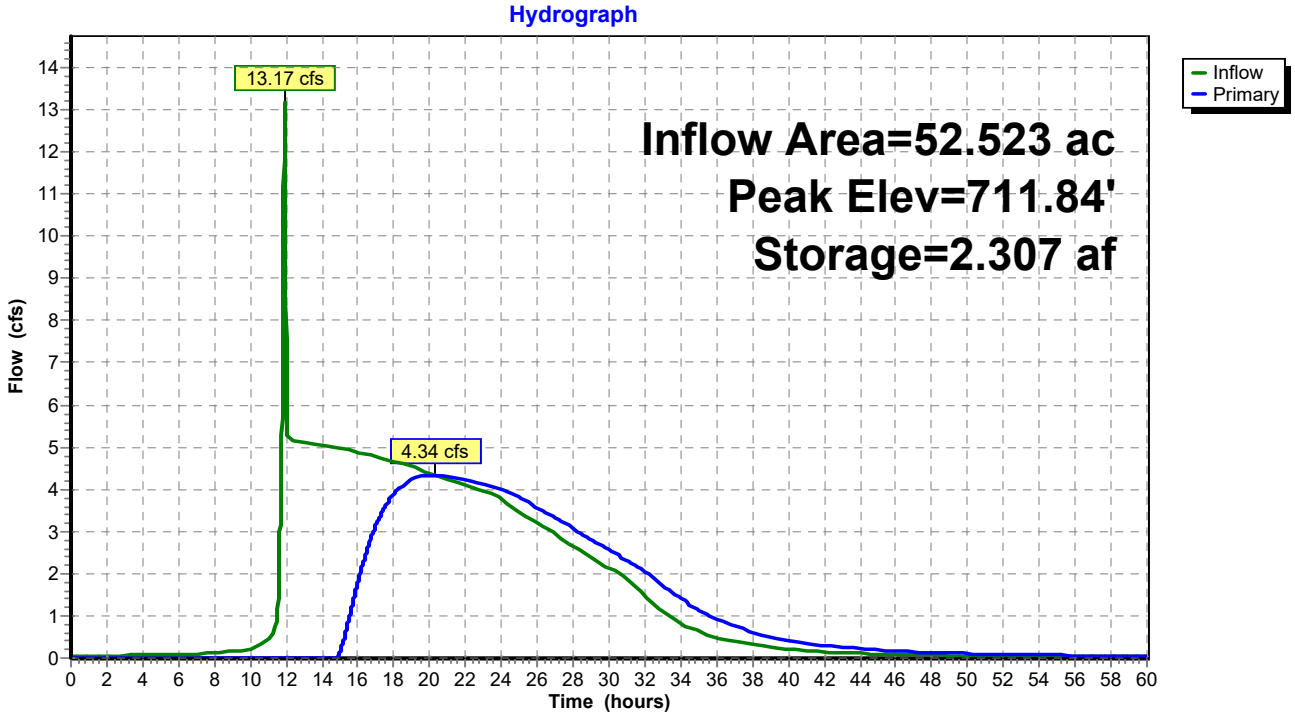
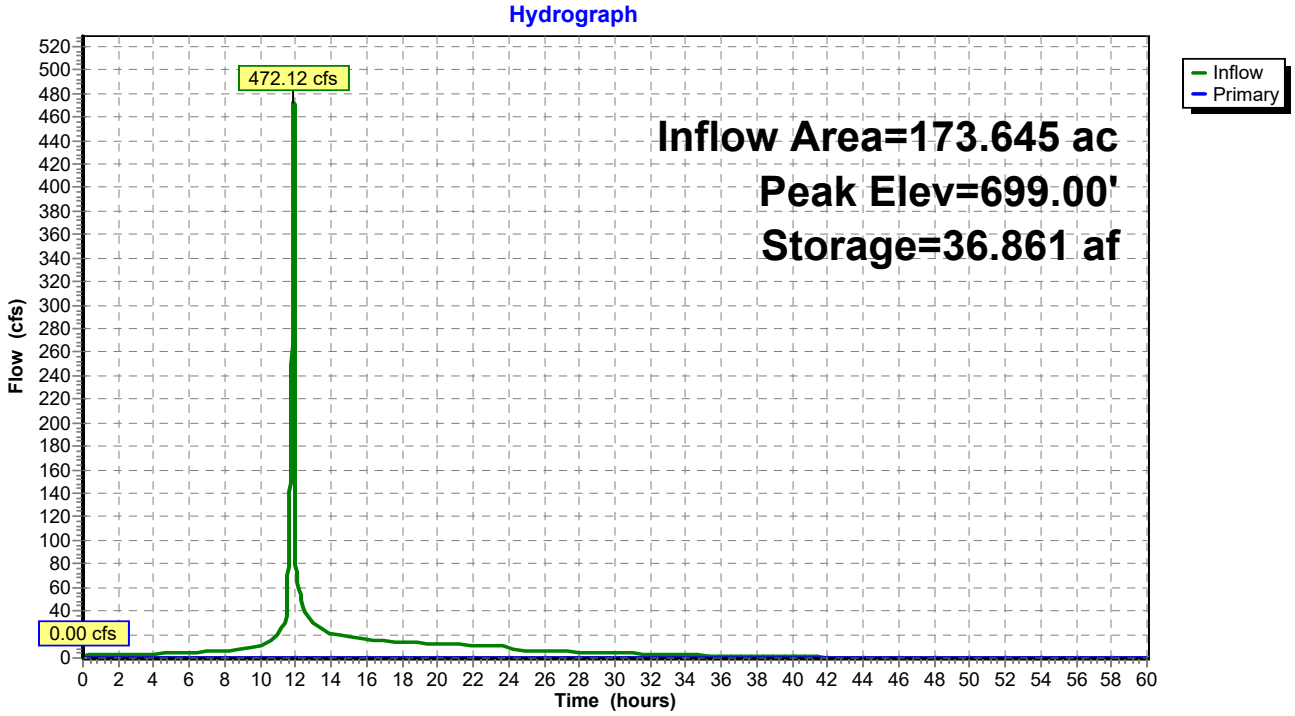


Post-Project 10-Year HydroCAD Analysis of Wetland Inputs

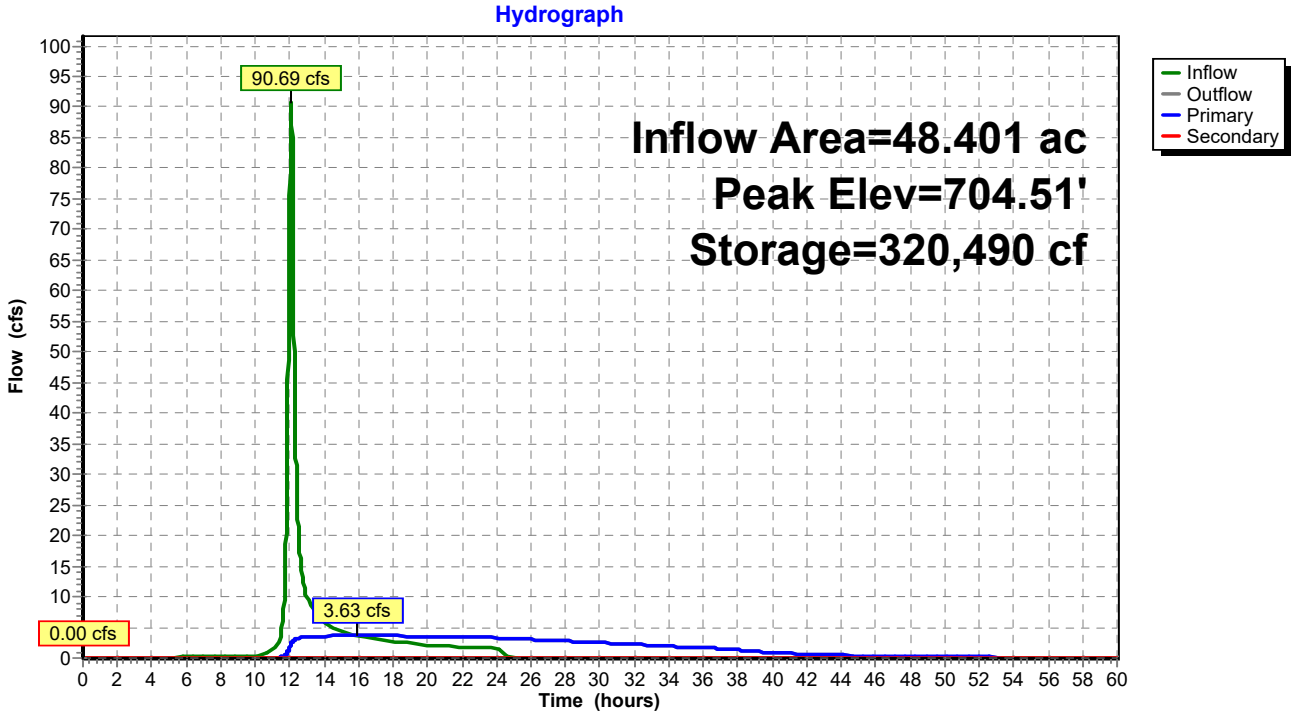
Pond 3P: Wetlands C-North



Pond 17P: Wetland B



Pond P-N1: N Pond



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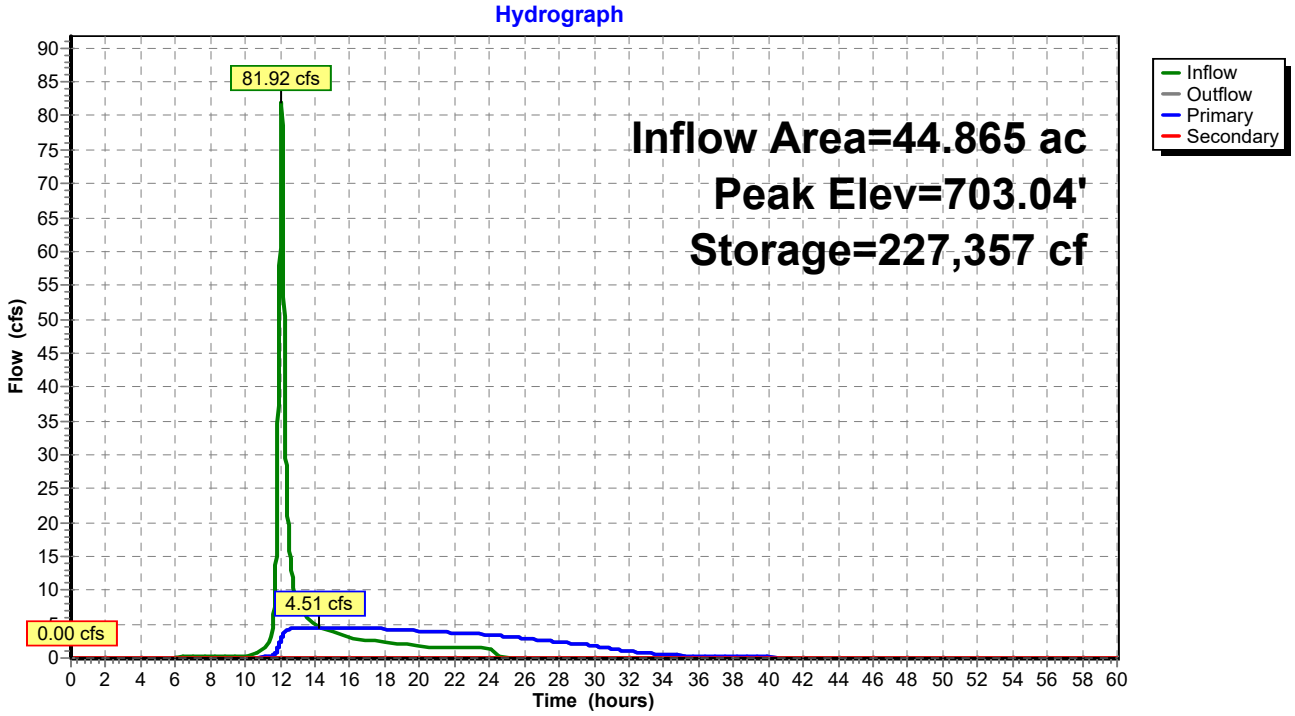
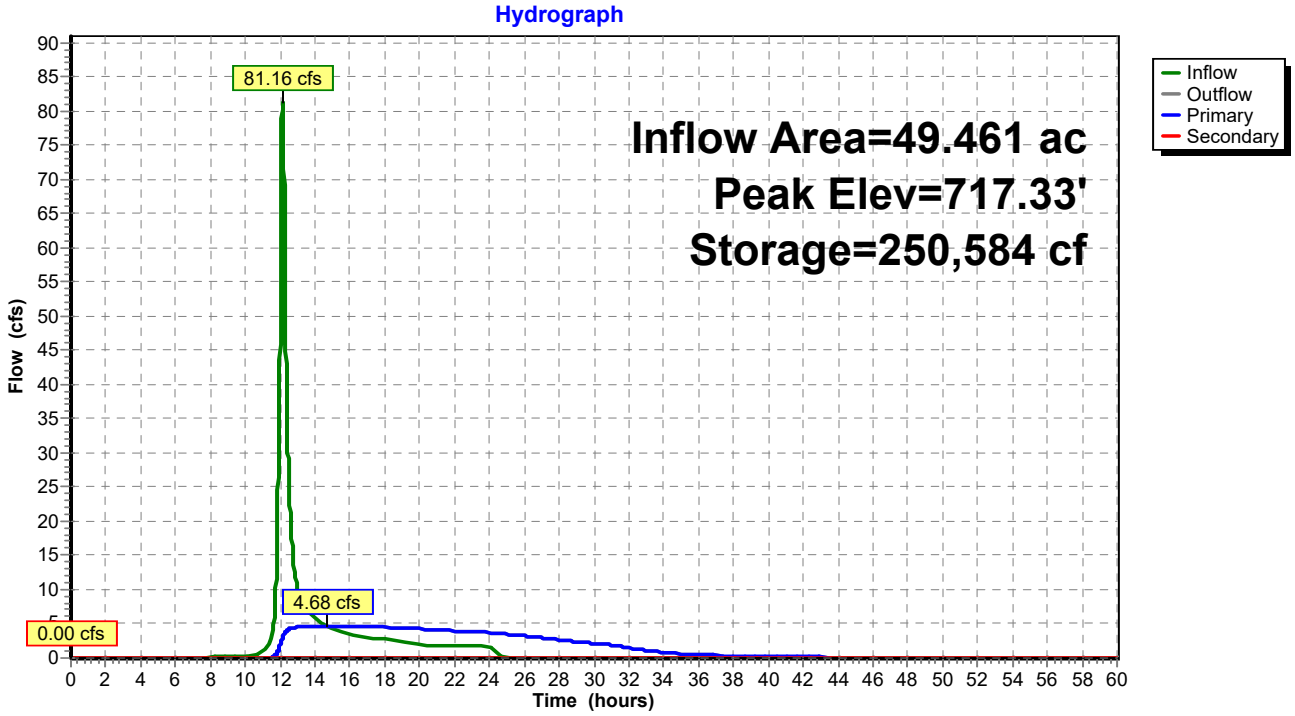
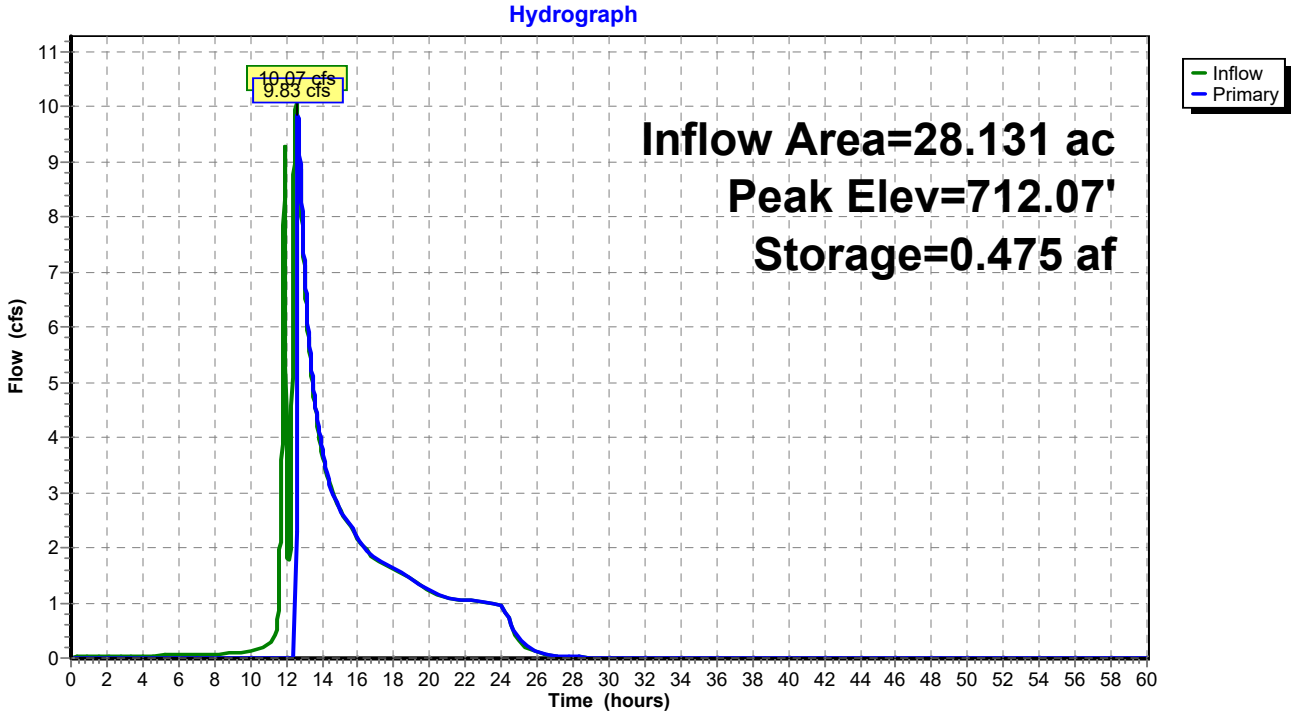


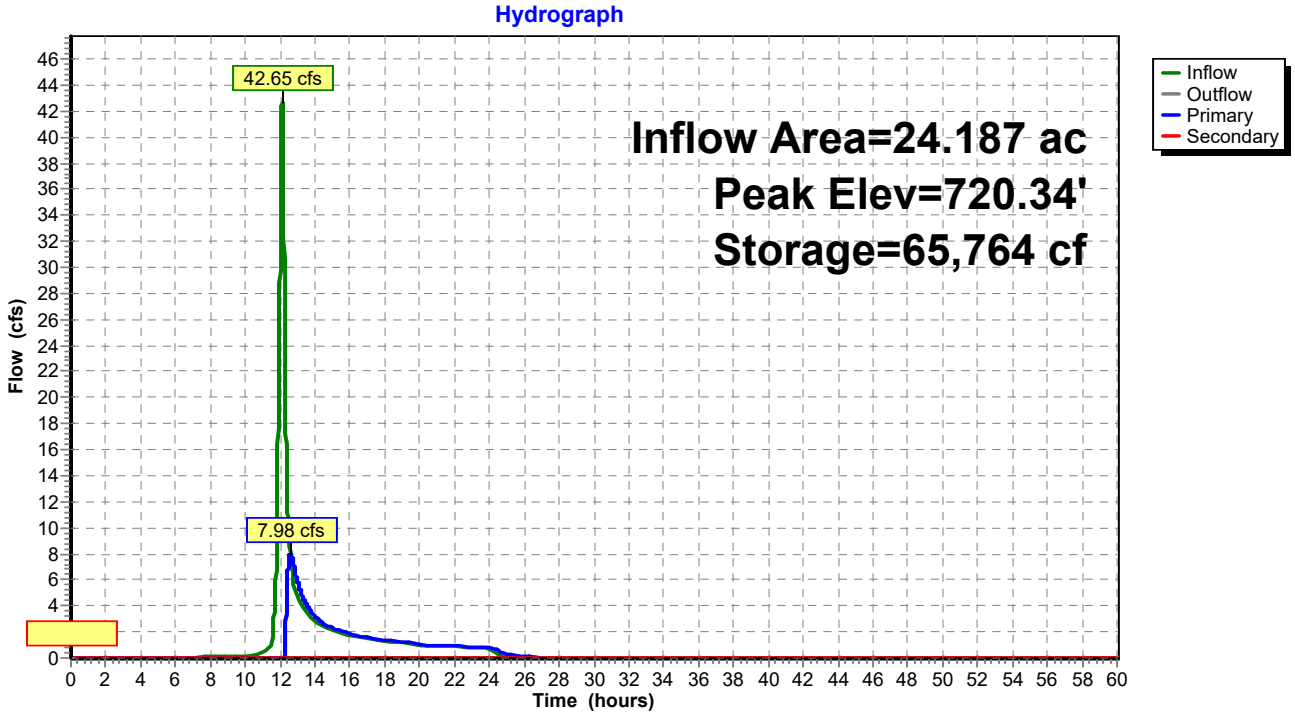
Pond P-W1: W Pond



Pond 4P: Wetlands C-South

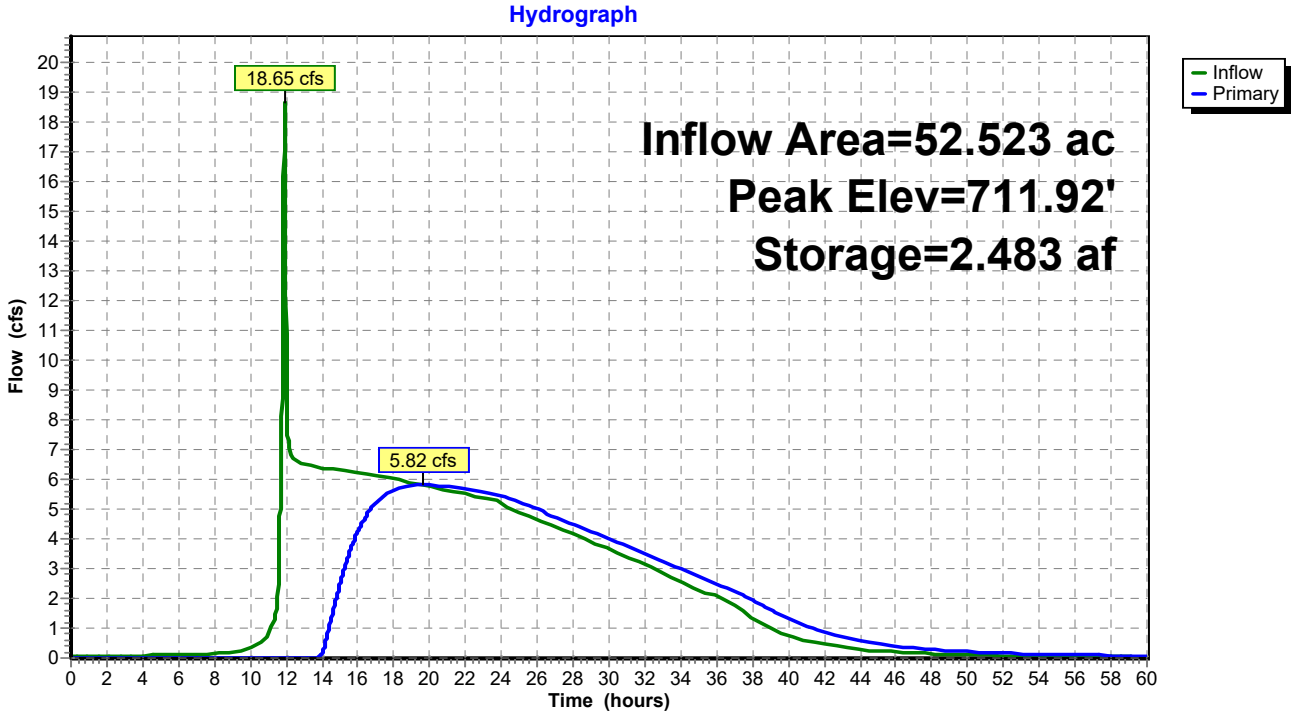


Pond P-SW1: Southwest Pond

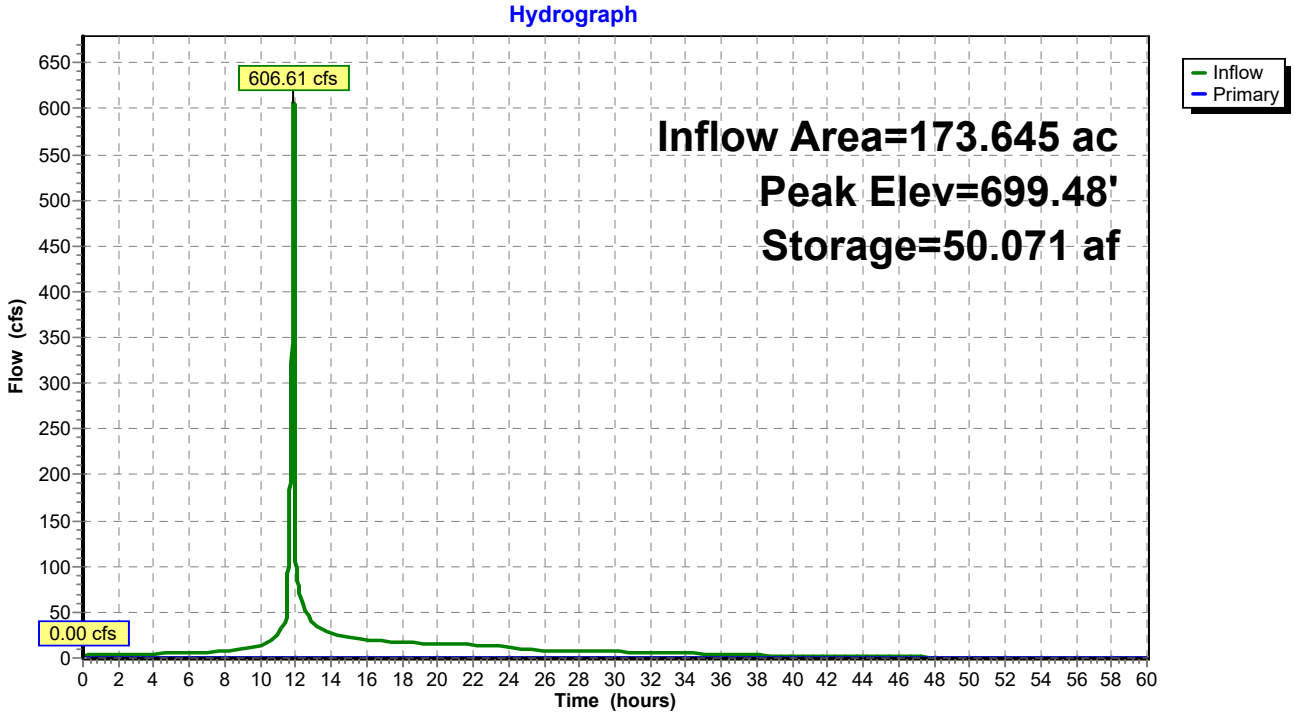


Post-Project 25-Year HydroCAD Analysis of Wetland Inputs

Pond 3P: Wetlands C-North



Pond 17P: Wetland B



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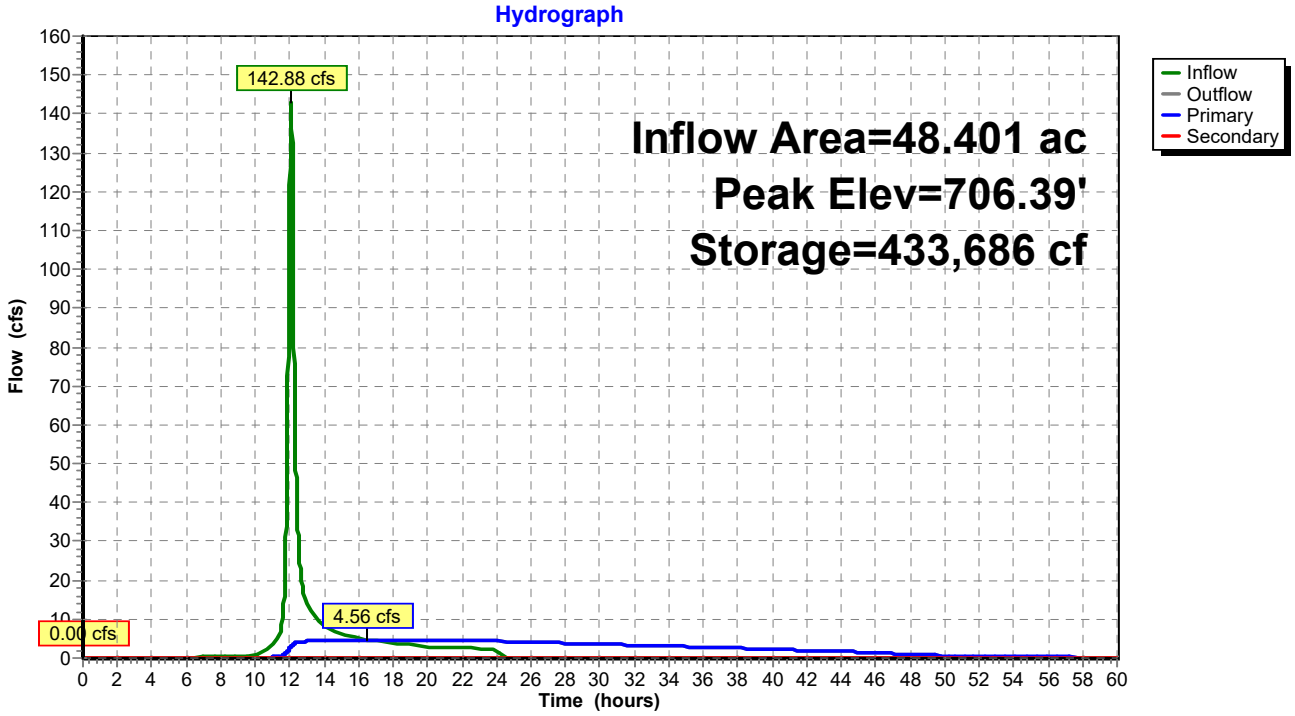

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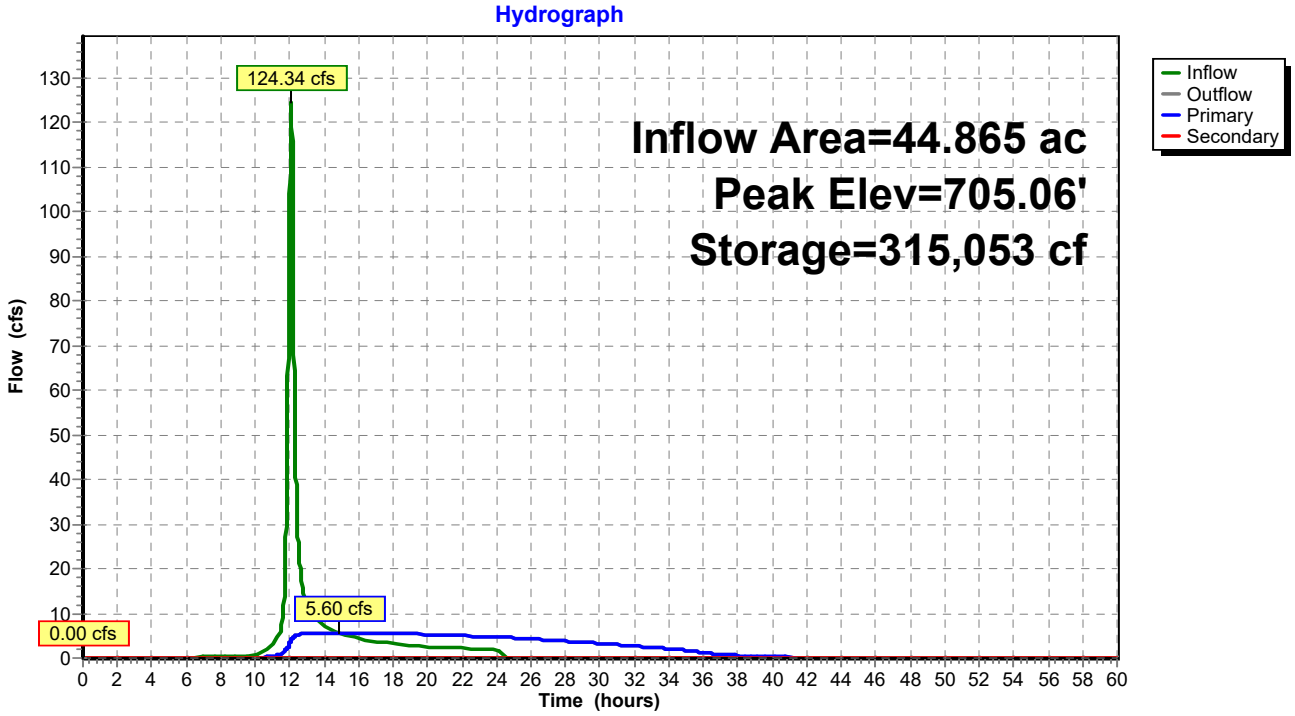
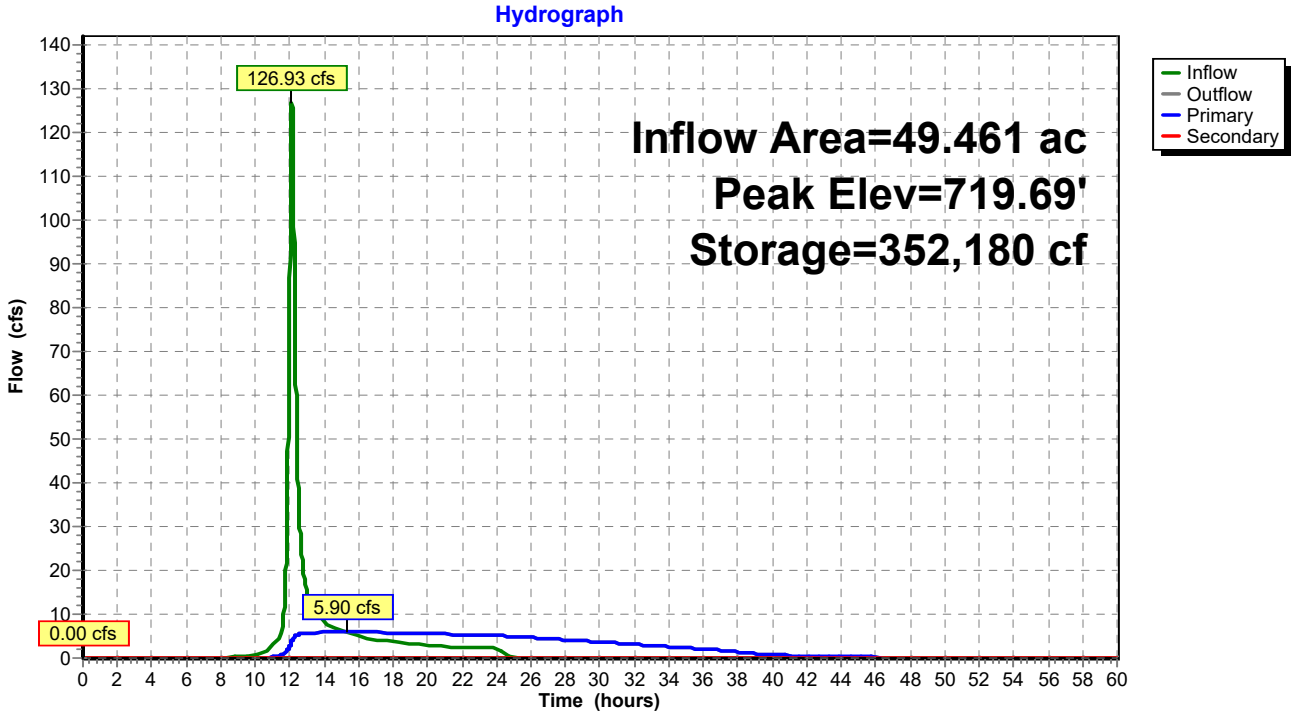
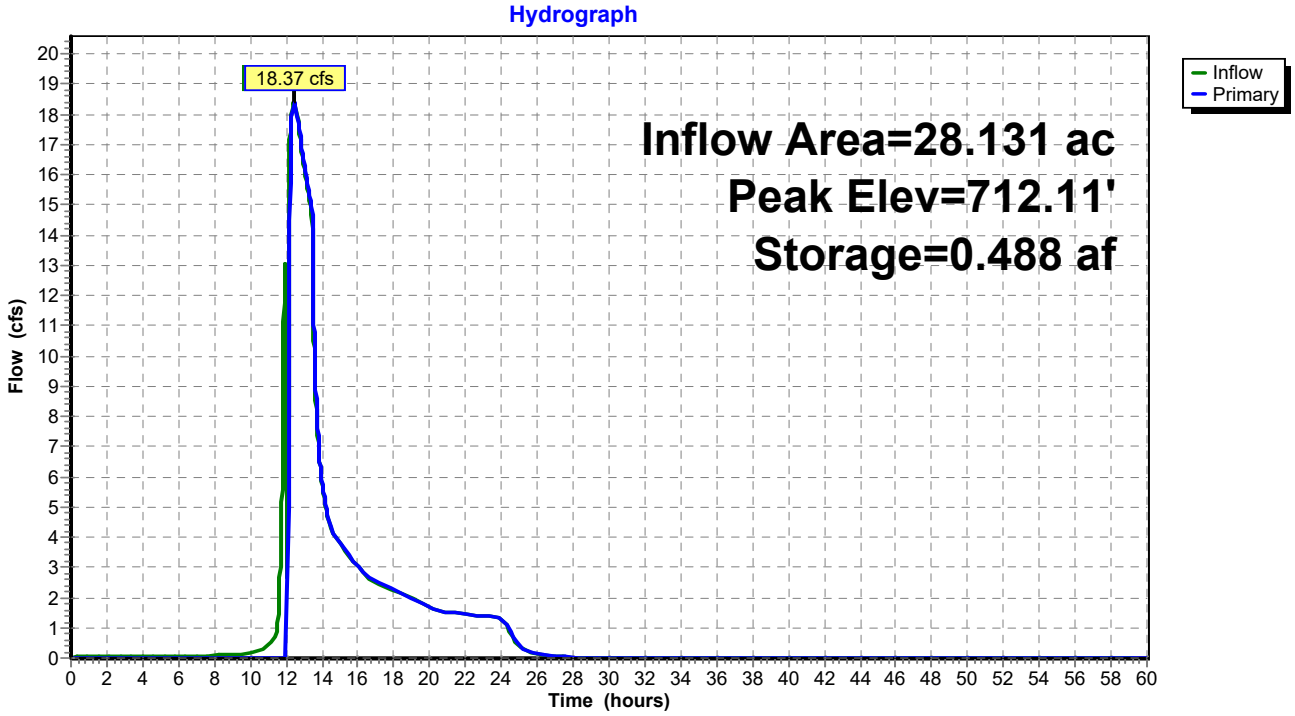


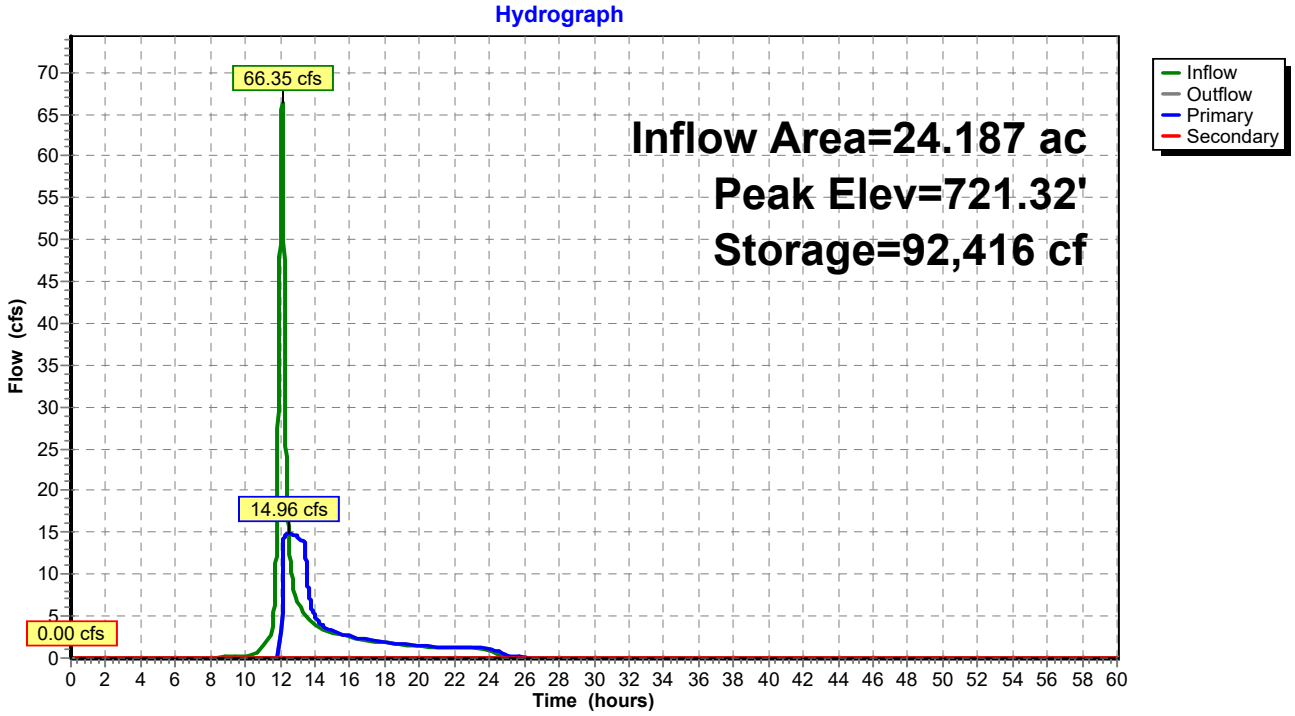
Pond P-W1: W Pond



Pond 4P: Wetlands C-South



Pond P-SW1: Southwest Pond



Attachment D

Liner and Leachate Collection System Information

Attachment D-1

Analysis of Levee Erosion by the 500-Year River Flood

Attachment D-1: Analysis of Levee Erosion by the 500-Year River Flood

Estimate of the Velocity of the Minnesota River in the Floodway Fringe at Burnsville Sanitary Landfill (River-Mile 12.5)

Table 5 from the 2016 Dakota County Flood Insurance Study (FIS)[1] indicates a peak discharge of 148,000 cfs for the 0.2-percent annual chance flood event in the Minnesota River at the Jordan gauge (river-mile 40.2). However, since the composition, shape and vegetation of the flood plain is quite different than that of the main channel, floodway fringe flow and velocity will be different than the mean river flow and velocity. To estimate the floodway fringe flow and velocity, Manning's Open Channel flow equation can be used:

$$Q = V * A = \frac{1.49}{n} * A * R^{\frac{2}{3}} * S^{1/2} \qquad (1)$$

Where:

Q = river flow rate (ft^3/s)

V = river velocity (ft/s)

A = cross-sectional area of the river (ft^2)

n = Manning's roughness coefficient

R = hydraulic radius (ft) = A / P_w

P_w = wetted perimeter (ft)

S = slope of channel or hydraulic grade line

A figure showing the cross section of the river's floodway fringe for both the pre-expansion and post-Project conditions is included as Figure 6-9. For the purposes of viewing, the cross sections are vertically exaggerated 10 times.

The flow area and wetted perimeter, along with the hydraulic radius during the 500-year flood (EL. 722.5) are presented below:

	Pre-Expansion Condition	Post-Project Condition
Flood Fringe Flow Area (sf)	22,617	38,454
Wetted Perimeter (ft)	1,168	1,883
Hydraulic Radius (ft)	19.4	20.4

Table 6 from the FIS indicates an average Manning's "n" value of 0.028 – 0.15 for overbank flow (flow in the floodway fringe) in the Minnesota River. According to the US Army Corps of Engineers Hydraulic Engineering Center's River Analysis System (HEC-RAS) model of the Minnesota River at Mile 12.5, the Manning's n value for the floodway fringe is designated as 0.078.

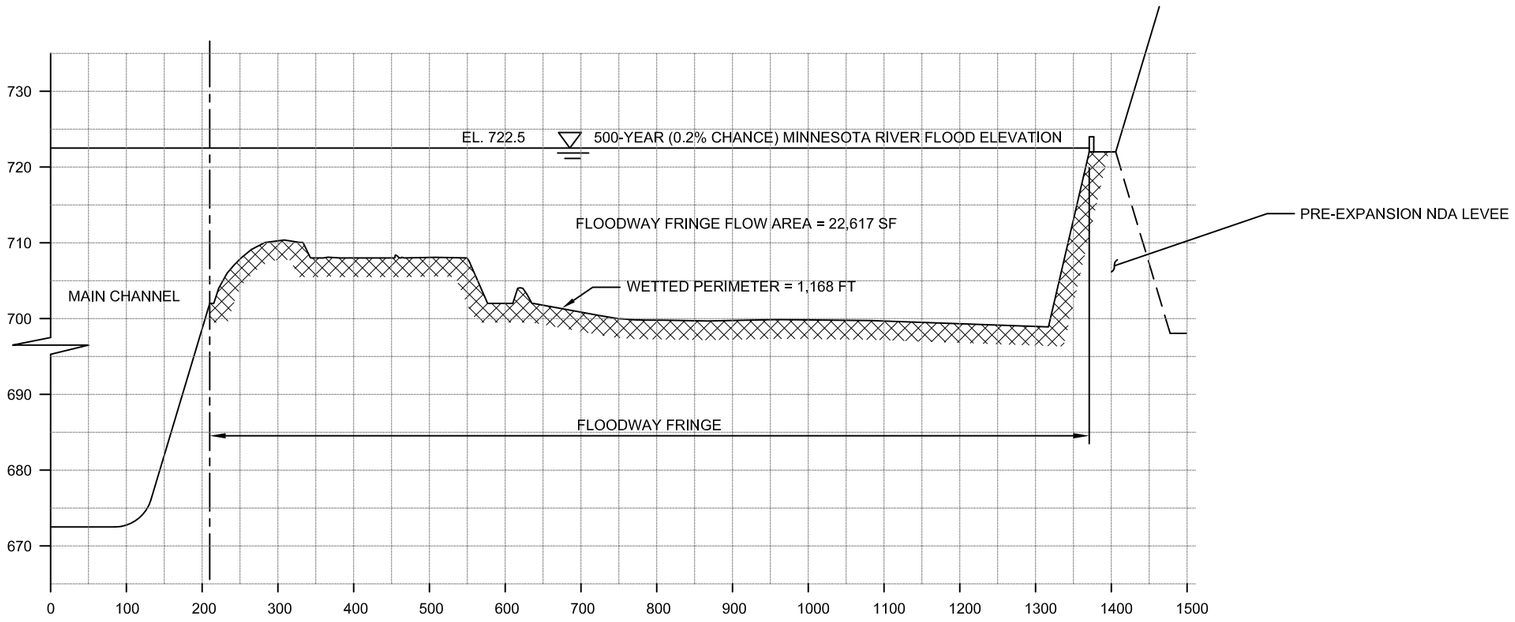
The channel slope is determined by the slope of the 500-year flood elevation between two points on either side of the site. From the Flood Profile on page 35B of Volume 2 of the FIS, S = 0.0001.

Using equation (1), the resulting flow rates for the 500-year flood event in the floodway fringe for the pre-expansion and post-Project conditions are shown below.

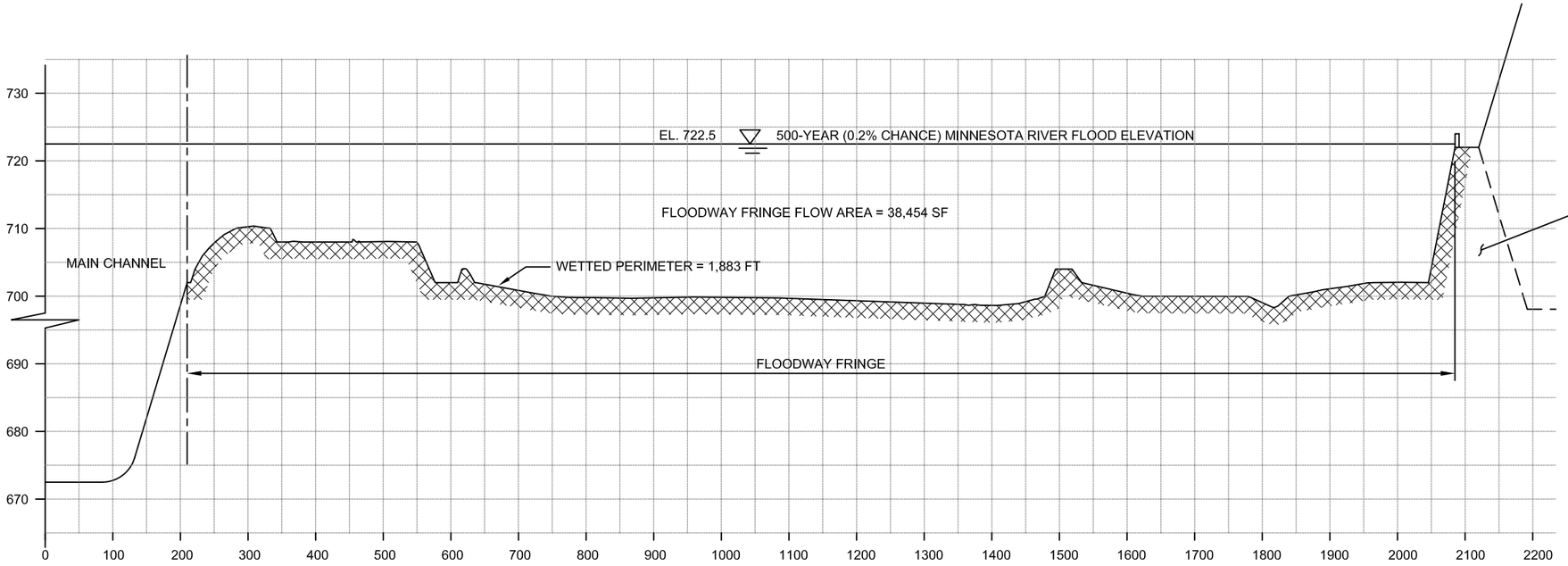
	Pre-Expansion Condition	Post-Project Condition
Flow Rate (cfs)	31,193	54,843
Velocity (ft/s)	1.38	1.43

References:

[1] *Flood Insurance Study, Volumes 1 through 3, Dakota County, Minnesota and Incorporated Areas, Federal Emergency Management Agency, March 16, 2016*



1/6-9 SECTION: PRE-EXPANSION RIVER FLOODWAY FRINGE



2/6-9 SECTION: POST-PROJECT RIVER FLOODWAY FRINGE

NOTE: VERTICAL AXIS IS EXAGGERATED 10X

0 50 100 200
SCALE IN FEET
(HORIZONTAL)

P:\Projects\WMBSL\17694 BLF Exp Pmit\Env Review\EIS\Surface Water Impacts\Wetlands\Wetland Impacts 2019_EIS.dwg

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SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT
BURNSVILLE SANITARY LANDFILL (SW-56)

FIGURE 6-9
500-YEAR FLOOD EVENT
RIVER CROSS SECTIONS

Attachment D-2

Evaluation of Liner Degradation

Attachment D-2: Evaluation of Liner Degradation

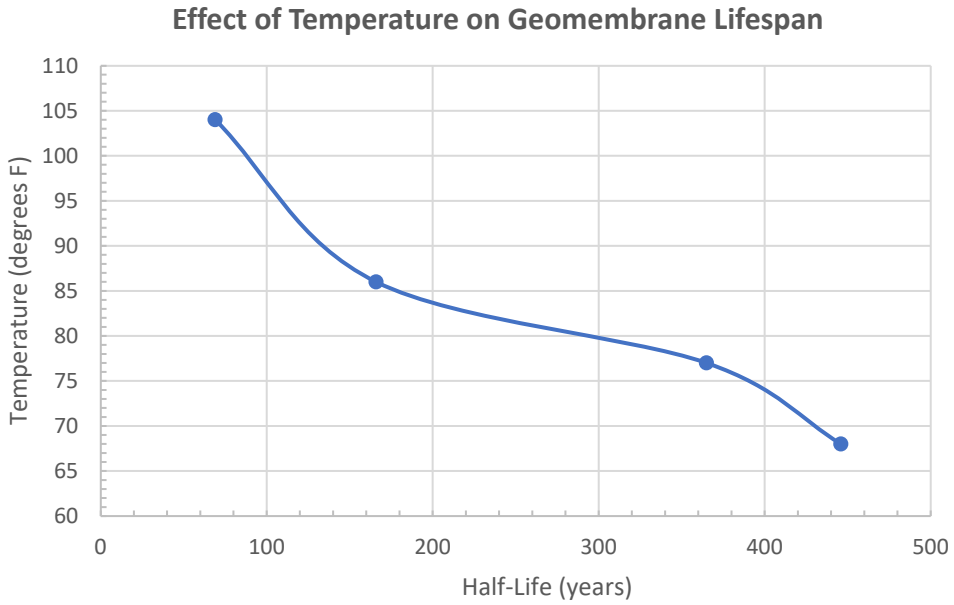
Degradation of Composite Liner System

There are approximately 87.82 acres of waste over an unlined base at BSL, as indicated by Figure 6-7. Under the proposed design, approximately 60.25 acres of that have been, or will be covered by a composite slope liner to accept more waste which encapsulates the underlying waste. The other 27.57 acres of the unlined disposal area have been permanently capped with a compacted clay barrier and cover soils to promote vegetation. The remaining 116.78 acres of already-constructed, and proposed landfill footprint are over a composite base liner. Once the landfill has been completely developed and capped, the final cover component is designed to prevent precipitation from infiltrating the waste. Assuming the encapsulated waste is 100% sealed, the leachate generation would eventually approach zero. However, it is somewhat likely that defects in the final cover system would continue to allow a minimal amount of precipitation to enter the waste. The composite base liner at BSL is comprised of 2-feet of compacted and moisture-conditioned clay with a permeability of less than $1x10^{-7}$ cm/s overlain by a 60-mil high-density polyethylene (HDPE) geomembrane. The composite slope liner developed over in-situ waste is comprised of a geosynthetic clay liner (GCL), which has a permeability of less than $5x10^{-9}$ cm/s, overlain by a 60-mil linear-low density polyethylene (LLDPE) geomembrane. Since the protection of groundwater depends on the integrity of both the final cover and base liner components, the life-span of the waste containment system should be evaluated as a whole entity.

Geomembrane Integrity

The plastic component of the composite liner is subject to natural degradation. According to a white paper published by the Geosynthetic Institute, *Geomembrane Lifetime Prediction: Unexposed and Exposed Conditions*[1], there are three stages of decomposition in the synthetic membrane. The first phase is the depletion of antioxidants included in the formulation of the geomembrane. The second phase is the induction time until the onset of degradation of polymers. The third phase of the degradation results in the rapid oxidation of polymer chains. Once the degradation has caused a reduction in the strength properties (tear, puncture, burst, etc.) by 50%, the material has reached its "half-life," and is no longer serviceable. It is important to note that the material will still be physically present, but may not perform to the required level it was designed for. For the purposes of this evaluation, the half-life is the life-span of the liner system.

The primary factor of geomembrane lifetime predictions is the in-service temperature. According to the referenced white paper, covered high density polyethylene (HDPE) geomembrane has an average lifespan of 446 years when subject to a temperature of 68 degrees F. The lifespan is reduced to 365 years when subject to a temperature of 77 degrees F; 166 years when subject to a temperature of 86 degrees F; and 69 years when subject to a temperature of 104 degrees F. The referenced lifespans represent the total of all three phases as described above when covered with waste or soil. A chart of the relationship between temperature and geomembrane half-life is shown below.



Waste temperatures inside a typical landfill cell can vary depending on waste thickness, age of the waste, moisture content, oxygen levels, and vacuum applied through active gas systems. Temperatures at the base liner and final cover strata, however, are typically moderated from the core waste temperatures by the landfill sub-base and final cover soil temperatures. Analysis of a long-term field study conducted on a similar landfill to BSL located in the midwestern region of the U.S. was completed in 2003, and presented at the 2003 Ninth International Waste Management and Landfill Symposium (*Analysis of Temperatures at a Municipal Solid Waste Landfill, N. Yesiller and J.L. Hanson*). The landfill in the study was located in a humid continental temperate climate with an annual average high temperature of 59 degrees F, and an annual average low temperature of 42 degrees F during the study period. In comparison, the Twin Cities area experiences an annual average high temperature of 55 degrees F, and an average low of 37 degrees F. The size of the landfill in the study was approximately 123 acres, with an average waste thickness of approximately 130 feet. There were 200 thermocouples installed in 17 different arrays, covering over 5,000 lineal feet of arrays at varying depths. Multiple cells with various base liner configurations were measured (with and without geomembrane). The final cover profile, from top to bottom, consisted of 6 inches of topsoil over 2-feet of rooting soil, a geocomposite drainage layer, 40-mil HDPE geomembrane and 18" of compacted clay.

The conclusions of the study were that temperatures within the base liner system of an active landfill generally trend upward with time, relative to waste placement in the cell. Base liner temperatures trended to follow seasonal temperature fluctuations for locations within approximately 75 feet of the edge of the cell. Temperatures at the final cover component experienced similar variations in temperature relative to seasonal fluctuations. In general, the trend line of temperature measurements at the base liner appear to average between 62 and 82 degrees F in one cell over a 4-year time span, and between 54 and 68 degrees F in another cell over a 3-year time span. Ultimate peak temperatures at the high end of each range of temperatures can be expected to last approximately 5 years. After peak waste decomposition has occurred, and biological activity has decreased, temperatures will

decrease, and eventually become asymptotic with the natural soils (approximately 55 degrees for south-central Minnesota).

The temperature of the final cover membrane is less likely to be moderated by the sub-base soil, and more likely to vary with seasonal conditions. In both liner components, the reduction in lifespan that can be attributed to temperature increase is at best an approximation.

A base liner with no temperature effects would be expected to last at least 446 years (according to the GRI white paper). However, the fraction of the lifespan with elevated temperatures represents the period of greatest biological activity, and should be accounted for. The referenced landfill temperature study indicates that each temperature range (68, 77 and 86 degrees F) will occur for a duration approximately two years on either side of the ultimate temperature reached. An estimation of the effect on lifespan of the base liner geomembrane would predict the duration of time at each elevated temperature interval, find the reduction in half-life at that interval, and solve for the remaining time-span at the greatest half-life cycle at 68 degrees F. The table below illustrates that the expected total half-life would be approximately 437 years.

Temperature Average	**Expected Duration (Years)**	**Half-Life (Years)**	**Fraction of Half-Life Used**
77 degrees F	4	365	1%
86 degrees F	5	166	3%
Subtract the fraction of half-life already used up by the elevated temperatures from 100%, and apply that fraction to the half-life of 68-degrees. Therefore:			
68 degrees F	428	446	96%
Total	**437**		**100%**

For the final cover membrane, with more frequent temperature increases in the summer months, a reasonable estimate of average geomembrane temperatures could be calculated as high as 86 degrees for as much as 10% of the typical year (half of every day for 10 weeks). The white paper does not indicate that temperatures below 68 degrees would increase the geomembrane lifespan beyond 446 years, and therefore, for the remainder of the year, a reasonable estimate may include 20% of the year (shoulder seasons) at 77 degrees, and 70% of the year at 68 degrees F. Therefore, a similar method could be used for final cover membrane:

Temperature Average	**Expected Duration (Years)**	**Half-Life (Years)**	**Fraction of Half-Life Used**
77 degrees F	73	365	20%
86 degrees F	16	166	10%
Subtract the fraction of half-life already used up by the elevated temperatures from 100%, and apply that fraction to the half-life of 68-degrees. Therefore:			
68 degrees F	312	446	70%
Total	**401**		**100%**

Lifespan of Compacted Clay

In its most elemental form, the compacted clay component of the base liner is an in-organic layer of minerals. Clay minerals are one of the final products of thousands of years of weathering of rocks. The

inert nature of the clay material in its compacted, consolidated form indicate that chemical stability and longevity of particle composition is intrinsic to the material.

The GCL layer on existing slope liners, and the slope liner proposed for the annex development area are comprised of a layer bentonite sandwiched between two non-woven geotextiles. The mechanical stability of the GCL depends on the slope, the normal load applied by the waste and the interfacial friction angle with adjacent layers. Additionally, the performance is influenced by the elongation performance during differential settlement of the underlying waste. Most published data for quality control testing on polymeric materials used in the production of GCLs are short-term tests – such as tensile strength. Sustained loads result in lower strength values, and is referred to as "creep." GRI White Paper #4 [3](2005) describes reduction factors in strength parameters for long-term loads. Muller (2008) [4] prepared a study that concluded that a double-sided reinforced non-woven GCL has a minimum functional durability of at least 250 years at 60 degrees F.

Other factors can affect the permeability of the bentonite component in the GCL, such as chemical compatibility of water in the adjacent soil, or through potential geomembrane defects. Significant levels of electrolytes in water that may contact the bentonite can influence the cation exchange of the sodium in the manufactured product. The cation exchange causes reduced swelling of the bentonite upon hydration and increased hydraulic conductivity. Most soils contain significant concentrations of the elements with higher electrolytes such as potassium, calcium, magnesium and aluminum. In the specific instance of the GCL under a geomembrane on a slope liner, it would be unusual for the GCL to become saturated with water or leachate unless there were a defect in the geomembrane. Even then, considering the slope liner is on a slope, leachate flowing over any potential geomembrane defects is more likely to follow the drainage sand along the geomembrane rather than through the defect itself. Therefore, the risk of GCL becoming ineffective due to cation exchange on a slope liner would not warrant major concern.

Composite liner installed on the slope liner could be subject to differential settlement. Differential settlement can cause GCL panel separation below the geomembrane. It has been shown that panel separation can be reduced by heat-tacking the seams of adjacent GCL panels together, and/or by using a larger overlap. Typical installation of GCL includes overlapping adjacent panels at least 6-inches lengthwise and 18-inches at the ends of the panels. To mitigate the potential for GCL panel separation, the slope liner should be installed with GCL panels overlapping 12-inches each side and 36-inches on each end. All GCL seams should be heat-tacked together.

References:

[1] *Geomembrane Lifetime Prediction: Unexposed and Exposed Conditions, Geosynthetic Institute, Feb. 2011*

[2] *Analysis of Temperatures at a Municipal Solid Waste Landfill, N. Yesiller and J.L. Hanson, 2003 Ninth International Waste Management and Landfill Symposium*

[3] *Reduction Factors Used in Geosynthetic Design, Geosynthetic Institute, Feb. 2005, Revised Mar. 2007*

[4] *Long-Term Shear Strength of Geosynthetic Clay Liners, Muller, W., 2008*

Attachment D-3

Geomembrane Defect Analysis

Attachment D-3: Geomembrane Defect Analysis

Guidance on use of size and quantity of geomembrane defects for analysis of the maximum leakage rate is referenced from Leakage through Liners Constructed with Geomembranes – Part I, Geomembrane Liners, by J.P. Giroud & R. Bonaparte (9/23/1988). The study indicates that a reasonable estimate of geomembrane defects in landfills with intensive quality assurance during liner construction is one hole per acre with a cross-sectional area of $1cm^2$ ($0.16\ in^2$).

Cell construction at the Burnsville Sanitary Landfill (BSL) includes intensive quality assurance of geomembrane installation. The construction of new cells at BSL has utilized electrical leak testing quality control procedures since the construction of the Phase 20 slope liner and Cell 1 in the west development area. Electrical leak testing uses an electrical current applied to the top surface of the geomembrane to locate leaks after construction is complete. Since the procedure is conducted after the drainage sand layer is installed, any liner penetrations that could have occurred during construction would be discovered during the testing. Landfill operator training includes protecting the drainage sand layer from being displaced during waste placement in the first lift after construction, as well as preventing large protruding elements that are present in the waste from being placed in the first lift.

Seepage Into the Cell

In order for water to infiltrate the cell, the water would need to flow through two feet of compacted clay liner. MPCA requires the clay liner to be installed at a maximum permeability rate of $1x10^{-7}$ cm/s. If the clay liner is intact, but saturated, and the maximum 5.5-feet of head indicated by the Seep/W analysis is acting on the underside of the geomembrane, the infiltrating water could be estimated using the equation for orifice flow.

Free-flow orifice flow: $Q=Cc \times A \times V$

Where Cc = Contraction coefficient = 0.62 for sharp edged orifice

A = area of 1-cm^2 hole = $0.16\ in^2$ = $0.001\ ft^2$

V = velocity through the orifice

To determine the velocity of the water through the orifice, Darcy's equation for flow can be used, which considers the effect of static head pressure.

$V = Q/A = ki$

Where k = permeability of the clay soil = $1x10^{-7}$ cm/s = $3.28x10^{-9}$ fps

i = hydraulic gradient = static head pressure / flow path = 5.5-ft / 2-ft of clay = 2.75

Therefore, $Q = 0.62 \times 0.001\ ft^2 \times 3.28x10^{-9}$ fps $\times 2.75 = 5.6 \times 10^{-12}$ cfs.

Using the calculated flow rate per acre, the annex development area would be expected to take on 1.3×10^{-10} cubic feet per second (or 5.7×10^{-8} gpm), when the calculated flow rate is multiplied across the 22.72 acres of base liner. The resulting infiltration would have negligible impact on the efficacy of the leachate collection system.

Seepage Out of the Cell

Under normal conditions, when groundwater levels do not contact the bottom of the base liner, liner defects could allow downward leachate seepage. The seepage rate would likely be somewhat less than that calculated for the 500-year flood's infiltration, because the static head pressure acting on the liner would be a maximum of 12-inches, as opposed to the 5.5-feet indicated by the seepage analysis. According to the design parameters described in the Design Report submitted with the solid waste permit application for Burnsville Landfill, the base liner and leachate collection system was designed to allow sufficient transmissivity to limit the liquid head to 12-inches. Therefore, the hydraulic gradient (i) portion of the flow calculation would change from 2.75 to 0.5, and the resulting flow rate per acre of liner (assuming a 1 cm^2 hole per acre) is estimated to be 1x10-12 cfs.

LEGEND

- WASTE LIMIT - EXISTING
- WASTE LIMIT - FUTURE
- CELL BOUNDARY
- PROPERTY BOUNDARY
- EXISTING FINAL COVER LIMITS
- BOUNDARY OF DEMO LAYOVER LINER
- PROPOSED MONITORING WELL
- EXISTING LYSIMETER
- EXISTING MONITORING WELL
- SEALED WELL
- EXISTING GAS MIGRATION MONITORING PROBE
- BASE LINER: HDPE GEOMEMBRANE OVER 2-FT SOIL BARRIER
- SLOPE LINER: LLDPE GEOMEMBRANE OVER GEOSYNTHETIC CLAY LINER
- CAP ONLY - NO SYNTHETIC LINER
- BASE LINER: GEOMEMBRANE-ONLY
- EXISTING FINAL COVER: 2-FT COVER SOILS OVER GEOMEMBRANE
- EXISTING FINAL COVER: 2-FT COVER SOILS OVER 2-FT SOIL BARRIER
- EXISTING FINAL COVER: EVAPOTRANSPIRATION COVER SYSTEM

0 100 200 400
SCALE IN FEET

CLAY CAP OVER UNLINED BASE 27.57 ACRES

SLOPE LINER OVER UNLINED BASE 60.25 ACRES

COMPOSITE-LINED AREA 109.24 ACRES

GEOMEMBRANE-LINED AREA 7.54 ACRES

DEMO LINER LAYOVER BOUNDARY. PROJECT INCLUDES CONVERTING AREA TO SLOPE LINER EQUIVALENT COMPOSITE LINER.

PROPOSED ANNEX DEVELOPMENT AREA

EXISTING PHASE WD2B-1

EXISTING PHASE WD2A

EXISTING PHASE WD1B

EXISTING PHASE WD1A

PHASE WD2B-2

PHASE 2B

PHASE 5A

PHASE 6A

PHASE 6B

PHASE 7

PHASE 8

PHASE 9A

PHASE 9B

PHASE 9C

PHASE 9C UPPER SLOPE

PHASE 10

PHASE 11

PHASE 12

PHASE 13

PHASE 14

PHASE 15

PHASE 16

PHASE 17

PHASE 18

PHASE 19

PHASE 20

PHASE 21

PHASE 22

PHASE 23

PHASE 24

PHASE 25

1994 SLOPE LINER

1995 SLOPE LINER

PHASE 6A SLOPE LINER

PHASE 6B SLOPE LINER

PHASE 20 SLOPE LINER

PHASE 15 SLOPE LINER

MMP-1 MMP-2 MMP-3 (SEALED) MMP-4 (SEALED) MMP-4A MMP-5C MMP-8 MMP-8A MMP-10 MMP-11 MMP-12

W 139 W 140 W 141 W 222 W 227 W 231 W 233 W 234 W 235 W 237 W 242 W 246 W 247 W 322 W 323 W 325 W 331 W 425 W 431 W 531

P 238 P 242R P 244R P 245 P 344 P 346 B64

2B-1 (SEALED) 2B-2 (SEALED) 2B-3 (SEALED) 5A (SEALED) LS-7 (SEALED) 9A (SEALED) LS-10 LS-15 LS-20

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SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT
BURNSVILLE SANITARY LANDFILL (SW-56)

FIGURE 6-7
BASE LINER TYPES AND EXISTING FINAL COVER TYPES

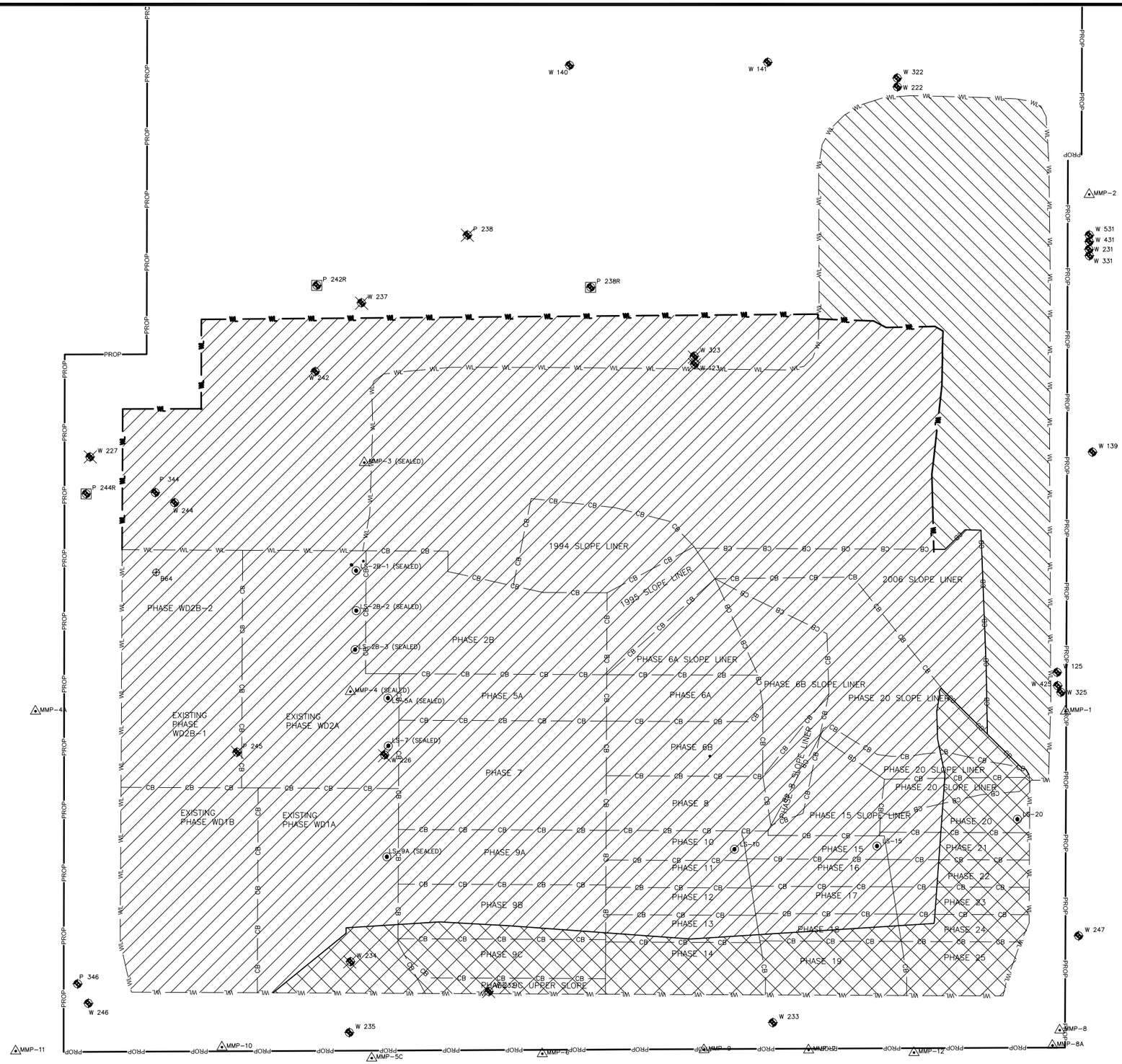
P:\Projects\WM\BSL\17694 BLF Exp Prmt\Env Review\Eft\SLiner and Leachate Collection\Lined vs Unlined.dwg

LEGEND

- WASTE LIMIT - EXISTING
- WASTE LIMIT - FUTURE
- CELL BOUNDARY
- PROPERTY BOUNDARY
- PROPOSED MONITORING WELL
- EXISTING LYSIMETER
- EXISTING MONITORING WELL
- SEALED WELL
- EXISTING GAS MIGRATION MONITORING PROBE
- FINAL COVER: 2-FT COVER SOILS OVER GEOMEMBRANE
- FINAL COVER: 2-FT COVER SOILS OVER 2-FT SOIL BARRIER
- FINAL COVER: EVAPOTRANSPIRATION COVER SYSTEM

N

0 100 200 400
SCALE IN FEET



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SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT
BURNSVILLE SANITARY LANDFILL (SW-56)

FIGURE 6-8
POST-PROJECT FINAL COVER TYPES

P:\Projects\MN\BSL\7260 BLE Exp Dom\Exp Dom\Design\ESIS Base and Leachate Collection\Base Unified.dwg

Attachment E

Visual Impacts Analysis

Attachment E-1

Photo Renderings

PHOTO LOCATION MAP

LEGEND

1. Hwy 13 at Savage Market Plaza
2. Hwy 13 at McDonald's
3. Hwy 13 at Co Rd 5
4. The Mulch Store
5. Dwan Golf Club
6. Xerxes Ave S
7. Kraemer Nature Preserve
8. Rose Bluff Subdivision
9. McAndrews Road at Co Rd 5
10. Hennen Rd at Harmony Circle
11. Washburn Court
12. 35W North of Minnesota River
13. 35W South of Minnesota River
14. Bloomington River Bluff (NE)
15. Bloomington River Bluff (N)
16. Bloomington River Bluff (NW)
17. Minnesota River Valley National Wildlife Refuge

EXISTING CONDITIONS - LEAF OFF

ELEV. 950' - INTERIM BUILDOUT

ELEV. 1082' - POST-PROJECT COMPLETE BUILDOUT

1. Hwy 13 at Savage Market Plaza

Photo time: 3:44 PM
Photo date: November 14, 2019
Photo location: Frontage road entrance to Savage Market Plaza on south side of Highway 13, adjacent monument sign.

LEGEND

ELEV. 820' - CURRENTLY PERMITTED COMPLETE BUILDOUT

EXISTING CONDITIONS - LEAF ON

ELEV. 950' - INTERIM BUILDOUT

ELEV. 1082' - POST-PROJECT COMPLETE BUILDOUT

2. Hwy 13 at McDonald's

Photo time: 4:34 PM
Photo date: October 4, 2019
Photo location: Adjacent lightpole on north end of McDonalds parking lot, Vincent Ave. S and Hwy 13 south frontage road.

LEGEND

ELEV. 820' - CURRENTLY PERMITTED COMPLETE BUILDOUT

EXISTING CONDITIONS - LEAF ON

ELEV. 950' - INTERIM BUILDOUT

ELEV. 1082' - POST-PROJECT COMPLETE BUILDOUT

3. Hwy 13 at Co Rd 5

Photo time: 4:27 PM
Photo date: May 7, 2019
Photo location: From ROW north of Hwy 13 and West of Co. Rd. 5

LEGEND

ELEV. 820' - CURRENTLY PERMITTED COMPLETE BUILDOUT

EXISTING CONDITIONS - LEAF OFF

ELEV. 950' - INTERIM BUILDOUT

ELEV. 1082' - POST-PROJECT COMPLETE BUILDOUT

4. The Mulch Store

Photo time: 4:52 PM
Photo date: May 7, 2019
Photo location: West entrance to The Mulch Store on W 122nd St Burnsville.

LEGEND

ELEV. 820' - CURRENTLY PERMITTED COMPLETE BUILDOUT

5. Dwan Golf Club

Photo time: 3:16 PM
Photo date: October 4, 2019

Photo time: 2:53 PM
Photo date: November 14, 2019
Photo location: Outside fence behind teebox at corner of Xerxes Ave. S and W 110 St. Bloomington.

6. Xerxes Ave. S

Photo time: 2:51 PM
Photo date: November 14, 2019
Photo location: On manhole cover in front of 11041 Xerxes Ave S Bloomington.

LEGEND

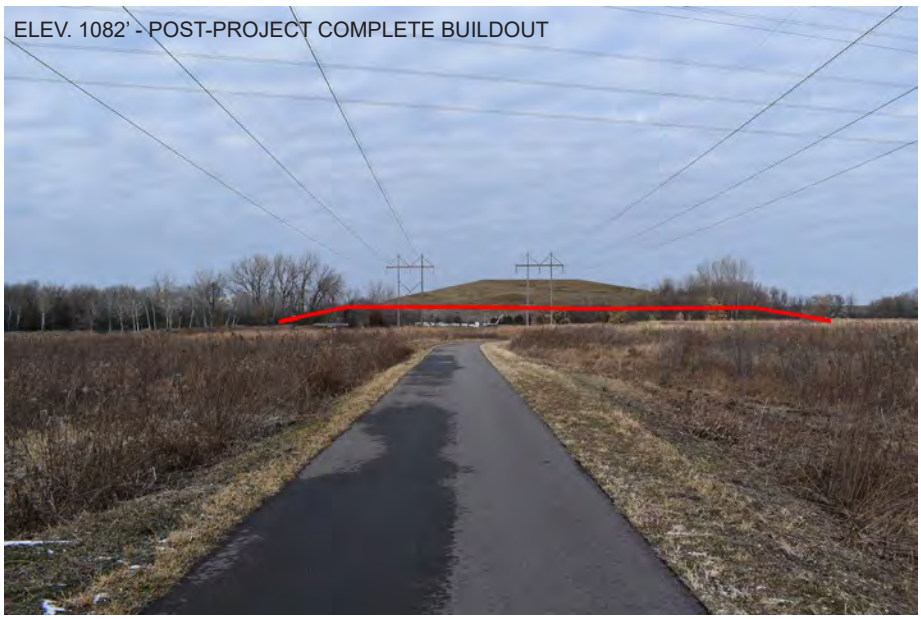
- ELEV. 1082' - POST-PROJECT COMPLETE BUILDOUT
- ELEV. 950' - INTERIM BUILDOUT
- ELEV. 820' - CURRENTLY PERMITTED COMPLETE BUILDOUT

7. Kraemer Nature Preserve

Photo time: 1:19 PM
Photo date: August 30, 2019
Photo location: Middle of paved trail south of parking lot, at location where grass path proceeds east toward 2-track trail.

LEGEND

ELEV. 820' - CURRENTLY PERMITTED COMPLETE BUILDOUT

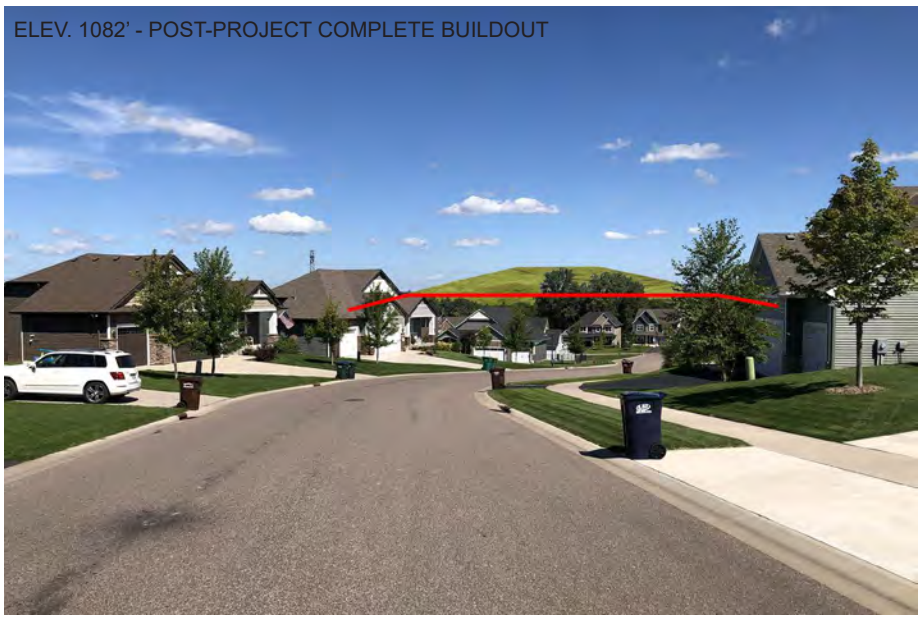


7. Kraemer Nature Preserve (cont.)

Photo time: 3:51 PM
Photo date: November 14, 2019
Photo location: Middle of paved trail south of parking lot, at location where grass path proceeds east toward 2-track trail.

LEGEND

ELEV. 820' - CURRENTLY PERMITTED COMPLETE BUILDOUT



8. Rose Bluff Subdivision

Photo time: 12:00 PM
Photo date: August 30, 2019
Photo location: In middle of street, aligned with electrical box between house number 12921 and 12917 Rose Bluff Blvd.

LEGEND

ELEV. 820' - CURRENTLY PERMITTED COMPLETE BUILDOUT

9. McAndrews Rd at Co Rd 5

Photo time: 4:28 PM
Photo date: November 14, 2019
Photo location: On manhole cover, next to stoplight pole, on sidewalk in the south east corner of intersection of McAndrews Road and County Road 5.

10. Hennen Road at Harmony Circle

Photo time: 12:12 PM
Photo date: August 30, 2019

Photo time: 4:15 PM
Photo date: November 14, 2019
Photo location: In street on southeastern manhole cover at the Hennen/Harmony intersection.

LEGEND

- ELEV. 1082' - POST-PROJECT COMPLETE BUILDOUT
- ELEV. 950' - INTERIM BUILDOUT
- ELEV. 820' - CURRENTLY PERMITTED COMPLETE BUILDOUT

11. Washburn Court

Photo time: 12:16 PM
Photo date: August 30, 2019

Photo time: 4:20 PM
Photo date: November 14, 2019
Photo location: In middle of street, aligned with center of driveway for home at 12908 Washburn Court.

12. 35W North of Minnesota River

Photo time: 2:33 PM
Photo date: November 14, 2019
Photo location: Southwest corner of Valley Office Park Building.

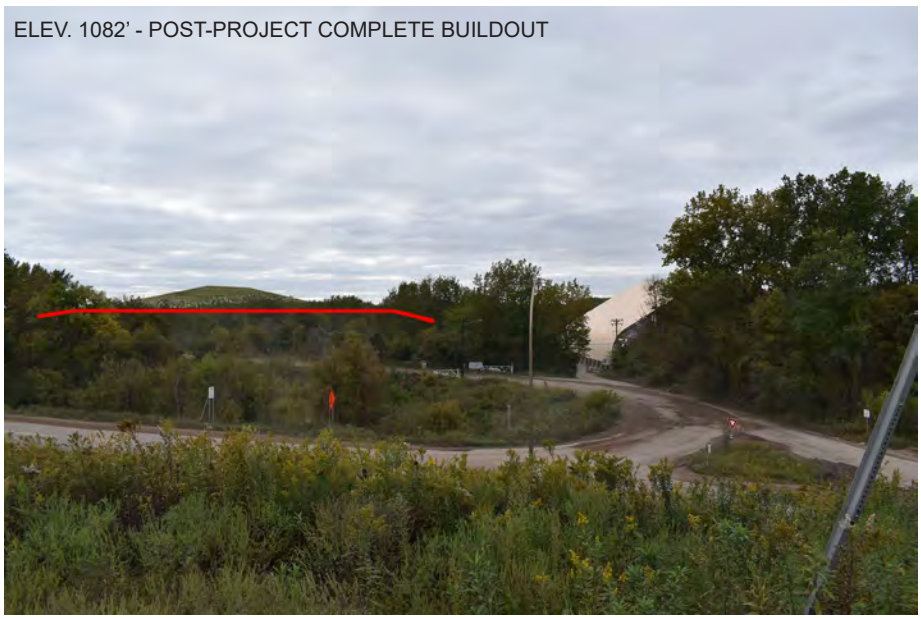
LEGEND

- ELEV. 1082' - POST-PROJECT COMPLETE BUILDOUT
- ELEV. 950' - INTERIM BUILDOUT
- ELEV. 820' - CURRENTLY PERMITTED COMPLETE BUILDOUT

EXISTING CONDITIONS - LEAF ON

ELEV. 950' - INTERIM BUILDOUT

ELEV. 1082' - POST-PROJECT COMPLETE BUILDOUT



13. 35W South of Minnesota River

Photo time: 3:55 PM
Photo date: October 4, 2019
Photo location: Adjacent guardrail at southwest end of bridge.

LEGEND

- ELEV. 950' - INTERIM BUILDOUT
- ELEV. 820' - CURRENTLY PERMITTED COMPLETE BUILDOUT

EXISTING CONDITIONS - LEAF OFF

ELEV. 950' - INTERIM BUILDOUT

ELEV. 1082' - POST-PROJECT COMPLETE BUILDOUT

13. 35W South of Minnesota River

Photo time: 3:26 PM
Photo date: November 14, 2019
Photo location: Adjacent guardrail at southwest end of bridge.

LEGEND

ELEV. 820' - CURRENTLY PERMITTED COMPLETE BUILDOUT

14. Bloomington River Bluff (NE)

Photo time: 3:05 PM
Photo date: October 4, 2019
Photo location: 2601 W 112th St Bloomington, SW corner of house adjacent pine tree.

LEGEND

ELEV. 820' - CURRENTLY PERMITTED COMPLETE BUILDOUT

14. Bloomington River Bluff (NE)

Photo time: 2:44 PM
Photo date: November 14, 2019
Photo location: 2601 W 112th St Bloomington, SW corner of house adjacent pine tree.

LEGEND

ELEV. 820' - CURRENTLY PERMITTED COMPLETE BUILDOUT

EXISTING CONDITIONS - LEAF ON

ELEV. 950' - INTERIM BUILDOUT

ELEV.1082' - POST-PROJECT COMPLETE BUILDOUT

15. Bloomington River Bluff (N)

Photo time: 3:12 PM
Photo date: October 4, 2019
Photo location: 3401 Overlook Drive Bloomington, adjacent mailbox.

LEGEND

ELEV. 820' - CURRENTLY PERMITTED COMPLETE BUILDOUT

15. Bloomington River Bluff (N)

Photo time: 2:48 PM
Photo date: November 14, 2019
Photo location: 3401 Overlook Drive Bloomington, adjacent mailbox.

LEGEND

ELEV. 820' - CURRENTLY PERMITTED COMPLETE BUILDOUT

16. Bloomington River Bluff (NW)

Photo time: 3:38 PM
Photo date: October 4, 2019
Photo location: 5025 Overlook Circle Bloomington, from corner of retaining wall on S side of house.

LEGEND

ELEV. 820' - CURRENTLY PERMITTED COMPLETE BUILDOUT

16. Bloomington River Bluff (NW)

Photo time: 3:00 PM
Photo date: November 14, 2019
Photo location: 5025 Overlook Circle Bloomington, from corner of retaining wall on S side of house.

LEGEND

ELEV. 820' - CURRENTLY PERMITTED COMPLETE BUILDOUT

EXISTING CONDITIONS - LEAF OFF

ELEV. 950' - INTERIM BUILDOUT

ELEV. 1082' - POST-PROJECT COMPLETE BUILDOUT

17. Minnesota River Valley NWR

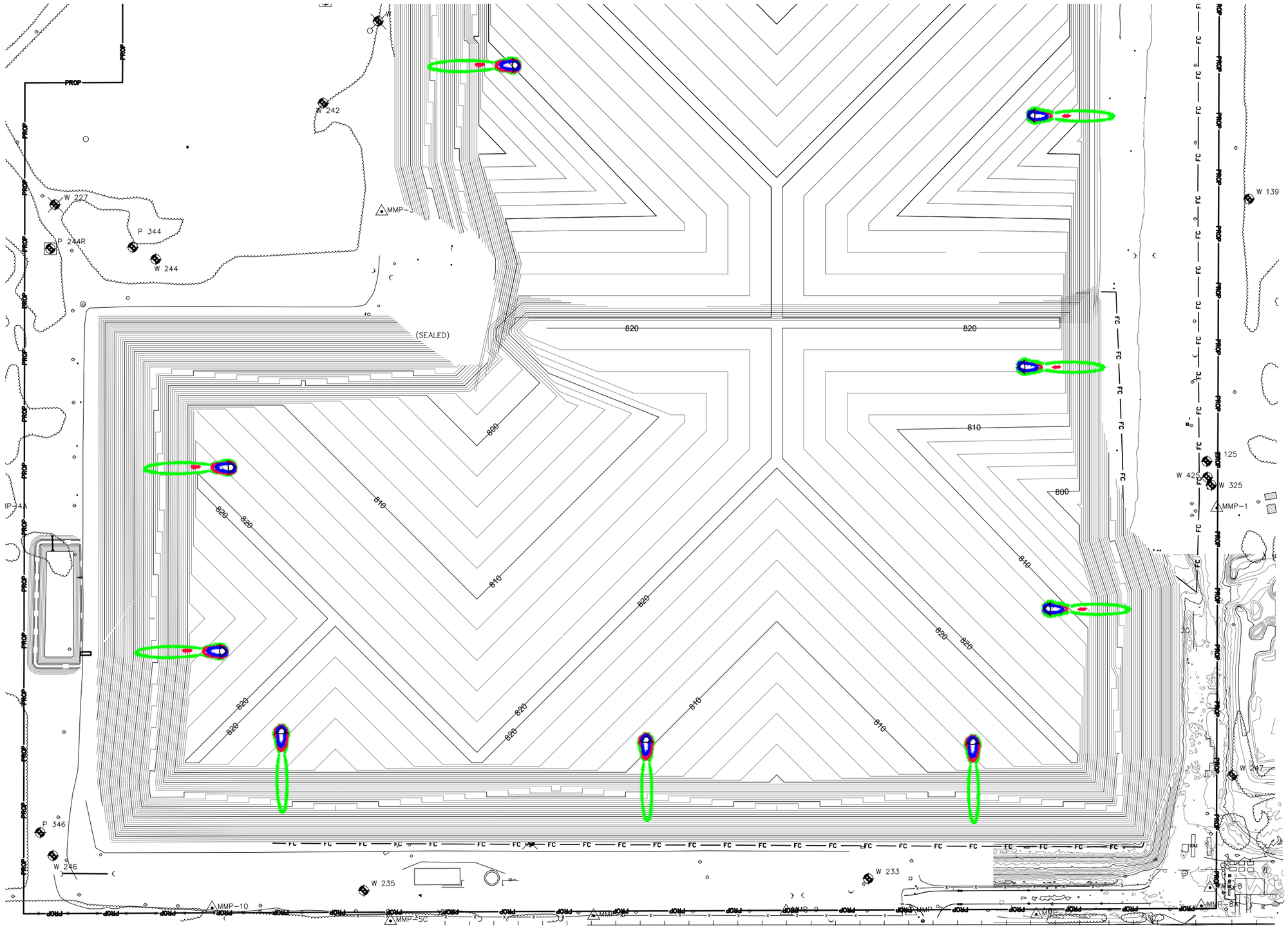
Photo time: 3:09 PM
Photo date: November 14, 2019
Photo location: 44°47'31.8"N 93°19'44.8"W - Trail ending at Minnesota River south of Coleman Lake.

LEGEND

ELEV. 820' - CURRENTLY PERMITTED COMPLETE BUILDOUT

Attachment E-2

Photometric Plans



LEGEND

- 1 - 5 LUMENS
- 5 - 10 LUMENS
- >10 LUMENS
- LIGHT LOCATION

0 50 100 150 300
SCALE IN FEET

N

NOTES:

1. PHOTOMETRIC ANALYSIS WAS PERFORMED USING "DESIGN MASTER PHOTOMETRICS" SOFTWARE, A THIRD-PARTY APPLICATION FOR AUTOCAD 2018.
2. LUMEN CONTOURS REPRESENT LIGHTING USED ON LANDFILL OPERATING EQUIPMENT DURING NIGHTTIME OPERATION. NO OTHER LIGHTING WILL BE USED FOR NIGHTTIME OPERATIONS.
3. THE MODEL WAS CREATED USING LIGHTNING INFORMATION FROM A GE 40579 SPOTLIGHT, WHICH IS TYPICALLY USED ON AIRPORT RUNWAYS. THIS LIGHT WAS CHOSEN TO PROVIDE A WORST-CASE SCENARIO ASSESSMENT SINCE THE GE 40579 IS SIGNIFICANTLY STRONGER THAN ANY LIGHTING THAT WILL BE USED ON LANDFILL OPERATING EQUIPMENT.

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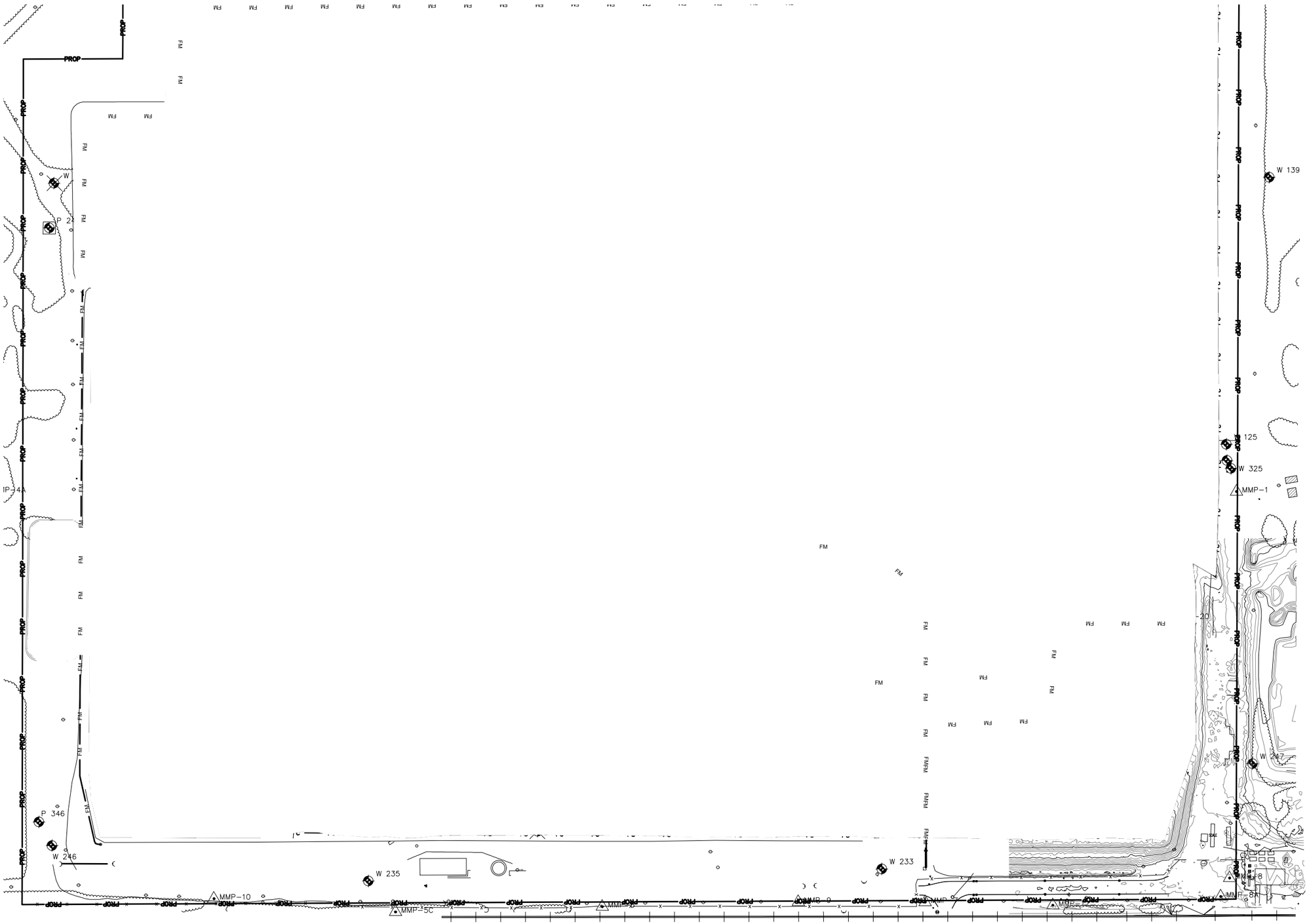
SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT
BURNSVILLE SANITARY LANDFILL (SW-56)

PHOTOMETRIC PLAN PERMITTED BUILDOUT

P:\Projects\WM\BSL\17694 BLF Exp Pmt\dwg\Photometric Plan Sheets Existing.dwg, SHT-09



LEGEND

- 1 - 5 LUMENS
- 5 - 10 LUMENS
- >10 LUMENS
- LIGHT LOCATION

0 50 100 150 300
SCALE IN FEET

N

NOTES:

1. PHOTOMETRIC ANALYSIS WAS PERFORMED USING "DESIGN MASTER PHOTOMETRICS" SOFTWARE, A THIRD-PARTY APPLICATION FOR AUTOCAD 2018.
2. LUMEN CONTOURS REPRESENT LIGHTING USED ON LANDFILL OPERATING EQUIPMENT DURING NIGHTTIME OPERATION. NO OTHER LIGHTING WILL BE USED FOR NIGHTTIME OPERATIONS.
3. THE MODEL WAS CREATED USING LIGHTNING INFORMATION FROM A GE 40579 SPOTLIGHT, WHICH IS TYPICALLY USED ON AIRPORT RUNWAYS. THIS LIGHT WAS CHOSEN TO PROVIDE A WORST-CASE SCENARIO ASSESSMENT SINCE THE GE 40579 IS SIGNIFICANTLY STRONGER THAN ANY LIGHTING THAT WILL BE USED ON LANDFILL OPERATING EQUIPMENT.

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SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT
BURNSVILLE SANITARY LANDFILL (SW-56)

PHOTOMETRIC PLAN
ANNEX AREA
PARTIAL BUILDOUT

P:\Projects\WMIBSLI\7694 BLF Exp Pmt\dwg\Photometric Plan Sheets.dwg, SHT-09

LEGEND

- 1 - 5 LUMENS
- 5 - 10 LUMENS
- >10 LUMENS
- LIGHT LOCATION

0 50 100 150 300
SCALE IN FEET

N

NOTES:

1. PHOTOMETRIC ANALYSIS WAS PERFORMED USING "DESIGN MASTER PHOTOMETRICS" SOFTWARE, A THIRD-PARTY APPLICATION FOR AUTOCAD 2018.
2. LUMEN CONTOURS REPRESENT LIGHTING USED ON LANDFILL OPERATING EQUIPMENT DURING NIGHTTIME OPERATION. NO OTHER LIGHTING WILL BE USED FOR NIGHTTIME OPERATIONS.
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SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT
BURNSVILLE SANITARY LANDFILL (SW-56)

PHOTOMETRIC PLAN
ANNEX AREA FULL BUILDOUT

P:\Projects\WM\BSL\7694 BLF Exp Pmt\dwg\Photometric Plan Sheets Full Build Out.dwg, SHT-09

Attachment E-3

FAA Hazard Determination Letter

Mail Processing Center
Federal Aviation Administration
Southwest Regional Office
Obstruction Evaluation Group
10101 Hillwood Parkway
Fort Worth, TX 76177

Aeronautical Study No.
2021-AGL-27015-OE
Prior Study No.
2021-AGL-25132-OE

Issued Date: 11/02/2021

Mike Miller
Burnsville Sanitary Landfill, Inc.
2650 Cliff Rd W
Burnsville, MN 55337

**** DETERMINATION OF NO HAZARD TO AIR NAVIGATION ****

The Federal Aviation Administration has conducted an aeronautical study under the provisions of 49 U.S.C., Section 44718 and if applicable Title 14 of the Code of Federal Regulations, part 77, concerning:

Structure:	Existing Municipal Solid Waste Landfill Burnsville Sanitary Landfill
Location:	Burnsville, MN
Latitude:	44-47-00.70N NAD 83
Longitude:	93-19-16.60W
Heights:	800 feet site elevation (SE) 281 feet above ground level (AGL) 1081 feet above mean sea level (AMSL)

This aeronautical study revealed that the structure does not exceed obstruction standards and would not be a hazard to air navigation provided the following condition(s), if any, is(are) met:

As a condition to this Determination, the structure is to be marked/lighted in accordance with FAA Advisory circular 70/7460-1 M, Obstruction Marking and Lighting, red lights-Chapters 4,5(Red),&15.

Any failure or malfunction that lasts more than thirty (30) minutes and affects a top light or flashing obstruction light, regardless of its position, should be reported immediately to (877) 487-6867 so a Notice to Airmen (NOTAM) can be issued. As soon as the normal operation is restored, notify the same number.

It is required that FAA Form 7460-2, Notice of Actual Construction or Alteration, be e-filed any time the project is abandoned or:

_____ At least 10 days prior to start of construction (7460-2, Part 1)
__X__ Within 5 days after the construction reaches its greatest height (7460-2, Part 2)

This determination expires on 05/02/2023 unless:

(a) the construction is started (not necessarily completed) and FAA Form 7460-2, Notice of Actual Construction or Alteration, is received by this office.
(b) extended, revised, or terminated by the issuing office.
(c) the construction is subject to the licensing authority of the Federal Communications Commission (FCC) and an application for a construction permit has been filed, as required by the FCC, within

6 months of the date of this determination. In such case, the determination expires on the date prescribed by the FCC for completion of construction, or the date the FCC denies the application.

NOTE: REQUEST FOR EXTENSION OF THE EFFECTIVE PERIOD OF THIS DETERMINATION MUST BE E-FILED AT LEAST 15 DAYS PRIOR TO THE EXPIRATION DATE. AFTER RE-EVALUATION OF CURRENT OPERATIONS IN THE AREA OF THE STRUCTURE TO DETERMINE THAT NO SIGNIFICANT AERONAUTICAL CHANGES HAVE OCCURRED, YOUR DETERMINATION MAY BE ELIGIBLE FOR ONE EXTENSION OF THE EFFECTIVE PERIOD.

This determination is based, in part, on the foregoing description which includes specific coordinates, heights, frequency(ies) and power. Any changes in coordinates, heights, and frequencies or use of greater power, except those frequencies specified in the Colo Void Clause Coalition; Antenna System Co-Location; Voluntary Best Practices, effective 21 Nov 2007, will void this determination. Any future construction or alteration, including increase to heights, power, or the addition of other transmitters, requires separate notice to the FAA.This determination includes all previously filed frequencies and power for this structure.

If construction or alteration is dismantled or destroyed, you must submit notice to the FAA within 5 days after the construction or alteration is dismantled or destroyed.

This determination does include temporary construction equipment such as cranes, derricks, etc., which may be used during actual construction of the structure. However, this equipment shall not exceed the overall heights as indicated above. Equipment which has a height greater than the studied structure requires separate notice to the FAA.

This determination concerns the effect of this structure on the safe and efficient use of navigable airspace by aircraft and does not relieve the sponsor of compliance responsibilities relating to any law, ordinance, or regulation of any Federal, State, or local government body.

If we can be of further assistance, please contact our office at (847) 294-7458, or fred.souchet@faa.gov. On any future correspondence concerning this matter, please refer to Aeronautical Study Number 2021-AGL-27015-OE.

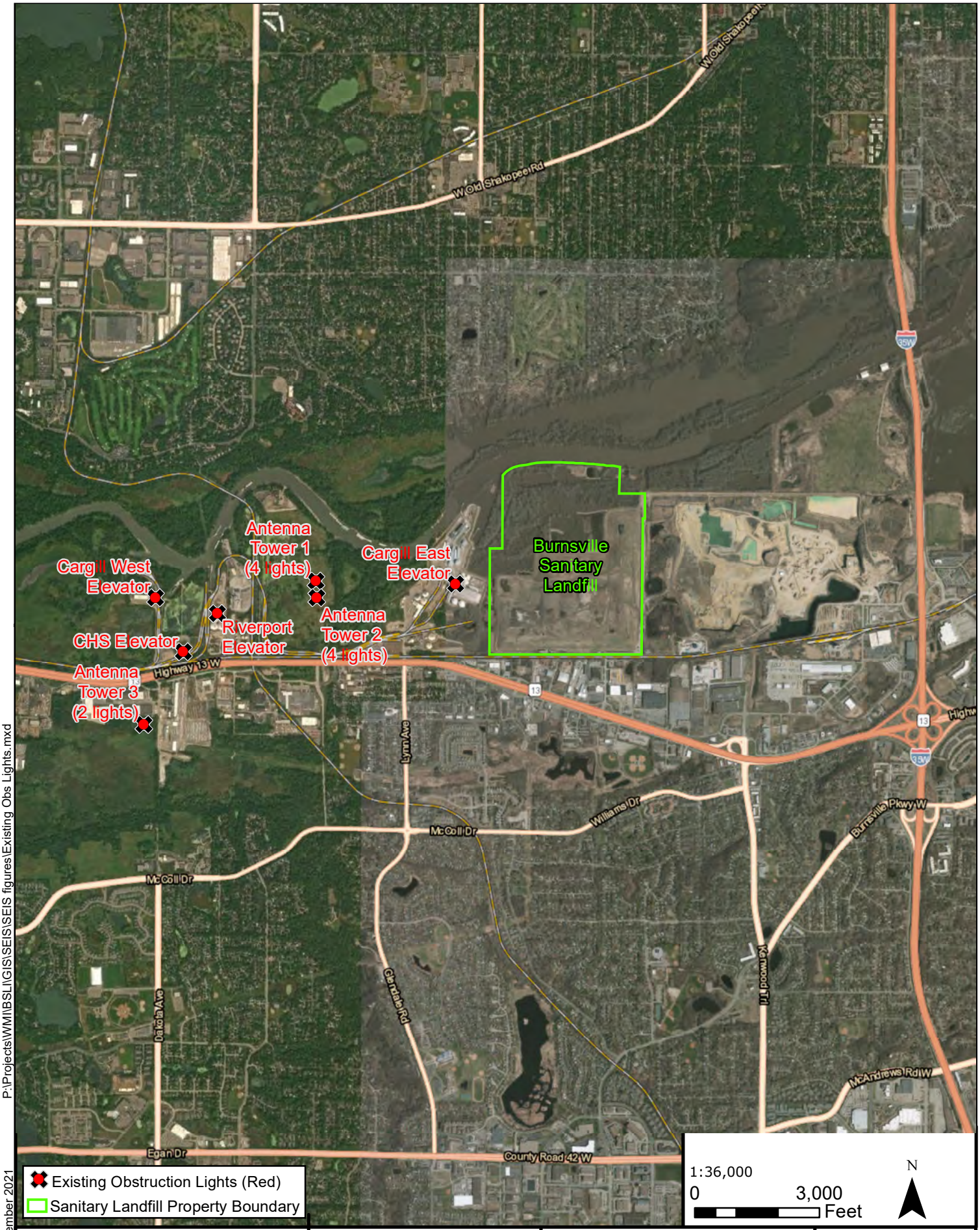
Signature Control No: 498005545-499627497 (DNE)
Fred Souchet
Specialist

Attachment(s)
Map(s)

TOPO Map for ASN 2021-AGL-27015-OE

Attachment E-4

Existing Obstruction Lights



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November 2021

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www.carlsonmccain.com

BURNSVILLE SANITARY LANDFILL, INC
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BURNSVILLE, MN 55337

SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT
BURNSVILLE SANITARY LANDFILL (SW-56)
BURNSVILLE, MINNESOTA

ATTACHMENT E-4
EXISTING
OBSTRUCTION LIGHTS

Attachment E-4: Existing Obstruction Lights

Supplemental Environmental Impact Statement - Burnsville Sanitary Landfill

Photo 1 11/3/2021	View at dawn from top of BSL looking west. Cargill East in foreground. Antenna towers and Cargill West in background.

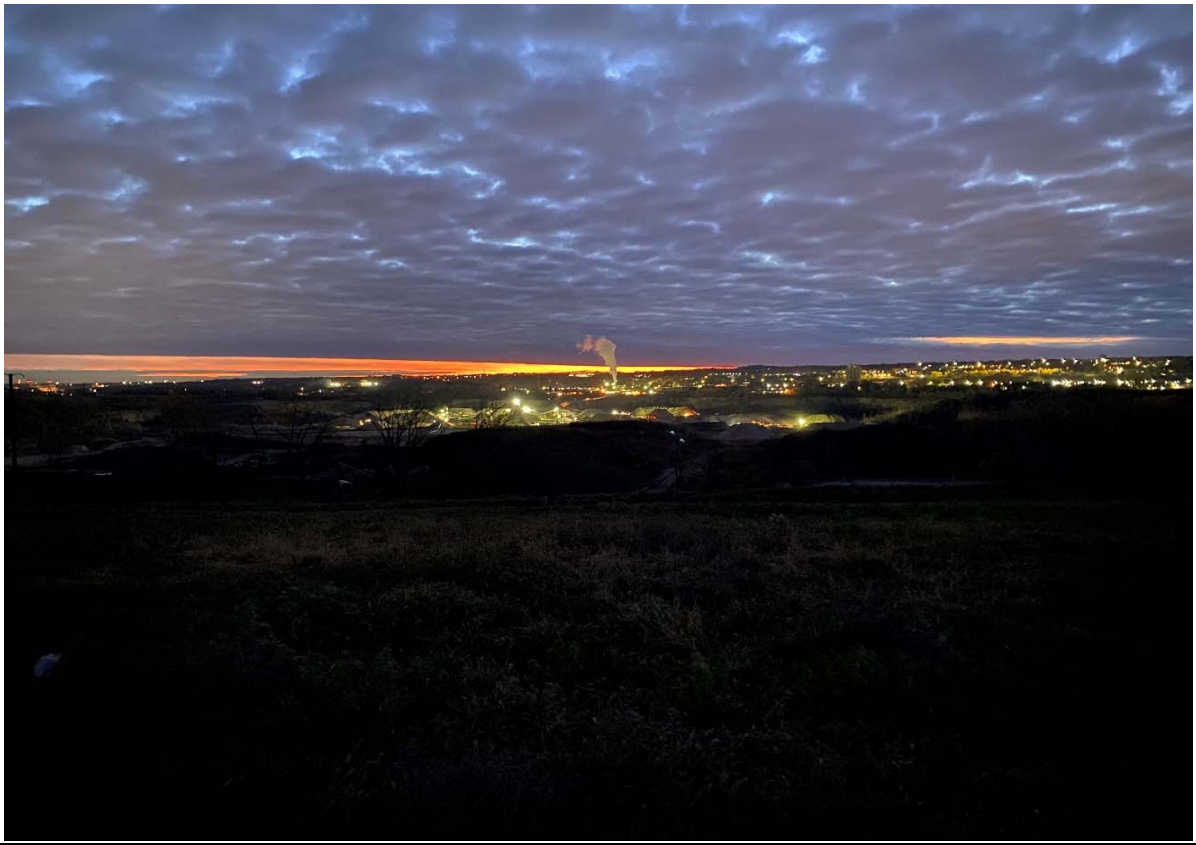


Photo 2 11/3/2021	View at dawn from top of BSL looking east. Kraemer Quarry visible in center, Xcel Black Dog towers far left.

Attachment F

Air Quality Technical Report

Burnsville Sanitary Landfill
Annex Development Project
Supplemental Environmental Impact Statement
Air Quality Technical Report

FEBRUARY 23, 2021
208-190164-004

PRESENTED TO

Waste Management – Burnsville Sanitary Landfill
2650 West Cliff Road
Burnsville, MN 55337

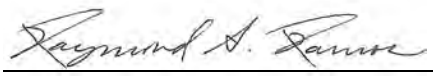
SUBMITTED BY

Cornerstone Environmental Group, LLC
A Tetra Tech Company
630 Riverfront Drive, Suite 100
Sheboygan, WI 53081

P +1.877.294.9070
F +1.877.845.1456
tetratech.com

REPORT CERTIFICATION

The material and data in this report were prepared under the supervision and direction of the undersigned.



2/23/2021

Raymond A. Ramos
Senior Project Manager

Date

SUMMARY OF AIR QUALITY IMPACTS

The major findings for the air quality impacts associated with the proposed landfill expansion (the "Project") at Burnsville Sanitary Landfill (BSL) are as follows:

- Using historical waste acceptance rates through 2020, the maximum volume of landfill gas generated occurred in the Year 2019, approximately 2,924 standard cubic feet per minute (scfm).

- The maximum landfill gas generated after the Project as predicted by LandGEM is 5,863 scfm (in the year 2068). Approximately 5,387 scfm of that is associated with the Project and 476 scfm is from the existing permitted landfill.

- Comparing the measured amount of landfill gas captured (i.e. 2,553 scfm in 2019) to the LandGEM-estimated landfill gas generation rate for 2019 of 2,924 scfm, results in a collection efficiency of 87 percent.

- For the Post-Project scenario, the collection efficiency is conservatively assumed to be equal to the AP-42 average collection efficiency of 75 percent.

- The ratio of landfill gas sent to the EGUs and flare after the Project will remain the same as current values (52 percent of collected landfill gas to the EGUs and 48 percent to the flare), unless the EGUs are shut down (as described in Section 2.4).

- The Project will increase uncollected landfill gas from approximately 371 scfm (Year 2019) to a maximum of 1,466 scfm (in the Year 2068). This estimate is based on the estimated gas generation rate and the conservative assumption of 75 percent collection efficiency described above.

- Total facility potential air emissions change from the Project at full build-out, during maximum future waste acceptance and gas generation rates are as follows:

    - Carbon monoxide: no change
    - Nitrogen oxides: no change
    - Particulate matter less than 2.5 microns in diameter (PM2.5): increase by 0.2 tons per year (ton/year)
    - Particulate matter less than 10 microns in diameter (PM10): increase by 1.9 tons/year
    - Total particulate matter (PM): increase by 7.3 tons/year
    - Sulfur dioxide: no change
    - Volatile organic compounds (VOC): increase by 10.2 tons/year
    - Total hazardous air pollutants (HAPs): increase by 5.4 tons/year
    - Total carbon dioxide equivalent (greenhouse gas): increase by 86,542 tons/year

- Pre-Project modeled impacts, assuming the EGUs and enclosed flare are conservatively assumed to be operating at capacity, exceed the National Ambient Air Quality Standards (NAAQS)/Minnesota Ambient Air Quality Standards (MAAQS) for nitrogen dioxide (NO_2), $PM_{2.5}$, PM_{10}, and SO_2 at the current stack heights for the EGUs.

- The stack height of the EGUs are being increased by 10 feet to meet the NAAQS/MAAQS. BSL shows compliance with the NAAQS/MAAQS with the Project at full build-out and the EGUs and enclosed flare operating at capacity.

- Modeled impacts of hydrogen sulfide comply with the MAAQS for both the Pre-Project and Post-Project scenarios.
- Based on Pre- and Post-Project emissions, risks from BSL air toxics emissions are below suggested health guidance values.
- The Project's incremental contribution to global GHGs cannot be translated into effects on climate change globally or regionally. There are no Minnesota or National Ambient Air Quality Standards for GHGs.
- The landfill will be designed and constructed according to Minnesota Rule 7035 (Solid Waste). The landfill will have an engineered liner system, a leachate collection and control system and a final cover system. In addition, BSL will expand the landfill gas collection system as part of the Project that will route landfill gas to the existing electric generating units (EGUs) and enclosed flare per New Source Performance Standards (NSPS) regulations.
- Landfill gas emissions will continue to be minimized by placing daily, intermediate, and final soil cover on the waste to help prevent the gases from migrating out of the landfill.
- Fugitive dust emissions will continue to be mitigated by implementing the Fugitive Dust Emissions Plan.
- No new landfill gas combustion equipment is required for the Project.
- Air toxics, VOCs, odors and methane emissions will continue to be mitigated through a well-operated gas collection and control system (GCCS, per NSPS regulations) and the combustion of the captured landfill gas.
- For odor control, BSL will continue to employ the proactive measures listed in the odor control plan (OCP) such as burying malodorous wastes immediately, minimizing excavations into the waste, and placing daily cover in order to minimize odors from the landfill working face.
- BSL will continue to comply with the Air Permit and NSPS Subpart WWW and National Emission Standards for Hazardous Air Pollutants (NESHAP) requirements.
- The Project will trigger NSPS Subpart XXX requirements which will largely be the same as those used to meet current Subpart WWW standards, i.e., BSL will install and operate a GCCS that routes landfill gas to a treatment system or a flare. The required equipment used to collect and combust the gas will remain the same.

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APPENDICES

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ACRONYMS/ABBREVIATIONS

Acronyms/Abbreviations	Definition
ADA	Annex Development Area
AERA	Air Emissions Risk Analysis
AERMOD	American Meteorological Society/Environmental Protection Agency Regulatory Model
AQDM	Air Quality Dispersion Modeling
BMP	Best Management Practices
BSER	Best System of Emission Reduction
BSL	Burnsville Sanitary Landfill
CALEPA	California Environmental Protection Agency
CFR	Code of Federal Regulations
CH_4	Methane
CIA	Cumulative Impact Modeling
CO	Carbon Monoxide
CO_2	Carbon Dioxide
CO_2e	Carbon Dioxide Equivalent
EG	Emission Guideline
EGU	Electric Generating Units
GCCS	Gas Collection and Control System
GHG	Greenhouse Gas
GIS	Geographic Information System
GPPP	General Public Preclusion Plan
GWP	Global Warming Potential
H_2S	Hydrogen Sulfide
HAP	Hazardous Air Pollutant
HBV	Health Based Values
HRV	Health Risk Values
IHB	Inhalation Health Benchmarks
IRIS	Integrated Risk Information System
LandGEM	Landfill Gas Emissions Generation Model
Lb/hr or lb per hr	Pounds per Hour
LFG	Landfill Gas

Acronyms/Abbreviations	Definition
MAAQS	Minnesota Ambient Air Quality Standard
MDH	Minnesota Department of Health
ug/m3 or ug per m3	Micrograms per cubic meter
MMSW	Mixed Municipal Solid Waste
MPCA	Minnesota Pollution Control Agency
MSW	Municipal Solid Waste
N_2O	Nitrous Oxide
NAAQS	National Ambient Air Quality Standard
NESHAP	National Emissions Standards for Hazardous Air Pollutants
NMOC	Nonmethane Organic Compound
NO_2	Nitrogen Dioxide
NO_x	Nitrogen Oxides (includes NO_2)
NSPS	New Source Performance Standards
OCP	Odor Control Plan
PM	Particulate Matter
$PM_{2.5}$	Particulate Matter with Diameter less than 2.5-Microns
PM_{10}	Particulate Matter with Diameter less than 10-Microns
PTE	Potential to Emit
RASS	Risk Analysis Screening Spreadsheet
SEIS	Supplemental Environmental Impact Statement
SIL	Significant Impact Level
SO_2	Sulfur Dioxide
Ton/yr or ton per yr	Tons per Year
U.S. EPA	United States Environmental Protection Agency
VOC	Volatile Organic Compound

1.0 INTRODUCTION

1.1 SEIS AIR QUALITY SCOPE ITEMS

The Minnesota Pollution Control Agency (MPCA) requested that a Supplemental Environmental Impact Statement (SEIS) be prepared for the proposed Burnsville Sanitary Landfill (BSL) Annex Development Area (ADA) expansion project (Project). This document presents an air quality impacts analysis that provides the information required by the Final Scoping Decision Document prepared by the MPCA for the SEIS, including the following specific information:

- Air quality impacts from the Project will be analyzed using data available from the BSL and from monitoring studies at other landfills in the state.
- The impacts associated with landfill gas emissions (methane and volatile organic compounds) during BSL operations and post closure will be evaluated using U.S. Environmental Protection Agency's (EPA's) Landfill Air Emissions Estimation Model (developed under EPA contract EPA-600/8-90-85a).
- The emissions will include those associated with the landfill gas, the electrical generating units, and landfill gas not captured by the BSL gas collection system.
- Results of the modeling will be compared to Ambient Air Quality Standards or Health Benchmarks.
- This information will be used to evaluate the following six scenarios:

    1. An estimate of the volume of landfill gas (LFG) currently being generated at the BSL.
    2. An estimate of the volume of LFG that is currently being captured at the BSL.
    3. An estimate of the percentage of the captured LFG that is flared, utilized in other ways, or discharged to the atmosphere at the BSL.
    4. An estimate of the volume of the LFG that is expected to be generated by the Project at the BSL.
    5. An estimate of the percentage of landfill gas that is expected to be captured by the LFG collection system (GCCS) for the Project.
    6. An estimate of the percentage of the captured LFG that will be flared, utilized in some other method, and allowed to escape to the atmosphere at the BSL for the Project.

- The SEIS will evaluate all direct, indirect, and cumulative ambient air impacts at the BSL consistent with the MPCA Air Quality Modeling Practices Manual for the Project.
- The SEIS will contain a discussion of the ability of the BSL to meet applicable MPCA air quality regulations for the Project.
- The applicability of federal New Source Performance Standards for new or modified MMSW landfills will be assessed at the BSL for the Project at complete buildout, including an analysis of implementation measures to meet the standards, if they apply.
- The SEIS will contain an evaluation of the mitigation options for controlling air emissions at the BSL for the Project.
- The SEIS will include a qualitative summary of expected greenhouse gas production from the Project.
- The SEIS will review existing odor issues at the landfill and compare expected changes resulting from the Project. The SEIS will review current odor control protocols used at the BSL and review odor control

methods used at other MSW landfills in the five-state area (Minnesota, North Dakota, South Dakota, Iowa, and Wisconsin.

1.2 BSL FACILITY DESCRIPTION

BSL is a mixed municipal solid waste (MMSW) landfill, where air emissions are associated with the breakdown of waste by bacteria over the course of several years, which creates landfill gas. For large landfills (including BSL), a well-designed and well-operated landfill gas collection and control system (GCCS) is required by regulation to be installed to capture the gas to minimize odors and mitigate emissions. BSL operates a GCCS to collect landfill gas and will expand the GCCS as part of the Project to collect landfill gas from all areas of the landfill.

A GCCS is not required by regulation to capture 100 percent of the landfill gas generated at a facility. The U.S. EPA has determined that the average percentage of landfill gas collected by landfills is 75 percent[1]. The uncaptured portion of the landfill gas (25 percent) is conservatively assumed to be emitted to the atmosphere.

Collected landfill gas at BSL is sent to an enclosed flare and/or a treatment system where it is compressed, dewatered, and filtered. The collected treated landfill gas is then combusted in the six electric generating units (EGUs).

Operational standards require a facility to monitor the GCCS continuously to ensure it is working properly. In addition, per federal regulations and BSL's air permit, the surface of the landfill is monitored quarterly for the presence of landfill gas (methane).

1.2.1 Emission Sources

1.2.1.1 Captured/Collected Landfill Gas

Collected landfill gas at BSL is directed to the EGUs to generate electricity or is combusted in an enclosed flare. The EGUs and enclosed flare reduce emissions of methane and other compounds present in landfill gas through combustion. Additional pollutants are emitted as a product of combustion as discussed in Section 3.0.

1.2.1.2 Uncaptured/Uncollected Landfill Gas

The uncollected landfill gas is emitted as fugitive through the landfill surface. The facility monitors surface emissions quarterly as required by federal and state regulations.

1.2.1.3 Fugitive Dust

Additional fugitive dust emissions are generated by vehicle traffic as the waste is brought to the facility and through the handling of the waste and soils used to cover the waste as it is placed in the landfill. BSL implements dust controls such as watering and paving roads to minimize emissions.

BSL is subject to state and federal regulations to control emissions and protect air quality. These regulations are implemented through the facility's air permit and are described in more detail in Section 6.0.

1.2.2 Project Emission Changes

The proposed Project will increase the facility's waste capacity by 23.6 million cubic yards and allow the facility to accept waste until the facility is full (approximately 2062). As a result, the maximum "peak" landfill gas generation

[1] U.S. EPA's AP-42, Fifth Edition Compilation of Air Pollutant Emissions Factors, Volume 1: Stationary Point and Area Sources, November 1998.(https://www.epa.gov/sites/production/files/2020-10/documents/c02s04.pdf)

will increase, as will the number of years the facility will generate landfill gas. The facility's existing combustion equipment capacity is sufficient to handle the additional landfill gas and no additional combustion equipment is being added as part of the Project.

There will be a slight increase in the number of waste hauling vehicles associated with the Project, leading to an increase in fugitive dust emissions, as provided in Section 3.0. As shown in Section 4.0, these emission changes will not result in significant environmental impacts.

1.3 METHODS USED TO ANALYZE AIR QUALITY IMPACTS

The Final Scoping Decision Document requires:

- *Air quality impacts from the Project to be analyzed using data available from the BSL and from monitoring studies at other landfills in the state.*

Air quality impacts associated with the Project were evaluated using the following resources and methodologies:

- Emission calculations were performed using site-specific information provided by BSL as well as accepted default values and emission factors from U.S. EPA.
- Landfill Gas Emissions Generation Model (LandGEM), Version 3.02 was used to estimate landfill gas generation.
- Dispersion modeling (AERMOD, Version 19191) was completed to compare predicted air quality impacts to National Ambient Air Quality Standards (NAAQS) and Minnesota Ambient Air Quality Standards (MAAQS).
- Emission rates from emission sources near BSL were obtained from MPCA or calculated (and approved) based on data provided by MPCA and included in the cumulative impact analysis (Section 4.2.2)
- Monitoring studies at other landfills were included in the odor impacts section (Section 7.0).

1.4 PRE-PROJECT AND POST-PROJECT SCENARIOS

To better understand the air quality impacts associated with the Project, both a "Pre-Project" and a "Post-Project" scenario were evaluated and compared. The descriptions of each scenario are provided below:

Pre-Project – Based on potential to emit (defined in Section 3.3) for the current facility – which includes the maximum landfill gas generation predicted without the expansion, and the landfill gas combustion devices conservatively assumed to be operating at capacity (as allowed by the current air permit).

Post-Project – Potential to emit was calculated at the maximum landfill gas generation rate at full build-out of the Project. As in the "Pre-project" scenario, landfill gas combustion devices were assumed to operate at capacity. No additional landfill gas combustion devices are required.

As the analysis was being prepared, BSL evaluated the financial viability of the EGUs. Based on the evaluation and changing market conditions, there is a possibility that the EGUs may be shut down for economic reasons. If this were to happen, landfill gas will be routed to the existing enclosed flare until such a time that the flare reaches its capacity of 3,000 scfm (approximately the Year 2039 for the Post-Project scenario). If a second flare is to be installed in the future, an air permit will be required, with additional dispersion modeling and MPCA review performed prior to installation. The modeling must demonstrate compliance with ambient air standards to secure an air permit. More information on the future viability of the EGUs is provided in Section 2.4.

The information provided in this SEIS is based on the six EGUs and enclosed flare continuing to operate.

2.0 LANDFILL GAS GENERATION

The Final Scoping Decision Document requires the following:

- *The impacts associated with landfill gas emissions (methane and volatile organic compounds) during BSL operations and post closure will be evaluated using U.S. Environmental Protection Agency's (EPA) Landfill Air Emissions Estimation Model (developed under EPA contract EPA-600/8-90-85a).*

- *This information will be used to evaluate the following six scenarios:*

    1. *An estimate of the volume of landfill gas (LFG) currently being generated at the BSL.*
    2. *An estimate of the volume of LFG that is currently being captured at the BSL.*
    3. *An estimate of the percentage of the captured LFG that is flared, utilized in other ways, or discharged to the atmosphere at the BSL.*
    4. *An estimate of the volume of the LFG that is expected to be generated by the Project at the BSL.*
    5. *An estimate of the percentage of landfill gas that is expected to be captured by the LFG collection system (GCCS) for the Project.*
    6. *An estimate of the percentage of the captured LFG that will be flared, utilized in some other method, and allowed to escape to the atmosphere at the BSL for the Project.*

Municipal solid waste deposited in a landfill is broken down by bacteria, first aerobically (with oxygen) and then anaerobically (without oxygen) over the course of several years. Anaerobic bacteria (or methanogens) produce landfill gas, consisting of approximately 50-55 percent methane by volume, 45-50 percent carbon dioxide, and 2-5 percent of other gases.

U.S. EPA's LandGEM uses the annual waste acceptance rates and a first-order decomposition rate equation to estimate the methane generation for a landfill. Landfill gas generation rates for BSL were calculated for the Pre-Project and Post-Project scenarios using default values from U.S. EPA's AP-42, Section 2.4 for the model inputs of methane generation rate, k (0.04 yr^{-1}) and potential methane generation capacity, L_o (100 m^3/Mg). Emission rates of methane and volatile organic compounds are provided in Tables 3-3 and 3-5, respectively.

The information for the six scenarios identified in the scoping document are provided below.

2.1.1 Pre-Project

Using historical waste acceptance rates through 2020, the maximum volume of landfill gas generated occurred in the Year 2019, approximately 2,924 standard cubic feet per minute (scfm, see Appendix A).

2.1.2 Post-Project

The landfill gas generation rates for the Post-Project scenario are based on the following assumptions:

- BSL reaches existing permitted waste capacity in 2023.
- Waste begins to be placed in the expansion area in 2023.

Waste acceptance rates for the Post-Project scenario are provided in Table 2-1.

Table 2-1. Projected Waste Acceptance Rates

Year	Waste Acceptance Rate (ton/yr)
2021[(a)]	209,673
2022[(a)]	209,673
2023	400,154
2024 & beyond	1 percent increase each year[(b)]

(a) Assumes a portion of waste will be diverted to Iowa facilities during construction of the Project and 209,673 tons/yr place at BSL.
(b) BSL conservative estimate.

These waste acceptance estimates differ from, and reflect higher annual volumes than, estimates presented in other sections of the SEIS, such as the alternative size analysis. Because landfill gas generation is proportional to waste acceptance rates, the higher waste acceptance estimates result in higher predicted gas generation and therefore provide a more conservative analysis than using lower acceptance rates.

The maximum landfill gas generated after the Project as predicted by LandGEM is 5,863 scfm (in the year 2068 – see Appendix B). Approximately 5,387 scfm (LandGEM for Post-Project - also provided in Appendix B) of that is associated with the Project and 476 scfm is from the existing permitted landfill.

2.2 LANDFILL GAS COLLECTION SYSTEM EFFICIENCY

The collection efficiency of a landfill is the percentage of landfill gas collected versus the landfill gas generated. Per U.S. EPA's AP-42 (Section 2.4), landfill gas collection efficiencies typically range from 60 to 85 percent, with an average of 75 percent most commonly assumed, as noted in Section 1.2.

2.2.1 Pre-Project

BSL is required to continuously monitor the amount of landfill gas burned in its combustion devices. In 2019, the year in which the maximum landfill gas generation is predicted for the existing facility, the total amount of landfill gas captured by the GCCS and sent to the combustion devices was 1,341,671,754 cubic feet (an average of approximately 2,553 scfm assuming 8,760 hours of operation).

Comparing the measured amount of landfill gas captured (i.e. 2,553 scfm) to the LandGEM-estimated landfill gas generation rate for 2019 of 2,924 scfm, results in a collection efficiency of 87 percent, which is slightly higher than the typical range provided in U.S. EPA's AP-42 document.

2.2.2 Post-Project

For the Post-Project scenario, the collection efficiency is conservatively assumed to be equal to the AP-42 average collection efficiency of 75 percent.

Table 2-2 compares the landfill gas generation, collected and uncollected landfill gas for the Pre-Project and Post-Project scenarios.

Table 2-2. Landfill Gas Generated, Captured, and Uncaptured

Parameter	Pre-Project	Post-Project
Maximum Volume of Landfill Gas Generated (LandGEM estimated)	2,924[(a)] (Year 2019)	5,863 (Year 2068)
Maximum Volume of Landfill Gas Captured (scfm)	2,553[(b)]	4,397[(c)]
Maximum Volume of Landfill Gas Uncaptured[(d)] (scfm)	371	1,466

(a) Based on waste acceptance rates through 2020.
(b) Average actual landfill gas burned in the EGUs and flare combined in 2019 (based on 8,760 hours of operation).
(c) Assuming U.S. EPA's average collection efficiency of 75 percent.
(d) Difference between LandGEM predicted landfill gas generation and volume of landfill gas captured.

2.3 UTILIZATION OF COLLECTED LANDFILL GAS

Collected landfill gas is sent to six EGUs or an enclosed flare. A comparison of the percentage of captured landfill gas that will be flared or utilized in another method is provided in Table 2-3. BSL indicated that the ratio of landfill gas sent to the EGUs and flare remains the same as current values (52 percent of collected landfill gas to the EGUs and 48 percent to the flare), unless the EGUs are shut down, as described in Section 2.4. If that is the case, then 100 percent of the landfill gas collected will go to the enclosed flare.

Table 2-3. Landfill Gas Utilization of Captured Landfill Gas

Parameter	Pre-Project[(a)]	Post-Project[(b)]
Percentage of Captured Landfill Gas Flared	48%	48%
Percentage of Captured Landfill Gas to EGUs	52%	52%
Percentage of Captured Landfill Gas Escaping to Atmosphere[(c)]	0%	0%

(a) Based on measured landfill gas in 2019.
(b) Assumes same breakdown of captured landfill gas to the flare and EGUs.
(c) Captured landfill gas is combusted in the EGUs or the flare and is not allowed to escape to atmosphere.

2.4 FUTURE VIABILITY OF EGUS

As discussed in Section 1.4, there is a possibility that the EGUs may be shut down for economic reasons. If that were to happen, landfill gas would be routed to the existing enclosed flare until such a time that the flare reaches its capacity of 3,000 scfm (approximately the Year 2039 for the Post-Project scenario).

BSL is currently researching the financial and operational feasibility of alternative beneficial re-uses of the landfill gas, including but not limited to compressed natural gas (CNG) fueling stations, renewable natural gas (RNG)

processing for injection into a natural gas pipeline and/or off-loading station, or selling the landfill gas to another entity. Alternatively, BSL could install an additional enclosed flare to combust the excess landfill gas.

The air quality impacts provided in this SEIS assumes that the existing EGUs and enclosed flare will continue to operate in the Pre-Project and Post-Project scenarios.

3.0 AIR EMISSIONS

The Final Scoping Decision Document requires the following to be included in the air emissions section:

- *The impacts associated with landfill gas emissions (methane and volatile organic compounds) during BSL operations and post closure will be evaluated using U.S. Environmental Protection Agency's (EPA) Landfill Air Emissions Estimation Model (developed under EPA contract EPA-600/8-90-85a).*
- *The emissions will include those associated with the landfill gas, the electrical generating units, and landfill gas not captured by the BSL gas collection system.*

3.1 EMISSIONS SOURCES AT BSL

Air emission sources at BSL are provided in Table 3-1. Point sources are emitted through a single point or stack. U.S. EPA defines fugitive emissions as "those emissions which could not reasonably pass through a stack, chimney, vent or other functionally-equivalent opening"[2]. The EGUs and enclosed flare act as both control devices for the landfill (by combusting collected landfill gas) and emission sources (pollutants are produced by combustion or are passed through the device (carbon dioxide)).

Table 3-1. Air Emissions Sources at BSL

Source	Source Type	Control Device/Method	Changes Associated with the Project
Municipal Solid Waste Landfill (uncaptured landfill gas)	Fugitive	EGUs, Enclosed Flare	Increase waste capacity of BSL by 23.6 million cubic yards Increase elevation of landfill
Dust from Vehicle Traffic	Fugitive	Watering, Paved Roads	Increased number of vehicles/loads Change in location and elevation of haul roads
Dust from Material Handling & Bulldozing	Fugitive	Watering	Increase in amount of waste and soils handled
EGUs	Point	None	Increase stack height by 10 feet
Enclosed Flare	Point	None	None

3.2 POLLUTANTS EMITTED

Air pollutants are classified into three different groups: criteria pollutants, greenhouse gases and air toxics. More information for each group is provided below.

- Criteria pollutants include carbon monoxide (CO), nitrogen oxides (NO_x), particulate matter (PM), particulate matter with diameter less than 10 microns (PM_{10}), particulate matter with diameter less than 2.5 microns ($PM_{2.5}$), sulfur dioxide (SO_2), and volatile organic compounds (VOCs).

[2] https://www.epa.gov/sites/production/files/2015-07/documents/fug-def.pdf

- Air toxics are a group of pollutants that cause or may cause cancer or other serious health effects or adverse environmental or ecological effects. U.S. EPA has identified a selected subset of air toxics known as hazardous air pollutants (HAPs).
- Greenhouse gases are pollutants that absorb and emit radiant energy within the thermal infrared range, causing the "greenhouse effect" in the atmosphere. Carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O) are greenhouse gases emitted by landfill sources. Information about greenhouse gas emissions from the project are provided in Sections 3.4 (greenhouse gas qualitative summary) and 5.3 (greenhouse gas mitigation and climate change impacts). Each greenhouse gas is assigned a "global warming potential" (GWP) value. The U.S. EPA's Mandatory Greenhouse Gas Reporting Rule (40 CFR 98) defines GWP as:

  "the ratio of the time-integrated radiative forcing from the instantaneous release of one kilogram of a trace substance relative to that of one kilogram of a reference gas (i.e., CO_2)."

  In other words, GWP is a measure of how much energy the emissions of a greenhouse gas will absorb in the atmosphere, relative to the emissions of the same mass of CO_2. As outlined in 40 CFR 98, the GWP of the greenhouse gases associated with landfills and landfill gas combustion are as follows:

  - CO_2: 1
  - Methane: 25
  - N_2O: 298

This means that methane is a more potent of a greenhouse gas than carbon dioxide, absorbing 25 times more energy than an equivalent amount of CO_2.

Carbon dioxide equivalent (CO_2e) is the number of metric tons of carbon dioxide emissions with the same global warming potential as one metric ton of another greenhouse gas and is calculated as the emission rate of a greenhouse gas times its GWP. CO_2e is often expressed in terms of metric tons (equal to 1000 kilograms or 2,204 pounds. Based on the GWP's outlined above, one metric ton of methane is equivalent to 25 metric tons of CO_2e.

The pollutants emitted by each emission source at BSL is presented in Table 3-2.

Table 3-2. Pollutants Emitted by Source

Source	Pollutants Emitted
Municipal Solid Waste Landfill (uncaptured landfill gas)	• VOCs • Air toxics • Greenhouse gases (GHGs, including CO_2, N_2O and methane)
Dust from Vehicle Traffic	• PM • PM_{10} • $PM_{2.5}$
Dust from Material Handling & Bulldozing	• PM • PM_{10} • $PM_{2.5}$
EGUs	• CO • NO_x • PM • PM_{10} • $PM_{2.5}$

	• SO_2 • VOCs • GHGs (including CO_2, N_2O and methane) • Air toxics
Enclosed Flare	• CO • NO_x • PM • PM_{10} • $PM_{2.5}$ • SO_2 • VOCs • GHGs (including CO_2, N_2O and methane) • Air toxics

The pollutants emitted by each source will not change as a result of the Project, but the emission rates will be modified, as described in Section 3.3.

3.3 EMISSION RATES

A summary of the major findings associated with air emissions from the Project is provided below:

- Potential emissions for the flare and EGUs will not change with the Project.
- In both Pre-Project and Post-Project scenarios, the flare and EGUs are conservatively assumed to operate at capacity, as allowed by the current air permit (Permit No. 03700192-004).
- Emissions increases for the Project are associated with fugitive emissions from the landfill generated by:
  - Uncaptured landfill gas emitted through the landfill surface (VOCs, air toxics/HAPs, and GHGs) and
  - The generation of dust (PM, PM_{10}, and $PM_{2.5}$) from vehicle traffic, waste and material handling, and bulldozing operations.

Air quality emission changes associated with the Project were evaluated using “potential to emit” (PTE), which is defined by U.S. EPA[3] as:

> *“the maximum capacity of a stationary source to emit under its physical and operational design. Any physical or operational limitation on the source to emit an air pollutant, including air pollution control equipment and restrictions on hours of operation, or on the type or amount of material combusted, stored, or processed, shall be treated as part of its design if the limitation is enforceable by the Administrator.”*

Potential to emit is used by MPCA to evaluate air permit requirements. It provides a conservative estimate of emissions based on the capacity of each unit and includes operational limits and controls when enforceable.

[3] U.S. EPA Memorandum, “Potential to Emit (PTE) Guidance for Specific Source Categories”, from John S. Seitz, Director of Air Quality Planning and Standards, OAR and Eric Schaeffer, Director, Office of Regulatory Enforcement, OECA. https://www.epa.gov/sites/production/files/2015-07/documents/lowmarch.pdf

Total facility potential emissions for the Pre- and Post-Project scenarios are provided in Table 3-3, 3-4 and 3-5 for criteria pollutants, air toxics and greenhouse gases, respectively. Detailed potential emission calculations are provided in Appendix C (Pre-Project) and Appendix D (Post-Project). The emission calculations are based on the maximum capacity of each source and incorporates air pollution control equipment where enforceable, as described in more detail in Sections 3.3.1 to 3.3.4. Post-Project values correspond to the maximum annual waste acceptance and gas generation rates over the life of the landfill.

Table 3-3. Total Facility Potential to Emit – Criteria Pollutants

Pollutant	Pre-Project (tons/year)	Post-Project (tons/year)
CO	223.4	223.4
NO_x	155.1	155.1
$PM_{2.5}$	23.1	23.3
PM_{10}	31.0	32.9
PM	63.2	70.5
SO_2	53.9	53.9
VOC	55.6	65.8

Table 3-4. Total Facility Potential to Emit – Air Toxics

Pollutant	Pre-Project (tons/year)	Post-Project (tons/year)
1,1,1 - Trichloroethane (methyl chloroform)[a]	0.037	0.069
1,1,2,2 – Tetrachloroethane[a]	0.11	0.20
1,1 - Dichloroethane (ethylidene dichloride) [a]	0.13	0.25
1,1 - Dichloroethene (vinylidene chloride) [a]	0.011	0.021
1,2 - Dichloroethane (ethylene dichloride) [a]	0.023	0.044
1,2 - Dichloropropane (propylene dichloride) [a]	0.012	0.022
2-Propanol (isopropyl alcohol)	1.7	3.3
Acetone (2-propanone)	0.23	0.44
Acrylonitrile (Propenenitrile) [a]	0.19	0.36
Benzene[a]	0.086	0.16
Bromodichloromethane	0.29	0.55
Butane	0.17	0.32
Carbon Disulfide[a]	0.025	0.048
Carbon Tetrachloride[a]	0.00035	0.00067
Carbonyl Sulfide[a]	0.017	0.032
Chlorobenzene (monochlorobenzene) [a]	0.016	0.030
Chlorodifluoromethane (CFC-22, freon-22)	0.065	0.12
Chloroethane (ethyl chloride) [a]	0.046	0.087
Chloroform (trichloromethane) [a]	0.0021	0.0039
Chloromethane (methyl chloride) [a]	0.035	0.066
1,4 Dichlorobenzene (p-dichlorobenzene) [a]	0.018	0.033
Dichlorodifluoromethane (CFC-12, freon-12)	1.1	2.1
Dichlorofluoromethane (freon-21)	0.15	0.29
Dichloromethane (methylene chloride) [a]	0.70	1.3
Dimethyl Sulfide (methyl sulfide)	0.28	0.53
Ethane	15.3	28.9
Ethanol (ethyl alcohol)	0.72	1.4
Ethylbenzene[a]	0.28	0.53
Ethyl Mercaptan (ethanethiol)	0.081	0.15
Ethylene dibromide (1,2 dibromoethane) [a]	0.00011	0.00020
Fluorotrichloromethane (CFC-11, freon-11)	0.060	0.11

Table 3-4. Total Facility Potential to Emit – Air Toxics (cont'd)

Pollutant	Pre-Project (tons/year)	Post-Project (tons/year)
Hexane[(a)]	0.32	0.61
Hydrogen Sulfide	4.9	9.2
Mercury (total) [(a)]	0.00023	0.00026
Methyl Ethyl Ketone (2-butanone) [(a)]	0.29	0.55
Methyl Isobutyl Ketone (hexone) [(a)]	0.11	0.20
Methyl Mercaptan	0.069	0.13
Pentane	0.14	0.26
Tetrachloroethylene (perchloroethylene, -ethene) [(a)]	0.35	0.67
Propane	0.28	0.53
Toluene (methylbenzene) [(a)]	2.1	3.9
Trichloroethylene (trichloroethene) [(a)]	0.21	0.40
t - 1,2 - Dichloroethene (1,2 dichloroethylene)	0.16	0.30
Vinyl Chloride (chloroethylene, VCM) [(a)]	0.26	0.50
Xylenes (m, o, p) [(a)]	0.74	1.4
Hydrogen Chloride[(a,b)]	5.2	5.2
Single Hazardous Air Pollutant (HAP)	***5.2 (Hydrogen Chloride)***	***5.2 (Hydrogen Chloride)***
Total HAPs	***11.3***	***16.7***

(a) Hazardous air pollutant (HAP).
(b) Product of combustion.

Table 3-5. Total Facility Potential to Emit – Greenhouse Gases

Pollutant	Pre-Project (tons/year)	Post-Project (tons/year)
Nitrous Oxide (N2O)[(a)]	0.89	0.89
Methane[(a,b)]	3,048	6,107
Carbon Dioxide (CO2)[(b,c)]	157,402	167,473
Total Carbon Dioxide Equivalent (CO_2e)	***233,859***	***320,401***

(a) Product of combustion of landfill gas.
(b) A portion of the methane is converted to carbon dioxide upon combustion.
(c) Includes carbon dioxide formed by combustion and the carbon dioxide present in landfill gas that is "passed through" the combustion device.

3.3.1 Fugitive Emissions from Uncaptured Landfill Gas

As shown in Table 2-2, the maximum volume of landfill gas generated is expected to increase as a result of the Project. Potential fugitive emissions of VOCs, air toxics and GHGs from the uncaptured landfill gas were calculated using default concentrations of compounds in the landfill gas from U.S. EPA's AP-42 document. The default concentrations were then multiplied by the "flow rate" of uncaptured landfill gas to determine a pounds per hour (lb/hr) and tons per year (ton/yr) emission rate, assuming 8,760 hours per year of continuous operation.

Potential emissions from uncaptured landfill gas are presented in Table 3-6.

Table 3-6. Fugitive Landfill Potential to Emit

Pollutant	Pre-Project (tons/year)	Post-Project (tons/year)
VOC	10.1	20.3
Air Toxics		
Single Hazardous Air Pollutant (HAP)	1.8 (Toluene)	3.7 (Toluene)
Total HAPs	5.1	10.3
Greenhouse Gas		
Nitrous Oxide (N_2O)[(a)]	0	0
Methane	3,043	6,102
Carbon Dioxide (CO_2)	10,020	20,091
Total Carbon Dioxide Equivalent (CO_2e)	86,100	172,642

(a) Product of combustion and not present in landfill gas.

3.3.2 Fugitive Dust Emissions

The Project will increase truck traffic and amount of material handled at the facility. Bulldozing operations will remain unchanged as a result of the Project. Dust emissions associated with vehicle traffic, material and waste handling, and bulldozing were calculated based on conservative assumptions for vehicle weight, miles of paved and unpaved roads, and U.S. EPA AP-42 emission factors, as described below.

Potential emissions from roads and material and waste handling are and will continue to be reduced through dust control measures as specified in the facility's Fugitive Emissions Control Plan[4], including:

- Watering application (during non-freezing conditions)
- Solid chemical dust suppressant may be applied to unpaved roads in late fall prior to freeze
- Road maintenance including grading unpaved roads and paving
- Limiting vehicle speeds to 15 miles per hour

The Fugitive Emissions Control Plan meets the requirements of a Level III-A Plan[5]. Thus, an 80 percent reduction in emissions is applied to pounds per hour potential emissions and a 90 percent reduction is applied to annual emissions.

3.3.2.1 Vehicle Traffic

Waste hauling trucks are weighed upon entry to BSL. After the scale house, the trucks carrying waste travel along the haul road to the "active area" of the landfill where the waste is unloaded. The empty trucks then exit the facility along the same haul road to the scale where they are weighed again prior to departing.

Potential emission calculations for vehicle traffic on haul roads were based on the estimated amount of waste accepted, average vehicle weight, number of loads, and the distance traveled along paved and unpaved surfaces. Control efficiency of the dust control methods described in the Fugitive Emissions Control Plan are also included. Calculated potential emission rates and inputs for vehicle traffic emissions for the Pre- and Post-Project Scenarios are presented in Table 3-7. Note that the waste accepted for the Pre-Project scenario was based on a conservative worst-case estimate and not actual data from the facility.

[4] BSL Fugitive Emissions Control Plan, last updated October 21, 2014.
[5] MPCA's Guidance Document: "Taconite Industry Haul Truck Unpaved Haul Road Fugitive Particulate Emission Factor and Control Efficiency", last edited January 27, 1999.

Table 3-7. Vehicle Traffic Emissions Inputs and Potential to Emit

Parameter	Pre-Project	Post-Project
Total Waste Accepted (tons/year)	479,614	589,876
Tons per Load	6.57	6.57
Number of Loads per Year	73,001	89,783
Trip Distance on Paved Roads (miles, round trip)	0.47	0.47
Trip Distance on Unpaved Roads (miles, round trip)	0.68	0.68
Average Vehicle Weight Empty (tons)	20.0	20.0
Average Vehicle Weight Full (tons)	26.6	26.6
Control Efficiency – Vehicle Traffic Emissions (hourly)	80%	80%
Control Efficiency – Vehicle Traffic Emissions (annual)	90%	90%
Potential to Emit (controlled, ton/yr)		
Total PM	41.2	48.5
PM_{10}	9.0	10.9
$PM_{2.5}$	1.1	1.3

No new haul roads will be added to the facility as part of the Project. The distance traveled by waste hauling trucks will remain the same after the Project. However, the location and elevation of the haul roads will change as waste is placed in the landfill. The impact of the changes to the haul road are described in more detail in Section 4.

Potential emissions were calculated using AP-42 emission factors (found in Section 13.2.1-4) as shown in Appendices C and D.

3.3.2.2 Material Handling and Aggregate Storage Piles

Emissions associated with waste and soil handling and storage are calculated based on the total amount of material handled, the mean wind speed, material moisture content, and hours of operation. The mean wind speed, moisture content and hours of operation are the same for Pre-Project and Post-Project scenarios. The only difference between the two is the quantity of material handled.

Potential emission calculations and inputs for material handling and storage are summarized in Table 3-8.

Table 3-8. Material Handling and Storage Emissions Inputs and Potential to Emit

Parameter	Pre-Project	Post-Project
Total Waste Accepted (tons/year)	479,614	589,876
Daily Cover Soils (tons/year)[(a)]	65,209	100,279
Total Material Handled per Year	544,823	690,155
Potential to Emit (ton/yr)		
Total PM	0.05	0.07
PM_{10}	0.02	0.03
$PM_{2.5}$	0.004	0.005

(a) Amount of daily cover needed is approximately 17 percent of the total municipal solid waste intake (based on BSL data).

Potential emissions were calculated using AP-42 emission factors (found in Section 13.2.4). Detailed emission calculations are included in Appendices C and D.

3.3.2.3 Bulldozing

Bulldozing emissions are based on AP-42 equations (found in Section 11.9), with inputs of material silt content and moisture content. The resulting pounds per hour emission rates are then multiplied by the estimated operation of 3,780 hours per year to calculate tons per year of PM, PM_{10} and $PM_{2.5}$ emissions. The silt content, moisture content, hours of operation and resulting emission rates will be the same for the Pre- and Post-Project scenarios, as shown in Table 3-9.

Table 3-9. Bulldozing Emissions Inputs and Potential to Emit

Parameter	Pre-Project	Post-Project
Material moisture content	12%	12%
Material silt content	9%	9%
Hours of Operation per Year (10 hours per day, 260 days per year)	3,780	3,780
Potential to Emit (ton/yr)		
Total PM	9.4	9.4
PM_{10}	0.7	0.7
$PM_{2.5}$	0.1	0.1

3.3.3 Emissions from EGUs

BSL operates three sets of “tandem” EGUs (for a total of six units). Each pair of EGUs shares an exhaust stack. Prior to combustion in the EGUs, collected landfill gas is sent to a treatment system to filter, compress, and remove moisture from the landfill gas. When treated landfill gas is combusted, volatile organic compounds (VOCs), methane (a greenhouse gas) and air toxics/HAPs present in the landfill gas are reduced. Upon

combustion, pollutants such as CO, NO_x, PM, PM_{10}, $PM_{2.5}$ and hydrogen chloride are emitted. Sulfur compounds present in the landfill gas (e.g. hydrogen sulfide) are converted to sulfur dioxide (SO_2) upon combustion.

Section 2.4 of U.S. EPA's AP-42 document provides equations and emission factors for calculating emissions for landfill gas combustion in EGUs. Inputs and potential emission rates for the EGUs at BSL are provided in Table 3-10. As previously noted, potential emissions for both the Pre- and Post-Project scenarios assume the EGUs are operating at capacity.

Table 3-10. EGUs Emissions Inputs and Potential to Emit

Parameter	Pre-Project	Post-Project
Landfill gas combustion capacity per EGU (scfm)	310	310
Landfill gas combustion capacity all EGUs (scfm)	1,860	1,860
Landfill gas sulfur content (parts per million by volume, ppmv)	250	250
Potential to Emit (all EGUs combined, ton/yr)		
CO	144.5	144.5
NO_x	131.4	131.4
Total PM	15.3	15.3
PM_{10}	15.3	15.3
$PM_{2.5}$	15.3	15.3
SO_2	20.6	20.6
VOC	44.7	44.7
Single Hazardous Air Pollutant (HAP)	2.0 (hydrogen chloride)	2.0 (hydrogen chloride)
Total HAPs	2.3	2.3
Greenhouse Gas(1)		
Nitrous Oxide (N_2O)	0.34	0.34
Methane	1.7	1.7
Carbon Dioxide (CO_2)	56,406	56,406
Carbon Dioxide Equivalent (CO_2e)	56,550	56,550

(1) Based on EPA's emission factor in the Greenhouse Gas Reporting Rule (40 CFR Part 98, Tables C-1 and C-2) for biogas combustion. Carbon dioxide emissions include those formed through combustion and "pass-through" of the carbon dioxide present in the landfill gas. Methane emissions from this process reflect the small quantity uncombusted fuel, and nitrous oxide emissions are a byproduct of combustion.

3.3.4 Emissions from Enclosed Flare

BSL operates an enclosed flare adjacent to the EGUs that combusts captured landfill gas. As with the EGUs, when landfill gas is combusted, volatile organic compounds (VOCs), methane (a greenhouse gas) and air toxics/HAPs present in the landfill gas are reduced. Additional pollutants, such as CO, NO_x, PM, PM_{10}, $PM_{2.5}$ and hydrogen chloride are emitted during combustion. Sulfur compounds present in the landfill gas (e.g. hydrogen sulfide) are converted to sulfur dioxide (SO_2) upon combustion.

Section 2.4 of U.S. EPA's AP-42 document provides equations and emission factors for calculating emissions for landfill gas combustion in enclosed flares. Inputs and potential emission rates for the enclosed flare at BSL are provided in Table 3-11. As previously noted, potential emissions for both the Pre- and Post-Project scenarios assume the enclosed flare is operating at capacity.

Table 3-11. Enclosed Flare Emissions Inputs and Potential to Emit

Parameter	Pre-Project	Post-Project
Landfill gas combustion capacity (scfm)	3,000	3,000
Landfill gas sulfur content (parts per million by volume, ppmv)	250	250
Potential to Emit (ton/yr)		
CO	78.8	78.8
NO_x	23.7	23.7
PM	6.7	6.7
PM_{10}	6.7	6.7
$PM_{2.5}$	6.7	6.7
SO_2	33.3	33.3
VOC	0.83	0.83
Single Hazardous Air Pollutant (HAP)	3.2 (hydrogen chloride)	3.2 (hydrogen chloride)
Total HAPs	3.6	3.6
Greenhouse Gas		
Nitrous Oxide (N_2O)	0.55	0.55
Methane	2.8	2.8
Carbon Dioxide (CO_2)	90,977	90,977
Carbon Dioxide Equivalent (CO_2e, metric tons/yr)	91,209	91,290

(1) Based on EPA's emission factor in the Greenhouse Gas Reporting Rule (40 CFR Part 98, Tables C-1 and C-2) for biogas combustion. Carbon dioxide emissions include those formed through combustion and "pass-through" of the carbon dioxide present in the landfill gas. Methane emissions from this process reflect the small quantity uncombusted fuel, and nitrous oxide emissions are a byproduct of combustion.

3.4 GREENHOUSE GAS EMISSIONS – QUALITATIVE SUMMARY

The Final Scoping Decision Document requires that the SEIS includes:

- *A qualitative summary of expected greenhouse gas production from the Project. This qualitative summary seeks to provide a broader description of carbon sources in the landfill, as well as greenhouse gas production.*

3.4.1 Captured and Combusted Landfill Gas

As solid waste is broken down by bacteria in the landfill, methane and carbon dioxide are produced. From a broad mass-balance perspective, carbon placed in a landfill is either sequestered or emitted as methane or carbon dioxide. BSL's primary focus is to minimize the emission of methane, which is a more potent greenhouse gas than carbon dioxide. This is primarily accomplished by operation of the GCCS sending the landfill gas to the EGUs and flare. The methane fraction of landfill gas that is collected and combusted in the EGUs and flare is emitted as carbon dioxide.

The carbon dioxide in the collected landfill gas is not combusted but is emitted to the atmosphere as "pass-through" emissions through the combustion device. This is similar to other waste processing techniques like composting or waste incineration where carbon in the waste is converted to carbon dioxide and emitted to the atmosphere.

3.4.1.1 Uncaptured Landfill Gas

As previously mentioned, the portion of the landfill gas that is not captured by the GCCS (an average of 25 percent of the landfill gas generated according to U.S. EPA) is conservatively assumed to be emitted to the atmosphere (as shown in Tables 3-5 and 3-6). However, the uncaptured landfill gas does not have a clear path to the air. The waste is covered with soil ("cover soil") as it is placed in the landfill. Aerobic bacteria in the upper layers of soil also consume the uncaptured landfill gas (in a process called oxidation), further reducing emissions.[6] Depending on conditions (e.g., methane generation, soil type, etc.), USEPA's Mandatory Greenhouse Gas Reporting Rule (40 CFR 98, Subpart HH) estimates that between 10 and 35 percent of fugitive methane emissions are oxidized to carbon dioxide in the soil cover.

3.4.1.2 Carbon Sequestration in Landfills

Carbon sequestration is probably the least studied phenomenon relating to the overall greenhouse gas emissions from landfills, but carbon stored in landfills is removed from the carbon cycle. Carbon from materials that do not fully decompose under the anaerobic conditions in landfills is counted as an anthropogenic (man-made) "sink", by keeping this carbon buried in the landfill.

[6] https://www.waste360.com/landfill/what-landfill-operators-should-know-about-methane-oxidation

4.0 AMBIENT AIR IMPACTS

The Final Scoping Decision Document requires the following:

- *An evaluation of all direct, indirect, and cumulative ambient air impacts at the Landfill consistent with the MPCA Air Quality Modeling Practices Manual for the Project.*
- *Results of the modeling will be compared to Ambient Air Quality Standards or Health Benchmarks*

Air quality impacts associated with the increase in emissions from the Project are direct and cumulative. Direct impacts were quantified using dispersion modeling to estimate offsite changes in concentrations associated with the Project. Cumulative impacts were evaluated by including nearby emission sources and monitored background concentrations. There were no additional indirect air quality impacts identified for the Project. However, as the Post-Project scenario occurs at full-buildout (approximately 47 years into the future), the modeled impact can be considered an indirect effect per 40 CFR 1508.8, as these effects "are caused by the action and are later in time but still reasonably foreseeable[7]."

Dispersion modeling was performed using a computer program (AERMOD, Version 19191) that incorporates site-specific source information, changes to the landfill elevation, local meteorological data, nearby sources, monitored background concentrations and offsite terrain elevations to predict ambient air concentrations of pollutants emitted by a facility. Modeled impacts are compared to the National Ambient Air Quality Standards (NAAQS), Minnesota Ambient Air Quality Standards (MAAQS) and health benchmarks.

The major findings for the BSL Project were:

- Pre-Project modeled impacts, assuming the EGUs and enclosed flare are conservatively assumed to be operating at capacity, exceed the NAAQS/MAAQS for nitrogen dioxide (NO_2), $PM_{2.5}$, PM_{10}, and SO_2 at the current stack heights for the EGUs.

- When the EGUs' stack heights are increased by 10 feet and the Project is at full build-out, Post-Project modeled impacts meet the NAAQS/MAAQS with the EGUs and enclosed flare operating at capacity.

- Modeled impacts of hydrogen sulfide comply with the MAAQS for both the Pre-Project and Post-Project scenarios.

- Modeled impacts of air toxics emissions show that for all pollutants, there are no health impacts that are shown to be higher than the health benchmarks for both the Pre-Project and Post-Project scenarios.

4.1 MODELING PROTOCOL

A dispersion modeling protocol describing the modeling approach, including model selection, pollutants to be modeled, source parameters for BSL and other nearby sources, building downwash, ambient air boundary location, receptor placement, terrain elevations, selection of meteorological data, and pollutant-specific considerations (e.g. conversion of NO_x to NO_2) was submitted and approved by MPCA.

During the protocol review process, it was determined that the facility needed a General Public Preclusion Plan (GPPP) to define the ambient air boundary and describe how the facility will monitor the boundary and handle any

[7] https://www.law.cornell.edu/cfr/text/40/1508.8

possible breaches. The GPPP for BSL was approved by MPCA on November 23, 2020. A copy of the approved GPPP is provided in Appendix E.

The completed dispersion modeling analysis was approved by MPCA on December 17, 2020. A copy of MPCA's modeling review document is provided in Appendix F.

4.2 CRITERIA POLLUTANT MODELING

Dispersion modeling for criteria pollutants (CO, NO_x, PM_{10}, $PM_{2.5}$, and SO_2 – there is no ambient standard for VOC) was performed in two steps: significant impact level (SIL) modeling (i.e., direct impacts) and cumulative impact area (CIA) modeling (i.e., cumulative impacts). First, the BSL emission sources were modeled at each source's potential emission rate and the maximum predicted concentration was compared to the SIL. If the modeled impact exceeded SILs for any pollutant and/or averaging time, CIA modeling was required. CIA modeling must include nearby emission sources that could contribute to the ambient impact near BSL and ambient background concentrations. Only receptors with modeled impacts greater than the SIL were included in the CIA modeling.

4.2.1 Significant Impact Level Modeling

Maximum modeled concentrations from BSL emission sources in the Pre-Project and Post-Project scenarios were compared to the SILs for CO, NO_x $PM_{2.5}$, PM_{10}, and SO_2. Results of the SIL modeling are provided in Table 4-1.

Table 4-1
SIL Modeling
Maximum Impacts from BSL Sources

Pollutant	Averaging Time	Pre-Project (ug/m^3)	Post-Project (ug/m3)	SIL (ug/m^3)
CO	1-Hour	1650	213.5	2000
	8-Hour	1354	119.4	500
NO_2[(a)]	1-Hour	702.2	113.7	7.5
	Annual	31.1	3.4	1
$PM_{2.5}$	24-Hour	103.4	4.6	1.2
	Annual	7.1	0.48	0.1
PM_{10}	24-Hour	116	31.1	5
SO_2	1-Hour	219.1	23.5	7.9
	3-Hour	224	22.8	25
	24-Hour	150.6	9.0	5
	Annual	9.3	0.71	1

(a) To determine the NO_x to NO_2 ratio, the U.S. EPA-recommended Ambient Ratio Method (ARM2) with a default minimum ratio of 0.5 and default maximum ratio of 0.9 was used in the modeling.

For the Pre-Project scenario, modeled impacts exceeded the SILs for all pollutants and averaging times with the exception of CO (1-hour averaging period). Modeling results for the Post-Project scenario, including a stack

height increase of 10 feet for the EGUs, resulted in significantly lower impacts, with CO (both 1-hour and 8-hour averaging periods) and SO_2 (annual) impacts less than the SILs.

CIA modeling was required for the pollutants, averaging times and receptors where BSL modeled impacts exceed the SILs.

4.2.2 Cumulative Impact Area Modeling

CIA modeling was performed to evaluate the combined impact of BSL and nearby sources. Modeled concentrations were added to ambient background monitored data and compared to the NAAQS. Modeling results for both the Pre-Project and Post-Project scenarios are presented in Table 4-2.

Table 4-2
CIA Modeling Results

Pollutant	Averaging Time	Rank[1]	Cumulative Modeled Impact		Background Concentration (ug/m^3)	Maximum Modeled Impacts with Background		NAAQS (ug/m^3)	MAAQS (ug/m^3)
			Pre-Project (ug/m^3)	Post-Project (ug/m^3)		Pre-Project (ug/m^3)	Post-Project (ug/m^3)[3]		
CO	1-Hour	H2H	Not Required as BSL Impacts < SIL					*40,000*	*40,000*
	8-Hour	H2H	1293.4	Not Required as BSL Impacts < SIL	916.4	**2209.4**	**Not Required**	*10,000*	*10,000*
NO_2[1]	1-Hour	H8H	592.4	110.7	62.1	**654.5**[2]	**172.8**	*188*	*188*
	Annual	H1H	33.0	5.3	15.6	**48.6**	**20.9**	*99.7*	*100*
$PM_{2.5}$	24-Hour	H8H	67.1	13.0	18	**85.1**[2]	**31.0**	*35*	*35*
	Annual	H1H	8.8	5.1	6.6	**15.4**[2]	**11.7**	*12*	*12*
PM_{10}	24-Hour	H6H	96.0	76.0	50	**146.0**	**126.0**	*150*	*150*
SO_2	1-Hour	H4H	192.4	21.8	10.5	**202.9**[2]	**32.3**	*197*	*197*
	3-Hour	H2H	217.6	Not Required	6.6	**224.2**	**Not Required**	*1300*	*1310*
	24-Hour	H2H	143.5	8.3	6.6	**150.1**	**14.9**	*367*	*367*
	Annual	H1H	9.3	Not Required	6.6	**15.9**	**Not Required**	*79*	*79*

(1) Rank: H1H = Highest 1st-High, H2H = Highest 2nd-High, etc.
(2) Pre-Project modeled impacts, assuming the EGUs and enclosed flare are conservatively assumed to be operating at capacity, exceed the NAAQS/MAAQS for nitrogen dioxide (NO_2), $PM_{2.5}$, PM_{10}, and SO_2 at the current stack heights for the EGUs.
(3) Post-Project modeled impacts include a 10 foot increase in stack height for the EGUs.

As shown in Table 4-2, after the Project and increasing the EGU stacks, the cumulative impact meets the NAAQS for all pollutants and averaging times.

As stated previously, these modeling results in both the Pre-Project and Post-Project scenarios represent worst-case conditions with the EGUs and enclosed flare operating at capacity.

In the event that the EGUs are removed, their modeled impact goes to zero. At present, dispersion modeling for a second flare is not feasible since the location and stack parameters of the second flare are unknown. If a second flare is to be installed in the future, dispersion modeling will be required at that time as part of the permitting process. The modeling must demonstrate compliance with ambient air standards to secure an air permit.

Additional information about the selection of nearby sources and representative monitored values used in the CIA modeling is provided below.

4.2.2.1 Nearby Source Selection

Per MPCA dispersion modeling guidance, nearby source selection was performed via the GIS Nearby Source Tool (GIS Tool), using annual emission inventory data from 2014 to 2016. The sources that were identified by the GIS Tool were further evaluated in a two-step process to identify whether they would have a significant effect on the CIA modeling for BSL.

Initially, a wind distribution analysis was performed to evaluate the frequency of wind speed and direction (based on five (5) years of meteorological data from the Flying Cloud Airport) to determine the number of hours that a plume from each nearby source would reach the BSL facility each year. Since the ambient standards are based on 98th or 99th percentile, if the percent of time the plume could reach BSL are less than 1 or 2 percent of the year (depending on the pollutant), then the nearby facility does not significantly impact the receptors near BSL frequently enough and was eliminated from the CIA modeling.

The second step was to model each remaining nearby source individually at the maximum allowable emissions to determine whether the modeled impact from that nearby source exceeded the SIL at receptors that showed a significant impact from BSL sources.

Nearby sources remaining after these analyses were included in the CIA modeling and are listed in Table 4-3.

Table 4-3
CIA Modeling - Nearby Sources Included

Pollutant	Nearby Sources
CO	None
NO_x	Anchor Glass Commercial Asphalt Xcel Energy Blue Lake
$PM_{2.5}$ & PM_{10}	Burnsville Yard Waste Cemstone CertainTeed Kraemer Mining Port Cargill Superior Minerals
SO_2	None

Stack and emissions data for the nearby sources were approved by MPCA in the modeling protocol and the modeling report. Potential to emit for these nearby sources was used in the modeling. For some nearby sources, potential emissions were adjusted as prescribed in Table 8-2 of U.S. EPA's Guideline on Air Quality Models[8] (40 CFR Part 51, Appendix W), as described below.

[8] https://www.epa.gov/sites/production/files/2020-09/documents/appw_17.pdf

Burnsville Yard Waste

Maximum hourly potential emissions were calculated for the sources at Burnsville Yard Waste. Since Burnsville Yard Waste operates seasonally and with limited hours of operation, the following restrictions were applied to the emissions from the sources at Burnsville Yard Waste:

- Facility operates 1,837 hours per year (7:30 am to 5:00 pm each weekday and 7:30 am to 1:00 pm on Saturday).

Port Cargill

Maximum hourly potential emissions were calculated for the sources at Port Cargill. The following hours of operation restrictions were applied to the Port Cargill emissions:

- Grain Division operates 1,387 hours per year (6:00 am to 2:00 pm, weekdays April 1 to November 30).
- Salt Barge Receiving operates 1,733 hours per year (7:00 am to 5:00 pm, weekdays April 1 to November 30)
- Salt Truck Receiving operates 2,600 hours per year (7:00 am to 5:00 pm, weekdays year-round)
- Salt Truck Loadout operates 3,640 hours per year (7:00 am to 7:00 pm, weekdays year-round)

4.2.2.2 Monitored Background Concentrations

Selection of background concentrations was based on proximity to the source, land use, surface roughness and terrain, and whether the monitor may be influenced by sources near the BSL to avoid double-counting in the NAAQS/MAAQS modeling. Ambient monitored concentrations (measured from 2016 to 2018) approved by MPCA are provided in Table 4-4.

Table 4-4
Monitored Background Concentrations

Pollutant	Averaging Time	Monitored Background Value	Selected Monitor	Monitor ID
CO	1-Hour	Not Applicable – Modeled Impacts < SIL		
	8-Hour	916.2	Minneapolis Hennepin Center for the Arts	0954
NO_2	1-Hour	62.1	Rosemount Flint Hills Refinery	0420
Annual	Annual	15.6		
$PM_{2.5}$	24-Hour	18.0	BF Pearson School (Shakopee)	0505
	Annual	6.6		
PM_{10}	24-Hour	50.0	Blaine – Anoka County Airport	1002
SO_2	1-Hour	10.5	Rosemount Refinery	0443
	3-Hour	6.6		
	24-Hour	6.6		
	Annual	6.6		

4.2.2.3 Receptors Located on Nearby Sources' Property

For nearby sources within 1-kilometer (Burnsville Yard Waste (BYW), Cemstone, Kraemer, and Port Cargill), there were several significant receptors that were located on the nearby sources' property. Per Section 3.7.5 of the MPCA Air Dispersion Modeling Practices Manual, "the modeled nearby source pollutant contribution can be removed from the receptors on its own non-ambient property as part of the analysis". Therefore, Kraemer sources were not included in the impact within Kraemer's property, Cemstone impacts were not included for the receptors on Cemstone property, etc.

4.3 AIR TOXICS MODELING

Air toxics are evaluated differently than criteria pollutants. A list of air toxics emitted at BSL were provided in Table 3-4. There is one pollutant, hydrogen sulfide, with a state ambient air standard (MAAQS). Dispersion modeling was performed to demonstrate compliance with the MAAQS for hydrogen sulfide. All other air toxics emitted by BSL sources were evaluated for risk as described in Section 4.3.2.

4.3.1 Hydrogen Sulfide

AERMOD was used to evaluate impacts of hydrogen sulfide (H_2S) from the fugitive landfill and the landfill gas combustion devices to demonstrate compliance with the MAAQS. Modeling results for H_2S are provided in Table 4-5.

Table 4-5
H_2S Modeling Results

Pollutant	Averaging Time	Pre-Project (ug/m^3)	Post-Project (ug/m3)	MAAQS (ug/m^3)
H_2S	1-Hour	10.6	17.8	42

4.3.2 Risk Assessment

For air toxics emitted by BSL that do not have a MAAQS, modeled impacts were compared to health benchmarks. Per MPCA's air toxics website[9]:

> *"MPCA uses risk guidelines called health benchmarks to assess the health risks associated with air toxics concentrations. These values are set at levels that would protect people who are most vulnerable to the potentially harmful effects of a contaminant."*

4.3.2.1 Sources of Health Benchmarks

The MPCA/MDH (Minnesota Department of Health) hierarchy of toxicity data sources for assessing air toxics inhalation risks in Minnesota are as follows:

1. Specific MDH guidance (e.g. health based values (HBVs))
2. MDH Health Risk Values (HRVs)
3. EPA IRIS
4. California EPA (CALEPA)
5. Provisional Peer Reviewed Toxicity Values

This hierarchy is maintained in the Risk Assessment Screening Spreadsheet (RASS) associated with the AERA process described below.

4.3.2.2 AERA Process

Impacts from air toxics emissions were evaluated using MPCA's Air Emission Risk Analysis (AERA) process, which quantifies potential human health risks due to the emissions from a project. The AREA process involves the following steps:

1. Calculate potential air toxics emissions from each source (EGUs, enclosed flare and fugitive landfill)
2. Enter emission rates for those compounds with readily available inhalation health benchmarks (IHBs) in the Risk Assessment Screening Spreadsheet (RASS).
3. Perform dispersion modeling for each stack and fugitive source with a 1 gram per second unit emission rate.
4. Use the maximum modeled impacts (micrograms per cubic meter per 1 gram per second) to identify a "dispersion factor" for each stack and fugitive source. Note that the maximum modeled impacts, regardless of location, are conservatively used in the RASS, including impacts for farmers and residents. These maximum impacts occur near the BSL property boundary. Risk modeling was not performed for specific resident or farmer locations.

[9] https://www.pca.state.mn.us/air/air-toxics-minnesota

5. Enter the dispersion factors for each stack into the RASS.
6. Evaluate the RASS results. If all pollutants are below the risk management thresholds, then no further evaluation is needed, and the assessed health effects from the proposed action are unlikely to occur, or will be negligible.

Table 4-6
RASS Modeling Results

		Calculated Risk		
	Risk Type	Pre-Project	Post-Project	Risk Management Threshold
Inhalation Risks(1)	Acute(3)	0.4	0.6	> 1.0
	Sub-Chronic Noncancer	0.3	0.4	> 1.0
	Chronic Noncancer	0.8	1.0	> 1.0
	Cancer(4)	0.6	0.6	> 1.0
Multi-pathway Risks (2)	Farmer Noncancer(5)	0.8	1.0	> 1.0
	Farmer Cancer(4)	0.5	0.6	> 1.0
	Resident Noncancer(6)	0.8	1.0	> 1.0
	Resident Cancer(4)	0.5	0.6	> 1.0

(1) The RASS is designed to assess inhalation risks from long-term exposure to the average ambient air concentration during a year (chronic), short-term exposure to the maximum potential hourly ambient air concentration (acute), and mid-term exposure over a one-month period (sub-chronic).

(2) Multi-pathway modeling allows air particles to deposit from the air onto other environmental media (e.g. soil, water, crops) over time according to their density and particle size. Food chain analyses then use these modeled deposition rates along with other scientific data to estimate uptake of the pollutants into soil, water, produce, fish, livestock and related food products (eggs and milk). Includes indirect impacts from ingesting the impacted food and water.

(3) The acute inhalation exposure scenario is used to describe potential adverse effects from breathing hourly maximal air concentrations of facility air toxics at locations where this exposure could possibly occur. This type of exposure includes those living or working nearby; someone running or biking near a facility; snowmobiling along the facility boundary; or a delivery person waiting for their truck to be emptied.

(4) Cancer risk from exposure to air emissions from a given facility is the probability that a hypothetical human receptor will develop cancer based on an assumed set of exposure, model and toxicity assumptions. Values shown in this table for cancer risk are chances in 100,000 of developing cancer during their lifetime from exposure to pollutants emitted from the facility under evaluation. For example, a risk of 1.0 is interpreted to mean that a hypothetical individual has up to a one in 100,000 chance of

developing cancer during their lifetime from exposure to pollutants emitted from the facility under evaluation.

(5) A "Farmer" is an EPA-developed exposure scenario assessed over an approximate adult human lifetime for inhalation and 40 years for ingestion. This hypothetical "Farmer" inhales air, indirectly ingests soil, ingests homegrown produce, drinks home-produced milk, and eats home-grown meat products (pork, beef, chicken eggs, and chicken) that could be impacted by facility air emissions.

(6) A "Resident" is an EPA-developed exposure scenario assessed over an approximate adult human lifetime for inhalation and 30 years for ingestion. This hypothetical "Resident" inhales air, indirectly ingests soil, and ingests home-grown produce that could be affected by facility air emissions.

MPCA further notes in the RASS spreadsheet that:

> *"the hazard index (HI) against which facility risks are compared for acute, sub-chronic and chronic non-cancer risks is 1. The cancer risk against which facility risks are compared is 1 E-5 (or 1 chance in 100,000). These facility risk guidelines are risk management-based. They are not discrete indicators of observed adverse effect. If a risk estimate falls below facility risk guidelines, the MPCA may conclude that the assessed health effects from the proposed action are unlikely to occur, or will be negligible. A risk estimate that exceeds a guideline triggers further careful consideration."*

Based on Pre- and Post-Project emissions, risks from BSL air toxics emissions are below suggested health guidance values.

Even with the EGUs in operation, there are no health impacts that are shown to be higher than risk management thresholds for any pollutants in the RASS for the Pre-Project and Post-Project scenario. MPCA accepted the risk assessment as noted in Section 4 of the modeling review form provided in Appendix F.

4.4 GREENHOUSE GASES AND CLIMATE CHANGE

As indicated in Table 3.5, BSL currently generates emissions of GHGs and the Project at full build-out in the Year 2068 will result in an increase in total facility GHGs from 233,859 to 320,401 tons per year (CO_2e).

There are no Minnesota or National Ambient Air Quality Standards for GHGs. While there are no state or federal caps on GHG emissions, the Next Generation Energy Act, Minn. Stat. § 215H.02, sets Minnesota GHG emission reduction goals of 15% from 2005 levels by 2015, 30% from 2005 levels by 2025, and 80% by 2050. The most recently available data (2016) shows the state's total annual GHG emissions at 12% below the 2005 baseline. The MPCA estimates that, in 2016, activities in Minnesota released 154.2 million tons of CO2e.

Global climate change results from the total accumulation of GHGs in the Earth's atmosphere, as well as other man-made and natural factors. The GHG composition in the Earth's atmosphere is changing and causing the planet's climate to change. The Project's incremental contribution to global GHGs cannot be translated into effects on climate change globally or regionally.

In general, regional impacts from climate change may include the following effects: increased mean annual air temperature (summer and winter warming); increased surface water temperatures; later onset of winter and earlier onset of spring; precipitation may fall in fewer, but more intense, storms; species adapted to cold climates may shift out of the Great Lakes Basin into Canada; and aspen and birch forests may be replaced by hardwood forests of oak and hickory. Moderate climate change may increase agricultural yields and food production, with some regional and annual variability.

5.0 MITIGATION OPTIONS

The Final Scoping Decision Document requires:

- *The SEIS will contain an evaluation of the mitigation options for controlling air emissions at the BSL for the Project.*

Mitigation options are provided below.

5.1 CRITERIA POLLUTANTS

The landfill will be designed and constructed according to Minnesota Rule 7035 (Solid Waste). The landfill will have an engineered liner system, a leachate collection and control system and a final cover system. In addition, BSL will expand the landfill gas collection system as part of the Project that will route landfill gas to the existing control devices (EGUs and flare) per NSPS regulations. No additional EGUs or flares are planned as part of the Project, as the estimated landfill gas collection will remain below current permit limits. However, as described in previous sections, if the EGUs are shut down it is likely that additional combustion devices or other beneficial re-use technologies will be needed some time in the future to manage the anticipated gas generation.

Landfill gas emissions will continue to be minimized by placing daily, intermediate, and final soil cover on the waste to help prevent the gases from migrating out of the landfill.

Fugitive dust emissions will continue to be mitigated by implementing the Fugitive Dust Emissions Plan.

5.2 AIR TOXICS

Air toxics will continue to be mitigated through a well-operated GCCS (per NSPS regulations) and the combustion of the captured landfill gas.

5.3 GREENHOUSE GASES

Greenhouse gases will continue to be mitigated through a well-operated GCCS (per NSPS regulations) and the combustion of the captured landfill gas.

If the Project is approved, BSL will become subject to the provisions of NSPS XXX once it commences construction of the expansion. These provisions will apply to the entire facility, not just the expansion area. Applying the monitoring, recordkeeping and reporting requirements in NSPS XXX will further enhance the effectiveness of the GCCS in reducing greenhouse gas emissions from BSL.

GHG emissions are further reduced through BSL's operation of its 4.8-megawatt landfill gas-to-energy plant (i.e., the EGUs). Operation of the plant on renewable landfill gas results in emissions of CO_2, and each kilowatt generated offsets man-made CO_2 emissions from the combustion of fossil fuels. If the EGUs continue operating, the Project will extend the time period in which usable quantities of landfill gas are generated, thus extending the operating life of the gas-to-energy plant, or other potential new beneficial re-use technology that could augment or replace the plant.

6.0 REGULATORY DISCUSSION

6.1 APPLICABLE FEDERAL STANDARDS

The Final Scoping Decision Document requires that:

- *The applicability of federal New Source Performance Standards for new or modified MMSW landfills will be assessed at the BSL for the Project at complete buildout, including an analysis of implementation measures to meet the standards, if they apply.*

At the time of this report, the status of the applicable federal standards is best described as “transitional”. BSL is currently subject to certain standards; other standards are, or will soon be, applicable (independent of the Project); and others will become applicable as a result of the Project. Each of these federal standards, along with the current status, is described in the following sections.

With respect to ’implementation measures to meet the standards’, however; compliance with all applicable standards is currently achieved, and will continue to be achieved, by the installation and operation of a landfill gas collection and control system (GCCS).

6.1.1 Currently Applicable New Source Performance Standards

6.1.1.1 40 CFR 60 Subpart WWW

The U.S. EPA promulgated New Source Performance Standards (NSPS, Subpart WWW) for MSW landfills on March 12, 1996. Because the BSL was constructed, reconstructed, or modified after May 30, 1991, the NSPS rules in 40 CFR 60 Subpart WWW apply. The NSPS regulates landfill gas emissions by limiting emissions of a set of compounds characterized as nonmethane organic compounds (NMOC). The NMOCs present in landfill gas were included in Table 3-4.

Since BSL has NMOC emissions greater than 50 megagrams per year, the facility is currently subject to the collection and control requirements of Subpart WWW. Compliance with Subpart WWW includes installing and maintaining a GCCS system that can handle the maximum expected landfill gas flow rate and routing all of the collected landfill gas to an appropriate control system or a “treatment system” that processes the collected gas for subsequent sale or use.

BSL’s current Air Permit No. 03700192-004 includes monitoring, recordkeeping and reporting requirements of NSPS Subpart WWW. BSL will continue to comply with the Air Permit and NSPS Subpart WWW requirements.

6.1.1.2 40 CFR 60 Subpart Cf

On July 14, 2016, U.S. EPA promulgated updated Emissions Guidelines for existing landfills, codified under 40 CFR 60 Subpart Cf. The provisions of the rule become effective in April 2021. Even though the rule is not yet effective, it is listed here as a “currently applicable” NSPS due to the upcoming effective date and expected federal enforceability in the near future. This rule is applicable to BSL independent of the Project.

Like Subpart WWW, applicability is governed by emissions of NMOC. Subpart Cf lowers the applicability threshold from 50 megagrams per year to 34 megagrams per year; since BSL was subject to Subpart WWW and the higher threshold, it meets the applicability threshold for Subpart Cf.

Implementation measures to meet Subpart Cf will largely be the same as those used to meet current Subpart WWW standards, i.e., BSL will install and operate a GCCS that routes landfill gas to a treatment system or a flare. The required equipment used to collect and combust the gas will remain the same. There are some new and modified monitoring and recordkeeping requirements in Subpart Cf, including:

- Continued monthly monitoring of temperature, pressure, and oxygen at landfill gas collectors, although Subpart Cf does not include an operating standard for oxygen.
- Development of root cause and corrective action analyses for exceedances at landfill gas collectors.
- Continued quarterly monitoring of methane concentrations at the landfill surface, with an added requirement to monitor landfill cover penetrations
- Where a landfill gas treatment system is used, development of a site-specific treatment system monitoring plan.

6.1.2 Future Applicable New Source Performance Standards

6.1.2.1 40 CFR 60 Subpart XXX

On July 14, 2016, U.S. EPA published the final version of the updated NSPS for new or modified landfills, codified under 40 CFR 60 Subpart XXX. Subpart XXX applies to each municipal solid waste landfill that accepted waste after November 8, 1987 and commenced construction, reconstruction or modification after July 17, 2014.

A “modification” is defined in Subpart XXX as an increase in the permitted volume design capacity of the landfill by either lateral or vertical expansion based on its permitted design capacity as of July 17, 2014. Modification does not occur until the owner or operator commences construction on the lateral or vertical expansion. Subpart XXX requirements will become effective when BSL commences construction on the Project and will remain in effect at full build-out of the Project.

Implementation measures to meet Subpart XXX will largely be the same as those used to meet current Subpart WWW standards, i.e., BSL will install and operate a GCCS that routes landfill gas to a treatment system or a flare. The required equipment used to collect and combust the gas will remain the same. There are some new and modified monitoring and recordkeeping requirements in Subpart XXX, including:

- Continued monthly monitoring of temperature, pressure, and oxygen at landfill gas collectors, although Subpart XXX does not include an operating standard for oxygen.
- Development of root cause and corrective action analyses for exceedances at landfill gas collectors.
- Continued quarterly monitoring of methane concentrations at the landfill surface, with an added requirement to monitor landfill cover penetrations
- Where a landfill gas treatment system is used, development of a site-specific treatment system monitoring plan.

6.1.3 National Emission Standards for Hazardous Air Pollutants (NESHAP)

The U.S. EPA updated the National Emission Standard for Hazardous Air Pollutants (NESHAP) for MSW landfills, codified in 40 CFR 63 Subpart AAAA, on March 26, 2020. The updated rule requires continued compliance with NSPS Subpart WWW, as well as certain provisions of the prior NESHAP, before September 28, 2021. New operational standards, compliance provisions, and monitoring, reporting, and recordkeeping requirements under the new NESHAP rule take effect on September 27, 2021. Implementation measures to comply with NESHAP Subpart AAAA will largely be the same as those used to meet current NSPS Subpart WWW standards, i.e., BSL will install and operate a GCCS that routes landfill gas to a treatment system or a flare. The required equipment used to collect and combust the gas will remain the same. There are some new and modified in NESHAP Subpart AAAA, including:

- Continued monthly monitoring of temperature, pressure, and oxygen at landfill gas collectors, although NESHAP Subpart AAAA does not include an operating standard for oxygen, and the new temperature standard is 145 degrees F.
- Enhanced monitoring requirements for wells that exceed 145 degrees F, and additional requirements for wells that exceed 170 degrees F.

- Development of root cause and corrective action analyses for exceedances at landfill gas collectors.
- Continued quarterly monitoring of methane concentrations at the landfill surface, with an added requirement to monitor landfill cover penetrations
- Where a landfill gas treatment system is used, development of a site-specific treatment system monitoring plan.

This rule is applicable to BSL independent of the Project; BSL will thus implement the new NESHAP Subpart AAAA requirements beginning September 27, 2021. These requirements will continue to be implemented at BSL throughout the Project. Recent and ongoing regulatory efforts at U.S. EPA have sought to align the requirements of NESHAP Subpart AAAA and NSPS Subparts XXX and Cf. BSL will continue to comply with all applicable requirements.

6.2 APPLICABLE MPCA AIR QUALITY REGULATIONS

The Final Scoping Decision Document requires:

- *A discussion of the ability of the BSL to meet applicable MPCA air quality regulations for the Project.*

MPCA regulations appliable for the Project include:

- Minn. R. 7007.0800 Subpart 2B – Permit Conditions Necessary to Protect Human Health and the Environment
- Minn. R. 7009.0080 – Minnesota Ambient Air Quality Standards
- Minn. R. 7009.0090 – National Ambient Air Quality Standards
- Minn. R. 7011.3510 – Incorporation by Reference; New Source Performance Standards; Municipal Solid Waste Landfills Existing On or After May 30, 1991 (incorporates 40 CFR 60 Subpart WWW)
- Minn. R. 7011.3515 – Incorporation by Reference; New Source Performance Standards; Municipal Solid Waste Landfills Existing After July 17, 2014 (incorporates 40 CFR 60 Subpart XXX)
- Minn. R. 7011.3525 – Incorporation by Reference; Emission Guidelines and Compliance Times; Municipal Solid Waste Landfills Existing On or Before July 17, 2014 (incorporates 40 CFR 60 Subpart Cf)
- Minn. R. 7011.7390 – Incorporation by Reference; Emission Standards; Municipal Solid Waste Landfills (incorporates 40 CFR 63 Subpart AAAA)

More information regarding BSL's ability to meet these standards is provided below.

6.2.1 Protecting Human Health and the Environment (Minn. R. 7007.0800)

Compliance with air toxics requirements is provided in Section 4.3.2.

6.2.2 Ambient Air Quality Standards (Minn. R. 7009.0080 and 7009.0090)

As shown in Tables 4-2 and 4-5, the Project meets the MAAQS and NAAQS for all pollutants.

6.2.3 NSPS and NESHAP Rules (Minn. R. 7011.3510, 7011.3515, 7011.3525, and 7011.7390)

Section 6.1 describes implementation measures to ensure compliance with federal requirements in the NSPS and NESHAP rules for MSW landfills. As noted in Section 6.1.1.2, Minn. R. 7011.3525 is currently state-enforceable only at the time of this report, but this rule implementing NSPS Subpart Cf will become federally-enforceable once U.S. EPA approves MPCA's implementation plan.

6.2.4 Other State Rules

BSL will continue to comply with applicable state rules, including those applicable to the EGUs and flare, as required by the current Air Emissions Permit No. 03700192-004.

7.0 ODORS

The Final Scoping Decision Document requires that:

- *The SEIS will review existing odor issues at the landfill and compare expected changes resulting from the Project. The SEIS will review current odor control protocols used at the BSL and review odor control methods used at other MSW landfills in the five-state area (Minnesota, North Dakota, South Dakota, Iowa, and Wisconsin.*

This section presents a review of existing odor issues at BSL and a comparison of expected changes resulting from the Project. In addition, this section reviews current odor controls at BSL and at other MSW landfills in the five-state area (Minnesota, North Dakota, South Dakota, Iowa, and Wisconsin). The information presented in the following sections is based on work by Carlson McCain, Inc. of Plymouth, Minnesota.

7.1 EXISTING ODOR ISSUES AT BSL

All MMSW landfills, including BSL, have the potential to generate odors. Odors can be generated directly by the waste delivered to the landfill and by the decomposition of the waste at the landfill. Odors at landfills are primarily caused by hydrogen sulfide and ammonia, and landfills require preventive practices and controls to minimize the potential for fugitive emissions of these and other malodorous compounds.

An assessment of existing odor issues at BSL was conducted by inquiring with BSL management, the City of Burnsville, and Dakota County about documented odor complaints received in the past five years.

- BSL management stated that no odor complaints have been received in the past five years (M. Miller, personal communication, January 2021).
- The City of Burnsville reported no odor complaints in the past five years (Faulkner, 2021). The City provided one odor complaint record from September 2015, which was logged for informational purposes and did not result in follow-up actions.
- Dakota County reported no odor complaints in the past five years (Magnuson, 2021).

7.2 CURRENT ODOR CONTROL PROTOCOLS USED AT BSL

BSL operates under the provisions of its Odor Control Plan (OCP), dated March 3, 2015 (Waste Management, 2015). The OCP is required by the Minnesota Pollution Control Agency (MPCA) Solid Waste Management Facility Permit for operation of the BSL and is thus a publicly availably document and subject to regulatory compliance and enforcement. The OCP includes proactive and reactive processes to control odor emissions from the site. The Plan is designed to prevent odor emissions and to address odor complaints that may arise. The following is a summary of the contents of the OCP:

Proactive measures include use of best management practices (BMPs) in the receiving, handling, placing, and covering of waste materials. Proactive measures also include operation of an active gas control system at the site. BMPs include the following specific practices:

- Burying particularly malodorous wastes in trenches and covering immediately.
- Minimizing excavation of previously placed wastes and re-covering excavated wastes as soon as possible.
- Placing daily cover (soil or tarps) over waste materials.
- Installing and operating an active gas collection system.
- Notifying public agencies and private neighbors in advance of activities that may produce odors.
- Training staff in implementing odor control practices.

Reactive measures are used to respond to odor complaints and the OCP includes detailed instructions for documenting and responding to odor complaints. Procedures include collection of pertinent information from the complainant; investigating potential odor sources; taking corrective actions; reporting complaints and responses to responsible regulatory agencies; and documenting the reactive measures process.

7.3 EXPECTED CHANGES IN ODOR ISSUES RESULTING FROM THE PROJECT

The Project is not expected to cause increased odors relative to current conditions. The Project is a continuation of existing operations at BSL and procedures for waste acceptance, handling, placement, and covering will be consistent with current practices. In particular, BSL will continue to employ the proactive measures listed in the OCP such as burying malodorous wastes immediately, minimizing excavations into the waste, and placing daily cover in order to minimize odors from the landfill working face. As the landfill height increases, final cover is installed on the side slopes and the amount of area available for use as working face will shrink. The working face also moves further from the BSL property boundary. Both of these factors decrease the potential for odor issues.

BSL will continue to operate the active gas collection system to prevent fugitive emissions of landfill gas. Gas will be collected and combusted using a flare and/or EGUs and malodorous compounds such as hydrogen sulfide, ammonia, and other non-methane organic compounds (NMOCs) are destroyed during combustion. BSL's Odor Control Plan will remain in effect, subject to modification as may be needed based on MPCA review during the solid waste permitting process. As with other permit-required documents, the OCP is subject to annual review to ensure it reflects current operational practices at BSL.

7.4 REVIEW OF ODOR CONTROL METHODS USED AT OTHER MSW LANDFILLS IN THE FIVE-STATE AREA

The review of odor control methods presented below was compiled through email and telephone correspondence with solid waste regulators in Minnesota, North Dakota, South Dakota, Iowa, and Wisconsin; and/or by review of landfill operations plans on file with state agencies for MSW landfills in each of those states.

The odor control methods described in the landfill operations plans and implemented at MSW landfills in the five-state area are all very similar, and are rather brief, typically a few sentences or paragraphs in length. Odor control methods identified in the plans include:

- Immediately burying and covering malodorous loads. (Tetra Tech, 2019) (SCS, 2018), (Wenck, 2012)
- Placement of daily cover (soil or tarps) over waste materials. (SCS, 2018) (Wenck, 2012)
- Minimizing disturbance of previously placed wastes. (Tetra Tech, 2019)
- In the case of larger facilities, operation of a gas control system. (Wenck, 2017) (SCS, 2018)
- Mention is made in a few plans of use of odor-masking agents if necessary. (Tetra Tech, 2019)

7.4.1 South Dakota

Solid waste regulators stated that the state does not regulate odors at landfills. Most landfills are located in rural areas where the neighbors are not close. Odor complaints that have been received have been related to composting operations located at or near landfill sites rather than to the landfills themselves (Kropp, 2019).

7.4.2 Iowa

Solid waste regulators stated that the state does not require landfills to provide odor control plans (Smith, 2019).

7.4.3 Wisconsin

Solid waste regulators stated that odor control measures are discussed in the plan of operation for each site (Joosten, 2019). In addition, landfills in Wisconsin are required to negotiate a local agreement between them and any municipalities located within 1,500 feet of the limit of waste if the municipality so chooses. One such facility that negotiated a local agreement identifies the following odor control methods in its plan: minimizing the size of the open working face, compacting and covering waste each day with at least 6” of cover soil or alternative daily cover such as shredder fluff, burying high-odor loads immediately, maintaining an odor-masking mister at the site, avoiding disturbance of existing waste disposal areas during warm weather, and operating a gas control system (Tetra Tech, 2019).

7.4.4 North Dakota and Minnesota

Solid waste regulators both stated that odor control measures are discussed in landfill operating plans (D. Trussell, personal communication, December 2019).

8.0 REFERENCES

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Faulkner, 2021. Faulkner, Jenni. "Re: SEIS Odor questions?" Received by Mike Miller, January 20, 2021.

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9.0 LIMITATIONS

The work product included in the attached was undertaken in full conformity with generally accepted professional consulting principles and practices and to the fullest extent as allowed by law we expressly disclaim all warranties, express or implied, including warranties of merchantability or fitness for a particular purpose. The work product was completed in full conformity with the contract with our client and this document is solely for the use and reliance of our client (unless previously agreed upon that a third party could rely on the work product) and any reliance on this work product by an unapproved outside party is at such party's risk.

The work product herein (including opinions, conclusions, suggestions, etc.) was prepared based on the situations and circumstances as found at the time, location, scope and goal of our performance and thus should be relied upon and used by our client recognizing these considerations and limitations. Cornerstone Environmental Group, LLC shall not be liable for the consequences of any change in environmental standards, practices, or regulations following the completion of our work and there is no warrant to the veracity of information provided by third parties, or the partial utilization of this work product.

APPENDIX A

LANDGEM FOR EXISTING LANDFILL

Summary Report

Landfill Name or Identifier: Burnsville Sanitary Landfill AP42

Date: Friday, February 5, 2021

Description/Comments:
Adjusted for 906,034 cy remaining permitted air space as of 1/1/20 - Only Permitted capacity incluided

About LandGEM:

First-Order Decomposition Rate Equation:

$$Q_{CH_4} = \sum_{i=1}^{n} \sum_{j=0.1}^{1} kL_o \left(\frac{M_i}{10}\right) e^{-kt_{ij}}$$

Where,
Q_{CH4} = annual methane generation in the year of the calculation ($m^3/year$)
i = 1-year time increment
n = (year of the calculation) - (initial year of waste acceptance)
j = 0.1-year time increment
k = methane generation rate ($year^{-1}$)
L_o = potential methane generation capacity (m^3/Mg)
M_i = mass of waste accepted in the ith year (Mg)
t_{ij} = age of the jth section of waste mass M_i accepted in the ith year (*decimal years*, e.g., 3.2 years)

LandGEM is based on a first-order decomposition rate equation for quantifying emissions from the decomposition of landfilled waste in municipal solid waste (MSW) landfills. The software provides a relatively simple approach to estimating landfill gas emissions. Model defaults are based on empirical data from U.S. landfills. Field test data can also be used in place of model defaults when available. Further guidance on EPA test methods, Clean Air Act (CAA) regulations, and other guidance regarding landfill gas emissions and control technology requirements can be found at http://www.epa.gov/ttnatw01/landfill/landflpg.html.

LandGEM is considered a screening tool — the better the input data, the better the estimates. Often, there are limitations with the available data regarding waste quantity and composition, variation in design and operating practices over time, and changes occurring over time that impact the emissions potential. Changes to landfill operation, such as operating under wet conditions through leachate recirculation or other liquid additions, will result in generating more gas at a faster rate. Defaults for estimating emissions for this type of operation are being developed to include in LandGEM along with defaults for convential landfills (no leachate or liquid additions) for developing emission inventories and determining CAA applicability. Refer to the Web site identified above for future updates.

Input Review

LANDFILL CHARACTERISTICS

Landfill Open Year	**1962**	
Landfill Closure Year (with 80-year limit)	**2022**	
Actual Closure Year (without limit)	***2022***	
Have Model Calculate Closure Year?	**Yes**	
Waste Design Capacity	**13,889,663**	*short tons*

MODEL PARAMETERS

Methane Generation Rate, k	**0.040**	*year^{-1}*
Potential Methane Generation Capacity, L_o	**100**	*m^3/Mg*
NMOC Concentration	**400**	*ppmv as hexane*
Methane Content	**50**	*% by volume*

GASES / POLLUTANTS SELECTED

Gas / Pollutant #1:	**Total landfill gas**
Gas / Pollutant #2:	**Methane**
Gas / Pollutant #3:	**Carbon dioxide**
Gas / Pollutant #4:	**NMOC**

WASTE ACCEPTANCE RATES

Year	Waste Accepted		Waste-In-Place	
	(Mg/year)	*(short tons/year)*	*(Mg)*	*(short tons)*
1962	154,545	170,000	0	0
1963	154,545	170,000	154,545	170,000
1964	154,545	170,000	309,091	340,000
1965	154,545	170,000	463,636	510,000
1966	154,545	170,000	618,182	680,000
1967	154,545	170,000	772,727	850,000
1968	154,545	170,000	927,273	1,020,000
1969	154,545	170,000	1,081,818	1,190,000
1970	154,545	170,000	1,236,364	1,360,000
1971	154,545	170,000	1,390,909	1,530,000
1972	154,545	170,000	1,545,455	1,700,000
1973	154,545	170,000	1,700,000	1,870,000
1974	154,545	170,000	1,854,545	2,040,000
1975	154,545	170,000	2,009,091	2,210,000
1976	154,545	170,000	2,163,636	2,380,000
1977	154,545	170,000	2,318,182	2,550,000
1978	154,545	170,000	2,472,727	2,720,000
1979	154,545	170,000	2,627,273	2,890,000
1980	154,545	170,000	2,781,818	3,060,000
1981	154,545	170,000	2,936,364	3,230,000
1982	154,545	170,000	3,090,909	3,400,000
1983	154,545	170,000	3,245,455	3,570,000
1984	154,545	170,000	3,400,000	3,740,000
1985	165,796	182,376	3,554,545	3,910,000
1986	219,347	241,282	3,720,342	4,092,376
1987	291,384	320,522	3,939,689	4,333,658
1988	298,135	327,949	4,231,073	4,654,180
1989	242,925	267,218	4,529,208	4,982,129
1990	94,323	103,755	4,772,134	5,249,347
1991	100,516	110,568	4,866,456	5,353,102
1992	107,050	117,755	4,966,973	5,463,670
1993	94,600	104,060	5,074,023	5,581,425
1994	107,740	118,514	5,168,623	5,685,485
1995	80,009	88,010	5,276,363	5,803,999
1996	144,970	159,467	5,356,372	5,892,009
1997	277,959	305,755	5,501,341	6,051,476
1998	272,727	300,000	5,779,300	6,357,231
1999	267,260	293,986	6,052,028	6,657,231
2000	281,890	310,079	6,319,288	6,951,217
2001	273,501	300,851	6,601,178	7,261,296

WASTE ACCEPTANCE RATES (Continued)

Year	Waste Accepted		Waste-In-Place	
	(Mg/year)	*(short tons/year)*	*(Mg)*	*(short tons)*
2002	236,568	260,225	6,874,679	7,562,146
2003	343,526	377,879	7,111,246	7,822,371
2004	326,965	359,661	7,454,772	8,200,250
2005	331,016	364,117	7,781,737	8,559,911
2006	336,102	369,712	8,112,753	8,924,028
2007	304,567	335,024	8,448,854	9,293,740
2008	283,122	311,434	8,753,422	9,628,764
2009	295,428	324,971	9,036,544	9,940,198
2010	283,720	312,092	9,331,972	10,265,169
2011	286,844	315,529	9,615,692	10,577,261
2012	258,709	284,580	9,902,536	10,892,790
2013	259,094	285,004	10,161,245	11,177,370
2014	224,948	247,443	10,420,340	11,462,374
2015	244,478	268,926	10,645,288	11,709,817
2016	298,499	328,349	10,889,766	11,978,742
2017	323,176	355,493	11,188,264	12,307,091
2018	305,604	336,165	11,511,440	12,662,584
2019	240,194	264,214	11,817,045	12,998,749
2020	207,516	228,268	12,057,239	13,262,963
2021	189,703	208,673	12,264,755	13,491,231
2022	172,509	189,760	12,454,458	13,699,904
2023	0	0	12,626,967	13,889,663
2024	0	0	12,626,967	13,889,663
2025	0	0	12,626,967	13,889,663
2026	0	0	12,626,967	13,889,663
2027	0	0	12,626,967	13,889,663
2028	0	0	12,626,967	13,889,663
2029	0	0	12,626,967	13,889,663
2030	0	0	12,626,967	13,889,663
2031	0	0	12,626,967	13,889,663
2032	0	0	12,626,967	13,889,663
2033	0	0	12,626,967	13,889,663
2034	0	0	12,626,967	13,889,663
2035	0	0	12,626,967	13,889,663
2036	0	0	12,626,967	13,889,663
2037	0	0	12,626,967	13,889,663
2038	0	0	12,626,967	13,889,663
2039	0	0	12,626,967	13,889,663
2040	0	0	12,626,967	13,889,663
2041	0	0	12,626,967	13,889,663

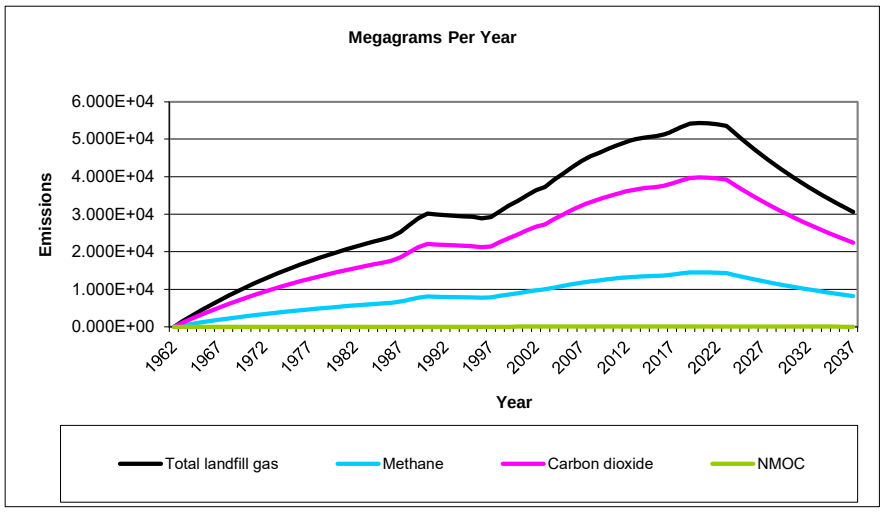
Pollutant Parameters

		Gas / Pollutant Default Parameters:		*User-specified Pollutant Parameters:*	
	Compound	Concentration (*ppmv*)	Molecular Weight	Concentration (*ppmv*)	Molecular Weight
Gases	Total landfill gas		0.00		
	Methane		16.04		
	Carbon dioxide		44.01		
	NMOC	4,000	86.18		
Pollutants	1,1,1-Trichloroethane (methyl chloroform) - HAP	0.48	133.41		
	1,1,2,2-Tetrachloroethane - HAP/VOC	1.1	167.85		
	1,1-Dichloroethane (ethylidene dichloride) - HAP/VOC	2.4	98.97		
	1,1-Dichloroethene (vinylidene chloride) - HAP/VOC	0.20	96.94		
	1,2-Dichloroethane (ethylene dichloride) - HAP/VOC	0.41	98.96		
	1,2-Dichloropropane (propylene dichloride) - HAP/VOC	0.18	112.99		
	2-Propanol (isopropyl alcohol) - VOC	50	60.11		
	Acetone	7.0	58.08		
	Acrylonitrile - HAP/VOC	6.3	53.06		
	Benzene - No or Unknown Co-disposal - HAP/VOC	1.9	78.11		
	Benzene - Co-disposal - HAP/VOC	11	78.11		
	Bromodichloromethane - VOC	3.1	163.83		
	Butane - VOC	5.0	58.12		
	Carbon disulfide - HAP/VOC	0.58	76.13		
	Carbon monoxide	140	28.01		
	Carbon tetrachloride - HAP/VOC	4.0E-03	153.84		
	Carbonyl sulfide - HAP/VOC	0.49	60.07		
	Chlorobenzene - HAP/VOC	0.25	112.56		
	Chlorodifluoromethane	1.3	86.47		
	Chloroethane (ethyl chloride) - HAP/VOC	1.3	64.52		
	Chloroform - HAP/VOC	0.03	119.39		
	Chloromethane - VOC	1.2	50.49		
	Dichlorobenzene - (HAP for para isomer/VOC)	0.21	147		
	Dichlorodifluoromethane	16	120.91		
	Dichlorofluoromethane - VOC	2.6	102.92		
	Dichloromethane (methylene chloride) - HAP	14	84.94		
	Dimethyl sulfide (methyl sulfide) - VOC	7.8	62.13		
	Ethane	890	30.07		
	Ethanol - VOC	27	46.08		

Pollutant Parameters (Continued)

		Gas / Pollutant Default Parameters:		***User-specified Pollutant Parameters:***	
	Compound	Concentration (*ppmv*)	Molecular Weight	Concentration (*ppmv*)	Molecular Weight
Pollutants	Ethyl mercaptan (ethanethiol) - VOC	2.3	62.13		
	Ethylbenzene - HAP/VOC	4.6	106.16		
	Ethylene dibromide - HAP/VOC	1.0E-03	187.88		
	Fluorotrichloromethane - VOC	0.76	137.38		
	Hexane - HAP/VOC	6.6	86.18		
	Hydrogen sulfide	36	34.08		
	Mercury (total) - HAP	2.9E-04	200.61		
	Methyl ethyl ketone - HAP/VOC	7.1	72.11		
	Methyl isobutyl ketone - HAP/VOC	1.9	100.16		
	Methyl mercaptan - VOC	2.5	48.11		
	Pentane - VOC	3.3	72.15		
	Perchloroethylene (tetrachloroethylene) - HAP	3.7	165.83		
	Propane - VOC	11	44.09		
	t-1,2-Dichloroethene - VOC	2.8	96.94		
	Toluene - No or Unknown Co-disposal - HAP/VOC	39	92.13		
	Toluene - Co-disposal - HAP/VOC	170	92.13		
	Trichloroethylene (trichloroethene) - HAP/VOC	2.8	131.40		
	Vinyl chloride - HAP/VOC	7.3	62.50		
	Xylenes - HAP/VOC	12	106.16		

Graphs


Megagrams Per Year
Emissions
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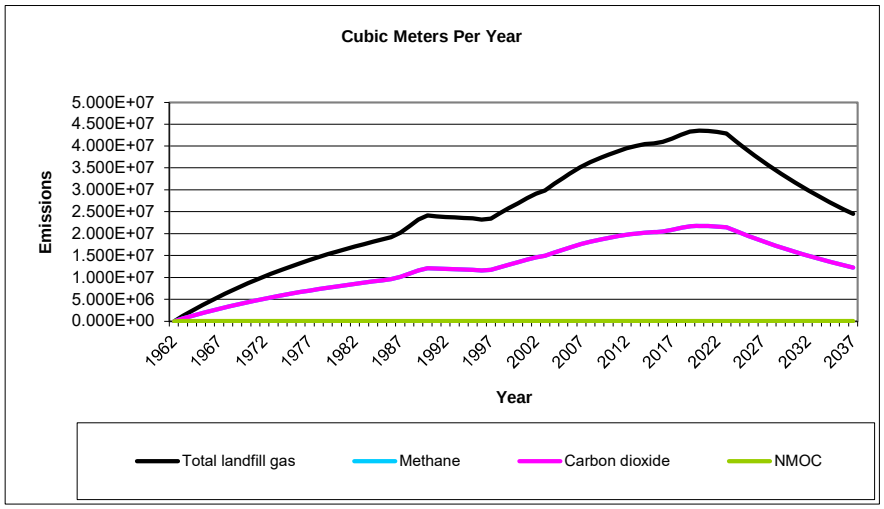
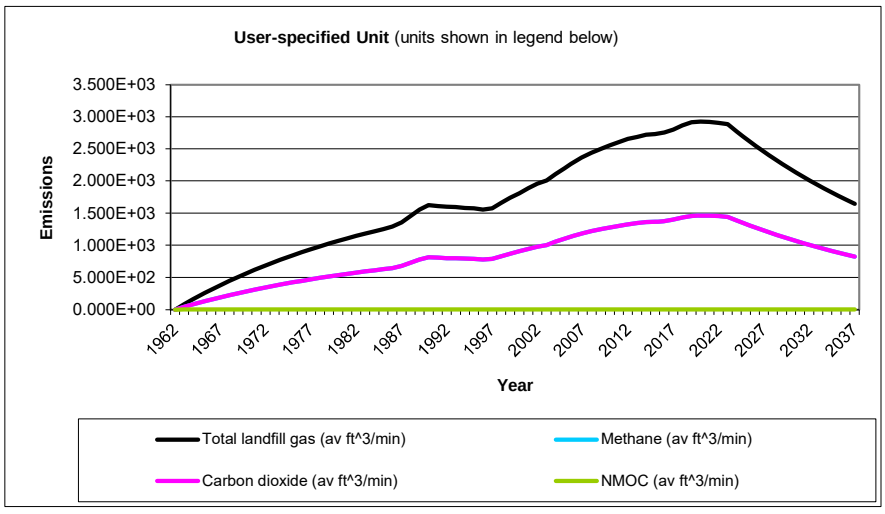
5.000E+04
4.000E+04
3.000E+04
2.000E+04
1.000E+04
0.000E+00
1962
1967
1972
1977
1982
1987
1992
1997
2002
2007
2012
2017
2022
2027
2032
2037
Year
Total landfill gas
Methane
Carbon dioxide
NMOC


Cubic Meters Per Year
Emissions
5.000E+07
4.500E+07
4.000E+07
3.500E+07
3.000E+07
2.500E+07
2.000E+07
1.500E+07
1.000E+07
5.000E+06
0.000E+00
1962
1967
1972
1977
1982
1987
1992
1997
2002
2007
2012
2017
2022
2027
2032
2037
Year
Total landfill gas
Methane
Carbon dioxide
NMOC


User-specified Unit (units shown in legend below)
Emissions
3.500E+03
3.000E+03
2.500E+03
2.000E+03
1.500E+03
1.000E+03
5.000E+02
0.000E+00
1962
1967
1972
1977
1982
1987
1992
1997
2002
2007
2012
2017
2022
2027
2032
2037
Year
Total landfill gas (av ft^3/min)
Methane (av ft^3/min)
Carbon dioxide (av ft^3/min)
NMOC (av ft^3/min)

Results

Year	Total landfill gas			Methane		
	(Mg/year)	*(m^3/year)*	*(av ft^3/min)*	*(Mg/year)*	*(m^3/year)*	*(av ft^3/min)*
1962	0	0	0	0	0	0
1963	1.517E+03	1.214E+06	8.159E+01	4.051E+02	6.072E+05	4.080E+01
1964	2.974E+03	2.381E+06	1.600E+02	7.943E+02	1.191E+06	7.999E+01
1965	4.374E+03	3.502E+06	2.353E+02	1.168E+03	1.751E+06	1.177E+02
1966	5.719E+03	4.579E+06	3.077E+02	1.528E+03	2.290E+06	1.538E+02
1967	7.011E+03	5.614E+06	3.772E+02	1.873E+03	2.807E+06	1.886E+02
1968	8.253E+03	6.608E+06	4.440E+02	2.204E+03	3.304E+06	2.220E+02
1969	9.446E+03	7.564E+06	5.082E+02	2.523E+03	3.782E+06	2.541E+02
1970	1.059E+04	8.481E+06	5.699E+02	2.829E+03	4.241E+06	2.849E+02
1971	1.169E+04	9.363E+06	6.291E+02	3.123E+03	4.682E+06	3.146E+02
1972	1.275E+04	1.021E+07	6.860E+02	3.406E+03	5.105E+06	3.430E+02
1973	1.377E+04	1.102E+07	7.407E+02	3.677E+03	5.512E+06	3.704E+02
1974	1.474E+04	1.181E+07	7.933E+02	3.938E+03	5.903E+06	3.966E+02
1975	1.568E+04	1.256E+07	8.438E+02	4.189E+03	6.279E+06	4.219E+02
1976	1.658E+04	1.328E+07	8.923E+02	4.430E+03	6.640E+06	4.461E+02
1977	1.745E+04	1.397E+07	9.389E+02	4.661E+03	6.987E+06	4.694E+02
1978	1.828E+04	1.464E+07	9.837E+02	4.884E+03	7.320E+06	4.918E+02
1979	1.908E+04	1.528E+07	1.027E+03	5.097E+03	7.640E+06	5.133E+02
1980	1.985E+04	1.590E+07	1.068E+03	5.302E+03	7.948E+06	5.340E+02
1981	2.059E+04	1.649E+07	1.108E+03	5.500E+03	8.243E+06	5.539E+02
1982	2.130E+04	1.705E+07	1.146E+03	5.689E+03	8.527E+06	5.730E+02
1983	2.198E+04	1.760E+07	1.183E+03	5.871E+03	8.800E+06	5.913E+02
1984	2.263E+04	1.812E+07	1.218E+03	6.046E+03	9.062E+06	6.089E+02
1985	2.326E+04	1.863E+07	1.252E+03	6.214E+03	9.314E+06	6.258E+02
1986	2.398E+04	1.920E+07	1.290E+03	6.405E+03	9.600E+06	6.450E+02
1987	2.519E+04	2.017E+07	1.355E+03	6.729E+03	1.009E+07	6.777E+02
1988	2.706E+04	2.167E+07	1.456E+03	7.229E+03	1.084E+07	7.280E+02
1989	2.893E+04	2.316E+07	1.556E+03	7.727E+03	1.158E+07	7.782E+02
1990	3.018E+04	2.416E+07	1.624E+03	8.060E+03	1.208E+07	8.118E+02
1991	2.992E+04	2.396E+07	1.610E+03	7.992E+03	1.198E+07	8.049E+02
1992	2.973E+04	2.381E+07	1.600E+03	7.942E+03	1.190E+07	7.998E+02
1993	2.962E+04	2.372E+07	1.593E+03	7.911E+03	1.186E+07	7.967E+02
1994	2.938E+04	2.353E+07	1.581E+03	7.849E+03	1.176E+07	7.905E+02
1995	2.929E+04	2.345E+07	1.576E+03	7.823E+03	1.173E+07	7.879E+02
1996	2.893E+04	2.316E+07	1.556E+03	7.726E+03	1.158E+07	7.781E+02
1997	2.921E+04	2.339E+07	1.572E+03	7.803E+03	1.170E+07	7.859E+02
1998	3.080E+04	2.466E+07	1.657E+03	8.226E+03	1.233E+07	8.285E+02
1999	3.226E+04	2.584E+07	1.736E+03	8.618E+03	1.292E+07	8.680E+02
2000	3.362E+04	2.692E+07	1.809E+03	8.981E+03	1.346E+07	9.045E+02
2001	3.507E+04	2.808E+07	1.887E+03	9.368E+03	1.404E+07	9.434E+02
2002	3.638E+04	2.913E+07	1.957E+03	9.717E+03	1.457E+07	9.786E+02
2003	3.727E+04	2.985E+07	2.005E+03	9.956E+03	1.492E+07	1.003E+03
2004	3.918E+04	3.138E+07	2.108E+03	1.047E+04	1.569E+07	1.054E+03
2005	4.086E+04	3.272E+07	2.198E+03	1.091E+04	1.636E+07	1.099E+03
2006	4.250E+04	3.403E+07	2.287E+03	1.135E+04	1.702E+07	1.143E+03
2007	4.413E+04	3.534E+07	2.374E+03	1.179E+04	1.767E+07	1.187E+03
2008	4.539E+04	3.635E+07	2.442E+03	1.212E+04	1.817E+07	1.221E+03
2009	4.639E+04	3.715E+07	2.496E+03	1.239E+04	1.857E+07	1.248E+03
2010	4.747E+04	3.801E+07	2.554E+03	1.268E+04	1.901E+07	1.277E+03
2011	4.839E+04	3.875E+07	2.604E+03	1.293E+04	1.938E+07	1.302E+03

Results (Continued)

Year	Total landfill gas			Methane		
	(Mg/year)	*(m^3/year)*	*(av ft^3/min)*	*(Mg/year)*	*(m^3/year)*	*(av ft^3/min)*
2012	4.931E+04	3.949E+07	2.653E+03	1.317E+04	1.974E+07	1.327E+03
2013	4.992E+04	3.997E+07	2.686E+03	1.333E+04	1.999E+07	1.343E+03
2014	5.050E+04	4.044E+07	2.717E+03	1.349E+04	2.022E+07	1.359E+03
2015	5.073E+04	4.062E+07	2.729E+03	1.355E+04	2.031E+07	1.365E+03
2016	5.114E+04	4.095E+07	2.751E+03	1.366E+04	2.047E+07	1.376E+03
2017	5.206E+04	4.169E+07	2.801E+03	1.391E+04	2.084E+07	1.401E+03
2018	5.319E+04	4.259E+07	2.862E+03	1.421E+04	2.130E+07	1.431E+03
2019	5.411E+04	4.332E+07	2.911E+03	1.445E+04	2.166E+07	1.455E+03
2020	5.434E+04	4.351E+07	2.924E+03	1.451E+04	2.176E+07	1.462E+03
2021	5.425E+04	4.344E+07	2.919E+03	1.449E+04	2.172E+07	1.459E+03
2022	5.398E+04	4.323E+07	2.904E+03	1.442E+04	2.161E+07	1.452E+03
2023	5.356E+04	4.289E+07	2.882E+03	1.431E+04	2.144E+07	1.441E+03
2024	5.146E+04	4.120E+07	2.769E+03	1.374E+04	2.060E+07	1.384E+03
2025	4.944E+04	3.959E+07	2.660E+03	1.321E+04	1.979E+07	1.330E+03
2026	4.750E+04	3.804E+07	2.556E+03	1.269E+04	1.902E+07	1.278E+03
2027	4.564E+04	3.655E+07	2.455E+03	1.219E+04	1.827E+07	1.228E+03
2028	4.385E+04	3.511E+07	2.359E+03	1.171E+04	1.756E+07	1.180E+03
2029	4.213E+04	3.374E+07	2.267E+03	1.125E+04	1.687E+07	1.133E+03
2030	4.048E+04	3.241E+07	2.178E+03	1.081E+04	1.621E+07	1.089E+03
2031	3.889E+04	3.114E+07	2.092E+03	1.039E+04	1.557E+07	1.046E+03
2032	3.737E+04	2.992E+07	2.010E+03	9.981E+03	1.496E+07	1.005E+03
2033	3.590E+04	2.875E+07	1.932E+03	9.589E+03	1.437E+07	9.658E+02
2034	3.449E+04	2.762E+07	1.856E+03	9.213E+03	1.381E+07	9.279E+02
2035	3.314E+04	2.654E+07	1.783E+03	8.852E+03	1.327E+07	8.915E+02
2036	3.184E+04	2.550E+07	1.713E+03	8.505E+03	1.275E+07	8.566E+02
2037	3.059E+04	2.450E+07	1.646E+03	8.172E+03	1.225E+07	8.230E+02
2038	2.939E+04	2.354E+07	1.581E+03	7.851E+03	1.177E+07	7.907E+02
2039	2.824E+04	2.261E+07	1.519E+03	7.543E+03	1.131E+07	7.597E+02
2040	2.713E+04	2.173E+07	1.460E+03	7.247E+03	1.086E+07	7.299E+02
2041	2.607E+04	2.087E+07	1.403E+03	6.963E+03	1.044E+07	7.013E+02
2042	2.505E+04	2.006E+07	1.348E+03	6.690E+03	1.003E+07	6.738E+02
2043	2.406E+04	1.927E+07	1.295E+03	6.428E+03	9.635E+06	6.474E+02
2044	2.312E+04	1.851E+07	1.244E+03	6.176E+03	9.257E+06	6.220E+02
2045	2.221E+04	1.779E+07	1.195E+03	5.934E+03	8.894E+06	5.976E+02
2046	2.134E+04	1.709E+07	1.148E+03	5.701E+03	8.545E+06	5.742E+02
2047	2.051E+04	1.642E+07	1.103E+03	5.478E+03	8.210E+06	5.517E+02
2048	1.970E+04	1.578E+07	1.060E+03	5.263E+03	7.888E+06	5.300E+02
2049	1.893E+04	1.516E+07	1.018E+03	5.056E+03	7.579E+06	5.092E+02
2050	1.819E+04	1.456E+07	9.785E+02	4.858E+03	7.282E+06	4.893E+02
2051	1.747E+04	1.399E+07	9.402E+02	4.668E+03	6.996E+06	4.701E+02
2052	1.679E+04	1.344E+07	9.033E+02	4.485E+03	6.722E+06	4.517E+02
2053	1.613E+04	1.292E+07	8.679E+02	4.309E+03	6.459E+06	4.339E+02
2054	1.550E+04	1.241E+07	8.339E+02	4.140E+03	6.205E+06	4.169E+02
2055	1.489E+04	1.192E+07	8.012E+02	3.978E+03	5.962E+06	4.006E+02
2056	1.431E+04	1.146E+07	7.698E+02	3.822E+03	5.728E+06	3.849E+02
2057	1.375E+04	1.101E+07	7.396E+02	3.672E+03	5.504E+06	3.698E+02
2058	1.321E+04	1.058E+07	7.106E+02	3.528E+03	5.288E+06	3.553E+02
2059	1.269E+04	1.016E+07	6.827E+02	3.389E+03	5.080E+06	3.414E+02
2060	1.219E+04	9.762E+06	6.559E+02	3.257E+03	4.881E+06	3.280E+02
2061	1.171E+04	9.380E+06	6.302E+02	3.129E+03	4.690E+06	3.151E+02
2062	1.125E+04	9.012E+06	6.055E+02	3.006E+03	4.506E+06	3.028E+02

Results (Continued)

Year	Total landfill gas			Methane		
	(Mg/year)	*(m^3/year)*	*(av ft^3/min)*	*(Mg/year)*	*(m^3/year)*	*(av ft^3/min)*
2063	1.081E+04	8.659E+06	5.818E+02	2.888E+03	4.329E+06	2.909E+02
2064	1.039E+04	8.319E+06	5.590E+02	2.775E+03	4.160E+06	2.795E+02
2065	9.982E+03	7.993E+06	5.370E+02	2.666E+03	3.996E+06	2.685E+02
2066	9.590E+03	7.679E+06	5.160E+02	2.562E+03	3.840E+06	2.580E+02
2067	9.214E+03	7.378E+06	4.957E+02	2.461E+03	3.689E+06	2.479E+02
2068	8.853E+03	7.089E+06	4.763E+02	2.365E+03	3.545E+06	2.382E+02
2069	8.506E+03	6.811E+06	4.576E+02	2.272E+03	3.406E+06	2.288E+02
2070	8.172E+03	6.544E+06	4.397E+02	2.183E+03	3.272E+06	2.198E+02
2071	7.852E+03	6.287E+06	4.224E+02	2.097E+03	3.144E+06	2.112E+02
2072	7.544E+03	6.041E+06	4.059E+02	2.015E+03	3.020E+06	2.029E+02
2073	7.248E+03	5.804E+06	3.900E+02	1.936E+03	2.902E+06	1.950E+02
2074	6.964E+03	5.576E+06	3.747E+02	1.860E+03	2.788E+06	1.873E+02
2075	6.691E+03	5.358E+06	3.600E+02	1.787E+03	2.679E+06	1.800E+02
2076	6.429E+03	5.148E+06	3.459E+02	1.717E+03	2.574E+06	1.729E+02
2077	6.176E+03	4.946E+06	3.323E+02	1.650E+03	2.473E+06	1.662E+02
2078	5.934E+03	4.752E+06	3.193E+02	1.585E+03	2.376E+06	1.596E+02
2079	5.702E+03	4.566E+06	3.068E+02	1.523E+03	2.283E+06	1.534E+02
2080	5.478E+03	4.387E+06	2.947E+02	1.463E+03	2.193E+06	1.474E+02
2081	5.263E+03	4.215E+06	2.832E+02	1.406E+03	2.107E+06	1.416E+02
2082	5.057E+03	4.049E+06	2.721E+02	1.351E+03	2.025E+06	1.360E+02
2083	4.859E+03	3.891E+06	2.614E+02	1.298E+03	1.945E+06	1.307E+02
2084	4.668E+03	3.738E+06	2.512E+02	1.247E+03	1.869E+06	1.256E+02
2085	4.485E+03	3.591E+06	2.413E+02	1.198E+03	1.796E+06	1.207E+02
2086	4.309E+03	3.451E+06	2.318E+02	1.151E+03	1.725E+06	1.159E+02
2087	4.140E+03	3.315E+06	2.228E+02	1.106E+03	1.658E+06	1.114E+02
2088	3.978E+03	3.185E+06	2.140E+02	1.063E+03	1.593E+06	1.070E+02
2089	3.822E+03	3.060E+06	2.056E+02	1.021E+03	1.530E+06	1.028E+02
2090	3.672E+03	2.940E+06	1.976E+02	9.808E+02	1.470E+06	9.878E+01
2091	3.528E+03	2.825E+06	1.898E+02	9.424E+02	1.413E+06	9.491E+01
2092	3.390E+03	2.714E+06	1.824E+02	9.054E+02	1.357E+06	9.119E+01
2093	3.257E+03	2.608E+06	1.752E+02	8.699E+02	1.304E+06	8.761E+01
2094	3.129E+03	2.506E+06	1.684E+02	8.358E+02	1.253E+06	8.418E+01
2095	3.006E+03	2.407E+06	1.618E+02	8.030E+02	1.204E+06	8.088E+01
2096	2.889E+03	2.313E+06	1.554E+02	7.716E+02	1.157E+06	7.771E+01
2097	2.775E+03	2.222E+06	1.493E+02	7.413E+02	1.111E+06	7.466E+01
2098	2.666E+03	2.135E+06	1.435E+02	7.122E+02	1.068E+06	7.173E+01
2099	2.562E+03	2.051E+06	1.378E+02	6.843E+02	1.026E+06	6.892E+01
2100	2.461E+03	1.971E+06	1.324E+02	6.575E+02	9.855E+05	6.622E+01
2101	2.365E+03	1.894E+06	1.272E+02	6.317E+02	9.469E+05	6.362E+01
2102	2.272E+03	1.819E+06	1.223E+02	6.069E+02	9.097E+05	6.113E+01

Results (Continued)

Year	Carbon dioxide			NMOC		
	(Mg/year)	*(m^3/year)*	*(av ft^3/min)*	*(Mg/year)*	*(m^3/year)*	*(av ft^3/min)*
1962	0	0	0	0	0	0
1963	1.111E+03	6.072E+05	4.080E+01	1.741E+00	4.858E+02	3.264E-02
1964	2.179E+03	1.191E+06	7.999E+01	3.414E+00	9.525E+02	6.400E-02
1965	3.205E+03	1.751E+06	1.177E+02	5.021E+00	1.401E+03	9.412E-02
1966	4.191E+03	2.290E+06	1.538E+02	6.566E+00	1.832E+03	1.231E-01
1967	5.138E+03	2.807E+06	1.886E+02	8.049E+00	2.246E+03	1.509E-01
1968	6.048E+03	3.304E+06	2.220E+02	9.475E+00	2.643E+03	1.776E-01
1969	6.923E+03	3.782E+06	2.541E+02	1.084E+01	3.025E+03	2.033E-01
1970	7.763E+03	4.241E+06	2.849E+02	1.216E+01	3.393E+03	2.279E-01
1971	8.570E+03	4.682E+06	3.146E+02	1.342E+01	3.745E+03	2.516E-01
1972	9.345E+03	5.105E+06	3.430E+02	1.464E+01	4.084E+03	2.744E-01
1973	1.009E+04	5.512E+06	3.704E+02	1.581E+01	4.410E+03	2.963E-01
1974	1.081E+04	5.903E+06	3.966E+02	1.693E+01	4.723E+03	3.173E-01
1975	1.149E+04	6.279E+06	4.219E+02	1.801E+01	5.023E+03	3.375E-01
1976	1.215E+04	6.640E+06	4.461E+02	1.904E+01	5.312E+03	3.569E-01
1977	1.279E+04	6.987E+06	4.694E+02	2.004E+01	5.589E+03	3.756E-01
1978	1.340E+04	7.320E+06	4.918E+02	2.099E+01	5.856E+03	3.935E-01
1979	1.399E+04	7.640E+06	5.133E+02	2.191E+01	6.112E+03	4.107E-01
1980	1.455E+04	7.948E+06	5.340E+02	2.279E+01	6.358E+03	4.272E-01
1981	1.509E+04	8.243E+06	5.539E+02	2.364E+01	6.595E+03	4.431E-01
1982	1.561E+04	8.527E+06	5.730E+02	2.445E+01	6.822E+03	4.584E-01
1983	1.611E+04	8.800E+06	5.913E+02	2.524E+01	7.040E+03	4.730E-01
1984	1.659E+04	9.062E+06	6.089E+02	2.599E+01	7.250E+03	4.871E-01
1985	1.705E+04	9.314E+06	6.258E+02	2.671E+01	7.451E+03	5.007E-01
1986	1.757E+04	9.600E+06	6.450E+02	2.753E+01	7.680E+03	5.160E-01
1987	1.846E+04	1.009E+07	6.777E+02	2.892E+01	8.069E+03	5.421E-01
1988	1.983E+04	1.084E+07	7.280E+02	3.107E+01	8.668E+03	5.824E-01
1989	2.120E+04	1.158E+07	7.782E+02	3.321E+01	9.265E+03	6.225E-01
1990	2.212E+04	1.208E+07	8.118E+02	3.465E+01	9.666E+03	6.494E-01
1991	2.193E+04	1.198E+07	8.049E+02	3.435E+01	9.583E+03	6.439E-01
1992	2.179E+04	1.190E+07	7.998E+02	3.414E+01	9.523E+03	6.399E-01
1993	2.171E+04	1.186E+07	7.967E+02	3.400E+01	9.486E+03	6.374E-01
1994	2.153E+04	1.176E+07	7.905E+02	3.374E+01	9.412E+03	6.324E-01
1995	2.147E+04	1.173E+07	7.879E+02	3.363E+01	9.381E+03	6.303E-01
1996	2.120E+04	1.158E+07	7.781E+02	3.321E+01	9.265E+03	6.225E-01
1997	2.141E+04	1.170E+07	7.859E+02	3.354E+01	9.357E+03	6.287E-01
1998	2.257E+04	1.233E+07	8.285E+02	3.536E+01	9.864E+03	6.628E-01
1999	2.365E+04	1.292E+07	8.680E+02	3.704E+01	1.033E+04	6.944E-01
2000	2.464E+04	1.346E+07	9.045E+02	3.860E+01	1.077E+04	7.236E-01
2001	2.570E+04	1.404E+07	9.434E+02	4.026E+01	1.123E+04	7.547E-01
2002	2.666E+04	1.457E+07	9.786E+02	4.177E+01	1.165E+04	7.829E-01
2003	2.732E+04	1.492E+07	1.003E+03	4.279E+01	1.194E+04	8.022E-01
2004	2.872E+04	1.569E+07	1.054E+03	4.499E+01	1.255E+04	8.433E-01
2005	2.994E+04	1.636E+07	1.099E+03	4.691E+01	1.309E+04	8.793E-01
2006	3.115E+04	1.702E+07	1.143E+03	4.880E+01	1.361E+04	9.147E-01
2007	3.234E+04	1.767E+07	1.187E+03	5.067E+01	1.414E+04	9.498E-01
2008	3.327E+04	1.817E+07	1.221E+03	5.211E+01	1.454E+04	9.769E-01
2009	3.400E+04	1.857E+07	1.248E+03	5.326E+01	1.486E+04	9.984E-01
2010	3.479E+04	1.901E+07	1.277E+03	5.450E+01	1.520E+04	1.022E+00
2011	3.547E+04	1.938E+07	1.302E+03	5.556E+01	1.550E+04	1.041E+00

Results (Continued)

Year	Carbon dioxide			NMOC		
	(Mg/year)	*(m^3/year)*	*(av ft^3/min)*	*(Mg/year)*	*(m^3/year)*	*(av ft^3/min)*
2012	3.614E+04	1.974E+07	1.327E+03	5.661E+01	1.579E+04	1.061E+00
2013	3.658E+04	1.999E+07	1.343E+03	5.731E+01	1.599E+04	1.074E+00
2014	3.701E+04	2.022E+07	1.359E+03	5.798E+01	1.618E+04	1.087E+00
2015	3.718E+04	2.031E+07	1.365E+03	5.824E+01	1.625E+04	1.092E+00
2016	3.748E+04	2.047E+07	1.376E+03	5.871E+01	1.638E+04	1.101E+00
2017	3.816E+04	2.084E+07	1.401E+03	5.977E+01	1.668E+04	1.120E+00
2018	3.898E+04	2.130E+07	1.431E+03	6.107E+01	1.704E+04	1.145E+00
2019	3.965E+04	2.166E+07	1.455E+03	6.212E+01	1.733E+04	1.164E+00
2020	3.983E+04	2.176E+07	1.462E+03	6.239E+01	1.741E+04	1.169E+00
2021	3.976E+04	2.172E+07	1.459E+03	6.228E+01	1.738E+04	1.167E+00
2022	3.956E+04	2.161E+07	1.452E+03	6.198E+01	1.729E+04	1.162E+00
2023	3.925E+04	2.144E+07	1.441E+03	6.149E+01	1.715E+04	1.153E+00
2024	3.771E+04	2.060E+07	1.384E+03	5.908E+01	1.648E+04	1.107E+00
2025	3.623E+04	1.979E+07	1.330E+03	5.676E+01	1.584E+04	1.064E+00
2026	3.481E+04	1.902E+07	1.278E+03	5.454E+01	1.521E+04	1.022E+00
2027	3.345E+04	1.827E+07	1.228E+03	5.240E+01	1.462E+04	9.822E-01
2028	3.214E+04	1.756E+07	1.180E+03	5.034E+01	1.404E+04	9.437E-01
2029	3.088E+04	1.687E+07	1.133E+03	4.837E+01	1.349E+04	9.067E-01
2030	2.967E+04	1.621E+07	1.089E+03	4.647E+01	1.297E+04	8.711E-01
2031	2.850E+04	1.557E+07	1.046E+03	4.465E+01	1.246E+04	8.370E-01
2032	2.738E+04	1.496E+07	1.005E+03	4.290E+01	1.197E+04	8.041E-01
2033	2.631E+04	1.437E+07	9.658E+02	4.122E+01	1.150E+04	7.726E-01
2034	2.528E+04	1.381E+07	9.279E+02	3.960E+01	1.105E+04	7.423E-01
2035	2.429E+04	1.327E+07	8.915E+02	3.805E+01	1.061E+04	7.132E-01
2036	2.334E+04	1.275E+07	8.566E+02	3.656E+01	1.020E+04	6.852E-01
2037	2.242E+04	1.225E+07	8.230E+02	3.512E+01	9.799E+03	6.584E-01
2038	2.154E+04	1.177E+07	7.907E+02	3.375E+01	9.415E+03	6.326E-01
2039	2.070E+04	1.131E+07	7.597E+02	3.242E+01	9.045E+03	6.078E-01
2040	1.989E+04	1.086E+07	7.299E+02	3.115E+01	8.691E+03	5.839E-01
2041	1.911E+04	1.044E+07	7.013E+02	2.993E+01	8.350E+03	5.610E-01
2042	1.836E+04	1.003E+07	6.738E+02	2.876E+01	8.023E+03	5.390E-01
2043	1.764E+04	9.635E+06	6.474E+02	2.763E+01	7.708E+03	5.179E-01
2044	1.695E+04	9.257E+06	6.220E+02	2.655E+01	7.406E+03	4.976E-01
2045	1.628E+04	8.894E+06	5.976E+02	2.550E+01	7.115E+03	4.781E-01
2046	1.564E+04	8.545E+06	5.742E+02	2.450E+01	6.836E+03	4.593E-01
2047	1.503E+04	8.210E+06	5.517E+02	2.354E+01	6.568E+03	4.413E-01
2048	1.444E+04	7.888E+06	5.300E+02	2.262E+01	6.311E+03	4.240E-01
2049	1.387E+04	7.579E+06	5.092E+02	2.173E+01	6.063E+03	4.074E-01
2050	1.333E+04	7.282E+06	4.893E+02	2.088E+01	5.826E+03	3.914E-01
2051	1.281E+04	6.996E+06	4.701E+02	2.006E+01	5.597E+03	3.761E-01
2052	1.230E+04	6.722E+06	4.517E+02	1.928E+01	5.378E+03	3.613E-01
2053	1.182E+04	6.459E+06	4.339E+02	1.852E+01	5.167E+03	3.472E-01
2054	1.136E+04	6.205E+06	4.169E+02	1.779E+01	4.964E+03	3.335E-01
2055	1.091E+04	5.962E+06	4.006E+02	1.710E+01	4.770E+03	3.205E-01
2056	1.049E+04	5.728E+06	3.849E+02	1.643E+01	4.583E+03	3.079E-01
2057	1.007E+04	5.504E+06	3.698E+02	1.578E+01	4.403E+03	2.958E-01
2058	9.679E+03	5.288E+06	3.553E+02	1.516E+01	4.230E+03	2.842E-01
2059	9.300E+03	5.080E+06	3.414E+02	1.457E+01	4.064E+03	2.731E-01
2060	8.935E+03	4.881E+06	3.280E+02	1.400E+01	3.905E+03	2.624E-01
2061	8.585E+03	4.690E+06	3.151E+02	1.345E+01	3.752E+03	2.521E-01
2062	8.248E+03	4.506E+06	3.028E+02	1.292E+01	3.605E+03	2.422E-01

Results (Continued)

Year	Carbon dioxide			NMOC		
	(Mg/year)	*(m^3/year)*	*(av ft^3/min)*	*(Mg/year)*	*(m^3/year)*	*(av ft^3/min)*
2063	7.925E+03	4.329E+06	2.909E+02	1.241E+01	3.463E+03	2.327E-01
2064	7.614E+03	4.160E+06	2.795E+02	1.193E+01	3.328E+03	2.236E-01
2065	7.315E+03	3.996E+06	2.685E+02	1.146E+01	3.197E+03	2.148E-01
2066	7.029E+03	3.840E+06	2.580E+02	1.101E+01	3.072E+03	2.064E-01
2067	6.753E+03	3.689E+06	2.479E+02	1.058E+01	2.951E+03	1.983E-01
2068	6.488E+03	3.545E+06	2.382E+02	1.016E+01	2.836E+03	1.905E-01
2069	6.234E+03	3.406E+06	2.288E+02	9.766E+00	2.724E+03	1.831E-01
2070	5.989E+03	3.272E+06	2.198E+02	9.383E+00	2.618E+03	1.759E-01
2071	5.755E+03	3.144E+06	2.112E+02	9.015E+00	2.515E+03	1.690E-01
2072	5.529E+03	3.020E+06	2.029E+02	8.661E+00	2.416E+03	1.624E-01
2073	5.312E+03	2.902E+06	1.950E+02	8.322E+00	2.322E+03	1.560E-01
2074	5.104E+03	2.788E+06	1.873E+02	7.995E+00	2.231E+03	1.499E-01
2075	4.904E+03	2.679E+06	1.800E+02	7.682E+00	2.143E+03	1.440E-01
2076	4.711E+03	2.574E+06	1.729E+02	7.381E+00	2.059E+03	1.383E-01
2077	4.527E+03	2.473E+06	1.662E+02	7.091E+00	1.978E+03	1.329E-01
2078	4.349E+03	2.376E+06	1.596E+02	6.813E+00	1.901E+03	1.277E-01
2079	4.179E+03	2.283E+06	1.534E+02	6.546E+00	1.826E+03	1.227E-01
2080	4.015E+03	2.193E+06	1.474E+02	6.289E+00	1.755E+03	1.179E-01
2081	3.857E+03	2.107E+06	1.416E+02	6.043E+00	1.686E+03	1.133E-01
2082	3.706E+03	2.025E+06	1.360E+02	5.806E+00	1.620E+03	1.088E-01
2083	3.561E+03	1.945E+06	1.307E+02	5.578E+00	1.556E+03	1.046E-01
2084	3.421E+03	1.869E+06	1.256E+02	5.359E+00	1.495E+03	1.005E-01
2085	3.287E+03	1.796E+06	1.207E+02	5.149E+00	1.437E+03	9.652E-02
2086	3.158E+03	1.725E+06	1.159E+02	4.947E+00	1.380E+03	9.274E-02
2087	3.034E+03	1.658E+06	1.114E+02	4.753E+00	1.326E+03	8.910E-02
2088	2.915E+03	1.593E+06	1.070E+02	4.567E+00	1.274E+03	8.561E-02
2089	2.801E+03	1.530E+06	1.028E+02	4.388E+00	1.224E+03	8.225E-02
2090	2.691E+03	1.470E+06	9.878E+01	4.216E+00	1.176E+03	7.903E-02
2091	2.586E+03	1.413E+06	9.491E+01	4.051E+00	1.130E+03	7.593E-02
2092	2.484E+03	1.357E+06	9.119E+01	3.892E+00	1.086E+03	7.295E-02
2093	2.387E+03	1.304E+06	8.761E+01	3.739E+00	1.043E+03	7.009E-02
2094	2.293E+03	1.253E+06	8.418E+01	3.593E+00	1.002E+03	6.734E-02
2095	2.203E+03	1.204E+06	8.088E+01	3.452E+00	9.630E+02	6.470E-02
2096	2.117E+03	1.157E+06	7.771E+01	3.316E+00	9.252E+02	6.216E-02
2097	2.034E+03	1.111E+06	7.466E+01	3.186E+00	8.889E+02	5.973E-02
2098	1.954E+03	1.068E+06	7.173E+01	3.061E+00	8.541E+02	5.738E-02
2099	1.878E+03	1.026E+06	6.892E+01	2.941E+00	8.206E+02	5.513E-02
2100	1.804E+03	9.855E+05	6.622E+01	2.826E+00	7.884E+02	5.297E-02
2101	1.733E+03	9.469E+05	6.362E+01	2.715E+00	7.575E+02	5.090E-02
2102	1.665E+03	9.097E+05	6.113E+01	2.609E+00	7.278E+02	4.890E-02

APPENDIX B

LANDGEM FOR EXPANSION AND POST-PROJECT

Summary Report

Landfill Name or Identifier: Burnsville Sanitary Landfill AP42

Date: Sunday, December 20, 2020

Description/Comments:
Expansion tons only - No Freeway. AUF=1 tons/cy

About LandGEM:

First-Order Decomposition Rate Equation:

$$Q_{CH_4} = \sum_{i=1}^{n} \sum_{j=0.1}^{1} kL_o \left(\frac{M_i}{10}\right) e^{-kt_{ij}}$$

Where,
Q_{CH4} = annual methane generation in the year of the calculation ($m^3/year$)
i = 1-year time increment
n = (year of the calculation) - (initial year of waste acceptance)
j = 0.1-year time increment
k = methane generation rate ($year^{-1}$)
L_o = potential methane generation capacity (m^3/Mg)
M_i = mass of waste accepted in the ith year (Mg)
t_{ij} = age of the jth section of waste mass M_i accepted in the ith year (*decimal years*, e.g., 3.2 years)

LandGEM is based on a first-order decomposition rate equation for quantifying emissions from the decomposition of landfilled waste in municipal solid waste (MSW) landfills. The software provides a relatively simple approach to estimating landfill gas emissions. Model defaults are based on empirical data from U.S. landfills. Field test data can also be used in place of model defaults when available. Further guidance on EPA test methods, Clean Air Act (CAA) regulations, and other guidance regarding landfill gas emissions and control technology requirements can be found at http://www.epa.gov/ttnatw01/landfill/landflpg.html.

LandGEM is considered a screening tool — the better the input data, the better the estimates. Often, there are limitations with the available data regarding waste quantity and composition, variation in design and operating practices over time, and changes occurring over time that impact the emissions potential. Changes to landfill operation, such as operating under wet conditions through leachate recirculation or other liquid additions, will result in generating more gas at a faster rate. Defaults for estimating emissions for this type of operation are being developed to include in LandGEM along with defaults for convential landfills (no leachate or liquid additions) for developing emission inventories and determining CAA applicability. Refer to the Web site identified above for future updates.

Input Review

LANDFILL CHARACTERISTICS

Landfill Open Year	**2023**	
Landfill Closure Year (with 80-year limit)	**2067**	
Actual Closure Year (without limit)	***2067***	
Have Model Calculate Closure Year?	**Yes**	
Waste Design Capacity	**22,439,261**	*short tons*

MODEL PARAMETERS

Methane Generation Rate, k	**0.040**	*year $^{-1}$*
Potential Methane Generation Capacity, L_o	**100**	*m^3/Mg*
NMOC Concentration	**400**	*ppmv as hexane*
Methane Content	**50**	*% by volume*

GASES / POLLUTANTS SELECTED

Gas / Pollutant #1:	**Total landfill gas**
Gas / Pollutant #2:	**Methane**
Gas / Pollutant #3:	**Carbon dioxide**
Gas / Pollutant #4:	**NMOC**

WASTE ACCEPTANCE RATES

Year	Waste Accepted		Waste-In-Place	
	(Mg/year)	*(short tons/year)*	*(Mg)*	*(short tons)*
2023	363,776	400,154	0	0
2024	367,415	404,156	363,776	400,154
2025	371,088	408,197	731,191	804,310
2026	374,799	412,279	1,102,279	1,212,507
2027	378,547	416,402	1,477,078	1,624,786
2028	382,333	420,566	1,855,625	2,041,188
2029	386,156	424,772	2,237,958	2,461,754
2030	390,017	429,019	2,624,115	2,886,526
2031	393,917	433,309	3,014,132	3,315,545
2032	397,857	437,643	3,408,049	3,748,854
2033	401,835	442,019	3,805,906	4,186,497
2034	405,854	446,439	4,207,742	4,628,516
2035	409,913	450,904	4,613,595	5,074,955
2036	414,012	455,413	5,023,508	5,525,859
2037	418,152	459,967	5,437,520	5,981,272
2038	422,333	464,566	5,855,672	6,441,239
2039	426,556	469,212	6,278,005	6,905,805
2040	430,822	473,904	6,704,561	7,375,017
2041	435,130	478,643	7,135,383	7,848,921
2042	439,482	483,430	7,570,513	8,327,564
2043	443,876	488,264	8,009,995	8,810,994
2044	448,315	493,147	8,453,871	9,299,258
2045	452,798	498,078	8,902,186	9,792,405
2046	457,326	503,059	9,354,985	10,290,483
2047	461,899	508,089	9,812,311	10,793,542
2048	466,518	513,170	10,274,210	11,301,631
2049	471,184	518,302	10,740,728	11,814,801
2050	475,895	523,485	11,211,912	12,333,103
2051	480,655	528,720	11,687,807	12,856,588
2052	485,461	534,007	12,168,462	13,385,308
2053	490,315	539,347	12,653,923	13,919,315
2054	495,219	544,741	13,144,238	14,458,662
2055	500,171	550,188	13,639,457	15,003,403
2056	505,173	555,690	14,139,628	15,553,591
2057	510,225	561,247	14,644,801	16,109,281
2058	515,326	566,859	15,155,025	16,670,528
2059	520,480	572,528	15,670,352	17,237,387
2060	525,685	578,253	16,190,832	17,809,915
2061	530,942	584,036	16,716,516	18,388,168
2062	536,251	589,876	17,247,458	18,972,204

WASTE ACCEPTANCE RATES (Continued)

Year	Waste Accepted		Waste-In-Place	
	(Mg/year)	*(short tons/year)*	*(Mg)*	*(short tons)*
2063	536,251	589,876	17,783,709	19,562,080
2064	536,251	589,876	18,319,960	20,151,956
2065	536,251	589,876	18,856,211	20,741,832
2066	536,251	589,876	19,392,462	21,331,708
2067	470,616	517,677	19,928,713	21,921,584
2068	0	0	20,399,328	22,439,261
2069	0	0	20,399,328	22,439,261
2070	0	0	20,399,328	22,439,261
2071	0	0	20,399,328	22,439,261
2072	0	0	20,399,328	22,439,261
2073	0	0	20,399,328	22,439,261
2074	0	0	20,399,328	22,439,261
2075	0	0	20,399,328	22,439,261
2076	0	0	20,399,328	22,439,261
2077	0	0	20,399,328	22,439,261
2078	0	0	20,399,328	22,439,261
2079	0	0	20,399,328	22,439,261
2080	0	0	20,399,328	22,439,261
2081	0	0	20,399,328	22,439,261
2082	0	0	20,399,328	22,439,261
2083	0	0	20,399,328	22,439,261
2084	0	0	20,399,328	22,439,261
2085	0	0	20,399,328	22,439,261
2086	0	0	20,399,328	22,439,261
2087	0	0	20,399,328	22,439,261
2088	0	0	20,399,328	22,439,261
2089	0	0	20,399,328	22,439,261
2090	0	0	20,399,328	22,439,261
2091	0	0	20,399,328	22,439,261
2092	0	0	20,399,328	22,439,261
2093	0	0	20,399,328	22,439,261
2094	0	0	20,399,328	22,439,261
2095	0	0	20,399,328	22,439,261
2096	0	0	20,399,328	22,439,261
2097	0	0	20,399,328	22,439,261
2098	0	0	20,399,328	22,439,261
2099	0	0	20,399,328	22,439,261
2100	0	0	20,399,328	22,439,261
2101	0	0	20,399,328	22,439,261
2102	0	0	20,399,328	22,439,261

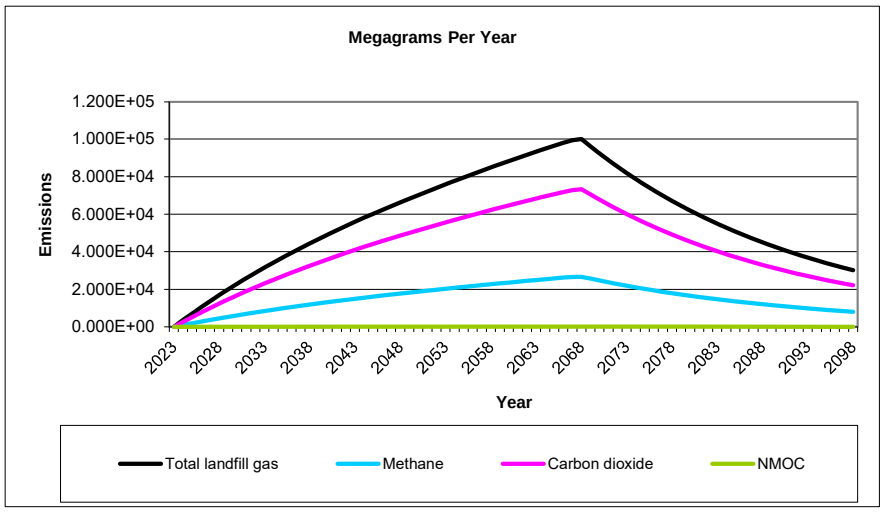
Pollutant Parameters

		Gas / Pollutant Default Parameters:		*User-specified Pollutant Parameters:*	
	Compound	Concentration (*ppmv*)	Molecular Weight	Concentration (*ppmv*)	Molecular Weight
Gases	Total landfill gas		0.00		
	Methane		16.04		
	Carbon dioxide		44.01		
	NMOC	4,000	86.18		
Pollutants	1,1,1-Trichloroethane (methyl chloroform) - HAP	0.48	133.41		
	1,1,2,2-Tetrachloroethane - HAP/VOC	1.1	167.85		
	1,1-Dichloroethane (ethylidene dichloride) - HAP/VOC	2.4	98.97		
	1,1-Dichloroethene (vinylidene chloride) - HAP/VOC	0.20	96.94		
	1,2-Dichloroethane (ethylene dichloride) - HAP/VOC	0.41	98.96		
	1,2-Dichloropropane (propylene dichloride) - HAP/VOC	0.18	112.99		
	2-Propanol (isopropyl alcohol) - VOC	50	60.11		
	Acetone	7.0	58.08		
	Acrylonitrile - HAP/VOC	6.3	53.06		
	Benzene - No or Unknown Co-disposal - HAP/VOC	1.9	78.11		
	Benzene - Co-disposal - HAP/VOC	11	78.11		
	Bromodichloromethane - VOC	3.1	163.83		
	Butane - VOC	5.0	58.12		
	Carbon disulfide - HAP/VOC	0.58	76.13		
	Carbon monoxide	140	28.01		
	Carbon tetrachloride - HAP/VOC	4.0E-03	153.84		
	Carbonyl sulfide - HAP/VOC	0.49	60.07		
	Chlorobenzene - HAP/VOC	0.25	112.56		
	Chlorodifluoromethane	1.3	86.47		
	Chloroethane (ethyl chloride) - HAP/VOC	1.3	64.52		
	Chloroform - HAP/VOC	0.03	119.39		
	Chloromethane - VOC	1.2	50.49		
	Dichlorobenzene - (HAP for para isomer/VOC)	0.21	147		
	Dichlorodifluoromethane	16	120.91		
	Dichlorofluoromethane - VOC	2.6	102.92		
	Dichloromethane (methylene chloride) - HAP	14	84.94		
	Dimethyl sulfide (methyl sulfide) - VOC	7.8	62.13		
	Ethane	890	30.07		
	Ethanol - VOC	27	46.08		

Pollutant Parameters (Continued)

		Gas / Pollutant Default Parameters:		*User-specified Pollutant Parameters:*	
	Compound	Concentration (*ppmv*)	Molecular Weight	Concentration (*ppmv*)	Molecular Weight
Pollutants	Ethyl mercaptan (ethanethiol) - VOC	2.3	62.13		
	Ethylbenzene - HAP/VOC	4.6	106.16		
	Ethylene dibromide - HAP/VOC	1.0E-03	187.88		
	Fluorotrichloromethane - VOC	0.76	137.38		
	Hexane - HAP/VOC	6.6	86.18		
	Hydrogen sulfide	36	34.08		
	Mercury (total) - HAP	2.9E-04	200.61		
	Methyl ethyl ketone - HAP/VOC	7.1	72.11		
	Methyl isobutyl ketone - HAP/VOC	1.9	100.16		
	Methyl mercaptan - VOC	2.5	48.11		
	Pentane - VOC	3.3	72.15		
	Perchloroethylene (tetrachloroethylene) - HAP	3.7	165.83		
	Propane - VOC	11	44.09		
	t-1,2-Dichloroethene - VOC	2.8	96.94		
	Toluene - No or Unknown Co-disposal - HAP/VOC	39	92.13		
	Toluene - Co-disposal - HAP/VOC	170	92.13		
	Trichloroethylene (trichloroethene) - HAP/VOC	2.8	131.40		
	Vinyl chloride - HAP/VOC	7.3	62.50		
	Xylenes - HAP/VOC	12	106.16		

Graphs


Megagrams Per Year
Emissions
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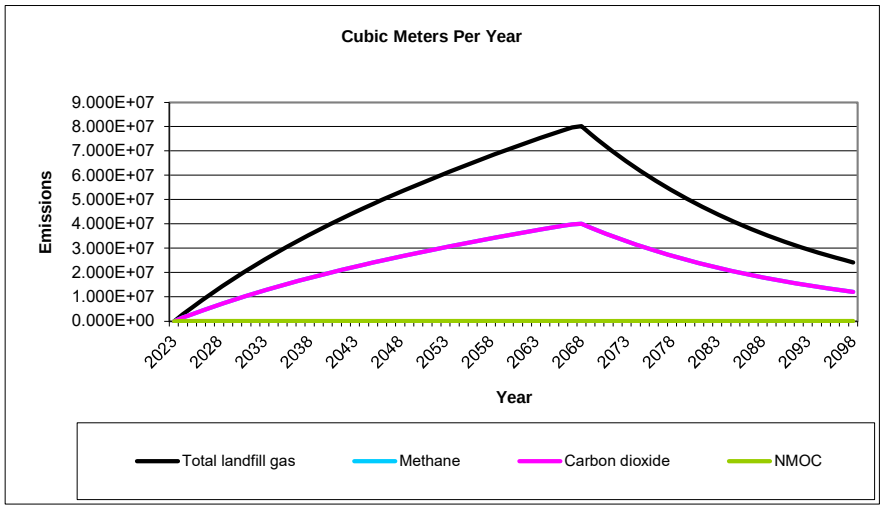
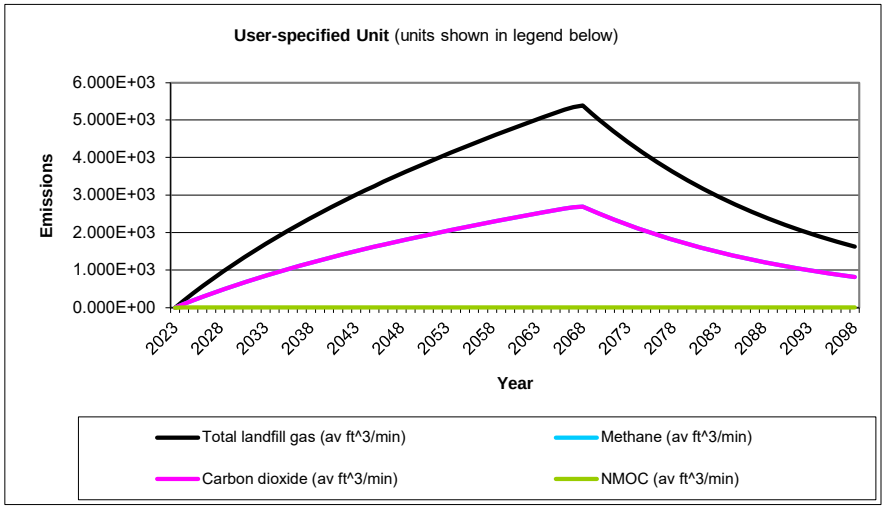
1.000E+05
8.000E+04
6.000E+04
4.000E+04
2.000E+04
0.000E+00
2023
2028
2033
2038
2043
2048
2053
2058
2063
2068
2073
2078
2083
2088
2093
2098
Year
Total landfill gas
Methane
Carbon dioxide
NMOC


Cubic Meters Per Year
Emissions
9.000E+07
8.000E+07
7.000E+07
6.000E+07
5.000E+07
4.000E+07
3.000E+07
2.000E+07
1.000E+07
0.000E+00
2023
2028
2033
2038
2043
2048
2053
2058
2063
2068
2073
2078
2083
2088
2093
2098
Year
Total landfill gas
Methane
Carbon dioxide
NMOC


User-specified Unit (units shown in legend below)
Emissions
6.000E+03
5.000E+03
4.000E+03
3.000E+03
2.000E+03
1.000E+03
0.000E+00
2023
2028
2033
2038
2043
2048
2053
2058
2063
2068
2073
2078
2083
2088
2093
2098
Year
Total landfill gas (av ft^3/min)
Methane (av ft^3/min)
Carbon dioxide (av ft^3/min)
NMOC (av ft^3/min)

Results

Year	Total landfill gas			Methane		
	(Mg/year)	*(m^3/year)*	*(av ft^3/min)*	*(Mg/year)*	*(m^3/year)*	*(av ft^3/min)*
2023	0	0	0	0	0	0
2024	3.570E+03	2.858E+06	1.921E+02	9.535E+02	1.429E+06	9.603E+01
2025	7.035E+03	5.633E+06	3.785E+02	1.879E+03	2.817E+06	1.893E+02
2026	1.040E+04	8.329E+06	5.596E+02	2.778E+03	4.164E+06	2.798E+02
2027	1.367E+04	1.095E+07	7.355E+02	3.652E+03	5.474E+06	3.678E+02
2028	1.685E+04	1.349E+07	9.066E+02	4.501E+03	6.746E+06	4.533E+02
2029	1.994E+04	1.597E+07	1.073E+03	5.326E+03	7.984E+06	5.364E+02
2030	2.295E+04	1.838E+07	1.235E+03	6.130E+03	9.188E+06	6.173E+02
2031	2.588E+04	2.072E+07	1.392E+03	6.912E+03	1.036E+07	6.961E+02
2032	2.873E+04	2.300E+07	1.546E+03	7.673E+03	1.150E+07	7.728E+02
2033	3.150E+04	2.523E+07	1.695E+03	8.415E+03	1.261E+07	8.475E+02
2034	3.421E+04	2.740E+07	1.841E+03	9.138E+03	1.370E+07	9.204E+02
2035	3.685E+04	2.951E+07	1.983E+03	9.844E+03	1.476E+07	9.914E+02
2036	3.943E+04	3.157E+07	2.121E+03	1.053E+04	1.579E+07	1.061E+03
2037	4.195E+04	3.359E+07	2.257E+03	1.120E+04	1.679E+07	1.128E+03
2038	4.441E+04	3.556E+07	2.389E+03	1.186E+04	1.778E+07	1.195E+03
2039	4.681E+04	3.748E+07	2.518E+03	1.250E+04	1.874E+07	1.259E+03
2040	4.916E+04	3.936E+07	2.645E+03	1.313E+04	1.968E+07	1.322E+03
2041	5.146E+04	4.121E+07	2.769E+03	1.375E+04	2.060E+07	1.384E+03
2042	5.371E+04	4.301E+07	2.890E+03	1.435E+04	2.150E+07	1.445E+03
2043	5.592E+04	4.478E+07	3.009E+03	1.494E+04	2.239E+07	1.504E+03
2044	5.808E+04	4.651E+07	3.125E+03	1.551E+04	2.325E+07	1.562E+03
2045	6.020E+04	4.821E+07	3.239E+03	1.608E+04	2.410E+07	1.620E+03
2046	6.229E+04	4.988E+07	3.351E+03	1.664E+04	2.494E+07	1.676E+03
2047	6.433E+04	5.151E+07	3.461E+03	1.718E+04	2.576E+07	1.731E+03
2048	6.634E+04	5.312E+07	3.569E+03	1.772E+04	2.656E+07	1.785E+03
2049	6.832E+04	5.471E+07	3.676E+03	1.825E+04	2.735E+07	1.838E+03
2050	7.026E+04	5.626E+07	3.780E+03	1.877E+04	2.813E+07	1.890E+03
2051	7.218E+04	5.780E+07	3.883E+03	1.928E+04	2.890E+07	1.942E+03
2052	7.406E+04	5.931E+07	3.985E+03	1.978E+04	2.965E+07	1.992E+03
2053	7.592E+04	6.080E+07	4.085E+03	2.028E+04	3.040E+07	2.042E+03
2054	7.776E+04	6.227E+07	4.184E+03	2.077E+04	3.113E+07	2.092E+03
2055	7.957E+04	6.372E+07	4.281E+03	2.125E+04	3.186E+07	2.141E+03
2056	8.136E+04	6.515E+07	4.377E+03	2.173E+04	3.257E+07	2.189E+03
2057	8.312E+04	6.656E+07	4.472E+03	2.220E+04	3.328E+07	2.236E+03
2058	8.487E+04	6.796E+07	4.566E+03	2.267E+04	3.398E+07	2.283E+03
2059	8.660E+04	6.935E+07	4.659E+03	2.313E+04	3.467E+07	2.330E+03
2060	8.831E+04	7.072E+07	4.751E+03	2.359E+04	3.536E+07	2.376E+03
2061	9.001E+04	7.208E+07	4.843E+03	2.404E+04	3.604E+07	2.421E+03
2062	9.169E+04	7.342E+07	4.933E+03	2.449E+04	3.671E+07	2.467E+03
2063	9.336E+04	7.476E+07	5.023E+03	2.494E+04	3.738E+07	2.511E+03
2064	9.496E+04	7.604E+07	5.109E+03	2.536E+04	3.802E+07	2.555E+03
2065	9.650E+04	7.727E+07	5.192E+03	2.578E+04	3.864E+07	2.596E+03
2066	9.798E+04	7.845E+07	5.271E+03	2.617E+04	3.923E+07	2.636E+03
2067	9.940E+04	7.959E+07	5.348E+03	2.655E+04	3.980E+07	2.674E+03
2068	1.001E+05	8.017E+07	5.387E+03	2.674E+04	4.008E+07	2.693E+03
2069	9.619E+04	7.703E+07	5.175E+03	2.569E+04	3.851E+07	2.588E+03
2070	9.242E+04	7.401E+07	4.972E+03	2.469E+04	3.700E+07	2.486E+03
2071	8.880E+04	7.110E+07	4.777E+03	2.372E+04	3.555E+07	2.389E+03
2072	8.531E+04	6.832E+07	4.590E+03	2.279E+04	3.416E+07	2.295E+03

Results (Continued)

Year	Total landfill gas			Methane		
	(Mg/year)	*(m^3/year)*	*(av ft^3/min)*	*(Mg/year)*	*(m^3/year)*	*(av ft^3/min)*
2073	8.197E+04	6.564E+07	4.410E+03	2.189E+04	3.282E+07	2.205E+03
2074	7.875E+04	6.306E+07	4.237E+03	2.104E+04	3.153E+07	2.119E+03
2075	7.567E+04	6.059E+07	4.071E+03	2.021E+04	3.030E+07	2.036E+03
2076	7.270E+04	5.821E+07	3.911E+03	1.942E+04	2.911E+07	1.956E+03
2077	6.985E+04	5.593E+07	3.758E+03	1.866E+04	2.797E+07	1.879E+03
2078	6.711E+04	5.374E+07	3.611E+03	1.793E+04	2.687E+07	1.805E+03
2079	6.448E+04	5.163E+07	3.469E+03	1.722E+04	2.582E+07	1.735E+03
2080	6.195E+04	4.961E+07	3.333E+03	1.655E+04	2.480E+07	1.667E+03
2081	5.952E+04	4.766E+07	3.202E+03	1.590E+04	2.383E+07	1.601E+03
2082	5.719E+04	4.579E+07	3.077E+03	1.528E+04	2.290E+07	1.538E+03
2083	5.495E+04	4.400E+07	2.956E+03	1.468E+04	2.200E+07	1.478E+03
2084	5.279E+04	4.227E+07	2.840E+03	1.410E+04	2.114E+07	1.420E+03
2085	5.072E+04	4.062E+07	2.729E+03	1.355E+04	2.031E+07	1.364E+03
2086	4.873E+04	3.902E+07	2.622E+03	1.302E+04	1.951E+07	1.311E+03
2087	4.682E+04	3.749E+07	2.519E+03	1.251E+04	1.875E+07	1.260E+03
2088	4.499E+04	3.602E+07	2.420E+03	1.202E+04	1.801E+07	1.210E+03
2089	4.322E+04	3.461E+07	2.325E+03	1.154E+04	1.730E+07	1.163E+03
2090	4.153E+04	3.325E+07	2.234E+03	1.109E+04	1.663E+07	1.117E+03
2091	3.990E+04	3.195E+07	2.147E+03	1.066E+04	1.597E+07	1.073E+03
2092	3.833E+04	3.070E+07	2.062E+03	1.024E+04	1.535E+07	1.031E+03
2093	3.683E+04	2.949E+07	1.982E+03	9.838E+03	1.475E+07	9.908E+02
2094	3.539E+04	2.834E+07	1.904E+03	9.452E+03	1.417E+07	9.520E+02
2095	3.400E+04	2.723E+07	1.829E+03	9.082E+03	1.361E+07	9.146E+02
2096	3.267E+04	2.616E+07	1.758E+03	8.725E+03	1.308E+07	8.788E+02
2097	3.139E+04	2.513E+07	1.689E+03	8.383E+03	1.257E+07	8.443E+02
2098	3.015E+04	2.415E+07	1.622E+03	8.055E+03	1.207E+07	8.112E+02
2099	2.897E+04	2.320E+07	1.559E+03	7.739E+03	1.160E+07	7.794E+02
2100	2.784E+04	2.229E+07	1.498E+03	7.435E+03	1.115E+07	7.488E+02
2101	2.674E+04	2.142E+07	1.439E+03	7.144E+03	1.071E+07	7.195E+02
2102	2.570E+04	2.058E+07	1.383E+03	6.864E+03	1.029E+07	6.913E+02
2103	2.469E+04	1.977E+07	1.328E+03	6.595E+03	9.885E+06	6.642E+02
2104	2.372E+04	1.899E+07	1.276E+03	6.336E+03	9.497E+06	6.381E+02
2105	2.279E+04	1.825E+07	1.226E+03	6.088E+03	9.125E+06	6.131E+02
2106	2.190E+04	1.753E+07	1.178E+03	5.849E+03	8.767E+06	5.891E+02
2107	2.104E+04	1.685E+07	1.132E+03	5.620E+03	8.423E+06	5.660E+02
2108	2.021E+04	1.619E+07	1.088E+03	5.399E+03	8.093E+06	5.438E+02
2109	1.942E+04	1.555E+07	1.045E+03	5.187E+03	7.776E+06	5.224E+02
2110	1.866E+04	1.494E+07	1.004E+03	4.984E+03	7.471E+06	5.020E+02
2111	1.793E+04	1.436E+07	9.646E+02	4.789E+03	7.178E+06	4.823E+02
2112	1.722E+04	1.379E+07	9.267E+02	4.601E+03	6.896E+06	4.634E+02
2113	1.655E+04	1.325E+07	8.904E+02	4.420E+03	6.626E+06	4.452E+02
2114	1.590E+04	1.273E+07	8.555E+02	4.247E+03	6.366E+06	4.277E+02
2115	1.528E+04	1.223E+07	8.219E+02	4.081E+03	6.117E+06	4.110E+02
2116	1.468E+04	1.175E+07	7.897E+02	3.921E+03	5.877E+06	3.949E+02
2117	1.410E+04	1.129E+07	7.587E+02	3.767E+03	5.646E+06	3.794E+02
2118	1.355E+04	1.085E+07	7.290E+02	3.619E+03	5.425E+06	3.645E+02
2119	1.302E+04	1.042E+07	7.004E+02	3.477E+03	5.212E+06	3.502E+02
2120	1.251E+04	1.002E+07	6.729E+02	3.341E+03	5.008E+06	3.365E+02
2121	1.202E+04	9.623E+06	6.466E+02	3.210E+03	4.811E+06	3.233E+02
2122	1.155E+04	9.246E+06	6.212E+02	3.084E+03	4.623E+06	3.106E+02
2123	1.109E+04	8.883E+06	5.968E+02	2.963E+03	4.442E+06	2.984E+02

Results (Continued)

Year	Total landfill gas			Methane		
	(Mg/year)	*(m^3/year)*	*(av ft^3/min)*	*(Mg/year)*	*(m^3/year)*	*(av ft^3/min)*
2124	1.066E+04	8.535E+06	5.734E+02	2.847E+03	4.267E+06	2.867E+02
2125	1.024E+04	8.200E+06	5.510E+02	2.735E+03	4.100E+06	2.755E+02
2126	9.839E+03	7.879E+06	5.294E+02	2.628E+03	3.939E+06	2.647E+02
2127	9.453E+03	7.570E+06	5.086E+02	2.525E+03	3.785E+06	2.543E+02
2128	9.082E+03	7.273E+06	4.887E+02	2.426E+03	3.636E+06	2.443E+02
2129	8.726E+03	6.988E+06	4.695E+02	2.331E+03	3.494E+06	2.347E+02
2130	8.384E+03	6.714E+06	4.511E+02	2.239E+03	3.357E+06	2.255E+02
2131	8.055E+03	6.450E+06	4.334E+02	2.152E+03	3.225E+06	2.167E+02
2132	7.740E+03	6.197E+06	4.164E+02	2.067E+03	3.099E+06	2.082E+02
2133	7.436E+03	5.954E+06	4.001E+02	1.986E+03	2.977E+06	2.000E+02
2134	7.144E+03	5.721E+06	3.844E+02	1.908E+03	2.860E+06	1.922E+02
2135	6.864E+03	5.497E+06	3.693E+02	1.834E+03	2.748E+06	1.847E+02
2136	6.595E+03	5.281E+06	3.548E+02	1.762E+03	2.641E+06	1.774E+02
2137	6.337E+03	5.074E+06	3.409E+02	1.693E+03	2.537E+06	1.705E+02
2138	6.088E+03	4.875E+06	3.276E+02	1.626E+03	2.438E+06	1.638E+02
2139	5.849E+03	4.684E+06	3.147E+02	1.562E+03	2.342E+06	1.574E+02
2140	5.620E+03	4.500E+06	3.024E+02	1.501E+03	2.250E+06	1.512E+02
2141	5.400E+03	4.324E+06	2.905E+02	1.442E+03	2.162E+06	1.453E+02
2142	5.188E+03	4.154E+06	2.791E+02	1.386E+03	2.077E+06	1.396E+02
2143	4.985E+03	3.991E+06	2.682E+02	1.331E+03	1.996E+06	1.341E+02
2144	4.789E+03	3.835E+06	2.577E+02	1.279E+03	1.917E+06	1.288E+02
2145	4.601E+03	3.685E+06	2.476E+02	1.229E+03	1.842E+06	1.238E+02
2146	4.421E+03	3.540E+06	2.379E+02	1.181E+03	1.770E+06	1.189E+02
2147	4.248E+03	3.401E+06	2.285E+02	1.135E+03	1.701E+06	1.143E+02
2148	4.081E+03	3.268E+06	2.196E+02	1.090E+03	1.634E+06	1.098E+02
2149	3.921E+03	3.140E+06	2.110E+02	1.047E+03	1.570E+06	1.055E+02
2150	3.767E+03	3.017E+06	2.027E+02	1.006E+03	1.508E+06	1.013E+02
2151	3.620E+03	2.898E+06	1.947E+02	9.668E+02	1.449E+06	9.737E+01
2152	3.478E+03	2.785E+06	1.871E+02	9.289E+02	1.392E+06	9.355E+01
2153	3.341E+03	2.676E+06	1.798E+02	8.925E+02	1.338E+06	8.988E+01
2154	3.210E+03	2.571E+06	1.727E+02	8.575E+02	1.285E+06	8.636E+01
2155	3.084E+03	2.470E+06	1.659E+02	8.239E+02	1.235E+06	8.297E+01
2156	2.963E+03	2.373E+06	1.594E+02	7.916E+02	1.186E+06	7.972E+01
2157	2.847E+03	2.280E+06	1.532E+02	7.605E+02	1.140E+06	7.659E+01
2158	2.736E+03	2.191E+06	1.472E+02	7.307E+02	1.095E+06	7.359E+01
2159	2.628E+03	2.105E+06	1.414E+02	7.021E+02	1.052E+06	7.070E+01
2160	2.525E+03	2.022E+06	1.359E+02	6.745E+02	1.011E+06	6.793E+01
2161	2.426E+03	1.943E+06	1.305E+02	6.481E+02	9.714E+05	6.527E+01
2162	2.331E+03	1.867E+06	1.254E+02	6.227E+02	9.333E+05	6.271E+01
2163	2.240E+03	1.793E+06	1.205E+02	5.982E+02	8.967E+05	6.025E+01

Results (Continued)

Year	Carbon dioxide			NMOC		
	(Mg/year)	*(m^3/year)*	*(av ft^3/min)*	*(Mg/year)*	*(m^3/year)*	*(av ft^3/min)*
2023	0	0	0	0	0	0
2024	2.616E+03	1.429E+06	9.603E+01	4.098E+00	1.143E+03	7.682E-02
2025	5.156E+03	2.817E+06	1.893E+02	8.077E+00	2.253E+03	1.514E-01
2026	7.623E+03	4.164E+06	2.798E+02	1.194E+01	3.331E+03	2.238E-01
2027	1.002E+04	5.474E+06	3.678E+02	1.570E+01	4.379E+03	2.942E-01
2028	1.235E+04	6.746E+06	4.533E+02	1.935E+01	5.397E+03	3.626E-01
2029	1.461E+04	7.984E+06	5.364E+02	2.289E+01	6.387E+03	4.291E-01
2030	1.682E+04	9.188E+06	6.173E+02	2.635E+01	7.350E+03	4.939E-01
2031	1.896E+04	1.036E+07	6.961E+02	2.971E+01	8.288E+03	5.569E-01
2032	2.105E+04	1.150E+07	7.728E+02	3.298E+01	9.201E+03	6.182E-01
2033	2.309E+04	1.261E+07	8.475E+02	3.617E+01	1.009E+04	6.780E-01
2034	2.507E+04	1.370E+07	9.204E+02	3.928E+01	1.096E+04	7.363E-01
2035	2.701E+04	1.476E+07	9.914E+02	4.231E+01	1.180E+04	7.931E-01
2036	2.890E+04	1.579E+07	1.061E+03	4.527E+01	1.263E+04	8.486E-01
2037	3.074E+04	1.679E+07	1.128E+03	4.816E+01	1.344E+04	9.028E-01
2038	3.254E+04	1.778E+07	1.195E+03	5.098E+01	1.422E+04	9.557E-01
2039	3.431E+04	1.874E+07	1.259E+03	5.374E+01	1.499E+04	1.007E+00
2040	3.603E+04	1.968E+07	1.322E+03	5.644E+01	1.575E+04	1.058E+00
2041	3.771E+04	2.060E+07	1.384E+03	5.908E+01	1.648E+04	1.107E+00
2042	3.936E+04	2.150E+07	1.445E+03	6.167E+01	1.720E+04	1.156E+00
2043	4.098E+04	2.239E+07	1.504E+03	6.420E+01	1.791E+04	1.203E+00
2044	4.257E+04	2.325E+07	1.562E+03	6.668E+01	1.860E+04	1.250E+00
2045	4.412E+04	2.410E+07	1.620E+03	6.912E+01	1.928E+04	1.296E+00
2046	4.565E+04	2.494E+07	1.676E+03	7.151E+01	1.995E+04	1.340E+00
2047	4.715E+04	2.576E+07	1.731E+03	7.386E+01	2.061E+04	1.384E+00
2048	4.862E+04	2.656E+07	1.785E+03	7.617E+01	2.125E+04	1.428E+00
2049	5.007E+04	2.735E+07	1.838E+03	7.844E+01	2.188E+04	1.470E+00
2050	5.150E+04	2.813E+07	1.890E+03	8.067E+01	2.251E+04	1.512E+00
2051	5.290E+04	2.890E+07	1.942E+03	8.287E+01	2.312E+04	1.553E+00
2052	5.428E+04	2.965E+07	1.992E+03	8.503E+01	2.372E+04	1.594E+00
2053	5.564E+04	3.040E+07	2.042E+03	8.717E+01	2.432E+04	1.634E+00
2054	5.699E+04	3.113E+07	2.092E+03	8.928E+01	2.491E+04	1.673E+00
2055	5.832E+04	3.186E+07	2.141E+03	9.135E+01	2.549E+04	1.712E+00
2056	5.963E+04	3.257E+07	2.189E+03	9.341E+01	2.606E+04	1.751E+00
2057	6.092E+04	3.328E+07	2.236E+03	9.544E+01	2.663E+04	1.789E+00
2058	6.220E+04	3.398E+07	2.283E+03	9.744E+01	2.718E+04	1.827E+00
2059	6.347E+04	3.467E+07	2.330E+03	9.943E+01	2.774E+04	1.864E+00
2060	6.472E+04	3.536E+07	2.376E+03	1.014E+02	2.829E+04	1.901E+00
2061	6.597E+04	3.604E+07	2.421E+03	1.033E+02	2.883E+04	1.937E+00
2062	6.720E+04	3.671E+07	2.467E+03	1.053E+02	2.937E+04	1.973E+00
2063	6.842E+04	3.738E+07	2.511E+03	1.072E+02	2.990E+04	2.009E+00
2064	6.959E+04	3.802E+07	2.555E+03	1.090E+02	3.042E+04	2.044E+00
2065	7.072E+04	3.864E+07	2.596E+03	1.108E+02	3.091E+04	2.077E+00
2066	7.181E+04	3.923E+07	2.636E+03	1.125E+02	3.138E+04	2.109E+00
2067	7.285E+04	3.980E+07	2.674E+03	1.141E+02	3.184E+04	2.139E+00
2068	7.337E+04	4.008E+07	2.693E+03	1.149E+02	3.207E+04	2.155E+00
2069	7.050E+04	3.851E+07	2.588E+03	1.104E+02	3.081E+04	2.070E+00
2070	6.773E+04	3.700E+07	2.486E+03	1.061E+02	2.960E+04	1.989E+00
2071	6.508E+04	3.555E+07	2.389E+03	1.019E+02	2.844E+04	1.911E+00
2072	6.253E+04	3.416E+07	2.295E+03	9.795E+01	2.733E+04	1.836E+00

Results (Continued)

Year	Carbon dioxide			NMOC		
	(Mg/year)	*(m^3/year)*	*(av ft^3/min)*	*(Mg/year)*	*(m^3/year)*	*(av ft^3/min)*
2073	6.007E+04	3.282E+07	2.205E+03	9.411E+01	2.625E+04	1.764E+00
2074	5.772E+04	3.153E+07	2.119E+03	9.042E+01	2.523E+04	1.695E+00
2075	5.546E+04	3.030E+07	2.036E+03	8.687E+01	2.424E+04	1.628E+00
2076	5.328E+04	2.911E+07	1.956E+03	8.347E+01	2.329E+04	1.565E+00
2077	5.119E+04	2.797E+07	1.879E+03	8.019E+01	2.237E+04	1.503E+00
2078	4.918E+04	2.687E+07	1.805E+03	7.705E+01	2.150E+04	1.444E+00
2079	4.726E+04	2.582E+07	1.735E+03	7.403E+01	2.065E+04	1.388E+00
2080	4.540E+04	2.480E+07	1.667E+03	7.113E+01	1.984E+04	1.333E+00
2081	4.362E+04	2.383E+07	1.601E+03	6.834E+01	1.906E+04	1.281E+00
2082	4.191E+04	2.290E+07	1.538E+03	6.566E+01	1.832E+04	1.231E+00
2083	4.027E+04	2.200E+07	1.478E+03	6.308E+01	1.760E+04	1.182E+00
2084	3.869E+04	2.114E+07	1.420E+03	6.061E+01	1.691E+04	1.136E+00
2085	3.717E+04	2.031E+07	1.364E+03	5.823E+01	1.625E+04	1.092E+00
2086	3.572E+04	1.951E+07	1.311E+03	5.595E+01	1.561E+04	1.049E+00
2087	3.431E+04	1.875E+07	1.260E+03	5.376E+01	1.500E+04	1.008E+00
2088	3.297E+04	1.801E+07	1.210E+03	5.165E+01	1.441E+04	9.681E-01
2089	3.168E+04	1.730E+07	1.163E+03	4.962E+01	1.384E+04	9.302E-01
2090	3.043E+04	1.663E+07	1.117E+03	4.768E+01	1.330E+04	8.937E-01
2091	2.924E+04	1.597E+07	1.073E+03	4.581E+01	1.278E+04	8.587E-01
2092	2.809E+04	1.535E+07	1.031E+03	4.401E+01	1.228E+04	8.250E-01
2093	2.699E+04	1.475E+07	9.908E+02	4.229E+01	1.180E+04	7.926E-01
2094	2.593E+04	1.417E+07	9.520E+02	4.063E+01	1.133E+04	7.616E-01
2095	2.492E+04	1.361E+07	9.146E+02	3.903E+01	1.089E+04	7.317E-01
2096	2.394E+04	1.308E+07	8.788E+02	3.750E+01	1.046E+04	7.030E-01
2097	2.300E+04	1.257E+07	8.443E+02	3.603E+01	1.005E+04	6.754E-01
2098	2.210E+04	1.207E+07	8.112E+02	3.462E+01	9.659E+03	6.490E-01
2099	2.123E+04	1.160E+07	7.794E+02	3.326E+01	9.280E+03	6.235E-01
2100	2.040E+04	1.115E+07	7.488E+02	3.196E+01	8.916E+03	5.991E-01
2101	1.960E+04	1.071E+07	7.195E+02	3.071E+01	8.566E+03	5.756E-01
2102	1.883E+04	1.029E+07	6.913E+02	2.950E+01	8.231E+03	5.530E-01
2103	1.809E+04	9.885E+06	6.642E+02	2.835E+01	7.908E+03	5.313E-01
2104	1.738E+04	9.497E+06	6.381E+02	2.723E+01	7.598E+03	5.105E-01
2105	1.670E+04	9.125E+06	6.131E+02	2.617E+01	7.300E+03	4.905E-01
2106	1.605E+04	8.767E+06	5.891E+02	2.514E+01	7.014E+03	4.712E-01
2107	1.542E+04	8.423E+06	5.660E+02	2.415E+01	6.739E+03	4.528E-01
2108	1.481E+04	8.093E+06	5.438E+02	2.321E+01	6.474E+03	4.350E-01
2109	1.423E+04	7.776E+06	5.224E+02	2.230E+01	6.220E+03	4.180E-01
2110	1.368E+04	7.471E+06	5.020E+02	2.142E+01	5.977E+03	4.016E-01
2111	1.314E+04	7.178E+06	4.823E+02	2.058E+01	5.742E+03	3.858E-01
2112	1.262E+04	6.896E+06	4.634E+02	1.978E+01	5.517E+03	3.707E-01
2113	1.213E+04	6.626E+06	4.452E+02	1.900E+01	5.301E+03	3.562E-01
2114	1.165E+04	6.366E+06	4.277E+02	1.826E+01	5.093E+03	3.422E-01
2115	1.120E+04	6.117E+06	4.110E+02	1.754E+01	4.893E+03	3.288E-01
2116	1.076E+04	5.877E+06	3.949E+02	1.685E+01	4.701E+03	3.159E-01
2117	1.034E+04	5.646E+06	3.794E+02	1.619E+01	4.517E+03	3.035E-01
2118	9.930E+03	5.425E+06	3.645E+02	1.556E+01	4.340E+03	2.916E-01
2119	9.541E+03	5.212E+06	3.502E+02	1.495E+01	4.170E+03	2.802E-01
2120	9.167E+03	5.008E+06	3.365E+02	1.436E+01	4.006E+03	2.692E-01
2121	8.807E+03	4.811E+06	3.233E+02	1.380E+01	3.849E+03	2.586E-01
2122	8.462E+03	4.623E+06	3.106E+02	1.326E+01	3.698E+03	2.485E-01
2123	8.130E+03	4.442E+06	2.984E+02	1.274E+01	3.553E+03	2.387E-01

Results (Continued)

Year	Carbon dioxide			NMOC		
	(Mg/year)	*(m^3/year)*	*(av ft^3/min)*	*(Mg/year)*	*(m^3/year)*	*(av ft^3/min)*
2124	7.811E+03	4.267E+06	2.867E+02	1.224E+01	3.414E+03	2.294E-01
2125	7.505E+03	4.100E+06	2.755E+02	1.176E+01	3.280E+03	2.204E-01
2126	7.211E+03	3.939E+06	2.647E+02	1.130E+01	3.151E+03	2.117E-01
2127	6.928E+03	3.785E+06	2.543E+02	1.085E+01	3.028E+03	2.034E-01
2128	6.656E+03	3.636E+06	2.443E+02	1.043E+01	2.909E+03	1.955E-01
2129	6.395E+03	3.494E+06	2.347E+02	1.002E+01	2.795E+03	1.878E-01
2130	6.145E+03	3.357E+06	2.255E+02	9.626E+00	2.685E+03	1.804E-01
2131	5.904E+03	3.225E+06	2.167E+02	9.248E+00	2.580E+03	1.734E-01
2132	5.672E+03	3.099E+06	2.082E+02	8.886E+00	2.479E+03	1.666E-01
2133	5.450E+03	2.977E+06	2.000E+02	8.537E+00	2.382E+03	1.600E-01
2134	5.236E+03	2.860E+06	1.922E+02	8.203E+00	2.288E+03	1.538E-01
2135	5.031E+03	2.748E+06	1.847E+02	7.881E+00	2.199E+03	1.477E-01
2136	4.834E+03	2.641E+06	1.774E+02	7.572E+00	2.112E+03	1.419E-01
2137	4.644E+03	2.537E+06	1.705E+02	7.275E+00	2.030E+03	1.364E-01
2138	4.462E+03	2.438E+06	1.638E+02	6.990E+00	1.950E+03	1.310E-01
2139	4.287E+03	2.342E+06	1.574E+02	6.716E+00	1.874E+03	1.259E-01
2140	4.119E+03	2.250E+06	1.512E+02	6.452E+00	1.800E+03	1.209E-01
2141	3.957E+03	2.162E+06	1.453E+02	6.199E+00	1.730E+03	1.162E-01
2142	3.802E+03	2.077E+06	1.396E+02	5.956E+00	1.662E+03	1.117E-01
2143	3.653E+03	1.996E+06	1.341E+02	5.723E+00	1.597E+03	1.073E-01
2144	3.510E+03	1.917E+06	1.288E+02	5.498E+00	1.534E+03	1.031E-01
2145	3.372E+03	1.842E+06	1.238E+02	5.283E+00	1.474E+03	9.902E-02
2146	3.240E+03	1.770E+06	1.189E+02	5.076E+00	1.416E+03	9.514E-02
2147	3.113E+03	1.701E+06	1.143E+02	4.877E+00	1.360E+03	9.141E-02
2148	2.991E+03	1.634E+06	1.098E+02	4.685E+00	1.307E+03	8.783E-02
2149	2.874E+03	1.570E+06	1.055E+02	4.502E+00	1.256E+03	8.438E-02
2150	2.761E+03	1.508E+06	1.013E+02	4.325E+00	1.207E+03	8.107E-02
2151	2.653E+03	1.449E+06	9.737E+01	4.156E+00	1.159E+03	7.790E-02
2152	2.549E+03	1.392E+06	9.355E+01	3.993E+00	1.114E+03	7.484E-02
2153	2.449E+03	1.338E+06	8.988E+01	3.836E+00	1.070E+03	7.191E-02
2154	2.353E+03	1.285E+06	8.636E+01	3.686E+00	1.028E+03	6.909E-02
2155	2.260E+03	1.235E+06	8.297E+01	3.541E+00	9.879E+02	6.638E-02
2156	2.172E+03	1.186E+06	7.972E+01	3.402E+00	9.492E+02	6.378E-02
2157	2.087E+03	1.140E+06	7.659E+01	3.269E+00	9.120E+02	6.127E-02
2158	2.005E+03	1.095E+06	7.359E+01	3.141E+00	8.762E+02	5.887E-02
2159	1.926E+03	1.052E+06	7.070E+01	3.018E+00	8.419E+02	5.656E-02
2160	1.851E+03	1.011E+06	6.793E+01	2.899E+00	8.088E+02	5.435E-02
2161	1.778E+03	9.714E+05	6.527E+01	2.786E+00	7.771E+02	5.222E-02
2162	1.708E+03	9.333E+05	6.271E+01	2.676E+00	7.467E+02	5.017E-02
2163	1.641E+03	8.967E+05	6.025E+01	2.571E+00	7.174E+02	4.820E-02

Landfill Gas Generation
With and Without Expansion

			Total Existing Facility		Total Facility After Expansion	
Year	Tons from Old gas Curve	Waste Accepted at MSW Landfill (tons)	Gas Collected, AP-42 Defaults, 75% Collection Efficency (cfm)	Gas Generated, AP42 Defaults (cfm)	Combined Gas Generated, AP42 75% CE (cfm)	Combined Gas Generated, AP42 (cfm)
1962	170,000	170,000	-	-	-	-
1963	170,000	170,000	61	82	61	82
1964	170,000	170,000	120	160	120	160
1965	170,000	170,000	176	235	176	235
1966	170,000	170,000	231	308	231	308
1967	170,000	170,000	283	377	283	377
1968	170,000	170,000	333	444	333	444
1969	170,000	170,000	381	508	381	508
1970	170,000	170,000	427	570	427	570
1971	170,000	170,000	472	629	472	629
1972	170,000	170,000	515	686	515	686
1973	170,000	170,000	556	741	556	741
1974	170,000	170,000	595	793	595	793
1975	170,000	170,000	633	844	633	844
1976	170,000	170,000	669	892	669	892
1977	170,000	170,000	704	939	704	939
1978	170,000	170,000	738	984	738	984
1979	170,000	170,000	770	1,027	770	1,027
1980	170,000	170,000	801	1,068	801	1,068
1981	170,000	170,000	831	1,108	831	1,108
1982	170,000	170,000	859	1,146	859	1,146
1983	170,000	170,000	887	1,183	887	1,183
1984	170,000	170,000	913	1,218	913	1,218
1985	182,376	182,376	939	1,252	939	1,252
1986	241,282	241,282	968	1,290	968	1,290
1987	320,522	320,522	1,016	1,355	1,016	1,355
1988	327,949	327,949	1,092	1,456	1,092	1,456
1989	267,218	267,218	1,167	1,556	1,167	1,556
1990	103,755	103,755	1,218	1,624	1,218	1,624
1991	110,568	110,568	1,207	1,610	1,207	1,610
1992	117,755	117,755	1,200	1,600	1,200	1,600
1993	104,060	104,060	1,195	1,593	1,195	1,593
1994	118,514	118,514	1,186	1,581	1,186	1,581
1995	88,010	88,010	1,182	1,576	1,182	1,576

Landfill Gas Generation
With and Without Expansion

			Total Existing Facility		Total Facility After Expansion	
Year	Tons from Old gas Curve	Waste Accepted at MSW Landfill (tons)	Gas Collected, AP-42 Defaults, 75% Collection Efficency (cfm)	Gas Generated, AP42 Defaults (cfm)	Combined Gas Generated, AP42 75% CE (cfm)	Combined Gas Generated, AP42 (cfm)
1996	159,467	159,467	1,167	1,556	1,167	1,556
1997	305,755	305,755	1,179	1,572	1,179	1,572
1998	300,000	300,000	1,243	1,657	1,243	1,657
1999	293,986	293,986	1,302	1,736	1,302	1,736
2000	310,079	310,079	1,357	1,809	1,357	1,809
2001	300,851	300,851	1,415	1,887	1,415	1,887
2002	260,225	260,225	1,468	1,957	1,468	1,957
2003	377,879	377,879	1,504	2,005	1,504	2,005
2004	359,661	359,661	1,581	2,108	1,581	2,108
2005	299,482	364,117	1,649	2,198	1,649	2,198
2006	322,887	369,712	1,715	2,287	1,715	2,287
2007	245,087	335,024	1,781	2,374	1,781	2,374
2008	298,165	311,434	1,832	2,442	1,832	2,442
2009	291,320	324,971	1,872	2,496	1,872	2,496
2010	245,880	312,092	1,916	2,554	1,916	2,554
2011	273,723	315,529	1,953	2,604	1,953	2,604
2012		284,580	1,990	2,653	1,990	2,653
2013		285,004	2,014	2,686	2,014	2,686
2014		247,443	2,038	2,717	2,038	2,717
2015		268,926	2,047	2,729	2,047	2,729
2016		328,349	2,064	2,751	2,064	2,751
2017		355,493	2,101	2,801	2,101	2,801
2018		336,165	2,146	2,862	2,146	2,862
2019	Divert	264,214	2,183	2,911	2,183	2,911
2020	Divert	190,323	**2,193**	**2,924**	2,193	2,924
2021	Divert	189,703	2,182	2,910	2,182	2,910
2022	Divert	189,703	2,172	2,896	2,172	2,896
2023	Expansion	400,154	2,162	2,882	2,162	2,882
2024		404,156	2,077	2,769	2,221	2,961
2025		408,197	1,995	2,661	2,279	3,039
2026		412,279	1,917	2,556	2,337	3,116
2027		416,402	1,842	2,456	2,394	3,192
2028		420,566	1,770	2,360	2,450	3,266
2029		424,772	1,700	2,267	2,505	3,340

Landfill Gas Generation
With and Without Expansion

			Total Existing Facility		Total Facility After Expansion	
Year	Tons from Old gas Curve	Waste Accepted at MSW Landfill (tons)	Gas Collected, AP-42 Defaults, 75% Collection Efficency (cfm)	Gas Generated, AP42 Defaults (cfm)	Combined Gas Generated, AP42 75% CE (cfm)	Combined Gas Generated, AP42 (cfm)
2030		429,019	1,634	2,178	2,560	3,413
2031		433,309	1,570	2,093	2,614	3,485
2032		437,643	1,508	2,011	2,667	3,556
2033		442,019	1,449	1,932	2,720	3,627
2034		446,439	1,392	1,856	2,773	3,697
2035		450,904	1,338	1,783	2,825	3,766
2036		455,413	1,285	1,714	2,876	3,835
2037		459,967	1,235	1,646	2,927	3,903
2038		464,566	1,186	1,582	2,978	3,971
2039		469,212	1,140	1,520	3,029	4,038
2040		473,904	1,095	1,460	3,079	4,105
2041		478,643	1,052	1,403	3,129	4,172
2042		483,430	1,011	1,348	3,178	4,238
2043		488,264	971	1,295	3,228	4,304
2044		493,147	933	1,244	3,277	4,369
2045		498,078	897	1,195	3,326	4,435
2046		503,059	861	1,149	3,375	4,500
2047		508,089	828	1,104	3,424	4,565
2048		513,170	795	1,060	3,472	4,630
2049		518,302	764	1,019	3,521	**4,694**
2050		523,485	734	979	3,569	**4,759**
2051		528,720	705	940	3,618	**4,824**
2052		534,007	678	904	3,666	**4,888**
2053		539,347	651	868	3,715	**4,953**
2054		544,741	626	834	3,763	**5,018**
2055		550,188	601	801	3,812	**5,082**
2056		555,690	577	770	3,860	**5,147**
2057		561,247	555	740	3,909	**5,212**
2058		566,859	533	711	3,958	**5,277**
2059		572,528	512	683	4,007	**5,342**
2060		578,253	492	656	4,056	**5,408**
2061		584,036	473	630	4,105	**5,473**
2062		589,876	454	606	4,154	**5,539**
2063			436	582	4,204	**5,605**

Landfill Gas Generation
With and Without Expansion

			Total Existing Facility		Total Facility After Expansion	
Year	Tons from Old gas Curve	Waste Accepted at MSW Landfill (tons)	Gas Collected, AP-42 Defaults, 75% Collection Efficency (cfm)	Gas Generated, AP42 Defaults (cfm)	Combined Gas Generated, AP42 75% CE (cfm)	Combined Gas Generated, AP42 (cfm)
2064			419	559	4,251	**5,668**
2065			403	537	4,297	**5,729**
2066			387	516	4,341	**5,787**
2067			372	496	4,383	**5,844**
2068			357	476	**4,397**	**5,863**
2069			343	458	4,225	**5,633**
2070			330	440	4,059	**5,412**
2071			317	423	3,900	**5,200**
2072			304	406	3,747	**4,996**
2073			293	390	3,600	4,800

APPENDIX C

PRE-PROJECT POTENTIAL EMISSION CALCULATIONS

Client: Burnsville Sanitary Landfill
Project: Pre-Project PTE

				PTE						
Device ID	**Unit ID**	**Device Name**	**Process Name**	**VOCs (ton/yr)**	**Nox (ton/yr)**	**SO2 (ton/yr)**	**CO (ton/yr)**	**PM (ton/yr)**	**PM_{10} (ton/yr)**	**$PM_{2.5}$ (ton/yr)**
	EU008	Decomposing Landfill Gas Emissions	Uncontrolled Fugitive Landfill Gas Emissions	10.12						
	EU009	Enclosed Flare	LFG Specialties 3,000 Enclosed Flare	0.83	23.65	33.28	78.84	6.70	6.70	6.70
T1E1	EU004	T1E1 - Caterpillar G3516 Engine/Generator	Caterpillar G3516 Engine/Generator	7.446	21.90	3.44	24.09	2.55	2.55	2.55
T1E2	EU003	T1E2 - Caterpillar G3516 Engine/Generator	Caterpillar G3516 Engine/Generator	7.446	21.90	3.44	24.09	2.55	2.55	2.55
T2E1	EU007	T2E1 - Caterpillar G3516 Engine/Generator	Caterpillar G3516 Engine/Generator	7.446	21.90	3.44	24.09	2.55	2.55	2.55
T2E2	EU006	T2E2 - Caterpillar G3516 Engine/Generator	Caterpillar G3516 Engine/Generator	7.446	21.90	3.44	24.09	2.55	2.55	2.55
T3E1	EU002	T3E1 - Caterpillar G3516 Engine/Generator	Caterpillar G3516 Engine/Generator	7.446	21.90	3.44	24.09	2.55	2.55	2.55
T3E2	EU001	T3E2 - Caterpillar G3516 Engine/Generator	Caterpillar G3516 Engine/Generator	7.446	21.90	3.44	24.09	2.55	2.55	2.55
	FS001	Dust from unpaved haul roads	Dust from unpaved haul roads					26.6	7.2	0.7
	FS001B	Dust from paved haul roads	Dust from paved haul roads					5.1	1.0	0.2
	FS002	Bulldozing	Bulldozing					9.4	0.74	0.10
	FS002B	Waste and Material Handling	Dust from material handling					0.05	0.02	0.004
Facility Total				**55.63**	**155.1**	**53.9**	**223.4**	**63.2**	**31.0**	**23.1**

Client: Burnsville Sanitary Landfill
Project: Pre-Project PTE

Total Facility HAP Emissions

LFG Compound	HAP	VOC	CAS	Concentration (ppmv)	PTE Total lb/yr	PTE Total ton/yr
1,1,1 - Trichloroethane (methyl chloroform)	x	--	71-55-6	0.48	73.5	0.037
1,1,2,2 - Tetrachloroethane	x	x	79-34-5	1.11	213.7	0.11
1,1 - Dichloroethane (ethylidene dichloride)	x	x	75-34-3	2.35	266.8	0.13
1,1 - Dichloroethene (vinylidene chloride)	x	x	75-35-4	0.20	22.2	0.011
1,2 - Dichloroethane (ethylene dichloride)	x	x	107-06-2	0.41	46.5	0.023
1,2 - Dichloropropane (propylene dichloride)	x	x	78-87-5	0.18	23.3	0.012
2-Propanol (isopropyl alcohol)	--	--	67-63-0	50.10	3454.5	1.7
Acetone (2-propanone)	--	--	67-64-1	7.01	467.0	0.23
Acrylonitrile (Propenenitrile)	x	x	107-13-1	6.33	385.3	0.19
Benzene	x	x	71-43-2	1.91	171.2	0.086
Bromodichloromethane	--	--	75-27-4	3.13	588.2	0.29
Butane	--	--	106-97-8	5.03	335.3	0.17
Carbon Disulfide	x	x	75-15-0	0.58	50.7	0.025
Carbon Tetrachloride	x	x	56-23-5	0.00	0.7	0.00035
Carbonyl Sulfide	x	x	463-58-1	0.49	33.8	0.017
Chlorobenzene (monochlorobenzene)	x	x	108-90-7	0.25	32.3	0.016
Chlorodifluoromethane (CFC-22, freon-22)	--	--	75-45-6	1.30	128.9	0.064
Chloroethane (ethyl chloride)	x	x	75-00-3	1.25	92.5	0.046
Chloroform (trichloromethane)	x	x	67-66-3	0.03	4.1	0.0021
Chloromethane (methyl chloride)	x	x	74-87-3	1.21	70.1	0.035
1,4 Dichlorobenzene (p-dichlorobenzene)	x	x	106-46-7	0.21	35.4	0.018
Dichlorodifluoromethane (CFC-12, freon-12)	--	--	75-71-8	15.70	2177.5	1.1
Dichlorofluoromethane (freon-21)	--	--	75-43-4	2.62	309.3	0.15
Dichloromethane (methylene chloride)	x	--	75-09-2	14.30	1393.2	0.70
Dimethyl Sulfide (methyl sulfide)[5]	--	--	75-18-3	7.82	557.3	0.28
Ethane	--	--	74-84-0	889.00	30664.7	15.3
Ethanol (ethyl alcohol)	--	--	64-17-5	27.20	1437.8	0.72
Ethylbenzene	x	x	100-41-4	4.61	561.4	0.28
Ethyl Mercaptan (ethanethiol)	--	--	75-08-1	2.28	162.5	0.081
Ethylene dibromide (1,2 dibromoethane)	x	x	106-93-4	0.00	0.2	0.00011
Fluorotrichloromethane (CFC-11, freon-11)	--	--	75-69-4	0.76	119.8	0.060
Hexane	x	x	110-54-3	6.57	649.5	0.32
Hydrogen Sulfide	--	--	7783-06-4	250.00	9773.4	4.89
Mercury (total)	x	--	7439-97-6	0.00	0.5	0.00023
Methyl Ethyl Ketone (2-butanone)	x	x	78-93-3	7.09	586.5	0.29
Methyl Isobutyl Ketone (hexone)	x	x	108-10-1	1.87	214.9	0.11
Methyl Mercaptan	--	--	74-93-1	2.49	137.4	0.069
Pentane	--	--	109-66-0	3.29	272.3	0.14
Tetrachloroethylene (perchloroethylene, -ethene)	x	--	127-18-4	3.73	709.5	0.35
Propane	--	--	74-98-6	11.10	561.5	0.28
Toluene (methylbenzene)	x	x	108-88-3	39.30	4153.8	2.1
Trichloroethylene (trichloroethene)	x	x	79-01-6	2.82	425.0	0.21
t - 1,2 - Dichloroethene (1,2 dichloroethylene)	--	--	156-60-5	2.84	315.8	0.16
Vinyl Chloride (chloroethylene, VCM)	x	x	75-01-4	7.34	526.2	0.26
Xylenes (m, o, p)	x	x	1330-20-7	12.10	1473.6	0.74
Hydrogen Chloride	x	--	7647-01-0	42.10	10341.6	5.2
				Total HAP	22557.9	11.3
				Max Indiv. HAP	10341.6	5.2

Client: Burnsville Sanitary Landfill
Project: Pre-Project PTE

Landfill Fugitive - PTE

Landfill Gas Collection System Collection Efficiency	75%	(assumed)	
Landfill gas generation rate	1,536,854,400	scf/yr LFG	
	2,924	scfm	Year 2019
LFG fugitive flow	384,213,600	scf/yr LFG	384.21 mmcf/year
	731	scfm	

LFG Compound	HAP	VOC	CAS	MW (lb/lb-mol)	Compound Conc & Mass in Inlet Gas (ppmv)	Compound Conc & Mass in Inlet Gas (lb/hr)	Control Eff	Fugitive Emissions (lb/hr)*	Fugitive Emissions (tpy)*
1,1,1 - Trichloroethane (methyl chloroform)	x	--	71-55-6	133.41	0.48	7.40E-03	0.0%	7.40E-03	3.24E-02
1,1,2,2 - Tetrachloroethane	x	x	79-34-5	167.85	1.11	2.15E-02	0.0%	2.15E-02	9.43E-02
1,1 - Dichloroethane (ethylidene dichloride)	x	x	75-34-3	98.96	2.35	2.69E-02	0.0%	2.69E-02	1.18E-01
1,1 - Dichloroethene (vinylidene chloride)	x	x	75-35-4	96.94	0.20	2.24E-03	0.0%	2.24E-03	9.82E-03
1,2 - Dichloroethane (ethylene dichloride)	x	x	107-06-2	98.96	0.41	4.69E-03	0.0%	4.69E-03	2.05E-02
1,2 - Dichloropropane (propylene dichloride)	x	x	78-87-5	112.99	0.18	2.35E-03	0.0%	2.35E-03	1.03E-02
2-Propanol (isopropyl alcohol)	--	x	67-63-0	60.11	50.1	3.48E-01	0.0%	3.48E-01	1.52E+00
Acetone (2-propanone)	--	--	67-64-1	58.08	7.01	4.71E-02	0.0%	4.71E-02	2.06E-01
Acrylonitrile (Propenenitrile)	x	x	107-13-1	53.06	6.33	3.88E-02	0.0%	3.88E-02	1.70E-01
Benzene	x	x	71-43-2	78.12	1.91	1.72E-02	0.0%	1.72E-02	7.55E-02
Bromodichloromethane	--	x	75-27-4	163.83	3.13	5.93E-02	0.0%	5.93E-02	2.60E-01
Butane	--	x	106-97-8	58.12	5.03	3.38E-02	0.0%	3.38E-02	1.48E-01
Carbon Disulfide	x	x	75-15-0	76.14	*0.58*	5.10E-03	0.0%	5.10E-03	2.24E-02
Carbon Tetrachloride	x	x	56-23-5	153.84	0.004	7.11E-05	0.0%	7.11E-05	3.12E-04
Carbonyl Sulfide	x	x	463-58-1	60.07	*0.49*	3.40E-03	0.0%	3.40E-03	1.49E-02
Chlorobenzene (monochlorobenzene)	x	x	108-90-7	112.56	0.25	3.25E-03	0.0%	3.25E-03	1.42E-02
Chlorodifluoromethane (CFC-22, freon-22)	--	--	75-45-6	86.47	1.30	1.30E-02	0.0%	1.30E-02	5.69E-02
Chloroethane (ethyl chloride)	x	x	75-00-3	64.52	1.25	9.32E-03	0.0%	9.32E-03	4.08E-02
Chloroform (trichloromethane)	x	x	67-66-3	119.38	0.03	4.14E-04	0.0%	4.14E-04	1.81E-03
Chloromethane (methyl chloride)	x	x	74-87-3	50.49	1.21	7.06E-03	0.0%	7.06E-03	3.09E-02
1,4 Dichlorobenzene (p-dichlorobenzene)	x	x	106-46-7	147	0.21	3.57E-03	0.0%	3.57E-03	1.56E-02
Dichlorodifluoromethane (CFC-12, freon-12)	--	--	75-71-8	120.91	15.7	2.19E-01	0.0%	2.19E-01	9.61E-01
Dichlorofluoromethane (freon-21)	--	--	75-43-4	102.92	2.62	3.12E-02	0.0%	3.12E-02	1.37E-01
Dichloromethane (methylene chloride)	x	--	75-09-2	84.93	14.3	1.40E-01	0.0%	1.40E-01	6.15E-01
Dimethyl Sulfide (methyl sulfide)	--	x	75-18-3	62.13	*7.82*	5.62E-02	0.0%	5.62E-02	2.46E-01
Ethane	--	--	74-84-0	30.07	889	3.09E+00	0.0%	3.09E+00	1.35E+01
Ethanol (ethyl alcohol)	--	x	64-17-5	46.08	27.2	1.45E-01	0.0%	1.45E-01	6.35E-01
Ethylbenzene	x	x	100-41-4	106.17	4.61	5.66E-02	0.0%	5.66E-02	2.48E-01
Ethyl Mercaptan (ethanethiol)	--	x	75-08-1	62.13	*2.28*	1.64E-02	0.0%	1.64E-02	7.17E-02
Ethylene dibromide (1,2 dibromoethane)	x	x	106-93-4	187.88	0.001	2.17E-05	0.0%	2.17E-05	9.51E-05
Fluorotrichloromethane (CFC-11, freon-11)	--	--	75-69-4	137.37	0.76	1.21E-02	0.0%	1.21E-02	5.29E-02
Hexane	x	x	110-54-3	86.18	6.57	6.54E-02	0.0%	6.54E-02	2.87E-01
Hydrogen Sulfide	--	--	7783-06-4	34.08	*250.0*	9.85E-01	0.0%	9.85E-01	4.31E+00
Mercury (total)	x	--	7439-97-6	200.61	2.92E-04	6.77E-06	0.0%	6.77E-06	2.97E-05
Methyl Ethyl Ketone (2-butanone)	--	x	78-93-3	72.11	7.09	5.91E-02	0.0%	5.91E-02	2.59E-01
Methyl Isobutyl Ketone (hexone)	x	x	108-10-1	100.16	1.87	2.16E-02	0.0%	2.16E-02	9.48E-02
Methyl Mercaptan	--	x	74-93-1	48.11	*2.49*	1.38E-02	0.0%	1.38E-02	6.06E-02
Pentane	--	x	109-66-0	72.15	3.29	2.74E-02	0.0%	2.74E-02	1.20E-01
Tetrachloroethylene (perchloroethylene, -ethene)	x	--	127-18-4	165.83	3.73	7.15E-02	0.0%	7.15E-02	3.13E-01
Propane	--	x	74-98-6	44.1	11.1	5.66E-02	0.0%	5.66E-02	2.48E-01
Toluene (methylbenzene)	x	x	108-88-3	92.14	39.3	4.19E-01	0.0%	4.19E-01	1.83E+00
Trichloroethylene (trichloroethene)	x	x	79-01-6	131.38	2.82	4.28E-02	0.0%	4.28E-02	1.88E-01
t - 1,2 - Dichloroethene (1,2 dichloroethylene)	--	x	156-60-5	96.94	2.84	3.18E-02	0.0%	3.18E-02	1.39E-01
Vinyl Chloride (chloroethylene, VCM)	x	x	75-01-4	62.50	7.34	5.30E-02	0.0%	5.30E-02	2.32E-01
Xylenes (m, o, p)	x	x	1330-20-7	106.17	12.1	1.48E-01	0.0%	1.48E-01	6.50E-01
VOC			NA	86.18	232.1	2.31E+00	0.0%	2.31	10.12
Total HAP								1.17	5.13
Maximum Single HAP								0.42	1.83

Each Engine Inputs

Standard Values, Assumed Constants

Category	Value		Equivalent	
Standard Temperature	60	^{o}F	520	^{o}R
Universal Gas Constant	0.7302	atm-ft^{3}/lb-mol^{o}R		
Pressure	1	atm		
Methane Heating Value	1,000	Btu/ft^{3}		
LFG Methane Component	50.0%			
LFG Typical Heating Value	500	Btu/ft^{3}		
LFG Temperature	100	^{o}F	560	^{o}R
LFG Moisture	8%			

Operating Parameters - Inputted and Calculated

Engine Information (per engine)	Value		Equivalent	
Operation Period	8,760.0	hr		
Mechanical Output	1,148	bhp		
LFG Burned	162,936,000	cf/yr		
LFG Inlet Flow	310	scfm	163	mmscf/yr
LFG Inlet Flow, dry standard	285	dscfm		
Heat Input	9.30	MMBtu/hr	81468	MMBtu/yr

Each Engine Criteria Pollutants

Operation Period	8,760	hr
LFG inlet flow, standard	310	scfm
Heat Input	9.3	MMBtu/hr
Mechanical Output	1,148	bhp
LFG inlet flow, dry	285	dscfm

SO_2 Emission Rate

SO_2 concentration in exhaust gas	250	ppmv		
SO_2 emission rate	0.78	lb/hr	3.4	ton/yr
	42.2	lb/MMCF LFG		
	0.084	lb/MMBTU		

Sulfur Compound	CAS	MW (lb/lb-mol)	Conc (ppmv)[a,b]	Control Eff[b]	S Atoms	Conc (ppmv)	Emiss (lb/hr)
Carbon Disulfide	75-15-0	76.13	0.58	98.0%	2	1.14	0.00
Carbonyl Sulfide	463-58-1	60.07	0.49	98.0%	1	0.48	0.00
Dimethyl Sulfide (methyl sulfide)	75-18-3	62.13	7.82	98.0%	1	7.66	0.02
Ethyl Mercaptan (ethanethiol)	54	62.13	2.28	98.0%	1	2.23	0.01
Hydrogen Sulfide	7783-06-4	34.08	250.00	98.0%	1	250.0	0.78
Methyl Mercaptan	74-93-1	48.11	2.49	98.0%	1	2.44	0.01
				Total Contribution to SO_2[a] :		250.0	0.78

PM/PM_{10} Emission Rate

Current Title V Permit No. 03700192-00	0.23	g/bhp-hr (manufacturer's guarantee)		
	0.58	lb/hr	2.55	ton/yr

NO_2 Emission Rate[d]

Title V Permit No. 03700192-004:	0.538	lb/MMBTU (calculated based on 5.0 lb/hr and 9.3 MMBTU/hr)				
	2.0	g/bhp-hr (calculated based on 5.0 lb/hr and 1148 hp)				
NO_2 emission rate - per engine	5.00	lb/hr	21.9	ton/yr	43800	lb/yr

CO Emission Rate[d]

Title V Permit No. 03700192-004:	0.591	lb/MMBTU (calculated based on 5.5 lb/hr and 9.3 MMBTU/hr)				
	2.2	g/bhp-hr (calculated based on 5.5 lb/hr and 1148 hp)				
CO emission rate - per engine	5.50	lb/hr	24.1	ton/yr	48180	lb/yr

NMOC Emission Rate

NMOC conc inlet gas[c]	595	ppmv		
MW hexane	86.18	lb/lb-mol		
destruction efficiency	98%			
mass NMOC inlet gas	2.5	lb/hr		
NMOC emission rate	0.05	lb/hr	0.22	ton/yr

VOC Emission Rate[d]

Title V Permit No. 03700192-004:	1.70	lb/hr (manufacturer guarantee)	7.45	ton/yr
	0.18	lb/MMBTU (calculated based on 1.7 lb/hr and 9.3 MMBTU/hr)		

[a] H2S concentration as proposed in Major Permit Amendment submitted in January 2018.

[b] AP-42 gives ranges for control efficiencies. Assume 98% control through treatment and burning landfill gas in engines.

[c] AP-42 Section 2.4.

[d] Based on technical support document included with current Air Emission Permit (Permit No. 03700192-004) issued August 22, 2013. Emission rate is 5 lb/hr for NOx, 5.5 lb/hr for CO and 1.7 lb/hr for VOC.

Each Engine HAPs

LFG inlet flow 310 scfm

LFG Compound	HAP	VOC	CAS	MW (lb/lb-mol)	Compound Conc & Mass in Inlet Gas (ppmv)[a]	(lb/hr)	Control Eff	PTE Each Engine lb/hr	ton/yr
1,1,1 - Trichloroethane (methyl chloroform)	x	--	71-55-6	133.41	0.48	3.14E-03	98.0%	6.27E-05	2.75E-04
1,1,2,2 - Tetrachloroethane	x	x	79-34-5	167.85	1.11	9.13E-03	98.0%	1.83E-04	7.99E-04
1,1 - Dichloroethane (ethylidene dichloride)	x	x	75-34-3	98.96	2.35	1.14E-02	98.0%	2.28E-04	9.98E-04
1,1 - Dichloroethene (vinylidene chloride)	x	x	75-35-4	96.94	0.20	9.50E-04	98.0%	1.90E-05	8.32E-05
1,2 - Dichloroethane (ethylene dichloride)	x	x	107-06-2	98.96	0.41	1.99E-03	98.0%	3.98E-05	1.74E-04
1,2 - Dichloropropane (propylene dichloride)	x	x	78-87-5	112.99	0.18	9.96E-04	98.0%	1.99E-05	8.73E-05
2-Propanol (isopropyl alcohol)	--	y	67-63-0	60.11	50.1	1.48E-01	98.0%	2.95E-03	1.29E-02
Acetone (2-propanone)	--	--	67-64-1	58.08	7.01	1.99E-02	98.0%	3.99E-04	1.75E-03
Acrylonitrile (Propenenitrile)	x	x	107-13-1	53.06	6.33	1.65E-02	98.0%	3.29E-04	1.44E-03
Benzene	x	x	71-43-2	78.12	1.91	7.31E-03	98.0%	1.46E-04	6.40E-04
Bromodichloromethane	--	y	75-27-4	163.83	3.13	2.51E-02	98.0%	5.02E-04	2.20E-03
Butane	--	y	106-97-8	58.12	5.03	1.43E-02	98.0%	2.86E-04	1.25E-03
Carbon Disulfide	x	x	75-15-0	76.14	0.58	2.16E-03	98.0%	4.33E-05	1.90E-04
Carbon Tetrachloride	x	x	56-23-5	153.84	0.004	3.01E-05	98.0%	6.03E-07	2.64E-06
Carbonyl Sulfide	x	x	463-58-1	60.07	0.49	1.44E-03	98.0%	2.88E-05	1.26E-04
Chlorobenzene (monochlorobenzene)	x	x	108-90-7	112.56	0.25	1.38E-03	98.0%	2.76E-05	1.21E-04
Chlorodifluoromethane (CFC-22, freon-22)	--	--	75-45-6	86.47	1.30	5.51E-03	98.0%	1.10E-04	4.82E-04
Chloroethane (ethyl chloride)	x	x	75-00-3	64.52	1.25	3.95E-03	98.0%	7.90E-05	3.46E-04
Chloroform (trichloromethane)	x	x	67-66-3	119.38	0.03	1.75E-04	98.0%	3.51E-06	1.54E-05
Chloromethane (methyl chloride)	x	x	74-87-3	50.49	1.21	2.99E-03	98.0%	5.99E-05	2.62E-04
1,4 Dichlorobenzene (p-dichlorobenzene)	x	x	106-46-7	147	0.21	1.51E-03	98.0%	3.02E-05	1.32E-04
Dichlorodifluoromethane (CFC-12, freon-12)	--	--	75-71-8	120.91	15.7	9.30E-02	98.0%	1.86E-03	8.15E-03
Dichlorofluoromethane (freon-21)	--	--	75-43-4	102.92	2.62	1.32E-02	98.0%	2.64E-04	1.16E-03
Dichloromethane (methylene chloride)	x	--	75-09-2	84.93	14.3	5.95E-02	98.0%	1.19E-03	5.21E-03
Dimethyl Sulfide (methyl sulfide)	--	y	75-18-3	62.13	7.82	2.38E-02	98.0%	4.76E-04	2.08E-03
Ethane	--	--	74-84-0	30.07	889	1.31E+00	98.0%	2.62E-02	1.15E-01
Ethanol (ethyl alcohol)	--	y	64-17-5	46.08	27.2	6.14E-02	98.0%	1.23E-03	5.38E-03
Ethylbenzene	x	x	100-41-4	106.17	4.61	2.40E-02	98.0%	4.80E-04	2.10E-03
Ethyl Mercaptan (ethanethiol)	--	y	75-08-1	62.13	2.28	6.94E-03	98.0%	1.39E-04	6.08E-04
Ethylene dibromide (1,2 dibromoethane)	x	x	106-93-4	187.88	0.001	9.20E-06	98.0%	1.84E-07	8.06E-07
Fluorotrichloromethane (CFC-11, freon-11)	--	--	75-69-4	137.37	0.76	5.11E-03	98.0%	1.02E-04	4.48E-04
Hexane	x	x	110-54-3	86.18	6.57	2.77E-02	98.0%	5.55E-04	2.43E-03
Hydrogen Sulfide[b]	--	--	7783-06-4	34.08	250.0	4.17E-01	98.0%	8.35E-03	3.66E-02
Mercury (total)	x	--	7439-97-6	200.61	2.92E-04	2.87E-06	0.0%	2.87E-06	1.26E-05
Methyl Ethyl Ketone (2-butanone)	x	x	78-93-3	72.11	7.09	2.50E-02	98.0%	5.01E-04	2.19E-03
Methyl Isobutyl Ketone (hexone)	x	x	108-10-1	100.16	1.87	9.17E-03	98.0%	1.83E-04	8.04E-04
Methyl Mercaptan	--	y	74-93-1	48.11	2.49	5.87E-03	98.0%	1.17E-04	5.14E-04
Pentane	--	y	109-66-0	72.15	3.29	1.16E-02	98.0%	2.33E-04	1.02E-03
Tetrachloroethylene (perchloroethylene, -ethene)	x	x	127-18-4	165.83	3.73	3.03E-02	98.0%	6.06E-04	2.65E-03
Propane	--	y	74-98-6	44.1	11.1	2.40E-02	98.0%	4.80E-04	2.10E-03
Toluene (methylbenzene)	x	x	108-88-3	92.14	39.3	1.77E-01	98.0%	3.55E-03	1.55E-02
Trichloroethylene (trichloroethene)	x	x	79-01-6	131.38	2.82	1.81E-02	98.0%	3.63E-04	1.59E-03
t - 1,2 - Dichloroethene (1,2 dichloroethylene)	--	--	156-60-5	96.94	2.84	1.35E-02	98.0%	2.70E-04	1.18E-03
Vinyl Chloride (chloroethylene, VCM)	x	x	75-01-4	62.50	7.34	2.25E-02	98.0%	4.49E-04	1.97E-03
Xylenes (m, o, p)	x	x	1330-20-7	106.17	12.1	6.29E-02	98.0%	1.26E-03	5.51E-03
Hydrogen Chloride[c]	x	--	7647-01-0	36.50	42.1	7.53E-02	0.0%	7.53E-02	3.30E-01
							Total HAP	0.086	0.38
							Maximum Single HAP	0.075	0.33

Enclosed Flare

Standard Conditions, Constants, and Typical Values

Category	Value		Equivalent	
Standard Temperature[1]	60	°F	520	R
Universal Gas Constant	0.7302	atm-ft^3/lb-mol-R		
Pressure[1]	1	atm		
Methane Heating Value[2]	1,000	Btu/ft^3		
LFG Methane Component[3]	**50.0%**	%		
LFG Typical Heating Value	500	Btu/ft^3		
LFG Temperature[3]	60	°F	520	R
LFG Moisture[3]	**8%**	%		

Fuel & Equipment - Enclosed Flare

Flare Information	Value		Equivalent	
No. of Hours of Operation Per Day[5]	**24**	hr		
No. of Days in Averaging Period[5]	**365**	day		
Operation Period[5]	8,760	hr		
LFG Burned	1,576,800,000	scf/yr	1,577	mmcf/year
LFG inlet flow, standard[4]	3,000	scfm	788.4	
LFG Inlet Flow, dry standard	2,760	dscfm		
Heat Input	90.0	MMBtu/hr	788,400	MMBtu/year
Design Flare Operating Temperature[4]	**1,650**	°F	2,110	R
Flare Tip Flow, standard	3,000	scfm		
Flare Tip Flow, actual	3,000	acfm		
Flare Tip Diameter[4]	**10.0**	ft		
Flare Heat release (gross)	6,300,000	cal/s		
Flare Heat release (net)	4,641,480			

[1] Industrial STP (60°F, 30.00 in. Hg, 1 atm)

[2] Typical

[3] Average measured value.

[4] Manufacturer's information.

[5] PTE based on an operating period of 8760 hours/year.

Criteria Pollutant Emissions - Enclosed Flare

Operation Period	8,760	hr
LFG inlet flow, standard	3,000	scfm
Heat Input	90	MMBtu/hr

CO Emission Rate

CO emission factor[1]	0.20	lb/MMBtu				
	100.0	lb/MMCF LFG (calculated)				
CO emission rate	18.0	lb/hr	78.8	tpy	157,680	lb/yr

NO_2 Emission Rate

NO_2 emission factor[1]	0.060	lb/MMBtu				
	30.0	lb/MMCF LFG (calculated)				
NO_2 emission rate	5.40	lb/hr	23.65	tpy	47,304	lb/yr

SO_2 Emission Rate

SO_2 concentration in exhaust gas	250.0	ppmv				
	42.21	lb/MMCF LFG (calculated)				
SO_2 emission rate	7.60	lb/hr	33.28	tpy	66,553	lb/yr

					Individual Compound				
LFG Compound	CAS	MW (lb/lb-mol)	Conc (ppmv)	Control Eff	No. of S Atoms	S Conc (ppmv)	SO_2 Emiss (lb/hr)	Conc (ppmv)	Control Eff[3]
Carbon Disulfide	75-15-0	76.13			2	1.14	0.03	0.58	98%
Carbonyl Sulfide	463-58-1	60.07			1	0.48	0.01	0.49	98%
Dimethyl Sulfide (methyl sulfide)	75-18-3	62.13			1	7.66	0.23	7.82	98%
Ethyl Mercaptan (ethanethiol)	75-08-1	62.13			1	2.23	0.07	2.28	98%
Hydrogen Sulfide	7783-06-4	34.08			1	250.0	7.60	250	98%
Methyl Mercaptan	74-93-1	48.11			1	2.44	0.07	2.49	98%
			Total Contribution to SO_2 :			250.00	7.60		

PM_{10} Emission Rate

PM emission factor[2]	17	lb/MM dscf CH_4				
	8.50	lb/MM scf LFG				
PM emission rate	1.53	lb/hr	6.70	tpy	13,403	lb/yr

NMOC Emission Rate

NMOC conc inlet gas[2]	595	ppmv				
MW hexane	86.18	lb/lb-mol				
destruction efficiency	98%					
mass NMOC inlet gas	24.32	lb/hr				
NMOC emission rate	0.49	lb/hr	2.13	tpy	4,261	lb/yr

VOC Emission Rate

NMOC conc inlet gas[2]	595	ppmv				
VOC fraction of NMOC[2]	39%					
VOC concentration in inlet gas	232	ppmv				
MW hexane	86.18	lb/lb-mol				
mass VOC inlet gas	9.49	lb/hr				
destruction efficiency	98%					
VOC emission rate	0.19	lb/hr	0.83	tpy	1,662	lb/yr

VOC emission factor uncontrolled	52.70 lb/MMCF LFG	(uncontrolled)	83097.926	lb/yr uncontrolled

[1] Manufacturers guarantee, noted Technical Support Document included with Permit 03700192-004

[2] EPA, *Compilation of Air Pollutant Emission Factors, Volume I. Stationary Point and Area Sources*, *5th Ed*. (November 1998).

[3] NSPS minimum required control efficiency

LFG Flow = 3,000 scfm

LFG Compound	HAP	VOC	CAS	MW (lb/lb-mol)	Compound Conc & Mass in Inlet Gas (ppmv)[a]	(lb/hr)	Control Eff	Flare Exhaust (lb/hr)	(tpy)
1,1,1 - Trichloroethane (methyl chloroform)	x	--	71-55-6	133.41	0.48	3.04E-02	98.0%	6.08E-04	2.66E-03
1,1,2,2 - Tetrachloroethane	x	x	79-34-5	167.85	1.11	8.84E-02	98.0%	1.77E-03	7.74E-03
1,1 - Dichloroethane (ethylidene dichloride)	x	x	75-34-3	98.96	2.35	1.10E-01	98.0%	2.21E-03	9.66E-03
1,1 - Dichloroethene (vinylidene chloride)	x	x	75-35-4	96.94	0.20	9.20E-03	98.0%	1.84E-04	8.06E-04
1,2 - Dichloroethane (ethylene dichloride)	x	x	107-06-2	98.96	0.41	1.92E-02	98.0%	3.85E-04	1.69E-03
1,2 - Dichloropropane (propylene dichloride)	x	x	78-87-5	112.99	0.18	9.65E-03	98.0%	1.93E-04	8.45E-04
2-Propanol (isopropyl alcohol)	--	x	67-63-0	60.11	50.1	1.43E+00	98.0%	2.86E-02	1.25E-01
Acetone (2-propanone)	--	--	67-64-1	58.08	7.01	1.93E-01	98.0%	3.86E-03	1.69E-02
Acrylonitrile (Propenenitrile)	x	x	107-13-1	53.06	6.33	1.59E-01	98.0%	3.19E-03	1.40E-02
Benzene	x	x	71-43-2	78.12	1.91	7.08E-02	98.0%	1.42E-03	6.20E-03
Bromodichloromethane	--	x	75-27-4	163.83	3.13	2.43E-01	98.0%	4.86E-03	2.13E-02
Butane	--	x	106-97-8	58.12	5.03	1.39E-01	98.0%	2.77E-03	1.21E-02
Carbon Disulfide	x	x	75-15-0	76.14	*0.58*	2.09E-02	98.0%	4.19E-04	1.84E-03
Carbon Tetrachloride	x	x	56-23-5	153.84	0.004	2.92E-04	98.0%	5.84E-06	2.56E-05
Carbonyl Sulfide	x	x	463-58-1	60.07	*0.49*	1.40E-02	98.0%	2.79E-04	1.22E-03
Chlorobenzene (monochlorobenzene)	x	x	108-90-7	112.56	0.25	1.33E-02	98.0%	2.67E-04	1.17E-03
Chlorodifluoromethane (CFC-22, freon-22)	--	--	75-45-6	86.47	1.30	5.33E-02	98.0%	1.07E-03	4.67E-03
Chloroethane (ethyl chloride)	x	x	75-00-3	64.52	1.25	3.83E-02	98.0%	7.65E-04	3.35E-03
Chloroform (trichloromethane)	x	x	67-66-3	119.38	0.03	1.70E-03	98.0%	3.40E-05	1.49E-04
Chloromethane (methyl chloride)	x	x	74-87-3	50.49	1.21	2.90E-02	98.0%	5.80E-04	2.54E-03
1,4 Dichlorobenzene (p-dichlorobenzene)	x	x	106-46-7	147	0.21	1.46E-02	98.0%	2.93E-04	1.28E-03
Dichlorodifluoromethane (CFC-12, freon-12)	--	--	75-71-8	120.91	15.7	9.00E-01	98.0%	1.80E-02	7.89E-02
Dichlorofluoromethane (freon-21)	--	--	75-43-4	102.92	2.62	1.28E-01	98.0%	2.56E-03	1.12E-02
Dichloromethane (methylene chloride)	x	--	75-09-2	84.93	14.3	5.76E-01	98.0%	1.15E-02	5.05E-02
Dimethyl Sulfide (methyl sulfide)	--	x	75-18-3	62.13	*7.82*	2.30E-01	98.0%	4.61E-03	2.02E-02
Ethane	--	--	74-84-0	30.07	889	1.27E+01	98.0%	2.54E-01	1.11E+00
Ethanol (ethyl alcohol)	--	x	64-17-5	46.08	27.2	5.95E-01	98.0%	1.19E-02	5.21E-02
Ethylbenzene	x	x	100-41-4	106.17	4.61	2.32E-01	98.0%	4.64E-03	2.03E-02
Ethyl Mercaptan (ethanethiol)	--	x	75-08-1	62.13	*2.28*	6.72E-02	98.0%	1.34E-03	5.89E-03
Ethylene dibromide (1,2 dibromoethane)	x	x	106-93-4	187.88	0.001	8.91E-05	98.0%	1.78E-06	7.81E-06
Fluorotrichloromethane (CFC-11, freon-11)	--	--	75-69-4	137.37	0.76	4.95E-02	98.0%	9.90E-04	4.34E-03
Hexane	x	x	110-54-3	86.18	6.57	2.69E-01	98.0%	5.37E-03	2.35E-02
Hydrogen Sulfide[b]	--	--	7783-06-4	34.08	*250.0*	4.04E+00	98.0%	8.08E-02	3.54E-01
Mercury (total)	x	--	7439-97-6	200.61	2.92E-04	2.78E-05	0.0%	2.78E-05	1.22E-04
Methyl Ethyl Ketone (2-butanone)	--	x	78-93-3	72.11	7.09	2.43E-01	98.0%	4.85E-03	2.12E-02
Methyl Isobutyl Ketone (hexone)	x	x	108-10-1	100.16	1.87	8.88E-02	98.0%	1.78E-03	7.78E-03
Methyl Mercaptan	--	x	74-93-1	48.11	*2.49*	5.68E-02	98.0%	1.14E-03	4.98E-03
Pentane	--	x	109-66-0	72.15	3.29	1.13E-01	98.0%	2.25E-03	9.86E-03
Tetrachloroethylene (perchloroethylene, -ethe	x	--	127-18-4	165.83	3.73	2.93E-01	98.0%	5.87E-03	2.57E-02
Propane	--	x	74-98-6	44.1	11.1	2.32E-01	98.0%	4.64E-03	2.03E-02
Toluene (methylbenzene)	x	x	108-88-3	92.14	39.3	1.72E+00	98.0%	3.44E-02	1.50E-01
Trichloroethylene (trichloroethene)	x	x	79-01-6	131.38	2.82	1.76E-01	98.0%	3.51E-03	1.54E-02
t - 1,2 - Dichloroethene (1,2 dichloroethylene)	--	x	156-60-5	96.94	2.84	1.31E-01	98.0%	2.61E-03	1.14E-02
Vinyl Chloride (chloroethylene, VCM)	x	x	75-01-4	62.50	7.34	2.18E-01	98.0%	4.35E-03	1.91E-02
Xylenes (m, o, p)	x	x	1330-20-7	106.17	12.1	6.09E-01	98.0%	1.22E-02	5.34E-02
Hydrogen Chloride[c]	x	--	7647-01-0	36.50	42.1	7.29E-01	0.0%	7.29E-01	3.19E+00
Total HAP								0.83	3.614
Maximum Single HAP								1.72	3.193

a. Concentrations from EPA, *Compilation of Air Pollutant Emission Factors, Volume I. Stationary Point and Area Sources, 5th Ed.* (November 1998). Tables 2.4-1 and 2.4-2 unless otherwise noted

b. Concentration based on site specific data

c. Product of combustion

Roads Inputs and Calcs

Site Specific Information	Value	Reference
Paved Road Length (one way)	0.47 mi	Front Entry Paved Area
Unpaved Road Length (one way)	0.68 mi	To Active Filling Area
No. of Hours of Operation Per Day	14 hr/day	Provided by WM
No. of Days in Averaging Period, N	270 day/yr	Provided by WM
No. of Hours of Operation Per Averaging Period	3780 hr/yr	Provided by WM
No. of "Wet" Days (i.e., at least 0.01 in. precip), P	120 day	AP-42 Figure 13.2.1-2
Silt Loading, sL	7.4 g/m2	AP-42, Table 13.2.1-3
Surface Material Silt Content, s	6.4%	AP-42 Table 13.2.2-1
Control Efficiency, CE 24-Hour	80%	Level 3A Plan
Control Efficiency, CE Annual	90%	Level 3A Plan

Calculation of Mean Vehicle Weight

	Vehicle Weight[1]				
	Unloaded	Loaded	Average	Vehicles	
Vehicle Type	(ton)	(ton)	(ton)	Per Day	Reference
Semi	20.00	26.57	23.3	270	1

Total Vehicle Count ..... 270 per day
Mean Vehicle Weight, W ..... 23.3 ton

Paved Road Emissions	Value	References
Predictive Emission Factor Equation	$E = \{[k*(sL)^{0.91}*(W)^{1.02}]*(1-P/4N)\}*CE$	2
Particle Size Multiplier - PM2.5, k	0.00054	2
Particle Size Multiplier - PM10, k	0.0022	2
Particle Size Multiplier2 - PM30, k	0.011	2

Emission Factors

	Uncontrolled	Controlled 24-Hour	Controlled Annual
PM2.5	0.07 lb/VMT	0.015 lb/VMT	0.007 lb/VMT
PM10	0.30 lb/VMT	0.060 lb/VMT	0.030 lb/VMT
Total PM	1.50 lb/VMT	0.300 lb/VMT	0.150 lb/VMT

Total Miles Traveled - Paved Roads per year ..... 67,968 VMT/yr
Total Miles Traveled - Paved Roads per day ..... 252 VMT/day

Emission Rates

	lb/hr	lb/day	ton/yr
Calculated Emissions - PM2.5	0.26 lb/hr	3.7 lb/day	0.25 ton/yr
Calculated Emissions - PM10	1.08 lb/hr	15.1 lb/day	1.02 ton/yr
Calculated Emissions - PM30	5.39 lb/hr	75.4 lb/day	5.09 ton/yr

Unpaved Road Emissions	Value	References
Predictive Emission Factor Equation	$[k*(s/12)^{a}*(W/3)^{b}]*[(365-P)/365)$	3

Constants

	k	a	b
PM2.5	0.15	0.9	0.45
PM10	1.50	0.9	0.45
Total PM	4.90	0.7	0.45

Emission Factors

	Uncontrolled	Controlled 24-Hour	Controlled Annual
PM2.5	0.14 lb/VMT	0.029 lb/VMT	0.014 lb/VMT
PM10	1.44 lb/VMT	0.288 lb/VMT	0.144 lb/VMT
Total PM	5.33 lb/VMT	1.065 lb/VMT	0.533 lb/VMT

Total Miles Traveled - Unpaved Roads per year ..... 99,933 VMT/yr
Total Miles Traveled - Unpaved Roads per day ..... 370 VMT/day

Emission Rates

	lb/hr	lb/day	ton/yr
Calculated Emissions - PM2.5	0.76 lb/hr	10.6 lb/day	0.72 ton/yr
Calculated Emissions - PM10	7.60 lb/hr	106.4 lb/day	7.18 ton/yr
Calculated Emissions - PM30	28.16 lb/hr	394.3 lb/day	26.61 ton/yr

1. Site specific information provided by facility staff

2. EPA, "Emissions Factors & AP 42, Compilation of Air Pollutant Emission Factors," Section 13.2.1, Jan. 2011.

3. EPA, "Emissions Factors & AP 42, Compilation of Air Pollutant Emission Factors," Section 13.2.2, Jan. 2011.

Aggregate Handling and Storage Piles

Site Specific Information	Value	Reference
Amount of Material Handled Per Day	2,018 ton/day	Based on estimate 2023 Max Total Waste + Daily Cover
No. of Hours of Operation Per Day	14 hr/day	Estimate
No. of Days in Averaging Period, N	270 day/yr	Estimated
No. of Hours of Operation Per Averaging Period	3780 hr/yr	Based on 270 day/yr, 10 hr/day
Mean Wind Speed, U	6 mph	Estimated
Surface Material Moisture Content, M	14.2%	Estimated

Aggregate Handling & Storage Pile Emissions	Value		References
Predictive Emission Factor Equation	$E = [k*0.0032]*[((U/5)^{1.3})/((M/2)^{1.4})]$		1
Particle Size Multiplier - PM2.5, k	0.053		1
Particle Size Multiplier - PM10, k	0.35		1
Particle Size Multiplier2 - PM30, k	0.74		1
Emission Factors			
	Uncontrolled		
PM2.5	1.38E-05 lb/ton		
PM10	9.13E-05 lb/ton		
Total PM	1.93E-04 lb/ton		
Calculated Emissions - PM2.5	0.0038 tpy	0.002 lb/hr	
Calculated Emissions - PM10	0.0249 tpy	0.013 lb/hr	
Calculated Emissions - PM30	0.0526 tpy	0.03 lb/hr	

Notes:

1. EPA, "Emissions Factors & AP 42, Compilation of Air Pollutant Emission Factors," Section 13.2.4, Nov. 2006.

Particulate Matter Emissions from Bulldozer Operations

AP-42 Table 13.2.3-1

Table 13.2.3-1 (cont.).

Construction Phase	Dust-generating Activities	Recommended Emission Factor	Comments	Rating Adjustment[b]
II. Site Preparation (earth moving)	1. Bulldozing	Dozer equation (overburden) in Tables 11.9-1 and 11.9-2		-1/-2[c]
	2. Scrapers unloading topsoil	Scraper unloading factor in Table 11.9-4		-1
	3. Scrapers in travel	Scraper (travel mode) expression in Tables 11.9-1 and 11.9-2		-0/-1[c]
	4. Scrapers removing topsoil	5.7 kg/vehicle kilometer traveled (VKT) (20.2 lb/vehicle mile traveled [VMT])		E[d]
	5. Loading of excavated material into trucks	Material handling emission factor equation in Section 13.2.4		-0/-1[c]
	6. Truck dumping of fill material, road base, or other materials	Material handling emission factor equation in Section 13.2.4	May occur offsite	-0/-1[c]
	7. Compacting	Dozer equation in Tables 11.9-1 and 11.9-2	Emission factor downgraded because of differences in operating equipment	-1/-2[c]
	8. Motor grading	Grading equation in Tables 11.9-1 and 11.9-2		-1/-2[c]

AP 42 Table 11.9-1

Table 11.9-1 (English Units). EMISSION FACTOR EQUATIONS FOR UNCONTROLLED OPEN DUST SOURCES AT WESTERN SURFACE COAL MINES[a]

Operation	Material	Emissions By Particle Size Range (Aerodynamic Diameter)[b,c]				Units	EMISSION FACTOR RATING
		Emission Factor Equations		Scaling Factors			
		TSP ≤30 µm	≤15 µm	≤10 µm[d]	≤2.5 µm/TSP*		
Blasting[f]	Coal or overburden	$0.000014(A)^{1.5}$	ND	0.52*	0.03	lb/blast	C_DD
Truck loading	Coal	$\frac{1.16}{(M)^{1.2}}$	$\frac{0.119}{(M)^{0.9}}$	0.75	0.019	lb/ton	BBCC
Bulldozing	Coal	$\frac{78.4\ (s)^{1.2}}{(M)^{1.3}}$	$\frac{18.6\ (s)^{1.5}}{(M)^{1.4}}$	0.75	0.022	lb/hr	CCDD
	Overburden	$\frac{5.7\ (s)^{1.2}}{(M)^{1.3}}$	$\frac{1.0\ (s)^{1.5}}{(M)^{1.4}}$	0.75	0.105	lb/hr	BCDD
Dragline	Overburden	$\frac{0.0021\ (d)^{1.1}}{(M)^{0.3}}$	$\frac{0.0021\ (d)^{0.7}}{(M)^{0.3}}$	0.75	0.017	lb/yd^3	BCDD
Vehicle traffic[g]							
Grading		$0.040\ (S)^{2.5}$	$0.051\ (S)^{2.0}$	0.60	0.031	lb/VMT	CCDD
Active storage pile[h] (wind erosion and maintenance)	Coal	0.72 u	ND	ND	ND	$\frac{lb}{(acre)(hr)}$	C[i]_ _ _

[a] Reference 1, except as noted. VMT = vehicle miles traveled. ND = no data. Quality ratings coded where "Q, X, Y, Z" are ratings for ≤30 µm, ≤15 µm, ≤10 µm, and ≤2.5 µm, respectively. See also note below.

[b] Particulate matter less than or equal to 30 µm in aerodynamic diameter is sometimes termed "suspendable particulate" and is often used as a surrogate for TSP (total suspended particulate). TSP denotes what is measured by a standard high volume sampler (see Section 13.2).

[c] Symbols for equations:
A = horizontal area (ft^2), with blasting depth ≤ 70 ft. Not for vertical face of a bench.
M = material moisture content (%)
s = material silt content (%)
u = wind speed (mph)
d = drop height (ft)
W = mean vehicle weight (tons)
S = mean vehicle speed (mph)
w = mean number of wheels

Inputs

M, Material Moisture Content %[1]	12%
s, Material Silt Content %[1]	9%
Hours of Operation[2]	3780

Emission Factors[3]

PM30 (TSP)	4.99 lb/hr
PM10	0.39 lb/hr
PM2.5	0.055 lb/hr

Emissions

PM30 (TSP)	9.4296 tpy	18859.15 lb/yr
PM10	0.7448 tpy	1489.58 lb/yr
PM2.5	0.1043 tpy	208.54 lb/yr

Notes:

1. From AP-42 Table 13.2.4-1 for MSW Landfill Cover Material
2. Based on operation of 14 hours a day for 270 days/year
3. Emission Factors based on AP-42 Table 13.2.3-1 (refers to Table 11.9-1)

Burnsville Sanitary Landfill GHG PTE Summary Pre-Project

				PTE GHGs			
Device ID	**Unit ID**	**Device Name**	**Process Name**	**CO2 (ton/yr)**	**CH4 (ton/yr)**	**N2O (ton/yr)**	**CO2e**
	EU008	Decomposing Landfill Gas Emissions	Uncontrolled Fugitive Landfill Gas Emissions	10,020	3,043		86,100
Flare	EU009	Enclosed Flare	LFG Specialties 3,000 Enclosed Flare	90,977	2.78	0.55	91,209
T1E1	EU004	T1E1 - Caterpillar G3516 Engine/Generator	Caterpillar G3516 Engine/Generator	9,401	0.29	0.06	9,425
T1E2	EU003	T1E2 - Caterpillar G3516 Engine/Generator	Caterpillar G3516 Engine/Generator	9,401	0.29	0.06	9,425
T2E1	EU007	T2E1 - Caterpillar G3516 Engine/Generator	Caterpillar G3516 Engine/Generator	9,401	0.29	0.06	9,425
T2E2	EU006	T2E2 - Caterpillar G3516 Engine/Generator	Caterpillar G3516 Engine/Generator	9,401	0.29	0.06	9,425
T3E1	EU002	T3E1 - Caterpillar G3516 Engine/Generator	Caterpillar G3516 Engine/Generator	9,401	0.29	0.06	9,425
T3E2	EU001	T3E2 - Caterpillar G3516 Engine/Generator	Caterpillar G3516 Engine/Generator	9,401	0.29	0.06	9,425
Facility Total (with fugitive)				**157,402**	**3,048**	**0.89**	**233,859**

Potential Methane Generation Rate

Sample calculation:

LFG generation rate * 60 min/hr * 50% CH_4 * 16.04 lb/mol / 0.7302 / 520 R * 8760 hr/yr / 2000 lb/ton = short tons CH_4 generated

Modeled CH_4 generated from the LandGEM	2,924	scfm
Modeled CH_4 generated from the LandGEM	16,231	short tons CH_4
Fugitive CH_4 (not collected by Landfill Gas Collection System)	4,058	short Tons CH_4 (assuming 75% collection)
Oxidation Factor (Mandatory GHG Reporting Rule, Subpart HH, Table H	0.25	
CH_4 adjusted for oxidation (MG)	3,043	short Tons CH_4
Global warming potential for CH_4 (GWP)	25	

Potential Carbon Dioxide Generation Rate

Sample calculation:

LFG generation rate * 60 min/hr * 45% CO_2 * 44.01 lb/mol / 0.7302 / 520 R * 8760 hr/yr / 2000 lb/ton = short tons CO_2 generated

(assuming 45% of landfill gas is CO2)

Modeled CO_2 generated from the LandGEM	40,079	short tons CO_2
Fugitive CO_2 (not collected by Landfill Gas Collection System)	10,020	short Tons CO_2 (assuming 75% collection)
Global warming potential for CO_2 (GWP)	1	

Potential GHG emissions

Total CO_{2e}	86,100	short Tons of CO_2e

Pre-Project Biogenic GHG PTE Summary

Given:

Methane fraction in landfill gas =	50%	(assumed)
Heating value of landfill gas =	500	Btu/scf
CO_2 emission factor (LFG combustion) =	52.07	kg/MMBtu (40 CFR 98, Table C-1 value for "biogas")
CH_4 emission factor (LFG combustion) =	3.2E-03	kg/MMBtu (40 CFR 98, Table C-2 value for "biogas")
N_2O emission factor (LFG combustion) =	6.3E-04	kg/MMBtu (40 CFR 98, Table C-2 value for "biogas")
Global warming potential of CO_2 =	1	
Global warming potential of CH_4 =	25	
Global warming potential of N_2O =	298	

BIOGENIC GHG EMISSIONS

Unit ID	Device Description	Capacity	Units	Combustion CO_2 PTE (tpy CO_2)	Pass-Through CO_2 PTE (tpy CO_2)	Total Biogenic GHG PTE (tpy CO_2)
EU009	Enclosed Flare	3,000	scfm	45,251.61	45,724.96	90,976.57
EU004	T1E1 - Caterpillar G3516 Engine/Generator	310	scfm	4,676.00	4,724.91	9,400.91
EU003	T1E2 - Caterpillar G3516 Engine/Generator	310	scfm	4,676.00	4,724.91	9,400.91
EU007	T2E1 - Caterpillar G3516 Engine/Generator	310	scfm	4,676.00	4,724.91	9,400.91
EU006	T2E2 - Caterpillar G3516 Engine/Generator	310	scfm	4,676.00	4,724.91	9,400.91
EU002	T3E1 - Caterpillar G3516 Engine/Generator	310	scfm	4,676.00	4,724.91	9,400.91
EU001	T3E2 - Caterpillar G3516 Engine/Generator	310	scfm	4,676.00	4,724.91	9,400.91
					TOTAL	**147,382.04**
					Total CO2e	**147,382.04**

Pre-Project Anthropogenic GHG PTE Summary

Given:

Methane fraction in landfill gas =	50%	(assumed)
Heating value of landfill gas =	500	Btu/scf
CO_2 emission factor (LFG combustion) =	52.07	kg/MMBtu (40 CFR 98, Table C-1 value for "biogas")
CH_4 emission factor (LFG combustion) =	3.2E-03	kg/MMBtu (40 CFR 98, Table C-2 value for "biogas")
N_2O emission factor (LFG combustion) =	6.3E-04	kg/MMBtu (40 CFR 98, Table C-2 value for "biogas")
Global warming potential of CO_2 =	1	
Global warming potential of CH_4 =	25	
Global warming potential of N_2O =	298	

ANTHROPOGENIC GHG EMISSIONS

Device ID	Device Description	Capacity	Units	Combustion CO_2 PTE (tpy CO_2e)	Combustion CH_4 PTE (tpy)	Combustion N_2O PTE (tpy)	Total Anthropogenic GHG PTE (tpy)	Total Anthropogenic GHG PTE (tpy CO2e)
EU009	Enclosed Flare	3,000	scfm	0.00	2.78	0.55	3.33	232.68
EU004	T1E1 - Caterpillar G3516 Engine/Generator	310	scfm	0.00	0.29	0.06	0.34	24.04
EU003	T1E2 - Caterpillar G3516 Engine/Generator	310	scfm	0.00	0.29	0.06	0.34	24.04
EU007	T2E1 - Caterpillar G3516 Engine/Generator	310	scfm	0.00	0.29	0.06	0.34	24.04
EU006	T2E2 - Caterpillar G3516 Engine/Generator	310	scfm	0.00	0.29	0.06	0.34	24.04
EU002	T3E1 - Caterpillar G3516 Engine/Generator	310	scfm	0.00	0.29	0.06	0.34	24.04
EU001	T3E2 - Caterpillar G3516 Engine/Generator	310	scfm	0.00	0.29	0.06	0.34	24.04
					TOTAL		**5.39**	**376.94**

APPENDIX D

POST-PROJECT POTENTIAL EMISSION CALCULATIONS

Client: Burnsville Sanitary Landfill
Project: Post-Project PTE

				PTE						
Device ID	**Unit ID**	**Device Name**	**Process Name**	**VOCs (ton/yr)**	**NOx (ton/yr)**	**SO2 (ton/yr)**	**CO (ton/yr)**	**PM (ton/yr)**	**PM_{10} (ton/yr)**	**$PM_{2.5}$ (ton/yr)**
	EU008	Decomposing Landfill Gas Emissions	Uncontrolled Fugitive Landfill Gas Emissions	20.3						
	EU009	Enclosed Flare	LFG Specialties 3,000 Enclosed Flare	0.83	23.65	33.28	78.84	6.70	6.70	6.70
T1E1	EU004	T1E1 - Caterpillar G3516 Engine/Generator	Caterpillar G3516 Engine/Generator	7.446	21.90	3.44	24.09	2.55	2.55	2.55
T1E2	EU003	T1E2 - Caterpillar G3516 Engine/Generator	Caterpillar G3516 Engine/Generator	7.446	21.90	3.44	24.09	2.55	2.55	2.55
T2E1	EU007	T2E1 - Caterpillar G3516 Engine/Generator	Caterpillar G3516 Engine/Generator	7.446	21.90	3.44	24.09	2.55	2.55	2.55
T2E2	EU006	T2E2 - Caterpillar G3516 Engine/Generator	Caterpillar G3516 Engine/Generator	7.446	21.90	3.44	24.09	2.55	2.55	2.55
T3E1	EU002	T3E1 - Caterpillar G3516 Engine/Generator	Caterpillar G3516 Engine/Generator	7.446	21.90	3.44	24.09	2.55	2.55	2.55
T3E2	EU001	T3E2 - Caterpillar G3516 Engine/Generator	Caterpillar G3516 Engine/Generator	7.446	21.90	3.44	24.09	2.55	2.55	2.55
	FS001	Dust from unpaved haul roads	Dust from unpaved haul roads					32.7	8.8	0.9
	FS001B	Dust from paved haul roads	Dust from paved haul roads					6.3	1.3	0.3
	FS002	Bulldozing	Bulldozing					9.4	0.74	0.10
	FS002B	Waste and Material Handling	Dust from material handling					0.07	0.03	0.005
Facility Total				**65.79**	**155.1**	**53.9**	**223.4**	**70.5**	**32.9**	**23.3**

Client: Burnsville Sanitary Landfill
Project: Post-Project PTE

Total Facility HAP Emissions

LFG Compound	HAP	VOC	CAS	Concentration (ppmv)	PTE Total lb/yr	PTE Total ton/yr
1,1,1 - Trichloroethane (methyl chloroform)	x	--	71-55-6	0.48	138.5	0.0693
1,1,2,2 - Tetrachloroethane	x	x	79-34-5	1.11	403.1	0.2015
1,1 - Dichloroethane (ethylidene dichloride)	x	x	75-34-3	2.35	503.1	0.2516
1,1 - Dichloroethene (vinylidene chloride)	x	x	75-35-4	0.20	41.9	0.0210
1,2 - Dichloroethane (ethylene dichloride)	x	x	107-06-2	0.41	87.8	0.0439
1,2 - Dichloropropane (propylene dichloride)	x	x	78-87-5	0.18	44.0	0.0220
2-Propanol (isopropyl alcohol)	--	--	67-63-0	50.10	6515.5	3.2578
Acetone (2-propanone)	--	--	67-64-1	7.01	880.9	0.4404
Acrylonitrile (Propenenitrile)	x	x	107-13-1	6.33	726.7	0.3633
Benzene	x	x	71-43-2	1.91	322.8	0.1614
Bromodichloromethane	--	--	75-27-4	3.13	1109.4	0.5547
Butane	--	--	106-97-8	5.03	632.5	0.3162
Carbon Disulfide	x	x	75-15-0	0.58	95.5	0.0478
Carbon Tetrachloride	x	x	56-23-5	0.00	1.3	0.00067
Carbonyl Sulfide	x	x	463-58-1	0.49	63.7	0.0318
Chlorobenzene (monochlorobenzene)	x	x	108-90-7	0.25	60.9	0.0304
Chlorodifluoromethane (CFC-22, freon-22)	--	--	75-45-6	1.30	243.2	0.1216
Chloroethane (ethyl chloride)	x	x	75-00-3	1.25	174.5	0.0872
Chloroform (trichloromethane)	x	x	67-66-3	0.03	7.7	0.0039
Chloromethane (methyl chloride)	x	x	74-87-3	1.21	132.2	0.0661
1,4 Dichlorobenzene (p-dichlorobenzene)	x	x	106-46-7	0.21	66.8	0.0334
Dichlorodifluoromethane (CFC-12, freon-12)	--	--	75-71-8	15.70	4107.0	2.0535
Dichlorofluoromethane (freon-21)	--	--	75-43-4	2.62	583.4	0.2917
Dichloromethane (methylene chloride)	x	--	75-09-2	14.30	2627.6	1.3138
Dimethyl Sulfide (methyl sulfide)[5]	--	--	75-18-3	7.82	1051.2	0.5256
Ethane	--	--	74-84-0	889.00	57836.3	28.9182
Ethanol (ethyl alcohol)	--	--	64-17-5	27.20	2711.7	1.3559
Ethylbenzene	x	x	100-41-4	4.61	1058.9	0.5295
Ethyl Mercaptan (ethanethiol)	--	--	75-08-1	2.28	306.5	0.1532
Ethylene dibromide (1,2 dibromoethane)	x	x	106-93-4	0.00	0.4	0.00020
Fluorotrichloromethane (CFC-11, freon-11)	--	--	75-69-4	0.76	225.9	0.1129
Hexane	x	x	110-54-3	6.57	1225.0	0.6125
Hydrogen Sulfide	--	--	7783-06-4	250.00	18433.4	9.2167
Mercury (total)	x	--	7439-97-6	0.00	0.5	0.00026
Methyl Ethyl Ketone (2-butanone)	x	x	78-93-3	7.09	1106.1	0.5531
Methyl Isobutyl Ketone (hexone)	x	x	108-10-1	1.87	405.2	0.2026
Methyl Mercaptan	--	--	74-93-1	2.49	259.2	0.1296
Pentane	--	--	109-66-0	3.29	513.6	0.2568
Tetrachloroethylene (perchloroethylene, -ethene)	x	--	127-18-4	3.73	1338.3	0.6691
Propane	--	--	74-98-6	11.10	1059.1	0.5295
Toluene (methylbenzene)	x	x	108-88-3	39.30	7834.4	3.9172
Trichloroethylene (trichloroethene)	x	x	79-01-6	2.82	801.6	0.4008
t - 1,2 - Dichloroethene (1,2 dichloroethylene)	--	--	156-60-5	2.84	595.6	0.2978
Vinyl Chloride (chloroethylene, VCM)	x	x	75-01-4	7.34	992.5	0.4963
Xylenes (m, o, p)	x	x	1330-20-7	12.10	2779.4	1.3897
Hydrogen Chloride	x	--	7647-01-0	42.10	10341.6	5.1708
				Total HAP	33382.3	16.691
				Max Indiv. HAP	10341.6	5.171

Client: Burnsville Sanitary Landfill

Project: Post-Project PTE

Burnsville Landfill Fugitive - PTE (after expansion)

Landfill Gas Collection System Collection Efficiency[a]	75%	(assumed)	
Landfill gas generation rate	3,081,592,800	scf/yr LFG	
	5,863	scfm	Year 2068
LFG fugitive flow	770,398,200	scf/yr LFG	770.40 mmcf/year
	1,466	scfm	

LFG Compound	HAP	VOC	CAS	MW (lb/lb-mol)	Compound Conc & Mass in Inlet Gas (ppmv)[b]	(lb/hr)	Control Eff	Fugitive Emissions (lb/hr)*	(tpy)*
1,1,1 - Trichloroethane (methyl chloroform)	x	--	71-55-6	133.41	**0.48**	1.48E-02	0.0%	1.48E-02	6.50E-02
1,1,2,2 - Tetrachloroethane	x	x	79-34-5	167.85	**1.11**	4.32E-02	0.0%	4.32E-02	1.89E-01
1,1 - Dichloroethane (ethylidene dichloride)	x	x	75-34-3	98.96	**2.35**	5.39E-02	0.0%	5.39E-02	2.36E-01
1,1 - Dichloroethene (vinylidene chloride)	x	x	75-35-4	96.94	**0.20**	4.49E-03	0.0%	4.49E-03	1.97E-02
1,2 - Dichloroethane (ethylene dichloride)	x	x	107-06-2	98.96	**0.41**	9.40E-03	0.0%	9.40E-03	4.12E-02
1,2 - Dichloropropane (propylene dichloride)	x	x	78-87-5	112.99	**0.18**	4.71E-03	0.0%	4.71E-03	2.06E-02
2-Propanol (isopropyl alcohol)	--	x	67-63-0	60.11	**50.1**	6.98E-01	0.0%	6.98E-01	3.06E+00
Acetone (2-propanone)	--	--	67-64-1	58.08	**7.01**	9.43E-02	0.0%	9.43E-02	4.13E-01
Acrylonitrile (Propenenitrile)	x	x	107-13-1	53.06	**6.33**	7.78E-02	0.0%	7.78E-02	3.41E-01
Benzene	x	x	71-43-2	78.12	**1.91**	3.46E-02	0.0%	3.46E-02	1.51E-01
Bromodichloromethane	--	x	75-27-4	163.83	**3.13**	1.19E-01	0.0%	1.19E-01	5.20E-01
Butane	--	x	106-97-8	58.12	**5.03**	6.77E-02	0.0%	6.77E-02	2.97E-01
Carbon Disulfide	x	x	75-15-0	76.14	***0.58***	1.02E-02	0.0%	1.02E-02	4.48E-02
Carbon Tetrachloride	x	x	56-23-5	153.84	**0.004**	1.43E-04	0.0%	1.43E-04	6.24E-04
Carbonyl Sulfide	x	x	463-58-1	60.07	***0.49***	6.82E-03	0.0%	6.82E-03	2.99E-02
Chlorobenzene (monochlorobenzene)	x	x	108-90-7	112.56	**0.25**	6.52E-03	0.0%	6.52E-03	2.85E-02
Chlorodifluoromethane (CFC-22, freon-22)	--	--	75-45-6	86.47	**1.30**	2.60E-02	0.0%	2.60E-02	1.14E-01
Chloroethane (ethyl chloride)	x	x	75-00-3	64.52	**1.25**	1.87E-02	0.0%	1.87E-02	8.18E-02
Chloroform (trichloromethane)	x	x	67-66-3	119.38	**0.03**	8.30E-04	0.0%	8.30E-04	3.63E-03
Chloromethane (methyl chloride)	x	x	74-87-3	50.49	**1.21**	1.42E-02	0.0%	1.42E-02	6.20E-02
1,4 Dichlorobenzene (p-dichlorobenzene)	x	x	106-46-7	147	**0.21**	7.15E-03	0.0%	7.15E-03	3.13E-02
Dichlorodifluoromethane (CFC-12, freon-12)	--	--	75-71-8	120.91	**15.7**	4.40E-01	0.0%	4.40E-01	1.93E+00
Dichlorofluoromethane (freon-21)	--	--	75-43-4	102.92	**2.62**	6.25E-02	0.0%	6.25E-02	2.74E-01
Dichloromethane (methylene chloride)	x	--	75-09-2	84.93	**14.3**	2.81E-01	0.0%	2.81E-01	1.23E+00
Dimethyl Sulfide (methyl sulfide)	--	x	75-18-3	62.13	***7.82***	1.13E-01	0.0%	1.13E-01	4.93E-01
Ethane	--	--	74-84-0	30.07	**889**	6.19E+00	0.0%	6.19E+00	2.71E+01
Ethanol (ethyl alcohol)	--	x	64-17-5	46.08	27.2	2.90E-01	0.0%	2.90E-01	1.27E+00
Ethylbenzene	x	x	100-41-4	106.17	4.61	1.13E-01	0.0%	1.13E-01	4.97E-01
Ethyl Mercaptan (ethanethiol)	--	x	75-08-1	62.13	*2.28*	3.28E-02	0.0%	3.28E-02	1.44E-01
Ethylene dibromide (1,2 dibromoethane)	x	x	106-93-4	187.88	0.001	4.35E-05	0.0%	4.35E-05	1.91E-04
Fluorotrichloromethane (CFC-11, freon-11)	--	--	75-69-4	137.37	0.76	2.42E-02	0.0%	2.42E-02	1.06E-01
Hexane	x	x	110-54-3	86.18	6.57	1.31E-01	0.0%	1.31E-01	5.74E-01
Hydrogen Sulfide[d]	--	--	7783-06-4	34.08	*250.0*	1.97E+00	0.0%	1.97E+00	8.64E+00
Mercury (total)	x	--	7439-97-6	200.61	2.92E-04	1.36E-05	0.0%	1.36E-05	5.94E-05
Methyl Ethyl Ketone (2-butanone)	--	x	78-93-3	72.11	7.09	1.18E-01	0.0%	1.18E-01	5.19E-01
Methyl Isobutyl Ketone (hexone)	x	x	108-10-1	100.16	1.87	4.34E-02	0.0%	4.34E-02	1.90E-01
Methyl Mercaptan	--	x	74-93-1	48.11	*2.49*	2.77E-02	0.0%	2.77E-02	1.22E-01
Pentane	--	x	109-66-0	72.15	3.29	5.50E-02	0.0%	5.50E-02	2.41E-01
Tetrachloroethylene (perchloroethylene, -ethene)	x	--	127-18-4	165.83	3.73	1.43E-01	0.0%	1.43E-01	6.27E-01
Propane	--	x	74-98-6	44.1	11.1	1.13E-01	0.0%	1.13E-01	4.97E-01
Toluene (methylbenzene)	x	x	108-88-3	92.14	39.3	8.39E-01	0.0%	8.39E-01	3.67E+00
Trichloroethylene (trichloroethene)	x	x	79-01-6	131.38	2.82	8.58E-02	0.0%	8.58E-02	3.76E-01
t - 1,2 - Dichloroethene (1,2 dichloroethylene)	--	x	156-60-5	96.94	2.84	6.38E-02	0.0%	6.38E-02	2.79E-01
Vinyl Chloride (chloroethylene, VCM)	x	x	75-01-4	62.50	7.34	1.06E-01	0.0%	1.06E-01	4.65E-01
Xylenes (m, o, p)	x	x	1330-20-7	106.17	12.1	2.98E-01	0.0%	2.98E-01	1.30E+00
NMOC (as hexane)				86.18	595.0	1.19E+01	0.0%	1.19E+01	5.20E+01
VOC (as hexane)				86.18	232.0	4.63E+00	0.0%	4.63	20.28
Total HAP								2.35	10.284786
Maximum Single HAP								0.84	3.673507

[a] Average collection efficiency of a landfill gas collection system is 75% based on AP-42 Section 2.4-4.2. Collection efficiencies could range from 60->90%.

[b] Concentrations (except acrylonitrile and hydrogen sulfide) based on U.S. E.P.A., Compilation of Air Pollutant Emission Factors, Volume I. Stationary Point and Area Sources ("AP-42"), 5th Ed., November 1998. Tables 2.4-1, 2.4-2, 2.4-3.

[d] Proposed Limit in Major Permit Amendment

Each Engine Inputs

Standard Values, Assumed Constants

Category	Value		Equivalent	
Standard Temperature	60	^{o}F	520	^{o}R
Universal Gas Constant	0.7302	atm-ft^{3}/lb-mol^{o}R		
Pressure	1	atm		
Methane Heating Value	1,000	Btu/ft^{3}		
LFG Methane Component	50.0%			
LFG Typical Heating Value	500	Btu/ft^{3}		
LFG Temperature	100	^{o}F	560	^{o}R
LFG Moisture	8%			

Operating Parameters - Inputted and Calculated

Engine Information (per engine)	Value		Equivalent	
Operation Period	8,760.0	hr		
Mechanical Output	1,148	bhp		
LFG Burned	162,936,000	cf/yr		
LFG Inlet Flow	310	scfm	163	mmscf/yr
LFG Inlet Flow, dry standard	285	dscfm		
Heat Input	9.30	MMBtu/hr	81468	MMBtu/yr

Each Engine Criteria Pollutants

Operation Period	8,760	hr
LFG inlet flow, standard	310	scfm
Heat Input	9.3	MMBtu/hr
Mechanical Output	1,148	bhp
LFG inlet flow, dry	285	dscfm

SO_2 Emission Rate

SO_2 concentration in exhaust gas	250	ppmv		
SO_2 emission rate	0.78	lb/hr	3.4	ton/yr
	42.2	lb/MMCF LFG		
	0.084	lb/MMBTU		

Sulfur Compound	CAS	MW (lb/lb-mol)	Conc (ppmv)[a,b]	Control Eff[b]	S Atoms	Conc (ppmv)	Emiss (lb/hr)
Carbon Disulfide	75-15-0	76.13	0.58	98.0%	2	1.14	0.00
Carbonyl Sulfide	463-58-1	60.07	0.49	98.0%	1	0.48	0.00
Dimethyl Sulfide (methyl sulfide)	75-18-3	62.13	7.82	98.0%	1	7.66	0.02
Ethyl Mercaptan (ethanethiol)	54	62.13	2.28	98.0%	1	2.23	0.01
Hydrogen Sulfide	7783-06-4	34.08	250.00	98.0%	1	250.0	0.78
Methyl Mercaptan	74-93-1	48.11	2.49	98.0%	1	2.44	0.01
				Total Contribution to SO_2[a] :		250.0	0.78

PM/PM_{10} Emission Rate

Current Title V Permit No. 03700192-00	0.23	g/bhp-hr (manufacturer's guarantee)		
	0.58	lb/hr	2.55	ton/yr

NO_2 Emission Rate[d]

Title V Permit No. 03700192-004:	0.538	lb/MMBTU (calculated based on 5.0 lb/hr and 9.3 MMBTU/hr)				
	2.0	g/bhp-hr (calculated based on 5.0 lb/hr and 1148 hp)				
NO_2 emission rate - per engine	5.00	lb/hr	21.9	ton/yr	43800	lb/yr

CO Emission Rate[d]

Title V Permit No. 03700192-004:	0.591	lb/MMBTU (calculated based on 5.5 lb/hr and 9.3 MMBTU/hr)				
	2.2	g/bhp-hr (calculated based on 5.5 lb/hr and 1148 hp)				
CO emission rate - per engine	5.50	lb/hr	24.1	ton/yr	48180	lb/yr

NMOC Emission Rate

NMOC conc inlet gas[c]	595	ppmv		
MW hexane	86.18	lb/lb-mol		
destruction efficiency	98%			
mass NMOC inlet gas	2.5	lb/hr		
NMOC emission rate	0.05	lb/hr	0.22	ton/yr

VOC Emission Rate[d]

Title V Permit No. 03700192-004:	1.70	lb/hr (manufacturer guarantee)	7.45	ton/yr
	0.18	lb/MMBTU (calculated based on 1.7 lb/hr and 9.3 MMBTU/hr)		

[a] H2S concentration as proposed in Major Permit Amendment submitted in January 2018.

[b] AP-42 gives ranges for control efficiencies. Assume 98% control through treatment and burning landfill gas in engines.

[c] AP-42 Section 2.4.

[d] Based on technical support document included with current Air Emission Permit (Permit No. 03700192-004) issued August 22, 2013. Emission rate is 5 lb/hr for NOx, 5.5 lb/hr for CO and 1.7 lb/hr for VOC.

Each Engine HAPs

LFG inlet flow 310 scfm

LFG Compound	HAP	VOC	CAS	MW (lb/lb-mol)	Compound Conc & Mass in Inlet Gas (ppmv)[a]	(lb/hr)	Control Eff	PTE Each Engine lb/hr	ton/yr
1,1,1 - Trichloroethane (methyl chloroform)	x	--	71-55-6	133.41	0.48	3.14E-03	98.0%	6.27E-05	2.75E-04
1,1,2,2 - Tetrachloroethane	x	x	79-34-5	167.85	1.11	9.13E-03	98.0%	1.83E-04	7.99E-04
1,1 - Dichloroethane (ethylidene dichloride)	x	x	75-34-3	98.96	2.35	1.14E-02	98.0%	2.28E-04	9.98E-04
1,1 - Dichloroethene (vinylidene chloride)	x	x	75-35-4	96.94	0.20	9.50E-04	98.0%	1.90E-05	8.32E-05
1,2 - Dichloroethane (ethylene dichloride)	x	x	107-06-2	98.96	0.41	1.99E-03	98.0%	3.98E-05	1.74E-04
1,2 - Dichloropropane (propylene dichloride)	x	x	78-87-5	112.99	0.18	9.96E-04	98.0%	1.99E-05	8.73E-05
2-Propanol (isopropyl alcohol)	--	y	67-63-0	60.11	50.1	1.48E-01	98.0%	2.95E-03	1.29E-02
Acetone (2-propanone)	--	--	67-64-1	58.08	7.01	1.99E-02	98.0%	3.99E-04	1.75E-03
Acrylonitrile (Propenenitrile)	x	x	107-13-1	53.06	6.33	1.65E-02	98.0%	3.29E-04	1.44E-03
Benzene	x	x	71-43-2	78.12	1.91	7.31E-03	98.0%	1.46E-04	6.40E-04
Bromodichloromethane	--	y	75-27-4	163.83	3.13	2.51E-02	98.0%	5.02E-04	2.20E-03
Butane	--	y	106-97-8	58.12	5.03	1.43E-02	98.0%	2.86E-04	1.25E-03
Carbon Disulfide	x	x	75-15-0	76.14	0.58	2.16E-03	98.0%	4.33E-05	1.90E-04
Carbon Tetrachloride	x	x	56-23-5	153.84	0.004	3.01E-05	98.0%	6.03E-07	2.64E-06
Carbonyl Sulfide	x	x	463-58-1	60.07	0.49	1.44E-03	98.0%	2.88E-05	1.26E-04
Chlorobenzene (monochlorobenzene)	x	x	108-90-7	112.56	0.25	1.38E-03	98.0%	2.76E-05	1.21E-04
Chlorodifluoromethane (CFC-22, freon-22)	--	--	75-45-6	86.47	1.30	5.51E-03	98.0%	1.10E-04	4.82E-04
Chloroethane (ethyl chloride)	x	x	75-00-3	64.52	1.25	3.95E-03	98.0%	7.90E-05	3.46E-04
Chloroform (trichloromethane)	x	x	67-66-3	119.38	0.03	1.75E-04	98.0%	3.51E-06	1.54E-05
Chloromethane (methyl chloride)	x	x	74-87-3	50.49	1.21	2.99E-03	98.0%	5.99E-05	2.62E-04
1,4 Dichlorobenzene (p-dichlorobenzene)	x	x	106-46-7	147	0.21	1.51E-03	98.0%	3.02E-05	1.32E-04
Dichlorodifluoromethane (CFC-12, freon-12)	--	--	75-71-8	120.91	15.7	9.30E-02	98.0%	1.86E-03	8.15E-03
Dichlorofluoromethane (freon-21)	--	--	75-43-4	102.92	2.62	1.32E-02	98.0%	2.64E-04	1.16E-03
Dichloromethane (methylene chloride)	x	--	75-09-2	84.93	14.3	5.95E-02	98.0%	1.19E-03	5.21E-03
Dimethyl Sulfide (methyl sulfide)	--	y	75-18-3	62.13	7.82	2.38E-02	98.0%	4.76E-04	2.08E-03
Ethane	--	--	74-84-0	30.07	889	1.31E+00	98.0%	2.62E-02	1.15E-01
Ethanol (ethyl alcohol)	--	y	64-17-5	46.08	27.2	6.14E-02	98.0%	1.23E-03	5.38E-03
Ethylbenzene	x	x	100-41-4	106.17	4.61	2.40E-02	98.0%	4.80E-04	2.10E-03
Ethyl Mercaptan (ethanethiol)	--	y	75-08-1	62.13	2.28	6.94E-03	98.0%	1.39E-04	6.08E-04
Ethylene dibromide (1,2 dibromoethane)	x	x	106-93-4	187.88	0.001	9.20E-06	98.0%	1.84E-07	8.06E-07
Fluorotrichloromethane (CFC-11, freon-11)	--	--	75-69-4	137.37	0.76	5.11E-03	98.0%	1.02E-04	4.48E-04
Hexane	x	x	110-54-3	86.18	6.57	2.77E-02	98.0%	5.55E-04	2.43E-03
Hydrogen Sulfide[b]	--	--	7783-06-4	34.08	250.0	4.17E-01	98.0%	8.35E-03	3.66E-02
Mercury (total)	x	--	7439-97-6	200.61	2.92E-04	2.87E-06	0.0%	2.87E-06	1.26E-05
Methyl Ethyl Ketone (2-butanone)	x	x	78-93-3	72.11	7.09	2.50E-02	98.0%	5.01E-04	2.19E-03
Methyl Isobutyl Ketone (hexone)	x	x	108-10-1	100.16	1.87	9.17E-03	98.0%	1.83E-04	8.04E-04
Methyl Mercaptan	--	y	74-93-1	48.11	2.49	5.87E-03	98.0%	1.17E-04	5.14E-04
Pentane	--	y	109-66-0	72.15	3.29	1.16E-02	98.0%	2.33E-04	1.02E-03
Tetrachloroethylene (perchloroethylene, -ethene)	x	x	127-18-4	165.83	3.73	3.03E-02	98.0%	6.06E-04	2.65E-03
Propane	--	y	74-98-6	44.1	11.1	2.40E-02	98.0%	4.80E-04	2.10E-03
Toluene (methylbenzene)	x	x	108-88-3	92.14	39.3	1.77E-01	98.0%	3.55E-03	1.55E-02
Trichloroethylene (trichloroethene)	x	x	79-01-6	131.38	2.82	1.81E-02	98.0%	3.63E-04	1.59E-03
t - 1,2 - Dichloroethene (1,2 dichloroethylene)	--	--	156-60-5	96.94	2.84	1.35E-02	98.0%	2.70E-04	1.18E-03
Vinyl Chloride (chloroethylene, VCM)	x	x	75-01-4	62.50	7.34	2.25E-02	98.0%	4.49E-04	1.97E-03
Xylenes (m, o, p)	x	x	1330-20-7	106.17	12.1	6.29E-02	98.0%	1.26E-03	5.51E-03
Hydrogen Chloride[c]	x	--	7647-01-0	36.50	42.1	7.53E-02	0.0%	7.53E-02	3.30E-01
							Total HAP	0.086	0.38
							Maximum Single HAP	0.075	0.33

Enclosed Flare

Standard Conditions, Constants, and Typical Values

Category	Value		Equivalent	
Standard Temperature[1]	60	°F	520	R
Universal Gas Constant	0.7302	atm-ft^3/lb-mol-R		
Pressure[1]	1	atm		
Methane Heating Value[2]	1,000	Btu/ft^3		
LFG Methane Component[3]	**50.0%**	%		
LFG Typical Heating Value	500	Btu/ft^3		
LFG Temperature[3]	60	°F	520	R
LFG Moisture[3]	**8%**	%		

Fuel & Equipment - Enclosed Flare

Flare Information	Value		Equivalent	
No. of Hours of Operation Per Day[5]	**24**	hr		
No. of Days in Averaging Period[5]	**365**	day		
Operation Period[5]	8,760	hr		
LFG Burned	1,576,800,000	scf/yr	1,577	mmcf/year
LFG inlet flow, standard[4]	3,000	scfm	788.4	
LFG Inlet Flow, dry standard	2,760	dscfm		
Heat Input	90.0	MMBtu/hr	788,400	MMBtu/year
Design Flare Operating Temperature[4]	**1,650**	°F	2,110	R
Flare Tip Flow, standard	3,000	scfm		
Flare Tip Flow, actual	3,000	acfm		
Flare Tip Diameter[4]	**10.0**	ft		
Flare Heat release (gross)	6,300,000	cal/s		
Flare Heat release (net)	4,641,480			

[1] Industrial STP (60°F, 30.00 in. Hg, 1 atm)

[2] Typical

[3] Average measured value.

[4] Manufacturer's information.

[5] PTE based on an operating period of 8760 hours/year.

Criteria Pollutant Emissions - Enclosed Flare

Operation Period	8,760	hr
LFG inlet flow, standard	3,000	scfm
Heat Input	90	MMBtu/hr

CO Emission Rate

CO emission factor[1]	0.20	lb/MMBtu				
	100.0	lb/MMCF LFG (calculated)				
CO emission rate	18.0	lb/hr	78.8	tpy	157,680	lb/yr

NO_2 Emission Rate

NO_2 emission factor[1]	0.060	lb/MMBtu				
	30.0	lb/MMCF LFG (calculated)				
NO_2 emission rate	5.40	lb/hr	23.65	tpy	47,304	lb/yr

SO_2 Emission Rate

SO_2 concentration in exhaust gas	250.0	ppmv				
	42.21	lb/MMCF LFG (calculated)				
SO_2 emission rate	7.60	lb/hr	33.28	tpy	66,553	lb/yr

					Individual Compound				
LFG Compound	CAS	MW (lb/lb-mol)	Conc (ppmv)	Control Eff	No. of S Atoms	S Conc (ppmv)	SO_2 Emiss (lb/hr)	Conc (ppmv)	Control Eff[3]
Carbon Disulfide	75-15-0	76.13			2	1.14	0.03	0.58	98%
Carbonyl Sulfide	463-58-1	60.07			1	0.48	0.01	0.49	98%
Dimethyl Sulfide (methyl sulfide)	75-18-3	62.13			1	7.66	0.23	7.82	98%
Ethyl Mercaptan (ethanethiol)	75-08-1	62.13			1	2.23	0.07	2.28	98%
Hydrogen Sulfide	7783-06-4	34.08			1	250.0	7.60	250	98%
Methyl Mercaptan	74-93-1	48.11			1	2.44	0.07	2.49	98%
			Total Contribution to SO_2 :			250.00	7.60		

PM_{10} Emission Rate

PM emission factor[2]	17	lb/MM dscf CH_4				
	8.50	lb/MM scf LFG				
PM emission rate	1.53	lb/hr	6.70	tpy	13,403	lb/yr

NMOC Emission Rate

NMOC conc inlet gas[2]	595	ppmv				
MW hexane	86.18	lb/lb-mol				
destruction efficiency	98%					
mass NMOC inlet gas	24.32	lb/hr				
NMOC emission rate	0.49	lb/hr	2.13	tpy	4,261	lb/yr

VOC Emission Rate

NMOC conc inlet gas[2]	595	ppmv				
VOC fraction of NMOC[2]	39%					
VOC concentration in inlet gas	232	ppmv				
MW hexane	86.18	lb/lb-mol				
mass VOC inlet gas	9.49	lb/hr				
destruction efficiency	98%					
VOC emission rate	0.19	lb/hr	0.83	tpy	1,662	lb/yr

VOC emission factor uncontrolled	52.70 lb/MMCF LFG	(uncontrolled)	83097.926	lb/yr uncontrolled

[1] Manufacturers guarantee, noted Technical Support Document included with Permit 03700192-004

[2] EPA, *Compilation of Air Pollutant Emission Factors, Volume I. Stationary Point and Area Sources*, *5th Ed*. (November 1998).

[3] NSPS minimum required control efficiency

LFG Flow = 3,000 scfm

LFG Compound	HAP	VOC	CAS	MW (lb/lb-mol)	Compound Conc & Mass in Inlet Gas (ppmv)[a]	(lb/hr)	Control Eff	Flare Exhaust (lb/hr)	(tpy)
1,1,1 - Trichloroethane (methyl chloroform)	x	--	71-55-6	133.41	0.48	3.04E-02	98.0%	6.08E-04	2.66E-03
1,1,2,2 - Tetrachloroethane	x	x	79-34-5	167.85	1.11	8.84E-02	98.0%	1.77E-03	7.74E-03
1,1 - Dichloroethane (ethylidene dichloride)	x	x	75-34-3	98.96	2.35	1.10E-01	98.0%	2.21E-03	9.66E-03
1,1 - Dichloroethene (vinylidene chloride)	x	x	75-35-4	96.94	0.20	9.20E-03	98.0%	1.84E-04	8.06E-04
1,2 - Dichloroethane (ethylene dichloride)	x	x	107-06-2	98.96	0.41	1.92E-02	98.0%	3.85E-04	1.69E-03
1,2 - Dichloropropane (propylene dichloride)	x	x	78-87-5	112.99	0.18	9.65E-03	98.0%	1.93E-04	8.45E-04
2-Propanol (isopropyl alcohol)	--	x	67-63-0	60.11	50.1	1.43E+00	98.0%	2.86E-02	1.25E-01
Acetone (2-propanone)	--	--	67-64-1	58.08	7.01	1.93E-01	98.0%	3.86E-03	1.69E-02
Acrylonitrile (Propenenitrile)	x	x	107-13-1	53.06	6.33	1.59E-01	98.0%	3.19E-03	1.40E-02
Benzene	x	x	71-43-2	78.12	1.91	7.08E-02	98.0%	1.42E-03	6.20E-03
Bromodichloromethane	--	x	75-27-4	163.83	3.13	2.43E-01	98.0%	4.86E-03	2.13E-02
Butane	--	x	106-97-8	58.12	5.03	1.39E-01	98.0%	2.77E-03	1.21E-02
Carbon Disulfide	x	x	75-15-0	76.14	*0.58*	2.09E-02	98.0%	4.19E-04	1.84E-03
Carbon Tetrachloride	x	x	56-23-5	153.84	0.004	2.92E-04	98.0%	5.84E-06	2.56E-05
Carbonyl Sulfide	x	x	463-58-1	60.07	*0.49*	1.40E-02	98.0%	2.79E-04	1.22E-03
Chlorobenzene (monochlorobenzene)	x	x	108-90-7	112.56	0.25	1.33E-02	98.0%	2.67E-04	1.17E-03
Chlorodifluoromethane (CFC-22, freon-22)	--	--	75-45-6	86.47	1.30	5.33E-02	98.0%	1.07E-03	4.67E-03
Chloroethane (ethyl chloride)	x	x	75-00-3	64.52	1.25	3.83E-02	98.0%	7.65E-04	3.35E-03
Chloroform (trichloromethane)	x	x	67-66-3	119.38	0.03	1.70E-03	98.0%	3.40E-05	1.49E-04
Chloromethane (methyl chloride)	x	x	74-87-3	50.49	1.21	2.90E-02	98.0%	5.80E-04	2.54E-03
1,4 Dichlorobenzene (p-dichlorobenzene)	x	x	106-46-7	147	0.21	1.46E-02	98.0%	2.93E-04	1.28E-03
Dichlorodifluoromethane (CFC-12, freon-12)	--	--	75-71-8	120.91	15.7	9.00E-01	98.0%	1.80E-02	7.89E-02
Dichlorofluoromethane (freon-21)	--	--	75-43-4	102.92	2.62	1.28E-01	98.0%	2.56E-03	1.12E-02
Dichloromethane (methylene chloride)	x	--	75-09-2	84.93	14.3	5.76E-01	98.0%	1.15E-02	5.05E-02
Dimethyl Sulfide (methyl sulfide)	--	x	75-18-3	62.13	*7.82*	2.30E-01	98.0%	4.61E-03	2.02E-02
Ethane	--	--	74-84-0	30.07	889	1.27E+01	98.0%	2.54E-01	1.11E+00
Ethanol (ethyl alcohol)	--	x	64-17-5	46.08	27.2	5.95E-01	98.0%	1.19E-02	5.21E-02
Ethylbenzene	x	x	100-41-4	106.17	4.61	2.32E-01	98.0%	4.64E-03	2.03E-02
Ethyl Mercaptan (ethanethiol)	--	x	75-08-1	62.13	*2.28*	6.72E-02	98.0%	1.34E-03	5.89E-03
Ethylene dibromide (1,2 dibromoethane)	x	x	106-93-4	187.88	0.001	8.91E-05	98.0%	1.78E-06	7.81E-06
Fluorotrichloromethane (CFC-11, freon-11)	--	--	75-69-4	137.37	0.76	4.95E-02	98.0%	9.90E-04	4.34E-03
Hexane	x	x	110-54-3	86.18	6.57	2.69E-01	98.0%	5.37E-03	2.35E-02
Hydrogen Sulfide[b]	--	--	7783-06-4	34.08	*250.0*	4.04E+00	98.0%	8.08E-02	3.54E-01
Mercury (total)	x	--	7439-97-6	200.61	2.92E-04	2.78E-05	0.0%	2.78E-05	1.22E-04
Methyl Ethyl Ketone (2-butanone)	--	x	78-93-3	72.11	7.09	2.43E-01	98.0%	4.85E-03	2.12E-02
Methyl Isobutyl Ketone (hexone)	x	x	108-10-1	100.16	1.87	8.88E-02	98.0%	1.78E-03	7.78E-03
Methyl Mercaptan	--	x	74-93-1	48.11	*2.49*	5.68E-02	98.0%	1.14E-03	4.98E-03
Pentane	--	x	109-66-0	72.15	3.29	1.13E-01	98.0%	2.25E-03	9.86E-03
Tetrachloroethylene (perchloroethylene, -ethe	x	--	127-18-4	165.83	3.73	2.93E-01	98.0%	5.87E-03	2.57E-02
Propane	--	x	74-98-6	44.1	11.1	2.32E-01	98.0%	4.64E-03	2.03E-02
Toluene (methylbenzene)	x	x	108-88-3	92.14	39.3	1.72E+00	98.0%	3.44E-02	1.50E-01
Trichloroethylene (trichloroethene)	x	x	79-01-6	131.38	2.82	1.76E-01	98.0%	3.51E-03	1.54E-02
t - 1,2 - Dichloroethene (1,2 dichloroethylene)	--	x	156-60-5	96.94	2.84	1.31E-01	98.0%	2.61E-03	1.14E-02
Vinyl Chloride (chloroethylene, VCM)	x	x	75-01-4	62.50	7.34	2.18E-01	98.0%	4.35E-03	1.91E-02
Xylenes (m, o, p)	x	x	1330-20-7	106.17	12.1	6.09E-01	98.0%	1.22E-02	5.34E-02
Hydrogen Chloride[c]	x	--	7647-01-0	36.50	42.1	7.29E-01	0.0%	7.29E-01	3.19E+00
Total HAP								0.83	3.614
Maximum Single HAP								1.72	3.193

a. Concentrations from EPA, *Compilation of Air Pollutant Emission Factors, Volume I. Stationary Point and Area Sources, 5th Ed.* (November 1998). Tables 2.4-1 and 2.4-2 unless otherwise noted

b. Concentration based on site specific data

c. Product of combustion

Road Emissions

Site Specific Information	Value	Reference
Paved Road Length (one way)	0.47 mi	Front Entry Paved Area
Unpaved Road Length (one way)	0.68 mi	To Active Filling Area
No. of Hours of Operation Per Day	14 hr/day	Provided by WM
No. of Days in Averaging Period, N	270 day/yr	Provided by WM
No. of Hours of Operation Per Averaging Period	3780 hr/yr	Provided by WM
No. of "Wet" Days (i.e., at least 0.01 in. precip), P	120 day	AP-42 Figure 13.2.1-2
Silt Loading, sL	7.4 g/m2	AP-42, Table 13.2.1-3
Surface Material Silt Content, s	6.4%	AP-42 Table 13.2.2-1
Control Efficiency, CE 24-Hour	80%	Level 2 Plan
Control Efficiency, CE Annual	90%	Level 2 Plan

Calculation of Mean Vehicle Weight

	Vehicle Weight[1]				
	Unloaded	Loaded	Average	Vehicles	
Vehicle Type	(ton)	(ton)	(ton)	Per Day	Reference
Semi	20.00	26.57	23.3	333	1

Total Vehicle Count ..... 333 per day
Total Vehicles per hour ..... 24 per hr
Mean Vehicle Weight, W ..... 23.3 ton

Paved Road Emissions	Value	References
Predictive Emission Factor Equation	$E = \{[k*(sL)^{0.91}*(W)^{1.02}]*(1-P/4N)\}*CE$	2
Particle Size Multiplier - PM2.5, k	0.00054	2
Particle Size Multiplier - PM10, k	0.0022	2
Particle Size Multiplier2 - PM30, k	0.011	2

Emission Factors

	Uncontrolled	Controlled 24-Hour	Controlled Annual
PM2.5	0.074 lb/VMT	0.015 lb/VMT	0.007 lb/VMT
PM10	0.300 lb/VMT	0.060 lb/VMT	0.030 lb/VMT
Total PM	1.499 lb/VMT	0.300 lb/VMT	0.150 lb/VMT

Total Miles Travelled - Paved Roads ..... 83,594 VMT/yr
Total Miles Traveled - Paved Roads per day ..... 310 VMT/day
Total Miles Traveled - Paved Roads per hour ..... 22 VMT/hr

Emission Rates

	lb/hr	lb/day	ton/yr
Calculated Emissions - PM2.5	0.33 lb/hr	4.6 lb/day	0.31 ton/yr
Calculated Emissions - PM10	1.33 lb/hr	18.6 lb/day	1.25 ton/yr
Calculated Emissions - PM30	6.63 lb/hr	92.8 lb/day	6.26 ton/yr

Unpaved Road Emissions	Value	References
Predictive Emission Factor Equation	$[k*(s/12)^{a}*(W/3)^{b}]*[(365-P)/365)$	3

Constants

	k	a	b
PM2.5	0.15	0.9	0.45
PM10	1.50	0.9	0.45
Total PM	4.90	0.7	0.45

Emission Factors

	Uncontrolled	Controlled 24-Hour	Controlled Annual
PM2.5	0.14 lb/VMT	0.029 lb/VMT	0.014 lb/VMT
PM10	1.44 lb/VMT	0.288 lb/VMT	0.144 lb/VMT
Total PM	5.33 lb/VMT	1.065 lb/VMT	0.533 lb/VMT

Total Miles Traveled - Unpaved Roads per year ..... 122,908 VMT/yr
Total Miles Traveled - Unpaved Roads per day ..... 455 VMT/day

Emission Rates

	lb/hr	lb/day	ton/yr
Calculated Emissions - PM2.5	0.94 lb/hr	13.1 lb/day	0.88 ton/yr
Calculated Emissions - PM10	9.35 lb/hr	130.9 lb/day	8.84 ton/yr
Calculated Emissions - PM30	34.64 lb/hr	484.9 lb/day	32.73 ton/yr

1. Site specific information provided by facility staff

2. EPA, "Emissions Factors & AP 42, Compilation of Air Pollutant Emission Factors," Section 13.2.1, Jan. 2011.

3. EPA, "Emissions Factors & AP 42, Compilation of Air Pollutant Emission Factors," Section 13.2.2, Jan. 2011.

Aggregate Handling and Storage Piles

Site Specific Information	Value	
Amount of Material Handled Per Day	2,556 ton/day	Total Waste + Daily Cover
No. of Hours of Operation Per Day	14 hr/day	Estimate
No. of Days in Averaging Period, N	270 day/yr	Estimate
No. of Hours of Operation Per Averaging Period	3780 hr/yr	Based on 270 day/yr, 10 hr/day
Mean Wind Speed, U	6 mph	Estimated
Surface Material Moisture Content, M	14.2%	Estimated

Aggregate Handling & Storage Pile Emissions	Value		References
Predictive Emission Factor Equation	$E = [k*0.0032]*[((U/5)^{1.3})/((M/2)^{1.4})]$		1
Particle Size Multiplier - PM2.5, k	0.053		1
Particle Size Multiplier - PM10, k	0.35		1
Particle Size Multiplier2 - PM30, k	0.74		1
Calculated Emission Factor - PM2.5, E	1.38E-05 lb/ton		
Calculated Emission Factor - PM10, E	9.13E-05 lb/ton		
Calculated Emission Factor - PM30, E	1.93E-04 lb/ton		
Calculated Emissions - PM2.5	0.0048 tpy	0.0025 lb/hr	
Calculated Emissions - PM10	0.0315 tpy	0.0167 lb/hr	
Calculated Emissions - PM30	0.0666 tpy	0.0352 lb/hr	

Notes:

1. EPA, "Emissions Factors & AP 42, Compilation of Air Pollutant Emission Factors," Section 13.2.4, Nov. 2006.

Particulate Matter Emissions from Bulldozer Operations

AP-42 Table 13.2.3-1

Table 13.2.3-1 (cont.).

Construction Phase	Dust-generating Activities	Recommended Emission Factor	Comments	Rating Adjustment[b]
II. Site Preparation (earth moving)	1. Bulldozing	Dozer equation (overburden) in Tables 11.9-1 and 11.9-2		-1/-2[c]
	2. Scrapers unloading topsoil	Scraper unloading factor in Table 11.9-4		-1
	3. Scrapers in travel	Scraper (travel mode) expression in Tables 11.9-1 and 11.9-2		-0/-1[c]
	4. Scrapers removing topsoil	5.7 kg/vehicle kilometer traveled (VKT) (20.2 lb/vehicle mile traveled [VMT])		E[d]
	5. Loading of excavated material into trucks	Material handling emission factor equation in Section 13.2.4		-0/-1[c]
	6. Truck dumping of fill material, road base, or other materials	Material handling emission factor equation in Section 13.2.4	May occur offsite	-0/-1[c]
	7. Compacting	Dozer equation in Tables 11.9-1 and 11.9-2	Emission factor downgraded because of differences in operating equipment	-1/-2[c]
	8. Motor grading	Grading equation in Tables 11.9-1 and 11.9-2		-1/-2[c]

AP 42 Table 11.9-1

Table 11.9-1 (English Units). EMISSION FACTOR EQUATIONS FOR UNCONTROLLED OPEN DUST SOURCES AT WESTERN SURFACE COAL MINES[a]

Operation	Material	Emissions By Particle Size Range (Aerodynamic Diameter)[b,c]				Units	EMISSION FACTOR RATING
		Emission Factor Equations		Scaling Factors			
		TSP ≤30 μm	≤15 μm	≤10 μm[d]	≤2.5 μm/TSP[e]		
Blasting[f]	Coal or overburden	$0.000014(A)^{1.5}$	ND	0.52[e]	0.03	lb/blast	C_DD
Truck loading	Coal	$\frac{1.16}{(M)^{1.2}}$	$\frac{0.119}{(M)^{0.9}}$	0.75	0.019	lb/ton	BBCC
Bulldozing	Coal	$\frac{78.4\ (s)^{1.2}}{(M)^{1.3}}$	$\frac{18.6\ (s)^{1.5}}{(M)^{1.4}}$	0.75	0.022	lb/hr	CCDD
	Overburden	$\frac{5.7\ (s)^{1.2}}{(M)^{1.3}}$	$\frac{1.0\ (s)^{1.5}}{(M)^{1.4}}$	0.75	0.105	lb/hr	BCDD
Dragline	Overburden	$\frac{0.0021\ (d)^{1.1}}{(M)^{0.3}}$	$\frac{0.0021\ (d)^{0.7}}{(M)^{0.3}}$	0.75	0.017	lb/yd^3	BCDD
Vehicle traffic[g]							
Grading		$0.040\ (S)^{2.5}$	$0.051\ (S)^{2.0}$	0.60	0.031	lb/VMT	CCDD
Active storage pile[h] (wind erosion and maintenance)	Coal	0.72 u	ND	ND	ND	$\frac{\text{lb}}{(\text{acre})(\text{hr})}$	C[i] _ _ _

[a] Reference 1, except as noted. VMT = vehicle miles traveled. ND = no data. Quality ratings coded where "Q, X, Y, Z" are ratings for ≤30 μm, ≤15 μm, ≤10 μm, and ≤2.5 μm, respectively. See also note below.

[b] Particulate matter less than or equal to 30 μm in aerodynamic diameter is sometimes termed "suspendable particulate" and is often used as a surrogate for TSP (total suspended particulate). TSP denotes what is measured by a standard high volume sampler (see Section 13.2).

[c] Symbols for equations:
A = horizontal area (ft^2), with blasting depth ≤ 70 ft. Not for vertical face of a bench.
M = material moisture content (%)
s = material silt content (%)
u = wind speed (mph)
d = drop height (ft)
W = mean vehicle weight (tons)
S = mean vehicle speed (mph)
w = mean number of wheels

Inputs

M, Material Moisture Content %[1]	12%
s, Material Silt Content %[1]	9%
Hours of Operation[2]	3780

Emission Factors[3]

PM30 (TSP)	4.99 lb/hr
PM10	0.39 lb/hr
PM2.5	0.055 lb/hr

Emissions

PM30 (TSP)	9.43 tpy	18859.15 lb/yr
PM10	0.74 tpy	1489.58 lb/yr
PM2.5	0.10 tpy	208.54 lb/yr

Notes:

1. From AP-42 Table 13.2.4-1 for MSW Landfill Cover Material
2. Based on operation of 10 hours a day for 260 days/year
3. Emission Factors based on AP-42 Table 13.2.3-1 (refers to Table 11.9-1)

Burnsville Sanitary Landfill GHG PTE Summary - Post-Project

				PTE GHGs			
Device ID	**Unit ID**	**Device Name**	**Process Name**	**CO2 (ton/yr)**	**CH4 (ton/yr)**	**N2O (ton/yr)**	**CO2e**
	EU008	Decomposing Landfill Gas Emissions	Uncontrolled Fugitive Landfill Gas Emissions	20,091	6,102		172,642
Flare	EU009	Enclosed Flare	LFG Specialties 3,000 Enclosed Flare	90,977	2.78	0.55	91,209
T1E1	EU004	T1E1 - Caterpillar G3516 Engine/Generator	Caterpillar G3516 Engine/Generator	9,401	0.29	0.06	9,425
T1E2	EU003	T1E2 - Caterpillar G3516 Engine/Generator	Caterpillar G3516 Engine/Generator	9,401	0.29	0.06	9,425
T2E1	EU007	T2E1 - Caterpillar G3516 Engine/Generator	Caterpillar G3516 Engine/Generator	9,401	0.29	0.06	9,425
T2E2	EU006	T2E2 - Caterpillar G3516 Engine/Generator	Caterpillar G3516 Engine/Generator	9,401	0.29	0.06	9,425
T3E1	EU002	T3E1 - Caterpillar G3516 Engine/Generator	Caterpillar G3516 Engine/Generator	9,401	0.29	0.06	9,425
T3E2	EU001	T3E2 - Caterpillar G3516 Engine/Generator	Caterpillar G3516 Engine/Generator	9,401	0.29	0.06	9,425
Facility Total (with fugitive)				**167,473**	**6,107**	**0.89**	**320,401**

Potential Methane Generation Rate

Sample calculation:

LFG generation rate * 60 min/hr * 50% CH_4 * 16.04 lb/mol / 0.7302 / 520 R * 8760 hr/yr / 2000 lb/ton = short tons CH_4 generated

Modeled CH_4 generated from the LandGEM	5,863	scfm
Modeled CH_4 generated from the LandGEM	32,544	short tons CH_4
Fugitive CH_4 (not collected by Landfill Gas Collection System)	8,136	short Tons CH_4 (assuming 75% collection)
Oxidation Factor (Mandatory GHG Reporting Rule, Subpart HH, Table H	0.25	
CH_4 adjusted for oxidation (MG)	6,102	short Tons CH_4
Global warming potential for CH_4 (GWP)	25	

Potential Carbon Dioxide Generation Rate

Sample calculation:

LFG generation rate * 60 min/hr * 45% CO_2 * 44.01 lb/mol / 0.7302 / 520 R * 8760 hr/yr / 2000 lb/ton = short tons CO_2 generated

(assuming 45% of landfill gas is CO2)

Modeled CO_2 generated from the LandGEM	80,364	short tons CO_2
Fugitive CO_2 (not collected by Landfill Gas Collection System)	20,091	short Tons CO_2 (assuming 75% collection)
Global warming potential for CO_2 (GWP)	1	

Potential GHG emissions

Total CO_{2e}	172,642	short Tons of CO_2e

Post-Project Biogenic GHG PTE Summary

Given:

Methane fraction in landfill gas =	50%	(assumed)
Heating value of landfill gas =	500	Btu/scf
CO_2 emission factor (LFG combustion) =	52.07	kg/MMBtu (40 CFR 98, Table C-1 value for "biogas")
CH_4 emission factor (LFG combustion) =	3.2E-03	kg/MMBtu (40 CFR 98, Table C-2 value for "biogas")
N_2O emission factor (LFG combustion) =	6.3E-04	kg/MMBtu (40 CFR 98, Table C-2 value for "biogas")
Global warming potential of CO_2 =	1	
Global warming potential of CH_4 =	25	
Global warming potential of N_2O =	298	

BIOGENIC GHG EMISSIONS

Unit ID	Device Description	Capacity	Units	Combustion CO_2 PTE (tpy CO_2)	Pass-Through CO_2 PTE (tpy $CO_{2)}$	Total Biogenic GHG PTE (tpy CO_2)
EU009	Enclosed Flare	3,000	scfm	45,251.61	45,724.96	90,976.57
EU004	T1E1 - Caterpillar G3516 Engine/Generator	310	scfm	4,676.00	4,724.91	9,400.91
EU003	T1E2 - Caterpillar G3516 Engine/Generator	310	scfm	4,676.00	4,724.91	9,400.91
EU007	T2E1 - Caterpillar G3516 Engine/Generator	310	scfm	4,676.00	4,724.91	9,400.91
EU006	T2E2 - Caterpillar G3516 Engine/Generator	310	scfm	4,676.00	4,724.91	9,400.91
EU002	T3E1 - Caterpillar G3516 Engine/Generator	310	scfm	4,676.00	4,724.91	9,400.91
EU001	T3E2 - Caterpillar G3516 Engine/Generator	310	scfm	4,676.00	4,724.91	9,400.91
					TOTAL	**147,382.04**
					Total CO2e	**147,382.04**

Post-Project Anthropogenic GHG PTE Summary

Given:

Methane fraction in landfill gas =	50%	(assumed)
Heating value of landfill gas =	500	Btu/scf
CO_2 emission factor (LFG combustion) =	52.07	kg/MMBtu (40 CFR 98, Table C-1 value for "biogas")
CH_4 emission factor (LFG combustion) =	3.2E-03	kg/MMBtu (40 CFR 98, Table C-2 value for "biogas")
N_2O emission factor (LFG combustion) =	6.3E-04	kg/MMBtu (40 CFR 98, Table C-2 value for "biogas")
Global warming potential of CO_2 =	1	
Global warming potential of CH_4 =	25	
Global warming potential of N_2O =	298	

ANTHROPOGENIC GHG EMISSIONS

Device ID	Device Description	Capacity	Units	Combustion CO_2 PTE (tpy CO_2e)	Combustion CH_4 PTE (tpy)	Combustion N_2O PTE (tpy)	Total Anthropogenic GHG PTE (tpy)	Total Anthropogenic GHG PTE (tpy CO2e)
EU009	Enclosed Flare	3,000	scfm	0.00	2.78	0.55	3.33	232.68
EU004	T1E1 - Caterpillar G3516 Engine/Generator	310	scfm	0.00	0.29	0.06	0.34	24.04
EU003	T1E2 - Caterpillar G3516 Engine/Generator	310	scfm	0.00	0.29	0.06	0.34	24.04
EU007	T2E1 - Caterpillar G3516 Engine/Generator	310	scfm	0.00	0.29	0.06	0.34	24.04
EU006	T2E2 - Caterpillar G3516 Engine/Generator	310	scfm	0.00	0.29	0.06	0.34	24.04
EU002	T3E1 - Caterpillar G3516 Engine/Generator	310	scfm	0.00	0.29	0.06	0.34	24.04
EU001	T3E2 - Caterpillar G3516 Engine/Generator	310	scfm	0.00	0.29	0.06	0.34	24.04
					TOTAL		**5.39**	**376.94**

APPENDIX E

GENERAL PUBLIC PRECLUSION PLAN

TETRA TECH

MEMO

To:	Mike Miller – Burnsville Sanitary Landfill
Cc:	Dan Leclaire – Burnsville Sanitary Landfill
From:	Ray Ramos
Date:	11/18/2020
Subject:	General Public Preclusion Plan

This General Public Preclusion Plan (GPPP) is provided as a supplement to the dispersion modeling results for the proposed expansion at Burnsville Sanitary Landfill (BSL). The modeling was performed as part of the Supplemental Environmental Impact Statement (SEIS) being prepared for the project. The GPPP includes information about restrictions to public access in and around BSL to justify the placement of receptors that were used for the dispersion modeling.

BSL is located on Cliff Road West between Kraemer Mining and Minerals (Kraemer) and Port Cargill (Cargill Savage East). The Minnesota River is along the northern edge of the BSL property boundary, as shown in Figure 1. For this modeling assessment, the ambient air boundary was conservatively moved to just north of the current solid waste area (see the purple line in Figure 1). Figure 2 shows the location of the receptors used in the significant impact level (SIL) modeling, at and beyond the ambient air boundary.

More detailed information about the methods used to restrict public access is provided below, first for the landfill perimeter and then for the engine plant.

BSL Perimeter

BSL Security Fencing and Remote Monitoring

Figure 3 depicts the methods for restricting site access at BSL. A permanent security fence is located along the southern boundary of the facility as shown in blue. At the front gate/scale house area at the BSL entrance, there is a security gate that is open during normal business hours (7 am to 4:30 pm), Monday through Friday. The gate is closed and locked during non-business hours. There are four cameras mounted outside and around the scale house building to ensure no illegal dumping or trespassing is taking place during non-business hours. The camera logs are checked and signed off on a weekly basis by BSL personnel. Information Technology staff handles the operation and maintenance of the cameras and security software. BSL staff ensures that any downtime for the cameras for updates or maintenance does not occur when the facility is closed.

The security fence extends westward from the front gate and crosses over Cliff Road West. A sliding gate extends across the road. The gate is operated by BSL and is closed during non-business hours, preventing access to the west. West of the gate, the fence extends on the southern edge of Cliff Road West to the southwest corner of the facility.

No Trespassing Signs and Daily Patrols

The yellow line in Figure 3 indicates where BSL plans to install “No Trespassing” signs approximately every 200 feet. The area is heavily wooded and not easily accessed by the public. BSL staff will also patrol the boundary once per day, Monday through Friday during normal business hours, to ensure that there are no breaches onto BSL property.

TETRA TECH
630 Riverfront Drive, Suite 100 ISheboygan, WI 53081
Tel 877.633.5520 Fax 877.845.1456 tetratech.com

BSL Engine Plant

The BSL Engine Plant has a security fence that encompasses the entire area around the engine plant building, as shown in Figure 4. The building is restricted to BSL personnel and authorized guests only.

There is a security gate operated by Kraemer extending across Cliff Road West that is closed during non-business hours (see the red line in Figure 4). In addition, there are no trespassing signs east of the gate, on the northern edge of Cliff Road West as shown in the yellow line in Figure 4.

Further east, along Cliff Road West is another gate across Cliff Road West that is closed during non-business hours, preventing vehicle access. A photo of the gate and its approximate location on the map are shown in Figures 5 and 6, respectively.

Public Preclusion Breaches

Protocol for addressing a public breach on site will be added to the annual environmental training for all relevant Burnsville Sanitary Landfill personnel. In the event of a breach, BSL personnel who discovered the breach will report the breach to both the site District Manager and Burnsville Police if necessary. Upon successful mitigation of the breach incident, BSL personnel will document the ambient air boundary breach within three calendar days in the landfill's master file. Any actions to prevent future breaches such as repairing of fence, addition of signage or other appropriate actions will be taken, if necessary. The breach report and any supplementary documentation will be included in the electronic master files maintained for the facility.

Figure 1
Property Boundary and Fenceline

Figure 2
Modeled Receptors

Figure 3
Public Access Preclusion Methods – BSL perimeter

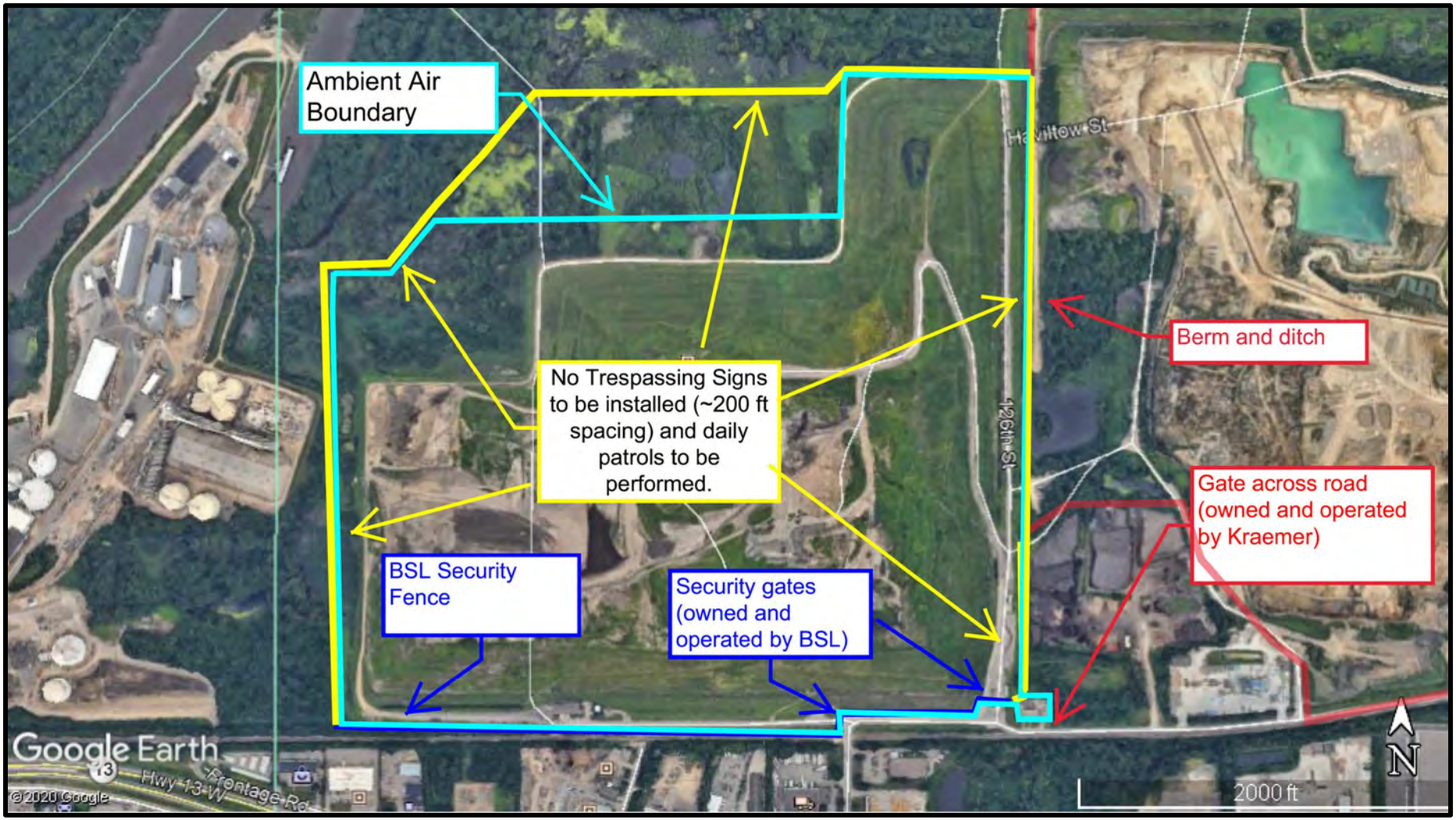


Figure 4
Public Access Preclusion Methods – BSL Engine Plant

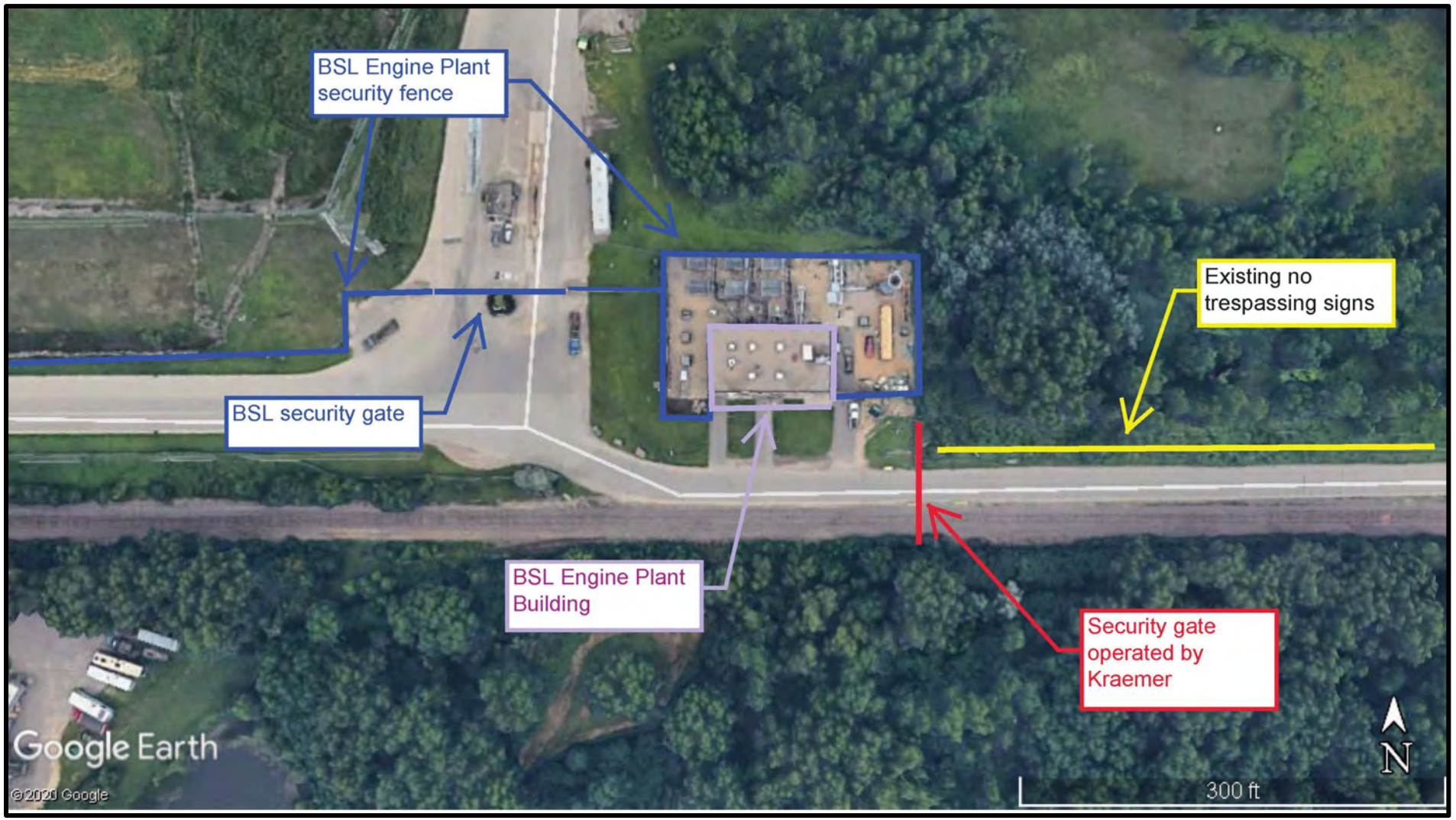


Figure 5
Cliff Road West Gate – Near Kraemer Facility

Figure 6
Additional Cliff Road West Security Gate

APPENDIX F

MPCA'S MODELING REVIEW – FORM AQDM-07

MINNESOTA POLLUTION CONTROL AGENCY
520 Lafayette Road North
St. Paul, MN 55155-4194

AQDM-07

AQDM results review form

Air Quality Dispersion Modeling (AQDM)

(Previously AQDMRRF-01)

Doc Type: Air Dispersion Modeling

Acronym information on page 3

Instructions: This form is used for Minnesota Pollution Control Agency (MPCA) internal use by Air Dispersion Modelers, Permit Engineers, and Risk Assessors to review modeling results.

Note: If results are marked not approved, please use the *AQDM-06* form to resubmit. Updated *AQDM-06* forms and updated attachments should be emailed to: AirModeling.PCA@state.mn.us. If files are too large to email, please mail a CD with the files to:

Air Quality Permit Document Coordinator
Minnesota Pollution Control Agency
520 Lafayette Road North
St. Paul, MN 55155-4194

Facility information

Tempo AI ID number: 279 AQ facility/permit ID number: 03700156 Submittal date (mm/dd/yyyy): 11/25/2020

Three-letter modeling facility ID (ex., XEK = Xcel Energy Allen S. King, MEC = Mankato Energy Center, etc.): BSL

Facility name: Burnsville Sanitary Landfill

Facility street address: 2650 Cliff Road W

City: Burnsville County: Dakota State: MN Zip Code: 55337-1684

Facility contact: Mike Miller Report prepared by: Ray Ramos

Facility contact phone: 952-656-5014 Preparer phone: Ray Ramos

Facility contact email: mmiller20@wm.com Preparer email: 920-980-0959

UTM coordinates of facility (NAD83, zone 15 extended **only**): x = 474,596.00 m East, y = 4,959,134.00 m North

MPCA Air Dispersion Modeler: Jim Sullivan MPCA Air Permit Engineer: Astera Sundance/Rand Silvers

MPCA Air Risk Assessor: Monika Vadali

List of files with names/descriptions submitted with modeling results

1. ☒ AERMOD input files (*.inp, *.adi, *.ami)
   ☒ AERMOD output files (*.out, *.ado, *.amo)
   ☐ AERMOD plot files (*.plt)
   ☐ AERMOD post files (*.pst) – If applicable
   ☐ AERMOD event files (*.evi, *.evo) – If applicable
   ☐ AERMOD miscellaneous/other files (MAXDCONT, SUMTABLE, etc.) – If applicable

2. ☒ AERMOD meteorological surface files (*.sfc)
   ☒ AERMOD meteorological upper air/profile files (*.pfl)

3. ☒ BPIP-PRIME input files (*.bpi, *.pip)
   ☒ BPIP-PRIME output files (*.bpo, *.sum)

4. ☐ Terrain file(s) for AERMAP(*.dem, *.tif)
   ☐ AERMAP input files (*.ami)
   ☐ AERMAP output files (*.rou, *.sou, etc.)

5. ☐ Background data files/background concentrations for applicable pollutants (seasonal, monthly, daily, hourly, etc.)

6. ☒ Figures for modeling results (*.jpeg, *.bmp, *.pdf)

   ☒ GIS maps for modeling results (*.shp)

7. ☒ *AQDM-02* form – if applicable (not applicable if changes were not made)

8. ☐ Paved Roads Results – If applicable

9. ☒ SIL Analysis and Results – If applicable

10. ☐ Hourly O_3 File – If applicable

11. ☒ AERA forms – If applicable

12. ☒ Other files and supporting documents (hourly ozone, background files, supplements, etc.):

    Post-Project Modeling Results.pdf; Post-Project Modeling Receptors.pdf

Section 1. Modeling review – 30-day substantial completeness determination

Completeness review of modeling report by sections

Section and section name	Substantially complete/incomplete	Deficiencies and/or comments	
Files to accompany modeling	Substantially Complete	No comments on this section	
Section 1: Modeling protocol	Substantially Complete	No comments on this section	
Section 2: Changes to modeling protocol	Substantially Complete	No comments on this section	
Section 3: Paved roads fugitive dust (optional)	Substantially Complete	No comments on this section	
Section 4: Modeling results	Substantially Complete	No comments on this section	
Section 5: Discussion	Substantially Complete	No comments on this section	
Section 6: Modeling results figures/maps	Substantially Complete	No comments on this section	
Modeling results substantially complete?	Substantially Complete	Date (mm/dd/yyyy):	12/14/2020

Section 2. Air dispersion modeler results review

Technical review of final modeling report

Review items	Acceptable/ Unacceptable	Deficiencies and/or comments
Are all changes from the protocol adequately described and addressed?	Acceptable	No further comment.
Are the model files consistent with the MPCA AQDM-02 spreadsheet accompanying the permit application?	Acceptable	A file naming inconsistency was noted in several files. The post-constructon files were based on the pre-construction files, which is consistent with the evaluation; however, the post-construction file names were the same as the pre-construction file names. This did not impact the final results; however, it should be noted in the record.
Is the effective ambient air boundary described by the general public preclusion plan consistent with the ambient air boundary receptor locations?	Acceptable	No further comment.
Modeling demonstrates compliance with applicable NAAQS/MAAQS, SIL's, and PSD increments?	Acceptable	The post-construction scenario complies with the applicable ambient air quality standards. In addition, the fenceline recpetors in the post-construction Annual NOx NAAQS modeling demonstration were missing from the analysis. Given that the modeled impacts were lower than

		the pre-construction demonstration for this same pollutant, the analysis was not invalidated. The MPCA added receptors to the missing sites and is confident that the post-construction modeling supports the determination of Annual NOx NAAQS compliance.	
This section is:	Acceptable	Date (mm/dd/yyyy):	12/16/2020

Section 3. Permit engineer results review

Has the 150-day completeness requirement been waived? ☐ No ☒ Yes

Technical review of final modeling report

Review items	Acceptable/ Unacceptable	Deficiencies and/or comments	
Are all emissions changes from the protocol adequately described and addressed?	Acceptable	No comments on this section	
Are the emission calculations on the AQDM-02 spreadsheet consistent with permitted emissions?	Acceptable	No comments on this section	
Are the emissions on the Nearby Sources Emission Calculations spreadsheet consistent with permitted emissions for those sources?	Acceptable	No comments on this section	
If a general public preclusion plan is required (as noted on form AQDM-05), does the attached plan include a map that clearly displays the ambient air boundary and identifies how access is precluded for each section of the boundary?	Acceptable	No comments on this section	
If a general public preclusion plan is required, are the boundary control strategies identified in the plan adequate?	Acceptable	No comments on this section	
This section is:	Acceptable	Date (mm/dd/yyyy):	12/14/2020
Recommended permit conditions or related items:			

Section 4. Air risk assessor results review (If applicable)

Technical review of final modeling report

Review items	Acceptable/ Unacceptable/ Not applicable	Deficiencies and/or comments	
Are all changes from the protocol phase adequately described and addressed in the AERA forms?	Acceptable	All necessary documents explaining the changes were provided on 11/17/2020	
Do the submitted results reflect the methodology described in the AERA forms?	Acceptable	No comments on this section	
This section is:	Acceptable	Date (mm/dd/yyyy):	11/23/2020
Are there any additional recommendations that will be submitted to the MPCA Air Managers?	No comments on this section		

Overall status of results

This modeling results are:	**Approved**

Comments on approvable-status:

The final modeling report is approved for both the ambient air quality standard demonstration and the risk evaluation.

Acronyms

AERA	Air Emission Risk Analysis
AERMAP	AERMOD Terrain Preprocessor
AERMOD	AMS/EPA Regulatory Model
AQ	Air Quality
AQDM	Air Quality Dispersion Modeling
AQDMRRF-01	Previous Results Review Form
BPIP-PRIME	Building Profile Input Program for PRIME
GIS	Geographic Information System
MAAQS	Minnesota State Ambient Air Quality Standard
MPCA	Minnesota Pollution Control Agency
NAAQS	National Ambient Air Quality Standard
O_3	Ozone
PSD	Prevention of Significant Deterioration Program
SIL	Significant Impact Level
UTM	Universal Transverse Mercator

Attachment G

Federal Aviation Administration Aviation Safety Letter

U.S. Department
of Transportation
Federal Aviation Administration

Dakota-Minnesota Airports District Office
Bismarck Office
2301 University Drive, Building 23B
Bismarck, ND 58504

Dakota-Minnesota Airports District Office
Minneapolis Office
6020 28th Avenue South, Suite 102
Minneapolis, MN 55450

March 4, 2019

Deb Garross
City Planner
City of Burnsville
100 Civic Center Parkway
Burnsville, Minnesota 55337

Re: Proposed Burnsville Sanitary Landfill Inc., Concept Stage Planned Unit Development Amendment

Dear Ms. Garross:

The Federal Aviation Administration (FAA) has reviewed the City of Burnsville's plan to create and expand a sanitary landfill mound at its existing 2650 Cliff Road West site within Burnsville city limits (Section 32, Township 27 North, Range 24 West, Dakota County, Minnesota). The goal of the proposal is to provide additional disposal capacity for up to 26 million cubic yards of solid waste. The top elevation of the landfill will increase to a maximum height of 1,082 feet above mean sea level, or approximately 260 feet above the currently permitted maximum height.

Municipal solid waste landfills are known to attract large numbers of hazardous wildlife, particularly birds. Wildlife hazards and bird strikes have been a long-term high priority for the FAA. The FAA is committed to addressing hazardous wildlife issues and is focused on preventing the creation of new hazards while promoting ways to reduce and/or mitigate the potential for wildlife strikes. Each airport setting is unique, as is the potential for wildlife hazards. In addition, there are areas more susceptible to wildlife strikes including the arrival/departure surfaces and the aircraft operating area (AOA). For these reasons the FAA must review each airport individually to identify hazardous wildlife conditions and develop ways to reduce and prevent wildlife strikes.

The FAA's Advisory Circular (AC) 150/5200-33B, Hazardous Wildlife Attractants On or Near Airports, provides separation criteria for the placement of potentially hazardous wildlife attractants near airports (Section 1) and includes a description of land uses such as landfills with the potential to attract hazardous wildlife (Section 2). Airports that receive Federal grant-in-aid assistance are required to follow the recommendations in the AC. For other government agencies, private property owners and businesses, the AC provides guidance to ensure adequate safety for airports.

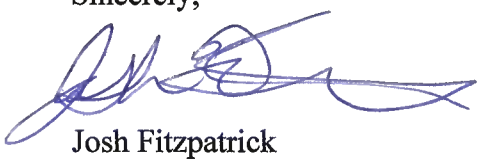
Based on our review and utilizing the criteria in AC's 150/5200-33B, the FAA is concerned with the initial proposed project given the location, and potential to create a wildlife hazard attractant near the Minneapolis-St. Paul International Airport (MSP). The proposed project

is within approximately 6.5 miles of the Airport approach and departure pathways. This location, in conjunction with bird activity at landfills has a higher probability to become a hazardous wildlife attractant. Our agency recognizes and understands the need for disposing of solid waste at an existing facility. Nonetheless, we cannot ignore the potential adverse effect this could have on airport safety.

The FAA often defers judgment for hazardous wildlife issues to the U.S. Department of Agriculture Wildlife Services (USDA WS) since their agency is considered a subject matter expert. The USDA WS works with the Metropolitan Airports Commission (MAC) on wildlife issues at MSP and its reliever airports. The FAA encourages you to work with the MAC and USDA WS to design and manage the landfill expansion in a way that can minimize hazardous wildlife activity.

We trust that you will fully utilize our input while making a final decision regarding the proposed project. If you have any questions or comments, please feel free to contact me at (612) 253-4639 or by E-mail at joshua.fitzpatrick@faa.gov.

Sincerely,



Josh Fitzpatrick
Environmental Protection Specialist
FAA Dakota-Minnesota Airport District Office

Cc: Alan Schumacher, USDA Wildlife Services
Bridget Rief, Metropolitan Airports Commission
John Ostrom, Metropolitan Airports Commission
Nancy Nistler, FAA
Ryan Gaug, MNDOT Aeronautics

Attachment H

Alternative Size and Waste Diversion Analysis

Table H-1A
Minnesota Solid Waste Facilities - Complete Inventory

Permit No.	Facility Name	County	Waste Type Accepted
	Land Disposal Units		
SW-60	Advanced Disposal Rolling Hills Landfill - SW-60	Wright	Industrial C&D
SW-461	Albert Lea Demolition Landfill - SW-461	Freeborn	C&D
SW-311	Becker County Transfer Station and Demolition Landfill - SW-311	Becker	C&D
SW-306	Beltrami County Demolition Landfill - SW-306	Beltrami	C&D
SW-450	Big Falls Demolition Landfill - SW-450	Koochiching	C&D
SW-442	Bongers/Met Con Demolition Lanfill - SW-442	Rice	C&D
SW-89	Brown County Sanitary Landfill SW-89	Brown	MSW C&D
SW-335	Bueckers City Sanitation - SW-335	Stearns	C&D
SW-56	Burnsville Sanitary Landfill - SW-56	Dakota	MSW Industrial C&D
SW-359	Camp Ripley Demolition Landfill - SW-359	Morrison	C&D
SW-511	Canby Demolition Debris Landfill - SW-511	Yellow Medicine	C&D
SW-475	Chippewa County Demolition Landfill - SW-475	Chippewa	C&D
SW-528	Clarks Grove Demo Landfill SW-528	Freeborn	C&D
SW-34	Clay County Sanitary Landfill - SW-34	Clay	MSW Industrial C&D
SW-277	Clay Demolition Landfill - SW-277	Clay	C&D
SW-168	Clearwater County Demolition Landfill - SW-168	Clearwater	C&D
SW-143	Cottonwood County Landfill - SW-143	Cottonwood	MSW C&D
SW-412	Crosslake Construction Demolition Debris Facility,Inc. - SW-412	Crow Wing	C&D
SW-440	Crow Wing County Demo Landfill - SW-440	Crow Wing	C&D
SW-376	Crow Wing County MSW Landfill - SW-376	Crow Wing	MSW Industrial C&D
SW-600	D & G Demolition Landfill - SW-600	Lyon	C&D
SW-303	Dawnway Demolition Landfill - SW-303	Dakota	C&D
SW-629	Dem-Con Landfill Hawick SW-629	Kandiyohi	C&D
SW-290	Dem-Con Landfill, LLC - SW-290	Scott	Industrial C&D
SW-429	DKV Demolition Landfill - SW-429	Chisago	C&D
SW-477	Dodge County Demolition Landfill - SW-477	Dodge	C&D
SW-590	Double D Demolition Landfill - SW-590	Pipestone	C&D
SW-406	Douglas County Demo Landfill, LLC SW-406	Douglas	C&D
SW-17	East Central Solid Waste Commission - SW-17	Kanabec	MSW Industrial C&D
SW-563	East Polk County Demolition Site - SW-563	Polk	C&D
SW-74	Elk River Landfill - SW-74	Sherburne	MSW Industrial C&D
SW-572	Fergus Falls Solid Waste Disposal Facility - SW-572	Otter Tail	C&D
SW-620	General Waste & Recycling SW-620	Itasca	Industrial C&D
SW-483	Geyer Demolition Landfill - SW-483	Swift	C&D
SW-408	Glenwood Demolition Disposal - SW-408	Pope	C&D
SW-556	Grinning Bear Demolition Landfill SW-556	Cass	C&D
SW-291	Hengel Ready Mix and Construction, Inc. - SW-291	Cass	C&D
SW-539	Hengel's Westside Demolition Landfill - SW-539	Cass	C&D
SW-188	Henkemeyer Demolition Landfill - SW-188	Benton	C&D
SW-395	Henning Transfer Station/Demolition Landfill - SW-395	Otter Tail	C&D
SW-423	Hibbing Demolition Landfill - SW-423	St. Louis	C&D
SW-464	Hoffman Demolition Landfill - SW-464	Brown	C&D
SW-543	Hoss Demolition Landfill - SW-543	Cass	C&D
SW-315	Hubbard County North Transfer Station - SW-315	Hubbard	C&D
SW-493	International Falls Demo Landfill - SW-493	Koochiching	C&D
SW-448	Itasca County Demolition Landfill - SW-448	Itasca	C&D
SW-79	Kandiyohi County Sanitary Landfill - SW-79 and UT0139	Kandiyohi	MSW Industrial C&D
SW-550	Koochiching County Demolition Landfill - SW-550	Koochiching	C&D
SW-473	Lac qui Parle Demolition Landfill - SW-473	Lac qui Parle	C&D
SW-469	Ladd Demolition Landfill - SW-469	Brown	C&D
SW-398	Lake County Demolition Landfill - SW-398	Lake	C&D
SW-407	Lakes Area Demolition Facility - SW-407	Becker	C&D

Table H-1A
Minnesota Solid Waste Facilities - Complete Inventory

Permit No.	Facility Name	County	Waste Type Accepted
SW-501	Lyon County Demo Landfill SW-501	Lyon	C&D
SW-23	Lyon County Regional Landfill - SW-23	Lyon	MSW Industrial
SW-337	Mahnomen County Demolition Landfill - SW-337	Mahnomen	C&D
SW-92	MAR-KIT Sanitary Landfill - SW-92	Kittson	MSW C&D
SW-422	Marshall County Demolition Landfill - SW-422	Marshall	C&D
SW-486	Meeker County Demolition Facility - SW-486	Meeker	C&D
SW-402	Mickow Demolition Landfill SW-402	Goodhue	C&D
SW-474	Minnesota Falls Demolition Landfill Inc - SW-474	Yellow Medicine	C&D
SW-15	Morrison County Solid Waste Management Facility - SW-15	Morrison	MSW C&D
SW-451	Murray County Demolition Landfill - SW-451	Murray	C&D
SW-544	NE Otter Tail Phase II Ash and Demolition Landfill - SW-544	Otter Tail	C&D
SW-11	Nobles County Landfill - SW-11	Nobles	MSW Industrial C&D
SW-332	Norman County Demolition Landfill - SW-332	Norman	C&D
SW-368	Northwoods Demolition Landfill - SW-368	St. Louis	C&D
SW-541	Oakridge Demolition Landfill - SW-541	Aitkin	C&D
SW-355	Olmsted County Kalmar Landfill - SW-355	Olmsted	MSW C&D
SW-416	Omega of Thief River Falls Demolition Debris Land Disposal Facility - S	Pennington	C&D
SW-45	Pine Bend Landfill - SW-45	Dakota	MSW Industrial C&D
SW-124	Polk County Landfill - SW-124	Polk	MSW C&D
SW-87	Ponderosa Landfill - SW-87	Blue Earth	MSW Industrial C&D
SW-364	Portage Demolition Landfill - SW-364	St. Louis	C&D
SW-612	R and G Demolition Landfill - SW-612	Lyon	C&D
SW-438	Red Lake County - Oklee Demolition Landfill - SW-438	Red Lake	C&D
SW-331	Red Lake County Demolition Landfill - SW-331	Red Lake	C&D
SW-90	Renville County Landfill - SW-90	Renville	MSW C&D
SW-123	Rice County Solid Waste Facility - SW-123	Rice	MSW C&D
SW-499	Rock County Demolition Landfill - SW-499	Rock	C&D
SW-518	Roseau County Transfer Station / Demolition Land Disposal Facility - S	Roseau	C&D
SW-399	Shamrock Landfill -SW-399	Carlton	Industrial C&D
SW-542	SKB Austin Demolition Landfill - SW-542	Mower	C&D
SW-514	SKB Lansing Landfill - SW-514	Mower	Industrial C&D
SW-383	SKB Rosemount Industrial Waste Facility - SW-383	Dakota	Industrial C&D
SW-489	Slagle Demolition Landfill - SW-489	Cass	C&D
SW-254	SMC Compost/Pilgrims Demolition Landfill - SW-254	Blue Earth	C&D
SW-6	Spruce Ridge Resource Management, Inc. - SW-6	McLeod	MSW Industrial C&D
SW-405	St Louis County Regional Landfill - SW-405	St. Louis	MSW Industrial C&D
SW-131	Steele County Sanitary Landfill - SW-131	Steele	MSW Industrial C&D
SW-508	Stevens County Demolition Debris Landfill and Solid Waste Transfer St	Stevens	C&D
SW-658	Timms Demolition Landfill - SW-658	Rice	C&D
SW-333	TK Demolition Disposal - SW-333	Stearns	C&D
SW-403	Todd County Demolition Landfill - SW-403	Todd	C&D
SW-603	Trout Demolition Debris Land Disposal - SW-603	Itasca	C&D
SW-527	Valley Demolition and Recycling, LLC - SW-527	Nicollet	C&D
SW-580	Vonco II Becker - SW-580	Sherburne	Industrial C&D
SW-536	Vonco V Duluth - SW-536/PBR001261	St. Louis	Industrial C&D
SW-428	Voyageur Industrial Landfill - SW-428	St. Louis	Industrial C&D
SW-317	Wadena County Solid Waste Facility - SW-317	Wadena	C&D
SW-485	Wagner Demolition Landfill - SW-485	Koochiching	C&D
SW-263	Wanamingo Demolition Debris Land Disposal Facility - SW-263	Goodhue	C&D
SW-548	Waste Management Demolition Landfill (WM of Hutchinson) - SW-54	McLeod	C&D
SW-404	Wheaton Demo Landfill - SW-404	Traverse	C&D
	Transfer Stations / Processing Facilities		
PBR001080	ACE Solid Waste Recycling Facility - SW-668	Huron	MSW

Table H-1A
Minnesota Solid Waste Facilities - Complete Inventory

Permit No.	Facility Name	County	Waste Type Accepted
SW-574	Advanced Disposal - SW-574	Ramsey	MSW C&D
PBR000350	Albert Lea Transfer Station - PBR000350	Freeborn	MSW
PBR000347	Alpha Container Services & Recycling - PBR000347	Dakota	C&D
PBR000423	American Disposal Transfer Station - PBR000423	Itasca	MSW
SW-222	Austin Waste Transfer Station - SW-222	Mower	MSW
PBR000341	Battle Lake Transfer Station - PBR000341	Otter Tail	MSW C&D
PBR000881	Becker County Transfer Station - PBR000881	Becker	MSW C&D
SW-311	Becker County Transfer Station and Demolition Landfill - SW-311	Becker	MSW C&D
SW-587	Beltrami County Bemidji Transfer SW-587	Beltrami	MSW C&D
SW-529	Beltrami County Blackduck Transfer SW-529	Beltrami	MSW C&D
PBR001153	BERWALD ROOFING CO INC - PBR001153	Ramsey	C&D
PBR000417	Bigfork Transfer Station - PBR000417	Itasca	MSW
SW-582	Blaine enviromental campus - SW-582	Anoka	MSW C&D
PBR000418	Bray Lake Transfer Station - PBR000418	Itasca	MSW C&D
SW-596	Broadway Resource Recovery LLC - SW-596	Hennepin	C&D
SW-344	Brooklyn Park Recycling Center and Transfer Station - SW-344	Hennepin	MSW
SW-346	Brookston Transfer Station - SW-346	Carlton	MSW C&D
PBR000491	Camp Ripley Transfer Station - PBR000491	Morrison	MSW C&D
SW-295	Carlton County Transfer Station - SW-295	Carlton	MSW C&D
SW-419	Cass County Transfer Station SW-419	Cass	MSW
SW-391	Clarks Grove Transfer SW-391	Freeborn	MSW
SW-34	Clay County Sanitary Landfill - SW-34	Clay	MSW C&D
SW-616	Commercial Container Mpls Recyc/Transfer - SW-616	Hennepin	C&D
SW-439	Como Recycling and Transfer Station SW-439	Hennepin	C&D
SW-347	Cook Transfer Station - SW-347	St. Louis	MSW C&D
PBR001007	Coon Rapids Recycling Center - PBR001007	Anoka	Recyclable Materials Only
SW-569	Creekside Organics Processing Facility - SW-569	McLeod	SSOM
PBR000989	Danckwart Feed and Grain Inc. - PBR000989	Wabasha	MSW C&D
SW-610	Danny's Disposal & Recycling, Inc. - SW-610	Stearns	C&D
SW-592	Dem-Con Blaine SW-592	Anoka	MSW C&D
SW-555	Dem-Con Recovery & Recycling, LLC - SW-555	Scott	MSW C&D
SW-577	Demolicious Transfer Station - SW-577	St. Louis	MSW C&D
SW-302	Dodge County Transfer Station - SW-302	Dodge	MSW C&D
SW-406	Douglas County Demo Landfill, LLC SW-406	Douglas County	MSW
SW-400	ECSWC Cambridge Transfer Station - SW-400	Isanti	MSW C&D
SW-597	Eden Prairie Transfer Station - SW-597	Hennepin	MSW
SW-572	Fergus Falls Solid Waste Disposal Facility - SW-572	Otter Tail	MSW
SW-624	Fergus Falls Transfer Station - SW-624	Otter Tail	MSW
SW-322	Fillmore County Resource and Recycling Center SW-322	Fillmore	MSW
SW-354	Freeway Transfer, Inc. - SW-354	Dakota	MSW C&D
SW-384	Garrison Disposal SW-384	Aitkin	MSW C&D
PBR001092	Gene's Transfer - PBR001092	Washington	MSW C&D
SW-408	Glenwood Demolition Disposal - SW-408	Pope	MSW
PBR000416	Goodland Transfer Station - PBR000416	Itasca	MSW
SW-556	Grinning Bear Demolition Landfill SW-556	Cass County	MSW
SW-649	Hansen Recycling and Transfer Station - SW-649	Le Sueur	C&D
PBR001219	Hartel's / DBJ Disposal Companies - PBR001219	St. Louis	MSW C&D
SW-291	Hengel Ready Mix and Construction, Inc. - SW-291	Cass	MSW
SW-395	Henning Transfer Station/Demolition Landfill - SW-395	Otter Tail	MSW
SW-455	Hibbing Transfer Station - SW-455	St. Louis	MSW C&D
SW-401	Hinckley Transfer Station - SW-401	Pine	MSW C&D
SW-315	Hubbard County North Transfer Station - SW-315	Hubbard	MSW
SW-318	Hubbard County South Transfer Station - SW-318	Hubbard	MSW

Table H-1A
Minnesota Solid Waste Facilities - Complete Inventory

Permit No.	Facility Name	County	Waste Type Accepted
SW-348	Hudson (Aurora) Transfer Station - SW-348	St. Louis	MSW C&D
PBR000420	Iron Range Transfer Station - PBR000420	Itasca	MSW
SW-448	Itasca County Demolition Landfill - SW-448	Itasca	MSW C&D
PBR000421	J & H Transfer Station - PBR000421	Aitkin	MSW
SW-657	JME Recycle Center/Transfer Station - SW-657	Wright	MSW Industrial C&D
SW-571	John's Sanitary Removal - SW-571	Lake	MSW C&D
SW-579	Keith Krupenny & Son Disposal Service, Inc. - SW-579	Ramsey	MSW C&D
SW-500	Koochiching County Recycling / Transfer Facility - SW-550	Rainy River District	MSW
SW-523	Lake City Recycling & Disposal - SW-523	Wabasha	MSW Industrial C&D
SW-342	Lake of the Woods Co Recovery Facility - SW-342	Lake of the Woods	MSW
PBR000447	Lincoln County Transfer Site - PBR000447	Lincoln	MSW C&D
SW-653	LJP Recycling Transfer Station - SW-653	Nicollet	MSW C&D
SW-445	Lloyd's Construction Services, Inc. Transfer - SW-445	Scott	MSW C&D
PBR000419	Long Lake Transfer Station - PBR000419	Itasca	MSW
SW-23	Lyon County Regional Landfill - SW-23	Lyon	C&D
SW-525	Malcolm Avenue Recycling & Transfer - SW-525	Hennepin	MSW Industrial C&D
SW-452	Mankato Transfer Station - SW-452	Blue Earth	MSW
SW-608	Matejka Recycling - SW-608	Winona	MSW
SW-651	Matejka Transfer Station - SW-651	Winona	MSW C&D
SW-441	Meeker County Transfer Station - SW-441	Meeker	MSW
SW-588	Minden Transfer Station SW-588	Benton	MSW C&D
SW-40	Minneapolis North Transfer Station - SW-40	Hennepin	MSW C&D
SW-41	Minneapolis Southside Transfer Station - SW-41	Hennepin	MSW C&D
SW-139	Moorhead Transfer Station - SW-139	Clay	MSW C&D
SW-544	NE Otter Tail Phase II Ash and Demolition Landfill - SW-544	Otter Tail	MSW
PBR001319	Nexeo Solutions, LLC - PBR001319	Miami-Dade	Industrial
SW-351	Nordstrom's Sanitation LLC SW-351	Carlton	MSW Industrial C&D
SW-654	Norm's Demolicious of Duluth - SW-654	St. Louis	C&D
PBR000422	North Shore Waste Transfer Station - PBR000422	Cook	MSW C&D
PBR000369	Northwest Angle SW Transfer Station - PBR000369	Lake of the Woods	MSW
SW-349	Northwoods Transfer Station - SW-349	St. Louis	MSW C&D
PBR000398	Olson Sanitation Inc - PBR000398	Lac qui Parle	MSW C&D
PBR000600	Otter Tail County Recycling Center - PBR000600	Otter Tail	Recyclable Materials Only
PBR000342	Parkers Prairie Transfer Station - PBR000342	Otter Tail	MSW
PBR000340	Pelican Rapids Transfer Station - PBR000340	Otter Tail	MSW C&D
SW-285	Pennington County Transfer Station - SW-285	Pennington	MSW
SW-327	Polk County Transfer Station - SW-327	Polk	MSW C&D
SW-578	Randy's Sanitation, Inc. - SW-578	Wright	MSW C&D
SW-586	Ray Anderson & Sons Companies, Inc - SW-586	Ramsey	MSW C&D
SW-678	Recycle Minnesota, LLC - SW-678	Dakota	MSW C&D
SW-661	Red Wing Integrated Solid Waste Management Campus - SW-661	Goodhue	MSW
SW-664	Redwood/Renville Regional Material Recovery Facility SW-664	Redwood	MSW
PBR000947	Reliable Rolloff & Transfer - PBR000947	Stearns	MSW C&D
SW-123	Rice County Solid Waste Facility - SW-123	Rice	Recyclable Materials Only
SW-476	Richards Asphalt Transfer Facility - SW-476	Scott	Recyclable Materials Only
PBR000620	Richards Sanitation LLC - PBR000620	Houston	Recyclable Materials Only
PBR001197	River Bend Recycling Center - PBR001197 FNA: North Mankato Recyc	Nicollet	Recyclable Materials Only
PBR000345	Rock County Transfer Station - PBR000345	Rock	MSW
SW-518	Roseau County Transfer Station / Demolition Land Disposal Facility - S	Roseau	MSW Industrial C&D
SW-601	SET Empire Processing - SW-601	Dakota County	MSW
SW-343	SKB Rich Valley Demolition Waste Management Facility - SW-343	Dakota	C&D
SW-623	SKB Stewartville Transfer Station - SW-623	Olmsted	MSW Industrial C&D
SW-618	SKB Transfer Station/Blaine Environmental Campus - SW-618	Anoka	MSW

Table H-1A
Minnesota Solid Waste Facilities - Complete Inventory

Permit No.	Facility Name	County	Waste Type Accepted
SW-489	Slagle Demolition Landfill - SW-489	Cass	MSW
PBR000985	Southwest Sanitation, Inc. - PBR000985	Lyon	Recyclable Materials Only
PBR000380	Spring Lake Transfer Station - PBR000380	Itasca	MSW C&D
SW-609	SRC, Incorporated - SW-609	Chisago	MSW C&D
SW-481	St. Louis County Canister Sites - SW-481	St. Louis	MSW C&D
PBR000367	Stericycle Environmental Solutions, Inc. - PBR000367	Anoka	Industrial
SW-508	Stevens County Demolition Debris Landfill and Solid Waste Transfer St	Stevens	MSW
PBR000933	Thompson Sanitation Inc. - PBR000933	Freeborn County	MSW C&D
PBR000493	Todd County Solid Waste - PBR000493	Todd	MSW C&D
PBR000426	Tofte Solid Waste Transfer Station - PBR000426	Cook	MSW C&D
PBR000486	Tom's Refuse - PBR000486	Stearns	MSW
SW-458	Tostenson Transfer Station - SW-458	Chippewa	MSW
SW-107	Twin City Refuse Recycling and Transfer Station - SW-107	Ramsey	MSW
PBR001100	Veit Disposal Systems Austin Transfer Station - PBR001100	Mower	C&D
SW-516	Veit Disposal Systems Rochester Transfer and Recycling Station SW-51	Olmsted	MSW C&D
SW-565	Veit Saint Paul Recycling & Transfer Station SW-565	Ramsey	MSW
SW-536	Vonco V Duluth - SW-536/PBR001261	St. Louis	MSW
SW-317	Wadena County Solid Waste Facility - SW-317	Wadena	MSW C&D
SW-663	Walters Recycling & Refuse SW-663	Anoka	MSW C&D
PBR000897	Waseca County Solid Waste Transfer Facility - PBR000897	Waseca	MSW C&D
SW-491	Waste Management - Alexandria Transfer - SW-491	Douglas	MSW
PBR000586	Waste Management - Mankato PBR000586	Blue Earth	Recyclable Materials Only
SW-594	Waste Management - Maple Grove Transfer - SW-594	Hennepin	MSW Industrial C&D
PBR000595	Waste Management - Marshall PBR000595	Lyon	Recyclable Materials Only
SW-498	Waste Management - Ortonville Transfer - SW-498	Big Stone	MSW
SW-37	Waste Management - Re-Cy-Co Transfer - SW-37	Anoka	MSW
PBR000407	Waste Management Baxter MRF PBR000407	Crow Wing	Recyclable Materials Only
PBR000348	Waste Management Cohasset - PBR000348	Itasca	MSW
SW-470	Waste Management Le Sueur SW-470	Le Sueur	MSW
SW-604	Waste Management of Rochester SW-604	Olmsted	MSW
PBR001304	Waste Management Recycling Facility - Cambridge - PBR001304	Isanti	Recyclable Materials Only
SW-235	Waste Management St. Cloud Transfer SSR SW-235	Benton County	MSW Industrial C&D
PBR001115	Waste Management-Duluth - PBR001115	St. Louis	Recyclable Materials Only
SW-675	West Central Sanitation - Alexandria Transfer Station - SW-675	Douglas	MSW
SW-552	West Central Sanitation - Willmar Transfer Station - SW-552	Kandiyohi	MSW
SW-48	Winona Transfer Station - SW-48	Winona	MSW Industrial C&D
SW-591	WLSSD Materials Recovery Center - SW-591	St. Louis	MSW
SW-558	WLSSD Transfer Station - SW-558	St. Louis	MSW C&D
SW-329	WM-Sauk Centre - SW-329	Stearns	MSW
	Waste-to-Energy Processing Facilities		
SW-396	Covanta Hennepin Energy Resource Company L.P. - SW-396	Hennepin	MSW Industrial
SW-305	Elk River (GRE) Resource Processing Plant - SW-305	Sherburne	MSW
SW-636	Olmsted Waste-to-Energy Facility - SW-636	Olmsted	MSW Industrial
SW-641	Perham Resource Recovery Facility - SW-641	Otter Tail	MSW
SW-640	Polk County Solid Waste Resource Recovery - SW-640	Polk	MSW
SW-642	Pope Douglas Solid Waste Management - SW-642	Douglas	MSW Industrial
SW-357	Prairieland Solid Waste Management - SW-357	Martin	MSW
SW-286	Ramsey/Washington Recycling and Energy Center (Newport) - SW-286	Washington	MSW
SW-637	Red Wing Solid Waste Boiler Facility - SW-637	Goodhue	MSW
SW-638	Xcel - Wilmarth Generating Plant - SW-638	Blue Earth	MSW
SW-639	Xcel Energy - Red Wing Generating Plant - SW-639	Goodhue	RDF

Table H-1B
Wisconsin Solid Waste Facilities - Complete Inventory

Permit No.	Facility Name	County	Waste Type Accepted
	Land Disposal Units		
3150	ADAMS CNTY LF & RECYCLING CENTER	Adams	MSW
2967	ADVANCED DISP SERV CRANBERRY CREEK LF LLC	Wood	MSW
3134	ADVANCED DISP SERV HICKORY MEADOWS LF LLC	Calumet	MSW
3097	ADVANCED DISP SERV SEVEN MILE CREEK LF	Eau Claire	MSW
3244	ADVANCED DISP SVCS MIDWEST MALLARD RIDGE LF	Walworth	MSW
3290	ADVANCED DISPOSAL EMERALD PARK LANDFILL LLC	Waukesha	MSW
3068	ADVANCED DISPOSAL SERVICES GLACIER RIDGE LLC	Dodge	MSW
3334	Alma City Small Demo Landfill	Buffalo	C&D
4258	Antigo City Demo Site #2	Langlade	C&D
3474	Lake Area Sarona Landfill	Washburn	MSW
3018	DANE CNTY LF #2 RODEFELD	Dane	MSW
3100	HWY G SANITARY LF	Vilas	MSW
3939	JANESVILLE CTY LF (NEW)	Rock	MSW
572	KESTREL HAWK LF	Racine	MSW
2975	KEWAUNEE CNTY SOLID WASTE	Kewaunee	MSW
3253	LA CROSSE CNTY LF MSW & ASH MONOFILL	La Crosse	MSW
3141	LINCOLN CNTY SANITARY LF	Lincoln	MSW
3338	MARATHON CNTY AREA B LF	Marathon	MSW Industrial C&D
4228	MARATHON CNTY BLUE BIRD RIDGE RDF	Marathon	MSW
3095	MAR-OCO LF	Marinette	MSW
3660	MONROE CNTY RIDGEVILLE II SAN LF	Monroe	MSW
3235	OUTAGAMIE CNTY NE LF (AREA 6)	Outagamie	MSW
3069	SHAWANO CTY PHASE 2 LF	Shawano	MSW
2627	SUPERIOR CTY MOCCASIN MIKE LF	Douglas	MSW
3268	VERNON CNTY SOLID WASTE/RECYCLING FACILITY	Vernon	MSW
3318	W M W I - MADISON PRAIRIE LF	Dane	Industrial C&D
3360	W M W I-ORCHARD RIDGE RECYCLING & DISPOSAL	Waukesha	MSW
4628	WINNEBAGO CNTY SUNNYVIEW LF	Winnebago	MSW
1099	WMWI - METRO RECYCLING & DISPOSAL	Milwaukee	MSW
3765	WMWI - PHEASANT RUN RECYCLING & DISPOSAL	Kenosha	MSW
3066	WMWI - VALLEY TRAIL RECYCLING & DISPOSAL	Green Lake	MSW
3230	WMWI- DEER TRACK PARK RDF	Jefferson	MSW
4292	WMWI -RIDGEVIEW RECYCLING & DISPOSAL - SOUTH	Manitowoc	MSW
3455	WMWI- TIMBERLINE TRAIL RECYCLING & DISPOSAL	Rusk	MSW
	Transfer Stations / Processing Facilities		
4255	AA ROLL OFF SERVICE INC	Douglas	MSW C&D
4339	Advanced Disposal (Beloit)	Rock	MSW C&D
4259	ADVANCED DISPOSAL RHINELANDER TRANSFER	Oneida	MSW C&D
4281	Advanced Disposal Serv Solid Waste Midwest	Door	MSW C&D
3760	Advanced Disposal Services - Eau Claire	Eau Claire	MSW C&D
3105	Advanced Disposal Services - Germantown	Washington	MSW
4172	Advanced Disposal Services - Minocqua	Oneida	MSW C&D
3012	Advanced Disposal Services - Muskego Transfer Station	Waukesha	MSW C&D
4229	Advanced Disposal Services - Wausau	Marathon	MSW Industrial
3169	Advanced Disposal Services (Marshfield)	Wood	MSW C&D
3077	Advanced Disposal Services (Medford)	Taylor	MSW C&D
3885	Advanced Disposal Services (Waunakee)	Dane	MSW C&D
3926	Advanced Disposal Services Sw Midwest LLC	Walworth	MSW Industrial C&D
4130	Advanced Disposal Services SW Midwest Llc	Green	MSW C&D
4121	Advanced Disposal Services SW Midwest LLC - Depere	Brown	MSW Industrial C&D
4156	Advanced Disposal Services SW Midwest LLC - Fort Atkinson	Jefferson	MSW Industrial C&D

Table H-1B
Wisconsin Solid Waste Facilities - Complete Inventory

Permit No.	Facility Name	County	Waste Type Accepted
3737	Advanced Disposal Services SW Midwest LLC - Omro	Winnebago	MSW Industrial C&D
3980	Advanced Disposal Services SW Midwest LLC - Roberts	St. Croix	C&D Industrial
3055	Advanced Disposal Services SW Midwest LLC - Sheboygan	Sheboygan	MSW C&D
3009	Advanced Disposal Services SW Midwest LLC - West Allis	Milwaukee	MSW
3013	Advanced Disposal Services SW Midwest LLC - West Bend	Dodge	MSW C&D
3204	Allied Waste Services Of North America LLC	Burnett	MSW C&D
3152	Arcadia Cty Transfer/Wbs	Trempealeau	MSW
4186	Beloit City Public Works	Rock	MSW
4421	BOXX SANITATION RECYCLING & TRANSFER STATION	Eau Claire	MSW C&D
4289	Brown Cnty West Lf & Transfer Station	Brown	MSW Industrial C&D
4240	County of Oneida	Oneida	MSW C&D
3745	County of Waupaca	Waupaca	MSW Industrial C&D
4446	Dane Cnty Lf #2 Rodefeld	Dane	C&D
3396	Dunn County Transfer Station and Recycling Center	Dunn	MSW C&D
3269	FAHERTY INC	Grant	MSW C&D
3618	GOING GARBAGE & RECYCLING INC	Door	MSW C&D
3636	GREAT AMERICAN DISPOSAL TRANSFER STATION	Marinette	MSW Industrial C&D
4187	GREEN CNTY PROCESSING/TRANSFER FACILITY	Green	MSW
4296	GUELIGS WASTE REMOVAL & DEMOLITION LLC	Fond Du Lac	C&D
4318	Harters Trash & Recycling Inc	La Crosse	MSW C&D
3744	Hayward Garbage Transfer Station	Sawyer	MSW C&D
4674	JOHNS DISPOSAL SERVICE INC - WHITEWATER	Jefferson	MSW C&D
3026	KENOSHA CTY TRANSFER FACILITY	Kenosha	MSW
4107	Kinney Properties Inc	Waukesha	MSW C&D
4609	LENORUD SERVICES INC	Juneau	MSW C&D
2026	MADISON CTY TRANSFER STATION & BRUSH SITE	Dane	MSW
3167	MINONG AREA DISPOSAL TRANSFER/COMPOST SITE	Washburn	MSW
3128	Modern Disposal Systems	Jackson	MSW C&D
3060	Oconto City Transfer Station	Oconto	MSW
4369	Outagamie County Dept of Solid Waste/Recycling	Outagamie	MSW C&D
3104	PARK FALLS TRANSFER FACILITY	Price	MSW C&D
3798	Paul's Industrial Garage LLC	Pierce	MSW C&D
4443	Pellitteri Waste Systems LLC	Dane	MSW C&D
4404	PORTAGE CNTY TRANSFER STATION - HHW COLL FAC	Portage	MSW C&D
4433	SAFETY-KLEEN SYSTEMS INC	Dane	Industrial
4299	SHAWANO CTY-SW BALER FACILITY	Shawano	MSW Industrial C&D
3388	SOLON SPRINGS SOLID WASTE FACILITY	Douglas	MSW C&D
4324	TOWN & COUNTRY TRANSFER STA	Richland	MSW C&D
2954	Town and Country	Grant	MSW C&D
3999	TRI-CITY SANITATION SERVICE INC	Trempealeau	MSW
3326	Village of Bonduel	Shawano	MSW
3562	W M W I - DARLINGTON	Lafayette	MSW Industrial C&D
4061	W M W I - JANESVILLE	Rock	MSW
3630	Waste Management - Antigo Transfer Station	Langlade	MSW C&D
4300	Waste Management - Fond du Lac Transfer Station	Fond Du Lac	MSW Industrial C&D
3627	Waste Management - Green Bay Transfer Station	Brown	MSW C&D
2062	Waste Management - Lincoln Avenue Transfer Station	Milwaukee	MSW
3725	Waste Management - Madison Transfer Station	Dane	MSW Industrial C&D
4119	Waste Management - Menasha Transfer Station	Winnebago	Industrial
2737	Waste Management - Northwest Transfer Station	Milwaukee	MSW
3375	Waste Management - Recycle America Madison MRF	Dane	MSW C&D
3818	Waste Management - Sheboygan Falls Transfer Station	Sheboygan	MSW C&D
3145	Waste Management- La Crosse Transfer Station	La Crosse	MSW C&D

Table H-1B
Wisconsin Solid Waste Facilities - Complete Inventory

Permit No.	Facility Name	County	Waste Type Accepted
3612	Waste Management Nelson Transfer Fac	Buffalo	MSW Industrial C&D
3528	Waste Management-Ashland Transfer Station	Ashland	MSW C&D
3930	Waste Management-Chippewa Falls Transfer Station	Chippewa	MSW C&D
4233	Waste Management-Mosinee Transfer Station	Marathon	MSW C&D
3374	Waste Management-Prairie Du Chien Transfer Station	Crawford	MSW Industrial C&D
3545	Waste Management-River Falls Transfer Station	St. Croix	MSW C&D
3940	Watermans Sanitation Transfer Station	Polk	MSW C&D
2452	WAUWATOSA PUBLIC WORKS BUILDING	Milwaukee	MSW
3317	Wi Lake Delton - Transfer	Sauk	MSW C&D
3274	WIEDERHOLT ENTERPRISES LLC	Lafayette	MSW C&D
4287	WINNEBAGO CNTY SUNNYVIEW SW TRANSFER FACILIT	Winnebago	MSW Industrial C&D
3805	WMWI - Osceola Transfer Station	Polk	MSW Industrial C&D
	Waste-to-Energy Processing Facilities		
	Barron County Waste-to-Energy and Recycling Facility	Barron	MSW C&D
	French Island RDF Processing Facility	La Crosse	MSW

Table H-1C
Iowa Solid Waste Facilities - Complete Inventory

Permit No.	Facility Name	County	Waste Type Accepted
	Land Disposal Units		
06-SDP-02-81	Benton County Sanitary Landfill	Benton	MSW
07-SDP-01-75	Black Hawk County Sanitary Landfill	Black Hawk	MSW
08-SDP-01-75	Boone County Sanitary Landfill	Boone	MSW
14-SDP-01-74	Carroll County Sanitary Landfill/Recycling Center	Carroll	MSW
15-SDP-01-75	Cass County Sanitary Landfill	Cass	MSW
57-SDP-01-72	Cedar Rapids/Linn Co. Solid Waste Agency #2 Sanitary Landfill	Linn	MSW
95-SDP-01-72	Central Disposal Landfill	Winnebago	MSW
18-SDP-01-75	Cherokee County Sanitary Landfill	Cherokee	MSW
52-SDP-01-72	City of Iowa City Sanitary Landfill	Johnson	MSW
50-SDP-01-75	City of Newton Sanitary Landfill	Jasper	MSW
23-SDP-01-74	Clinton County Sanitary Landfill (East Site)	Clinton	MSW
29-SDP-01-76	Des Moines County Regional Sanitary Landfill	Des Moines	MSW
30-SDP-01-75	Dickinson Landfill Inc.	Dickinson	MSW
31-SDP-02-7	Dubuque Metropolitan Sanitary Landfill	Dubuque	MSW
66-SDP-01-73	Floyd-Mitchell-Chickasaw Counties Sanitary Landfill	Mitchell	MSW
36-SDP-01-74	Fremont County Sanitary Landfill	Fremont	MSW
56-SDP-07-80	Great River Regional Waste Authority Sanitary Landfill	Lee	MSW
43-SDP-05-94	Harrison County Sanitary Landfill	Harrison	MSW
48-SDP-02-79	Iowa County Sanitary Landfill	Iowa	MSW
17-SDP-01-75	Landfill of North Iowa	Cerro Gordo	MSW
65-SDP-01-72	Loess Hills Regional Sanitary Landfill	Mills	MSW
62-SDP-01-74	Mahaska County Sanitary Landfill	Mahaska	MSW
64-SDP-02-75	Marshall County Sanitary Landfill	Marshall	MSW
77-SDP-01-72	Metro Park East Sanitary Landfill	Polk	MSW
08-SDP-03-84	Metro Park West Landfill (Formerly North Dallas)	Dallas-Boone-Greene	MSW
70-SDP-02-75	Muscatine County Sanitary Landfill	Muscatine	MSW
94-SDP-01-75	North Central Iowa Regional Sanitary Landfill	Webster	MSW
74-SDP-02-76	Northern Plains Regional Landfill	Palo Alto	MSW
84-SDP-01-74	Northwest Iowa Area Sanitary Landfill	Sioux	MSW
90-SDP-01-75	Ottumwa-Wapello County Sanitary Landfill	Wapello	MSW
73-SDP-01-75	Page County Sanitary Landfill	Page	MSW
75-SDP-01-74	Plymouth County Sanitary Landfill	Plymouth	C&D
42-SDP-01-72	Rural Iowa Sanitary Landfill	Hardin	MSW
82-SDP-09-92	Scott Area Sanitary Landfill	Scott	MSW
54-SDP-01-75	SEMCO,Southeast Multi-County Sanitary Landfill	Keokuk	MSW
61-SDP-01-78	South Central Iowa Sanitary Landfill	Madison	MSW
63-SDP-02-77	South Central Iowa Solid Waste Agency Landfill	Marion	MSW
25-SDP-01-75	South Dallas County Sanitary Landfill	Dallas	MSW
86-SDP-01-72	Tama County Sanitary Landfill	Tama	MSW
27-SDP-01-75	Wayne-Ringgold-Decatur County Sanitary Landfill	Decatur	MSW
96-SDP-01-74	Winneshiek County Sanitary Landfill	Winneshiek	MSW
	Transfer Stations (Iowa does not track processing of waste through transfer stations)		
01-SDP-09-09	Adair County Transfer Station	Adair	MSW
05-SDP-04-07	Audobon County Transfer Station	Audobon	MSW
28-SDP-04-06	Bi-County Disposal Inc.	Delaware	MSW
11-SDP-12-12	Buena Vista County Transfer Statio	Buena Vista	MSW
12-SDP-02-89	Butler County Transfer Station	Butler	MSW
16-SDP-02-88	Cedar County Transfer Station	Cedar	MSW
07-SDP-17-97	Cedar Valley Recycling & Transfer Company (Formerly Corkery)	Black Hawk	MSW
07-SDP-06-82	City of Cedar Falls Transfer Station	Black Hawk	MSW
70-SDP-11-94	City of Muscatine Xfr Stn, Recyc. Ctr & HHM Collection Ctr	Muscatine	MSW

Table H-1C
Iowa Solid Waste Facilities - Complete Inventory

Permit No.	Facility Name	County	Waste Type Accepted
21-SDP-01-76	City of Spencer Transfer Station	Clay	MSW
24-SDP-06-07	Crawford County Transfer Station	Crawford	MSW
32-SDP-02-78	Emmet County Transfer Station	Emmet	MSW
33-SDP-07-09	Fayette County Solid Waste Transfer Station	Fayette	MSW
56-SDP-16-89	Great River Regional Waste Authority Transfer Station	Lee	MSW
39-SDP-03-97	Guthrie County Transfer Station	Guthrie	MSW
40-SDP-06-01	Hamilton County Transfer Station	Hamilton	MSW
34-SDP-05-94	Jendro Sanitation Services, Inc. Transfer Station	Floyd	MSW
53-SDP-06-07	Jones County Transfer Station	Jones	MSW
55-SDP-06-07	Kossuth County Transfer Station	Kossuth	MSW
58-SDP-02-92	Louisa County Regional Solid Waste Agency Transfer Station	Louisa	MSW
77-SDP-69-14	Metro Northwest Transfer Station	Polk	MSW
77-SDP-10-76	Metro Transfer Station	Polk	MSW
67-SDP-03-91	Monona County Transfer Station	Monona	MSW
69-SDP-05-07	Montgomery County Transfer Station	Montgomery	MSW
74-SDP-01-76	Palo Alto County Transfer Station	Palo Alto	MSW
75-SDP-04-91	Plymouth County Transfer Station	Plymouth	MSW
76-SDP-01-75	Pocahontas County Transfer Station	Pocahontas	MSW
78-SDP-34-18	Pottawattamie County Transfer Station	Pottawattamie	MSW
79-SDP-04-92	Poweshiek Transfer Station	Poweshiek	MSW
04-SDP-09-05	Rathbun Area Solid Waste Management Commission Transfer Station	Appanoose	MSW
81-SDP-07-16	Sac County Transfer Station	Sac	MSW
83-SDP-04-94	Shelby County Transfer Station	Shelby	MSW
88-SDP-07-07	Union County Transfer Station	Union	MSW
49-SDP-03-92	Waste Authority of Jackson County Transfer Station	Jackson	MSW
10-SDP-02-97	Waste Management of Independence Transfer Station	Buchanan	MSW
77-SDP-21-84	Waste Management of Iowa Des Moines Transfer Station	Polk	MSW
57-SDP-27-98	Waste Transfer Stations, LLC	Linn	MSW
97-SDP-18-06	Woodbury County Transfer Station	Woodbury	MSW
99-SDP-03-89	Wright County Transfer Station	Wright	MSW

There are no Public Waste-to-Energy Processing Facilities in Iowa

Table H-2A
Minnesota MSW Facilities

Permit No.	Facility Name	County	Waste Type Accepted
	Land Disposal Units		
SW-89	Brown County Sanitary Landfill SW-89	Brown	MSW C&D
SW-56	Burnsville Sanitary Landfill - SW-56	Dakota	MSW Industrial C&D
SW-34	Clay County Sanitary Landfill - SW-34	Clay	MSW Industrial C&D
SW-143	Cottonwood County Landfill - SW-143	Cottonwood	MSW C&D
SW-376	Crow Wing County MSW Landfill - SW-376	Crow Wing	MSW Industrial C&D
SW-17	East Central Solid Waste Commission - SW-17	Kanabec	MSW Industrial C&D
SW-74	Elk River Landfill - SW-74	Sherburne	MSW Industrial C&D
SW-79	Kandiyohi County Sanitary Landfill - SW-79 and UT0139	Kandiyohi	MSW Industrial C&D
SW-23	Lyon County Regional Landfill - SW-23	Lyon	MSW Industrial
SW-92	MAR-KIT Sanitary Landfill - SW-92	Kittson	MSW C&D
SW-15	Morrison County Solid Waste Management Facility - SW-15	Morrison	MSW C&D
SW-11	Nobles County Landfill - SW-11	Nobles	MSW Industrial C&D
SW-355	Olmsted County Kalmar Landfill - SW-355	Olmsted	MSW C&D
SW-45	Pine Bend Landfill - SW-45	Dakota	MSW Industrial C&D
SW-124	Polk County Landfill - SW-124	Polk	MSW C&D
SW-87	Ponderosa Landfill - SW-87	Blue Earth	MSW Industrial C&D
SW-90	Renville County Landfill - SW-90	Renville	MSW C&D
SW-123	Rice County Solid Waste Facility - SW-123	Rice	MSW C&D
SW-6	Spruce Ridge Resource Management, Inc. - SW-6	McLeod	MSW Industrial C&D
SW-405	St Louis County Regional Landfill - SW-405	St. Louis	MSW Industrial C&D
SW-131	Steele County Sanitary Landfill - SW-131	Steele	MSW Industrial C&D
	Transfer Stations / Processing Facilities		
PBR001080	ACE Solid Waste Recycling Facility - SW-668	Huron	MSW
SW-574	Advanced Disposal - SW-574	Ramsey	MSW C&D
PBR000350	Albert Lea Transfer Station - PBR000350	Freeborn	MSW
PBR000423	American Disposal Transfer Station - PBR000423	Itasca	MSW
SW-222	Austin Waste Transfer Station - SW-222	Mower	MSW
PBR000341	Battle Lake Transfer Station - PBR000341	Otter Tail	MSW C&D
PBR000881	Becker County Transfer Station - PBR000881	Becker	MSW C&D
SW-311	Becker County Transfer Station and Demolition Landfill - SW-311	Becker	MSW C&D
SW-587	Beltrami County Bemidji Transfer SW-587	Beltrami	MSW C&D
SW-529	Beltrami County Blackduck Transfer SW-529	Beltrami	MSW C&D
PBR000417	Bigfork Transfer Station - PBR000417	Itasca	MSW
SW-582	Blaine enviromental campus - SW-582	Anoka	MSW C&D
PBR000418	Bray Lake Transfer Station - PBR000418	Itasca	MSW C&D
SW-344	Brooklyn Park Recycling Center and Transfer Station - SW-344	Hennepin	MSW
SW-346	Brookston Transfer Station - SW-346	Carlton	MSW C&D
PBR000491	Camp Ripley Transfer Station - PBR000491	Morrison	MSW C&D
SW-295	Carlton County Transfer Station - SW-295	Carlton	MSW C&D
SW-419	Cass County Transfer Station SW-419	Cass	MSW
SW-391	Clarks Grove Transfer SW-391	Freeborn	MSW
SW-34	Clay County Sanitary Landfill - SW-34	Clay	MSW C&D
SW-347	Cook Transfer Station - SW-347	St. Louis	MSW C&D
PBR000989	Danckwart Feed and Grain Inc. - PBR000989	Wabasha	MSW C&D
SW-592	Dem-Con Blaine SW-592	Anoka	MSW C&D
SW-555	Dem-Con Recovery & Recycling, LLC - SW-555	Scott	MSW C&D
SW-577	Demolicious Transfer Station - SW-577	St. Louis	MSW C&D
SW-302	Dodge County Transfer Station - SW-302	Dodge	MSW C&D
SW-406	Douglas County Demo Landfill, LLC SW-406	Douglas	MSW
SW-400	ECSWC Cambridge Transfer Station - SW-400	Isanti	MSW C&D
SW-597	Eden Prairie Transfer Station - SW-597	Hennepin	MSW

Table H-2A
Minnesota MSW Facilities

Permit No.	Facility Name	County	Waste Type Accepted
SW-572	Fergus Falls Solid Waste Disposal Facility - SW-572	Otter Tail	MSW
SW-624	Fergus Falls Transfer Station - SW-624	Otter Tail	MSW
SW-322	Fillmore County Resource and Recycling Center SW-322	Fillmore	MSW
SW-354	Freeway Transfer, Inc. - SW-354	Dakota	MSW C&D
SW-384	Garrison Disposal SW-384	Aitkin	MSW C&D
PBR001092	Gene's Transfer - PBR001092	Washington	MSW C&D
SW-408	Glenwood Demolition Disposal - SW-408	Pope	MSW
PBR000416	Goodland Transfer Station - PBR000416	Itasca	MSW
SW-556	Grinning Bear Demolition Landfill SW-556	Cass County	MSW
PBR001219	Hartel's / DBJ Disposal Companies - PBR001219	St. Louis	MSW C&D
SW-291	Hengel Ready Mix and Construction, Inc. - SW-291	Cass	MSW
SW-395	Henning Transfer Station/Demolition Landfill - SW-395	Otter Tail	MSW
SW-455	Hibbing Transfer Station - SW-455	St. Louis	MSW C&D
SW-401	Hinckley Transfer Station - SW-401	Pine	MSW C&D
SW-315	Hubbard County North Transfer Station - SW-315	Hubbard	MSW
SW-318	Hubbard County South Transfer Station - SW-318	Hubbard	MSW
SW-348	Hudson (Aurora) Transfer Station - SW-348	St. Louis	MSW C&D
PBR000420	Iron Range Transfer Station - PBR000420	Itasca	MSW
SW-448	Itasca County Demolition Landfill - SW-448	Itasca	MSW C&D
PBR000421	J & H Transfer Station - PBR000421	Aitkin	MSW
SW-657	JME Recycle Center/Transfer Station - SW-657	Wright	MSW Industrial C&D
SW-571	John's Sanitary Removal - SW-571	Lake	MSW C&D
SW-579	Keith Krupenny & Son Disposal Service, Inc. - SW-579	Ramsey	MSW C&D
SW-500	Koochiching County Recycling / Transfer Facility - SW-550	Rainy River District	MSW
SW-523	Lake City Recycling & Disposal - SW-523	Wabasha	MSW Industrial C&D
SW-342	Lake of the Woods Co Recovery Facility - SW-342	Lake of the Woods	MSW
PBR000447	Lincoln County Transfer Site - PBR000447	Lincoln	MSW C&D
SW-653	LJP Recycling Transfer Station - SW-653	Nicollet	MSW C&D
SW-445	Lloyd's Construction Services, Inc. Transfer - SW-445	Scott	MSW C&D
PBR000419	Long Lake Transfer Station - PBR000419	Itasca	MSW
SW-525	Malcolm Avenue Recycling & Transfer - SW-525	Hennepin	MSW Industrial C&D
SW-452	Mankato Transfer Station - SW-452	Blue Earth	MSW
SW-608	Matejka Recycling - SW-608	Winona	MSW
SW-651	Matejka Transfer Station - SW-651	Winona	MSW C&D
SW-441	Meeker County Transfer Station - SW-441	Meeker	MSW
SW-588	Minden Transfer Station SW-588	Benton	MSW C&D
SW-40	Minneapolis North Transfer Station - SW-40	Hennepin	MSW C&D
SW-41	Minneapolis Southside Transfer Station - SW-41	Hennepin	MSW C&D
SW-139	Moorhead Transfer Station - SW-139	Clay	MSW C&D
SW-544	NE Otter Tail Phase II Ash and Demolition Landfill - SW-544	Otter Tail	MSW
SW-351	Nordstrom's Sanitation LLC SW-351	Carlton	MSW Industrial C&D
PBR000422	North Shore Waste Transfer Station - PBR000422	Cook	MSW C&D
PBR000369	Northwest Angle SW Transfer Station - PBR000369	Lake of the Woods	MSW
SW-349	Northwoods Transfer Station - SW-349	St. Louis	MSW C&D
PBR000398	Olson Sanitation Inc - PBR000398	Lac qui Parle	MSW C&D
PBR000342	Parkers Prairie Transfer Station - PBR000342	Otter Tail	MSW
PBR000340	Pelican Rapids Transfer Station - PBR000340	Otter Tail	MSW C&D
SW-285	Pennington County Transfer Station - SW-285	Pennington	MSW
SW-327	Polk County Transfer Station - SW-327	Polk	MSW C&D
SW-578	Randy's Sanitation, Inc. - SW-578	Wright	MSW C&D
SW-586	Ray Anderson & Sons Companies, Inc - SW-586	Ramsey	MSW C&D
SW-678	Recycle Minnesota, LLC - SW-678	Dakota	MSW C&D
SW-661	Red Wing Integrated Solid Waste Management Campus - SW-661	Goodhue	MSW
SW-664	Redwood/Renville Regional Material Recovery Facility SW-664	Redwood	MSW

Table H-2A
Minnesota MSW Facilities

Permit No.	Facility Name	County	Waste Type Accepted
PBR000947	Reliable Rolloff & Transfer - PBR000947	Stearns	MSW C&D
PBR000345	Rock County Transfer Station - PBR000345	Rock	MSW
SW-518	Roseau County Transfer Station / Demolition Land Disposal Facility - S	Roseau	MSW Industrial C&D
SW-601	SET Empire Processing - SW-601	Dakota County	MSW
SW-623	SKB Stewartville Transfer Station - SW-623	Olmsted	MSW Industrial C&D
SW-618	SKB Transfer Station/Blaine Environmental Campus - SW-618	Anoka	MSW
SW-489	Slagle Demolition Landfill - SW-489	Cass	MSW
PBR000380	Spring Lake Transfer Station - PBR000380	Itasca	MSW C&D
SW-609	SRC, Incorporated - SW-609	Chisago	MSW C&D
SW-481	St. Louis County Canister Sites - SW-481	St. Louis	MSW C&D
SW-508	Stevens County Demolition Debris Landfill and Solid Waste Transfer S	Stevens	MSW
PBR000933	Thompson Sanitation Inc. - PBR000933	Freeborn County	MSW C&D
PBR000493	Todd County Solid Waste - PBR000493	Todd	MSW C&D
PBR000426	Tofte Solid Waste Transfer Station - PBR000426	Cook	MSW C&D
PBR000486	Tom's Refuse - PBR000486	Stearns	MSW
SW-458	Tostenson Transfer Station - SW-458	Chippewa	MSW
SW-107	Twin City Refuse Recycling and Transfer Station - SW-107	Ramsey	MSW
SW-516	Veit Disposal Systems Rochester Transfer and Recycling Station SW-51	Olmsted	MSW C&D
SW-565	Veit Saint Paul Recycling & Transfer Station SW-565	Ramsey	MSW
SW-536	Vonco V Duluth - SW-536/PBR001261	St. Louis	MSW
SW-317	Wadena County Solid Waste Facility - SW-317	Wadena	MSW C&D
SW-663	Walters Recycling & Refuse SW-663	Anoka	MSW C&D
PBR000897	Waseca County Solid Waste Transfer Facility - PBR000897	Waseca	MSW C&D
SW-491	Waste Management - Alexandria Transfer - SW-491	Douglas	MSW
SW-594	Waste Management - Maple Grove Transfer - SW-594	Hennepin	MSW Industrial C&D
SW-498	Waste Management - Ortonville Transfer - SW-498	Big Stone	MSW
SW-37	Waste Management - Re-Cy-Co Transfer - SW-37	Anoka	MSW
PBR000348	Waste Management Cohasset - PBR000348	Itasca	MSW
SW-470	Waste Management Le Sueur SW-470	Le Sueur	MSW
SW-604	Waste Management of Rochester SW-604	Olmsted	MSW
SW-235	Waste Management St. Cloud Transfer SSR SW-235	Benton County	MSW Industrial C&D
SW-675	West Central Sanitation - Alexandria Transfer Station - SW-675	Douglas	MSW
SW-552	West Central Sanitation - Willmar Transfer Station - SW-552	Kandiyohi	MSW
SW-48	Winona Transfer Station - SW-48	Winona	MSW Industrial C&D
SW-591	WLSSD Materials Recovery Center - SW-591	St. Louis	MSW
SW-558	WLSSD Transfer Station - SW-558	St. Louis	MSW C&D
SW-329	WM-Sauk Centre - SW-329	Stearns	MSW
	Waste-to-Energy Processing Facilities		
SW-396	Covanta Hennepin Energy Resource Company L.P. - SW-396	Hennepin	MSW Industrial
SW-305	Elk River (GRE) Resource Processing Plant - SW-305	Sherburne	MSW
SW-636	Olmsted Waste-to-Energy Facility - SW-636	Olmsted	MSW Industrial
SW-641	Perham Resource Recovery Facility - SW-641	Otter Tail	MSW
SW-640	Polk County Solid Waste Resource Recovery - SW-640	Polk	MSW
SW-642	Pope Douglas Solid Waste Management - SW-642	Douglas	MSW Industrial
SW-357	Prairieland Solid Waste Management - SW-357	Martin	MSW
SW-286	Ramsey/Washington Recycling and Energy Center (Newport) - SW-28	Washington	MSW
SW-637	Red Wing Solid Waste Boiler Facility - SW-637	Goodhue	MSW
SW-638	Xcel - Wilmarth Generating Plant - SW-638	Blue Earth	MSW

Table H-2B
Wisconsin MSW Facilities

Permit No.	Facility Name	County	Waste Type Accepted
	Land Disposal Units		
3150	ADAMS CNTY LF & RECYCLING CENTER	Adams	MSW
2967	ADVANCED DISP SERV CRANBERRY CREEK LF LLC	Wood	MSW
3134	ADVANCED DISP SERV HICKORY MEADOWS LF LLC	Calumet	MSW
3097	ADVANCED DISP SERV SEVEN MILE CREEK LF	Eau Claire	MSW
3244	ADVANCED DISP SVCS MIDWEST MALLARD RIDGE LF	Walworth	MSW
3290	ADVANCED DISPOSAL EMERALD PARK LANDFILL LLC	Waukesha	MSW
3068	ADVANCED DISPOSAL SERVICES GLACIER RIDGE LLC	Dodge	MSW
3474	Lake Area Sarona Landfill	Washburn	MSW
3018	DANE CNTY LF #2 RODEFELD	Dane	MSW
3100	HWY G SANITARY LF	Vilas	MSW
3939	JANESVILLE CTY LF (NEW)	Rock	MSW
572	KESTREL HAWK LF	Racine	MSW
2975	KEWAUNEE CNTY SOLID WASTE	Kewaunee	MSW
3253	LA CROSSE CNTY LF MSW & ASH MONOFILL	La Crosse	MSW
3141	LINCOLN CNTY SANITARY LF	Lincoln	MSW
3338	MARATHON CNTY AREA B LF	Marathon	MSW Industrial C&D
4228	MARATHON CNTY BLUE BIRD RIDGE RDF	Marathon	MSW
3095	MAR-OCO LF	Marinette	MSW
3660	MONROE CNTY RIDGEVILLE II SAN LF	Monroe	MSW
3235	OUTAGAMIE CNTY NE LF (AREA 6)	Outagamie	MSW
3069	SHAWANO CTY PHASE 2 LF	Shawano	MSW
2627	SUPERIOR CTY MOCCASIN MIKE LF	Douglas	MSW
3268	VERNON CNTY SOLID WASTE/RECYCLING FACILITY	Vernon	MSW
3360	W M W I-ORCHARD RIDGE RECYCLING & DISPOSAL	Waukesha	MSW
4628	WINNEBAGO CNTY SUNNYVIEW LF	Winnebago	MSW
1099	WMWI - METRO RECYCLING & DISPOSAL	Milwaukee	MSW
3765	WMWI - PHEASANT RUN RECYCLING & DISPOSAL	Kenosha	MSW
3066	WMWI - VALLEY TRAIL RECYCLING & DISPOSAL	Green Lake	MSW
3230	WMWI- DEER TRACK PARK RDF	Jefferson	MSW
4292	WMWI -RIDGEVIEW RECYCLING & DISPOSAL - SOUTH	Manitowoc	MSW
3455	WMWI- TIMBERLINE TRAIL RECYCLING & DISPOSAL	Rusk	MSW
	Transfer Stations / Processing Facilities		
4255	AA ROLL OFF SERVICE INC	Douglas	MSW C&D
4339	Advanced Disposal (Beloit)	Rock	MSW C&D
4259	ADVANCED DISPOSAL RHINELANDER TRANSFER	Oneida	MSW C&D
4281	Advanced Disposal Serv Solid Waste Midwest	Door	MSW C&D
3760	Advanced Disposal Services - Eau Claire	Eau Claire	MSW C&D
3105	Advanced Disposal Services - Germantown	Washington	MSW
4172	Advanced Disposal Services - Minocqua	Oneida	MSW C&D
3012	Advanced Disposal Services - Muskego Transfer Station	Waukesha	MSW C&D
4229	Advanced Disposal Services - Wausau	Marathon	MSW Industrial
3169	Advanced Disposal Services (Marshfield)	Wood	MSW C&D
3077	Advanced Disposal Services (Medford)	Taylor	MSW C&D
3885	Advanced Disposal Services (Waunakee)	Dane	MSW C&D
3926	Advanced Disposal Services Sw Midwest LLC	Walworth	MSW Industrial C&D
4130	Advanced Disposal Services SW Midwest Llc	Green	MSW C&D
4121	Advanced Disposal Services SW Midwest LLC - Depere	Brown	MSW Industrial C&D
4156	Advanced Disposal Services SW Midwest LLC - Fort Atkinson	Jefferson	MSW Industrial C&D
3737	Advanced Disposal Services SW Midwest LLC - Omro	Winnebago	MSW Industrial C&D
3055	Advanced Disposal Services SW Midwest LLC - Sheboygan	Sheboygan	MSW C&D
3009	Advanced Disposal Services SW Midwest LLC - West Allis	Milwaukee	MSW
3013	Advanced Disposal Services SW Midwest LLC - West Bend	Dodge	MSW C&D
3204	Allied Waste Services Of North America LLC	Burnett	MSW C&D
3152	Arcadia Cty Transfer/Wbs	Trempealeau	MSW
4186	Beloit City Public Works	Rock	MSW

Table H-2B
Wisconsin MSW Facilities

Permit No.	Facility Name	County	Waste Type Accepted
4421	BOXX SANITATION RECYCLING & TRANSFER STATION	Eau Claire	MSW C&D
4289	Brown Cnty West Lf & Transfer Station	Brown	MSW Industrial C&D
4240	County of Oneida	Oneida	MSW C&D
3745	County of Waupaca	Waupaca	MSW Industrial C&D
3396	Dunn County Transfer Station and Recycling Center	Dunn	MSW C&D
3269	FAHERTY INC	Grant	MSW C&D
3618	GOING GARBAGE & RECYCLING INC	Door	MSW C&D
3636	GREAT AMERICAN DISPOSAL TRANSFER STATION	Marinette	MSW Industrial C&D
4187	GREEN CNTY PROCESSING/TRANSFER FACILITY	Green	MSW
4318	Harters Trash & Recycling Inc	La Crosse	MSW C&D
3744	Hayward Garbage Transfer Station	Sawyer	MSW C&D
4674	JOHNS DISPOSAL SERVICE INC - WHITEWATER	Jefferson	MSW C&D
3026	KENOSHA CTY TRANSFER FACILITY	Kenosha	MSW
4107	Kinney Properties Inc	Waukesha	MSW C&D
4609	LENORUD SERVICES INC	Juneau	MSW C&D
2026	MADISON CTY TRANSFER STATION & BRUSH SITE	Dane	MSW
3167	MINONG AREA DISPOSAL TRANSFER/COMPOST SITE	Washburn	MSW
3128	Modern Disposal Systems	Jackson	MSW C&D
3060	Oconto City Transfer Station	Oconto	MSW
4369	Outagamie County Dept of Solid Waste/Recycling	Outagamie	MSW C&D
3104	PARK FALLS TRANSFER FACILITY	Price	MSW C&D
3798	Paul's Industrial Garage LLC	Pierce	MSW C&D
4443	Pellitteri Waste Systems LLC	Dane	MSW C&D
4404	PORTAGE CNTY TRANSFER STATION - HHW COLL FAC	Portage	MSW C&D
4299	SHAWANO CTY-SW BALER FACILITY	Shawano	MSW Industrial C&D
3388	SOLON SPRINGS SOLID WASTE FACILITY	Douglas	MSW C&D
4324	TOWN & COUNTRY TRANSFER STA	Richland	MSW C&D
2954	Town and Country	Grant	MSW C&D
3999	TRI-CITY SANITATION SERVICE INC	Trempealeau	MSW
3326	Village of Bonduel	Shawano	MSW
3562	W M W I - DARLINGTON	Lafayette	MSW Industrial C&D
4061	W M W I - JANESVILLE	Rock	MSW
3630	Waste Management - Antigo Transfer Station	Langlade	MSW C&D
4300	Waste Management - Fond du Lac Transfer Station	Fond Du Lac	MSW Industrial C&D
3627	Waste Management - Green Bay Transfer Station	Brown	MSW C&D
2062	Waste Management - Lincoln Avenue Transfer Station	Milwaukee	MSW
3725	Waste Management - Madison Transfer Station	Dane	MSW Industrial C&D
2737	Waste Management - Northwest Transfer Station	Milwaukee	MSW
3375	Waste Management - Recycle America Madison MRF	Dane	MSW C&D
3818	Waste Management - Sheboygan Falls Transfer Station	Sheboygan	MSW C&D
3145	Waste Management- La Crosse Transfer Station	La Crosse	MSW C&D
3612	Waste Management Nelson Transfer Fac	Buffalo	MSW Industrial C&D
3528	Waste Management-Ashland Transfer Station	Ashland	MSW C&D
3930	Waste Management-Chippewa Falls Transfer Station	Chippewa	MSW C&D
4233	Waste Management-Mosinee Transfer Station	Marathon	MSW C&D
3374	Waste Management-Prairie Du Chien Transfer Station	Crawford	MSW Industrial C&D
3545	Waste Management-River Falls Transfer Station	St. Croix	MSW C&D
3940	Watermans Sanitation Transfer Station	Polk	MSW C&D
2452	WAUWATOSA PUBLIC WORKS BUILDING	Milwaukee	MSW
3317	Wi Lake Delton - Transfer	Sauk	MSW C&D
3274	WIEDERHOLT ENTERPRISES LLC	Lafayette	MSW C&D
4287	WINNEBAGO CNTY SUNNYVIEW SW TRANSFER FACILIT	Winnebago	MSW Industrial C&D
3805	WMWI - Osceola Transfer Station	Polk	MSW Industrial C&D
	Waste-to-Energy Processing Facilities		
	Barron County Waste-to-Energy and Recycling Facility	Barron	MSW C&D
	French Island RDF Processing Facility	La Crosse	MSW

Table H-2C
Iowa MSW Facilities

Permit No.	Facility Name	County	Waste Type Accepted
	Land Disposal Units		
06-SDP-02-81	Benton County Sanitary Landfill	Benton	MSW
07-SDP-01-75	Black Hawk County Sanitary Landfill	Black Hawk	MSW
08-SDP-01-75	Boone County Sanitary Landfill	Boone	MSW
14-SDP-01-74	Carroll County Sanitary Landfill/Recycling Center	Carroll	MSW
15-SDP-01-75	Cass County Sanitary Landfill	Cass	MSW
57-SDP-01-72	Cedar Rapids/Linn Co. Solid Waste Agency #2 Sanitary Landfill	Linn	MSW
95-SDP-01-72	Central Disposal Landfill	Winnebago	MSW
18-SDP-01-75	Cherokee County Sanitary Landfill	Cherokee	MSW
52-SDP-01-72	City of Iowa City Sanitary Landfill	Johnson	MSW
50-SDP-01-75	City of Newton Sanitary Landfill	Jasper	MSW
23-SDP-01-74	Clinton County Sanitary Landfill (East Site)	Clinton	MSW
29-SDP-01-76	Des Moines County Regional Sanitary Landfill	Des Moines	MSW
30-SDP-01-75	Dickinson Landfill Inc.	Dickinson	MSW
31-SDP-02-7	Dubuque Metropolitan Sanitary Landfill	Dubuque	MSW
66-SDP-01-73	Floyd-Mitchell-Chickasaw Counties Sanitary Landfill	Mitchell	MSW
36-SDP-01-74	Fremont County Sanitary Landfill	Fremont	MSW
56-SDP-07-80	Great River Regional Waste Authority Sanitary Landfill	Lee	MSW
43-SDP-05-94	Harrison County Sanitary Landfill	Harrison	MSW
48-SDP-02-79	Iowa County Sanitary Landfill	Iowa	MSW
17-SDP-01-75	Landfill of North Iowa	Cerro Gordo	MSW
65-SDP-01-72	Loess Hills Regional Sanitary Landfill	Mills	MSW
62-SDP-01-74	Mahaska County Sanitary Landfill	Mahaska	MSW
64-SDP-02-75	Marshall County Sanitary Landfill	Marshall	MSW
77-SDP-01-72	Metro Park East Sanitary Landfill	Polk	MSW
08-SDP-03-84	Metro Park West Landfill (Formerly North Dallas)	Dallas-Boone-Greene	MSW
70-SDP-02-75	Muscatine County Sanitary Landfill	Muscatine	MSW
94-SDP-01-75	North Central Iowa Regional Sanitary Landfill	Webster	MSW
74-SDP-02-76	Northern Plains Regional Landfill	Palo Alto	MSW
84-SDP-01-74	Northwest Iowa Area Sanitary Landfill	Sioux	MSW
90-SDP-01-75	Ottumwa-Wapello County Sanitary Landfill	Wapello	MSW
73-SDP-01-75	Page County Sanitary Landfill	Page	MSW
42-SDP-01-72	Rural Iowa Sanitary Landfill	Hardin	MSW
82-SDP-09-92	Scott Area Sanitary Landfill	Scott	MSW
54-SDP-01-75	SEMCO,Southeast Multi-County Sanitary Landfill	Keokuk	MSW
61-SDP-01-78	South Central Iowa Sanitary Landfill	Madison	MSW
63-SDP-02-77	South Central Iowa Solid Waste Agency Landfill	Marion	MSW
25-SDP-01-75	South Dallas County Sanitary Landfill	Dallas	MSW
86-SDP-01-72	Tama County Sanitary Landfill	Tama	MSW
27-SDP-01-75	Wayne-Ringgold-Decatur County Sanitary Landfill	Decatur	MSW
96-SDP-01-74	Winneshiek County Sanitary Landfill	Winneshiek	MSW
	Transfer Stations (Iowa does not track processing of waste through transfer stations)		
01-SDP-09-09	Adair County Transfer Station	Adair	MSW
05-SDP-04-07	Audobon County Transfer Station	Audobon	MSW
28-SDP-04-06	Bi-County Disposal Inc.	Delaware	MSW
11-SDP-12-12	Buena Vista County Transfer Statio	Buena Vista	MSW
12-SDP-02-89	Butler County Transfer Station	Butler	MSW
16-SDP-02-88	Cedar County Transfer Station	Cedar	MSW
07-SDP-17-97	Cedar Valley Recycling & Transfer Company (Formerly Corkery)	Black Hawk	MSW
07-SDP-06-82	City of Cedar Falls Transfer Station	Black Hawk	MSW
70-SDP-11-94	City of Muscatine Xfr Stn, Recyc. Ctr & HHM Collection Ctr	Muscatine	MSW
21-SDP-01-76	City of Spencer Transfer Station	Clay	MSW

Table H-2C
Iowa MSW Facilities

Permit No.	Facility Name	County	Waste Type Accepted
24-SDP-06-07	Crawford County Transfer Station	Crawford	MSW
32-SDP-02-78	Emmet County Transfer Station	Emmet	MSW
33-SDP-07-09	Fayette County Solid Waste Transfer Station	Fayette	MSW
56-SDP-16-89	Great River Regional Waste Authority Transfer Station	Lee	MSW
39-SDP-03-97	Guthrie County Transfer Station	Guthrie	MSW
40-SDP-06-01	Hamilton County Transfer Station	Hamilton	MSW
34-SDP-05-94	Jendro Sanitation Services, Inc. Transfer Station	Floyd	MSW
53-SDP-06-07	Jones County Transfer Station	Jones	MSW
55-SDP-06-07	Kossuth County Transfer Station	Kossuth	MSW
58-SDP-02-92	Louisa County Regional Solid Waste Agency Transfer Station	Louisa	MSW
77-SDP-69-14	Metro Northwest Transfer Station	Polk	MSW
77-SDP-10-76	Metro Transfer Station	Polk	MSW
67-SDP-03-91	Monona County Transfer Station	Monona	MSW
69-SDP-05-07	Montgomery County Transfer Station	Montgomery	MSW
74-SDP-01-76	Palo Alto County Transfer Station	Palo Alto	MSW
75-SDP-04-91	Plymouth County Transfer Station	Plymouth	MSW
76-SDP-01-75	Pocahontas County Transfer Station	Pocahontas	MSW
78-SDP-34-18	Pottawattamie County Transfer Station	Pottawattamie	MSW
79-SDP-04-92	Poweshiek Transfer Station	Poweshiek	MSW
04-SDP-09-05	Rathbun Area Solid Waste Management Commission Transfer Station	Appanoose	MSW
81-SDP-07-16	Sac County Transfer Station	Sac	MSW
83-SDP-04-94	Shelby County Transfer Station	Shelby	MSW
88-SDP-07-07	Union County Transfer Station	Union	MSW
49-SDP-03-92	Waste Authority of Jackson County Transfer Station	Jackson	MSW
10-SDP-02-97	Waste Management of Independence Transfer Station	Buchanan	MSW
77-SDP-21-84	Waste Management of Iowa Des Moines Transfer Station	Polk	MSW
57-SDP-27-98	Waste Transfer Stations, LLC	Linn	MSW
97-SDP-18-06	Woodbury County Transfer Station	Woodbury	MSW
99-SDP-03-89	Wright County Transfer Station	Wright	MSW

There are no Public Waste-to-Energy Processing Facilities in Iowa

APPENDIX H-3
MMSW DIVERSION ANALYSIS - NO BUILD ALTERNATIVE

Data

Diversion miles from-->>							Diversion Cost (transfer/load, transportation, tipping fee)			
to (below):	BSL	PB	ERL	SR		Tipping Fee	BSL	PB	ERL	SR
BSL	0	15	52	52	$	64.46		$76.39	$86.08	$86.08
PB	15	0	57	71	$	58.57	$70.50		$81.50	$85.17
ERL	52	57	0	71	$	60.41	$82.03	$83.34		$87.01
SR	52	71	71	0	$	50.00	$71.62	$76.60	$76.60	
CD	108	117	157	128	$	35.40	$71.70	$74.05	$84.53	$76.94
SMC	110	97	131	154	$	107.44	$144.26	$140.85	$149.76	$155.79
LAS	126	113	121	168	$	93.99	$135.00	$131.60	$133.69	$146.01
TT	135	132	123	177	$	60.99	$104.36	$103.57	$101.22	$115.36
FI	148	136	191	204	$	62.00	$108.78	$105.63	$120.04	$123.45
DL	165	198	205	139	$	39.25	$90.48	$99.13	$100.96	$83.67
NC	170	187	213	147	$	31.51	$84.05	$88.50	$95.32	$78.02
Avg tons per diverted load	19									
Avg Diversion Transport Speed (mph)	55									
Avg Diversion load/unload time (hrs)	1									
Transporation cost per ton-mile	$0.131	$0.131	$0.131	$0.131	$0.131	$0.131	$0.131	$0.131	$0.131	$0.131	$0.131
Transfer-load cost per ton	$8.00	$8.00	$8.00	$8.00	$8.00	$8.00	$8.00	$8.00	$8.00	$8.00	$8.00
Local taxes/fees per ton	$4.33	$7.70	$5.00	$0.00							
County taxes/fees per ton	$10.77	$10.77	$4.50	$3.50							
State taxes/fees per ton	$6.66	$6.66	$6.66	$6.66							

No-Build Scenario

Facility	Burnsville Sanitary Landfill (BSL)	Pine Bend Landfill (PB)	Elk River Landfill (ERL)	Spruce Ridge (SR)	Central Disposal (CD)	Seven Mile Creek (SMC)	Lake Area Sarona (LAS)	Timberline Trail (TT)	French Island RDF Plant (FI)	Dickinson Landfill (DL)	Nobles County Landfill (NC)
Market Area Waste Volume Generated 2019 (CY)	399,792	496,466	510,436	216,287	155,837	438,552	234,837	120,865	NA	36,911	74,108
Remaining Design Capacity Year-End 2019 (CY)	1,205,001	5,440,936	4,813,312	1,854,180	30,791,049	5,452,048	5,707,624	4,142,318	NA	4,743,573	3,247,927
MSW Volume Growth Factor	0.0168	0.0168	0.0168	0.0168	0.0168	0.0168	0.0168	0.0168	NA	0.0168	0.0168
Facility AUF (tons/CY)	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	NA	0.95	0.95

APPENDIX H-3
MMSW DIVERSION ANALYSIS - NO BUILD ALTERNATIVE

Facility	Burnsville Sanitary Landfill (BSL)	Pine Bend Landfill (PB)	Elk River Landfill (ERL)	Spruce Ridge (SR)	Central Disposal (CD)	Seven Mile Creek (SMC)	Lake Area Sarona (LAS)	Timberline Trail (TT)	French Island RDF Plant (FI)	Dickinson Landfill (DL)	Nobles County Landfill (NC)	Notes
End of Year	**2020**											
MSW Generated in Market Area (CY)	406,500	504,795	519,000	219,915	158,451	445,909	238,777	122,893	NA	37,530	75,351	MSW Generated in "Identified Facilities" Market Areas (includes BSL) (CY)
Year-End Remaining Airspace (CY)	886,008	4,936,141	4,277,913	1,609,369	30,586,386	5,006,139	5,468,847	4,019,425	NA	4,706,043	3,172,576	Remaining Airspace in "Identified Facilities" (includes BSL) (CY)
MSW Diverted To:												
BSL	318,993											CY Disposed
PB		504,795										CY Disposed
ERL	16,399		519,000									CY Disposed
SR	24,896			219,915								CY Disposed
CD	46,212				158,451							CY Disposed
SMC						445,909						CY Disposed
LAS							238,777					CY Disposed
TT								122,893				CY Disposed
FI												CY Disposed
DL										37,530		CY Disposed
NC											75,351	
CY Diverted	87,506	0	0	0								CY Diverted
Tons Diverted	83,131	0	0	0								Tons Diverted
Ton-Miles Diverted	13,562,573	0	0	0								Ton-Miles Diverted
Diversion Transport Hours	12,980	0	0	0								
Transfer-Load Cost	$665,047	$0	$0	$0								
Transportation Cost	$1,776,697	$0	$0	$0								Ton-Miles Cost
Tipping Fee Difference	-$1,680,859	$0	$0	$0								
Total Diversion Cost	$760,885	$0	$0	$0								
Local Taxes/Fees on BSL Market MMSW	$1,312,180	$0	$77,894	$0								local taxes/fees
County Taxes/Fees on BSL Market MMSW	$3,263,781	$0	$70,104	$82,778								county taxes/fees
State Taxes/Fees on BSL Market MMSW	$2,018,272	$0	$103,754	$157,514								state taxes/fees
End of Year	**2021**											
MSW Generated in Market Area (CY)	413,207	513,124	527,564	223,544	161,066	453,267	242,717	124,921	NA	38,149	76,595	MSW Generated in "Identified Facilities" Market Areas (includes BSL) (CY)
Year-End Remaining Airspace (CY)	561,751	4,423,017	3,733,681	1,360,519	30,378,346	4,552,872	5,226,130	3,894,505	NA	4,667,894	3,095,981	Remaining Airspace in "Identified Facilities" (includes BSL) (CY)
MSW Diverted To:												
BSL	324,257											CY Disposed
PB		513,124										CY Disposed
ERL	16,669		527,564									CY Disposed
SR	25,306			223,544								CY Disposed
CD	46,975				161,066							CY Disposed
SMC						453,267						CY Disposed
LAS							242,717					CY Disposed
TT								124,921				CY Disposed
FI												CY Disposed
DL										38,149		CY Disposed
NC											76,595	
CY Diverted	88,950	0	0	0								CY Diverted
Tons Diverted	84,503	0	0	0								Tons Diverted
Ton-Miles Diverted	13,786,364	0	0	0								Ton-Miles Diverted
Diversion Transport Hours	13,194	0	0	0								
Transfer-Load Cost	$676,021	$0	$0	$0								
Transportation Cost	$1,806,014	$0	$0	$0								Ton-Miles Cost
Tipping Fee Difference	-$1,708,594	$0	$0	$0								
Total Diversion Cost	$773,440	$0	$0	$0								
Local Taxes/Fees on BSL Market MMSW	$1,333,831	$0	$79,179	$0								local taxes/fees
County Taxes/Fees on BSL Market MMSW	$3,317,634	$0	$71,261	$84,143								county taxes/fees
State Taxes/Fees on BSL Market MMSW	$2,051,573	$0	$105,466	$160,113								state taxes/fees

APPENDIX H-3
MMSW DIVERSION ANALYSIS - NO BUILD ALTERNATIVE

Facility	Burnsville Sanitary Landfill (BSL)	Pine Bend Landfill (PB)	Elk River Landfill (ERL)	Spruce Ridge (SR)	Central Disposal (CD)	Seven Mile Creek (SMC)	Lake Area Sarona (LAS)	Timberline Trail (TT)	French Island RDF Plant (FI)	Dickinson Landfill (DL)	Nobles County Landfill (NC)	Notes
End of Year	**2022**											
MSW Generated in Market Area (CY)	419,914	521,453	536,127	227,172	163,680	460,624	246,657	126,948	NA	38,768	77,838	MSW Generated in "Identified Facilities" Market Areas (includes BSL) (CY)
Year-End Remaining Airspace (CY)	232,230	3,901,563	3,180,614	1,107,630	30,166,929	4,092,248	4,979,473	3,767,556	NA	4,629,125	3,018,143	Remaining Airspace in "Identified Facilities" (includes BSL) (CY)
MSW Diverted To:												
BSL	329,520											CY Disposed
PB		521,453										CY Disposed
ERL	16,940		536,127									CY Disposed
SR	25,717			227,172								CY Disposed
CD	47,737				163,680							CY Disposed
SMC						460,624						CY Disposed
LAS							246,657					CY Disposed
TT								126,948				CY Disposed
FI												CY Disposed
DL										38,768		CY Disposed
NC											77,838	
CY Diverted	90,394	0	0	0								CY Diverted
Tons Diverted	85,874	0	0	0								Tons Diverted
Ton-Miles Diverted	14,010,154	0	0	0								Ton-Miles Diverted
Diversion Transport Hours	13,408	0	0	0								
Transfer-Load Cost	$686,995	$0	$0	$0								
Transportation Cost	$1,835,330	$0	$0	$0								Ton-Miles Cost
Tipping Fee Difference	-$1,736,329	$0	$0	$0								
Total Diversion Cost	$785,995	$0	$0	$0								
Local Taxes/Fees on BSL Market MMSW	$1,355,482	$0	$80,464	$0								local taxes/fees
County Taxes/Fees on BSL Market MMSW	$3,371,487	$0	$72,418	$85,509								county taxes/fees
State Taxes/Fees on BSL Market MMSW	$2,084,875	$0	$107,178	$162,712								state taxes/fees
End of Year	**2023**											
MSW Generated in Market Area (CY)	426,622	529,783	544,691	230,801	166,295	467,982	250,597	128,976	NA	39,388	79,081	MSW Generated in "Identified Facilities" Market Areas (includes BSL) (CY)
Year-End Remaining Airspace (CY)	0	3,264,866	2,635,923	876,829	29,913,158	3,624,266	4,728,876	3,638,580	NA	4,589,738	2,939,061	Remaining Airspace in "Identified Facilities" (includes BSL) (CY)
MSW Diverted To:												
BSL	232,230											CY Disposed
PB	106,915	529,783										CY Disposed
ERL			544,691									CY Disposed
SR				230,801								CY Disposed
CD	87,476				166,295							CY Disposed
SMC						467,982						CY Disposed
LAS							250,597					CY Disposed
TT								128,976				CY Disposed
FI												CY Disposed
DL										39,388		CY Disposed
NC											79,081	
CY Diverted	194,391	0	0	0								CY Diverted
Tons Diverted	184,672	0	0	0								Tons Diverted
Ton-Miles Diverted	20,997,165	0	0	0								Ton-Miles Diverted
Diversion Transport Hours	20,094	0	0	0								
Transfer-Load Cost	$1,477,373	$0	$0	$0								
Transportation Cost	$2,750,629	$0	$0	$0								Ton-Miles Cost
Tipping Fee Difference	-$3,013,195	$0	$0	$0								
Total Diversion Cost	$1,214,807	$0	$0	$0								
Local Taxes/Fees on BSL Market MMSW	$955,280	$782,084	$0	$0								local taxes/fees
County Taxes/Fees on BSL Market MMSW	$2,376,065	$1,093,902	$0	$0								county taxes/fees
State Taxes/Fees on BSL Market MMSW	$1,469,322	$676,452	$0	$0								state taxes/fees

APPENDIX H-3
MMSW DIVERSION ANALYSIS - NO BUILD ALTERNATIVE

Facility	Burnsville Sanitary Landfill (BSL)	Pine Bend Landfill (PB)	Elk River Landfill (ERL)	Spruce Ridge (SR)	Central Disposal (CD)	Seven Mile Creek (SMC)	Lake Area Sarona (LAS)	Timberline Trail (TT)	French Island RDF Plant (FI)	Dickinson Landfill (DL)	Nobles County Landfill (NC)	Notes
End of Year	**2024**											
MSW Generated in Market Area (CY)	433,329	538,112	553,254	234,430	168,909	475,339	254,537	131,004	NA	40,007	80,325	MSW Generated in "Identified Facilities" Market Areas (includes BSL) (CY)
Year-End Remaining Airspace (CY)	0	2,488,423	2,082,669	642,399	29,549,251	3,148,926	4,474,340	3,507,577	NA	4,549,731	2,858,737	Remaining Airspace in "Identified Facilities" (includes BSL) (CY)
MSW Diverted To:												
BSL												CY Disposed
PB	238,331	538,112										CY Disposed
ERL			553,254									CY Disposed
SR				234,430								CY Disposed
CD	194,998				168,909							CY Disposed
SMC						475,339						CY Disposed
LAS							254,537					CY Disposed
TT								131,004				CY Disposed
FI												CY Disposed
DL										40,007		CY Disposed
NC											80,325	
CY Diverted	433,329	0	0	0								CY Diverted
Tons Diverted	411,662	0	0	0								Tons Diverted
Ton-Miles Diverted	46,806,024	0	0	0								Ton-Miles Diverted
Diversion Transport Hours	44,791	0	0	0								
Transfer-Load Cost	$3,293,300	$0	$0	$0								
Transportation Cost	$6,131,589	$0	$0	$0								Ton-Miles Cost
Tipping Fee Difference	-$6,716,891	$0	$0	$0								
Total Diversion Cost	$2,707,998	$0	$0	$0								
Local Taxes/Fees on BSL Market MMSW	$0	$1,743,391	$0	$0								local taxes/fees
County Taxes/Fees on BSL Market MMSW	$0	$2,438,483	$0	$0								county taxes/fees
State Taxes/Fees on BSL Market MMSW	$0	$1,507,920	$0	$0								state taxes/fees
End of Year	**2025**											
MSW Generated in Market Area (CY)	440,036	546,441	561,818	238,058	171,524	482,697	258,476	133,032	NA	40,626	81,568	MSW Generated in "Identified Facilities" Market Areas (includes BSL) (CY)
Year-End Remaining Airspace (CY)	0	1,699,962	1,520,851	404,341	29,179,711	2,666,229	4,215,863	3,374,545	NA	4,509,105	2,777,169	Remaining Airspace in "Identified Facilities" (includes BSL) (CY)
MSW Diverted To:												
BSL												CY Disposed
PB	242,020	546,441										CY Disposed
ERL			561,818									CY Disposed
SR				238,058								CY Disposed
CD	198,016				171,524							CY Disposed
SMC						482,697						CY Disposed
LAS							258,476					CY Disposed
TT								133,032				CY Disposed
FI												CY Disposed
DL										40,626		CY Disposed
NC											81,568	
CY Diverted	440,036	0	0	0								CY Diverted
Tons Diverted	418,034	0	0	0								Tons Diverted
Ton-Miles Diverted	47,530,514	0	0	0								Ton-Miles Diverted
Diversion Transport Hours	45,485	0	0	0								
Transfer-Load Cost	$3,344,275	$0	$0	$0								
Transportation Cost	$6,226,497	$0	$0	$0								Ton-Miles Cost
Tipping Fee Difference	-$6,820,859	$0	$0	$0								
Total Diversion Cost	$2,749,914	$0	$0	$0								
Local Taxes/Fees on BSL Market MMSW	$0	$1,770,376	$0	$0								local taxes/fees
County Taxes/Fees on BSL Market MMSW	$0	$2,476,227	$0	$0								county taxes/fees
State Taxes/Fees on BSL Market MMSW	$0	$1,531,260	$0	$0								state taxes/fees

APPENDIX H-3
MMSW DIVERSION ANALYSIS - NO BUILD ALTERNATIVE

Facility	Burnsville Sanitary Landfill (BSL)	Pine Bend Landfill (PB)	Elk River Landfill (ERL)	Spruce Ridge (SR)	Central Disposal (CD)	Seven Mile Creek (SMC)	Lake Area Sarona (LAS)	Timberline Trail (TT)	French Island RDF Plant (FI)	Dickinson Landfill (DL)	Nobles County Landfill (NC)	Notes
End of Year	**2026**											
MSW Generated in Market Area (CY)	446,744	554,770	570,381	241,687	174,138	490,055	262,416	135,059	NA	41,245	82,811	MSW Generated in "Identified Facilities" Market Areas (includes BSL) (CY)
Year-End Remaining Airspace (CY)	0	899,483	950,469	162,654	28,804,538	2,176,175	3,953,447	3,239,486	NA	4,467,860	2,694,358	Remaining Airspace in "Identified Facilities" (includes BSL) (CY)
MSW Diverted To:												
BSL												CY Disposed
PB	245,709	554,770										CY Disposed
ERL			570,381									CY Disposed
SR				241,687								CY Disposed
CD	201,035				174,138							CY Disposed
SMC						490,055						CY Disposed
LAS							262,416					CY Disposed
TT								135,059				CY Disposed
FI												CY Disposed
DL										41,245		CY Disposed
NC											82,811	
CY Diverted	446,744	0	0	0								CY Diverted
Tons Diverted	424,406	0	0	0								Tons Diverted
Ton-Miles Diverted	48,255,005	0	0	0								Ton-Miles Diverted
Diversion Transport Hours	46,178	0	0	0								
Transfer-Load Cost	$3,395,251	$0	$0	$0								
Transportation Cost	$6,321,406	$0	$0	$0								Ton-Miles Cost
Tipping Fee Difference	-$6,924,827	$0	$0	$0								
Total Diversion Cost	$2,791,830	$0	$0	$0								
Local Taxes/Fees on BSL Market MMSW	$0	$1,797,361	$0	$0								local taxes/fees
County Taxes/Fees on BSL Market MMSW	$0	$2,513,971	$0	$0								county taxes/fees
State Taxes/Fees on BSL Market MMSW	$0	$1,554,601	$0	$0								state taxes/fees
End of Year	**2027**											
MSW Generated in Market Area (CY)	453,451	563,099	578,945	245,316	176,753	497,412	266,356	137,087	NA	41,865	84,055	MSW Generated in "Identified Facilities" Market Areas (includes BSL) (CY)
Year-End Remaining Airspace (CY)	0	86,985	371,524	-82,662	28,423,732	1,678,762	3,687,091	3,102,399	NA	4,425,995	2,610,303	Remaining Airspace in "Identified Facilities" (includes BSL) (CY)
MSW Diverted To:												
BSL												CY Disposed
PB	249,398	563,099										CY Disposed
ERL			578,945									CY Disposed
SR				245,316								CY Disposed
CD	204,053				176,753							CY Disposed
SMC						497,412						CY Disposed
LAS							266,356					CY Disposed
TT								137,087				CY Disposed
FI												CY Disposed
DL										41,865		CY Disposed
NC											84,055	
CY Diverted	453,451	0	0	0								CY Diverted
Tons Diverted	430,778	0	0	0								Tons Diverted
Ton-Miles Diverted	48,979,496	0	0	0								Ton-Miles Diverted
Diversion Transport Hours	46,871	0	0	0								
Transfer-Load Cost	$3,446,227	$0	$0	$0								
Transportation Cost	$6,416,314	$0	$0	$0								Ton-Miles Cost
Tipping Fee Difference	-$7,028,795	$0	$0	$0								
Total Diversion Cost	$2,833,746	$0	$0	$0								
Local Taxes/Fees on BSL Market MMSW	$0	$1,824,346	$0	$0								local taxes/fees
County Taxes/Fees on BSL Market MMSW	$0	$2,551,715	$0	$0								county taxes/fees
State Taxes/Fees on BSL Market MMSW	$0	$1,577,941	$0	$0								state taxes/fees

APPENDIX H-3
MMSW DIVERSION ANALYSIS - NO BUILD ALTERNATIVE

Facility	Burnsville Sanitary Landfill (BSL)	Pine Bend Landfill (PB)	Elk River Landfill (ERL)	Spruce Ridge (SR)	Central Disposal (CD)	Seven Mile Creek (SMC)	Lake Area Sarona (LAS)	Timberline Trail (TT)	French Island RDF Plant (FI)	Dickinson Landfill (DL)	Nobles County Landfill (NC)	Notes
End of Year	**2028**											
MSW Generated in Market Area (CY)	460,158	571,429	587,509	248,944	179,367	504,770	270,296	139,115	NA	42,484	85,298	MSW Generated in "Identified Facilities" Market Areas (includes BSL) (CY)
Year-End Remaining Airspace (CY)	0	-737,531	-215,984	-331,606	28,037,294	1,173,993	3,416,795	2,963,284	NA	4,383,511	2,525,005	Remaining Airspace in "Identified Facilities" (includes BSL) (CY)
MSW Diverted To:												
BSL												CY Disposed
PB	253,087	571,429										CY Disposed
ERL			587,509									CY Disposed
SR				248,944								CY Disposed
CD	207,071				179,367							CY Disposed
SMC						504,770						CY Disposed
LAS							270,296					CY Disposed
TT								139,115				CY Disposed
FI												CY Disposed
DL										42,484		CY Disposed
NC											85,298	
CY Diverted	460,158	0	0	0								CY Diverted
Tons Diverted	437,150	0	0	0								Tons Diverted
Ton-Miles Diverted	49,703,987	0	0	0								Ton-Miles Diverted
Diversion Transport Hours	47,565	0	0	0								
Transfer-Load Cost	$3,497,202	$0	$0	$0								
Transportation Cost	$6,511,222	$0	$0	$0								Ton-Miles Cost
Tipping Fee Difference	-$7,132,763	$0	$0	$0								
Total Diversion Cost	$2,875,662	$0	$0	$0								
Local Taxes/Fees on BSL Market MMSW	$0	$1,851,331	$0	$0								local taxes/fees
County Taxes/Fees on BSL Market MMSW	$0	$2,589,460	$0	$0								county taxes/fees
State Taxes/Fees on BSL Market MMSW	$0	$1,601,281	$0	$0								state taxes/fees
End of Year	**2029**											
MSW Generated in Market Area (CY)	466,866	579,758	596,072	252,573	181,982	512,127	274,236	141,143	NA	43,103	86,541	MSW Generated in "Identified Facilities" Market Areas (includes BSL) (CY)
Year-End Remaining Airspace (CY)	0	-1,574,064	-812,057	-584,179	27,645,223	661,865	3,142,559	2,822,142	NA	4,340,408	2,438,464	Remaining Airspace in "Identified Facilities" (includes BSL) (CY)
MSW Diverted To:												
BSL												CY Disposed
PB	256,776	579,758										CY Disposed
ERL			596,072									CY Disposed
SR				252,573								CY Disposed
CD	210,089				181,982							CY Disposed
SMC						512,127						CY Disposed
LAS							274,236					CY Disposed
TT								141,143				CY Disposed
FI												CY Disposed
DL										43,103		CY Disposed
NC											86,541	
CY Diverted	466,866	0	0	0								CY Diverted
Tons Diverted	443,522	0	0	0								Tons Diverted
Ton-Miles Diverted	50,428,477	0	0	0								Ton-Miles Diverted
Diversion Transport Hours	48,258	0	0	0								
Transfer-Load Cost	$3,548,178	$0	$0	$0								
Transportation Cost	$6,606,131	$0	$0	$0								Ton-Miles Cost
Tipping Fee Difference	-$7,236,730	$0	$0	$0								
Total Diversion Cost	$2,917,578	$0	$0	$0								
Local Taxes/Fees on BSL Market MMSW	$0	$1,878,317	$0	$0								local taxes/fees
County Taxes/Fees on BSL Market MMSW	$0	$2,627,204	$0	$0								county taxes/fees
State Taxes/Fees on BSL Market MMSW	$0	$1,624,622	$0	$0								state taxes/fees

APPENDIX H-3
MMSW DIVERSION ANALYSIS - NO BUILD ALTERNATIVE

Facility	Burnsville Sanitary Landfill (BSL)	Pine Bend Landfill (PB)	Elk River Landfill (ERL)	Spruce Ridge (SR)	Central Disposal (CD)	Seven Mile Creek (SMC)	Lake Area Sarona (LAS)	Timberline Trail (TT)	French Island RDF Plant (FI)	Dickinson Landfill (DL)	Nobles County Landfill (NC)	Notes
End of Year	**2030**											
MSW Generated in Market Area (CY)	473,573	588,087	604,636	256,202	184,596	519,485	278,176	143,170	NA	43,722	87,785	MSW Generated in "Identified Facilities" Market Areas (includes BSL) (CY)
Year-End Remaining Airspace (CY)	0	-2,422,617	-1,416,693	-840,381	27,247,519	142,380	2,864,383	2,678,971	NA	4,296,686	2,350,679	Remaining Airspace in "Identified Facilities" (includes BSL) (CY)
MSW Diverted To:												
BSL												CY Disposed
PB	260,465	588,087										CY Disposed
ERL			604,636									CY Disposed
SR				256,202								CY Disposed
CD	213,108				184,596							CY Disposed
SMC						519,485						CY Disposed
LAS							278,176					CY Disposed
TT								143,170				CY Disposed
FI												CY Disposed
DL										43,722		CY Disposed
NC											87,785	
CY Diverted	473,573	0	0	0								CY Diverted
Tons Diverted	449,894	0	0	0								Tons Diverted
Ton-Miles Diverted	51,152,968	0	0	0								Ton-Miles Diverted
Diversion Transport Hours	48,951	0	0	0								
Transfer-Load Cost	$3,599,153	$0	$0	$0								
Transportation Cost	$6,701,039	$0	$0	$0								Ton-Miles Cost
Tipping Fee Difference	-$7,340,698	$0	$0	$0								
Total Diversion Cost	$2,959,494	$0	$0	$0								
Local Taxes/Fees on BSL Market MMSW	$0	$1,905,302	$0	$0								local taxes/fees
County Taxes/Fees on BSL Market MMSW	$0	$2,664,948	$0	$0								county taxes/fees
State Taxes/Fees on BSL Market MMSW	$0	$1,647,962	$0	$0								state taxes/fees

Diversion Totals	BSL	PB	ERL	SR	CD	Total
Tons BSL Market MMSW Disposed	1,144,751	1,760,066	47,507	72,123	1,573,931	4,598,379
Tons Diverted	3,453,628	0	0	0	0	3,453,628
Ton-Miles Diverted	405,212,728	NA	NA	NA	NA	405,212,728
Diversion Transport Hours	387,774	NA	NA	NA	NA	387,774
Transfer-Load Cost	$27,629,022	NA	NA	NA	NA	$27,629,022
Transportation Cost	$53,082,867	NA	NA	NA	NA	$53,082,867
Tipping Fee Difference	-$57,340,540	NA	NA	NA	NA	-$57,340,540
Total Diversion Cost	$23,371,350	NA	NA	NA	NA	$23,371,350
Local Taxes/Fees on BSL Market MMSW	$4,956,772	$13,552,508	$237,537	$0	NA	$18,746,816
County Taxes/Fees on BSL Market MMSW	$12,328,968	$18,955,910	$213,783	$252,430	NA	$31,751,092
State Taxes/Fees on BSL Market MMSW	$7,624,041	$11,722,039	$316,399	$480,339	NA	$20,142,819

APPENDIX H-4
MMSW DIVERSION ANALYSIS - PROPOSED PROJECT

Data

Diversion miles from-->>						Tipping Fee		Diversion Cost (transfer/load, transportation, tipping fee)			
to (below):	BSL	PB	ERL	SR				BSL	PB	ERL	SR
BSL	0	15	52	52	$	64.46			$76.39	$86.08	$86.08
PB	15	0	57	71	$	58.57		$70.50		$81.50	$85.17
ERL	52	57	0	71	$	60.41		$82.03	$83.34		$87.01
SR	52	71	71	0	$	50.00		$71.62	$76.60	$76.60	
CD	108	117	157	128	$	35.40		$71.70	$74.05	$84.53	$76.94
SMC	110	97	131	154	$	107.44		$144.26	$140.85	$149.76	$155.79
LAS	126	113	121	168	$	93.99		$135.00	$131.60	$133.69	$146.01
TT	135	132	123	177	$	60.99		$104.36	$103.57	$101.22	$115.36
FI	148	136	191	204	$	62.00		$108.78	$105.63	$120.04	$123.45
DL	165	198	205	139	$	39.25		$90.48	$99.13	$100.96	$83.67
NC	170	187	213	147	$	31.51		$84.05	$88.50	$95.32	$78.02
Avg tons per diverted load	19										
Avg Diversion Transport Speed (mph)	55										
Avg Diversion load/unload time (hrs)	1										
Transporation cost per ton-mile	$0.131	$0.131	$0.131	$0.131	$0.131	$0.131	$0.131	$0.131	$0.131	$0.131	$0.131
Transfer-load cost per ton	$8.00	$8.00	$8.00	$8.00	$8.00	$8.00	$8.00	$8.00	$8.00	$8.00	$8.00
Local taxes/fees per ton	$4.33	$7.70	$5.00	$0.00							
County taxes/fees per ton	$10.77	$10.77	$4.50	$3.50							
State taxes/fees per ton	$6.66	$6.66	$6.66	$6.66							

No-Build Scenario

Facility	Burnsville Sanitary Landfill (BSL)	Pine Bend Landfill (PB)	Elk River Landfill (ERL)	Spruce Ridge (SR)	Central Disposal (CD)	Seven Mile Creek (SMC)	Lake Area Sarona (LAS)	Timberline Trail (TT)	French Island RDF Plant (FI)	Dickinson Landfill (DL)	Nobles County Landfill (NC)
Market Area Waste Volume Generated 2019 (CY)	399,792	496,466	510,436	216,287	155,837	438,552	234,837	120,865	NA	36,911	74,108
Remaining Design Capacity Year-End 2019 (CY)	1,205,001	5,440,936	4,813,312	1,854,180	30,791,049	5,452,048	5,707,624	4,142,318	NA	4,743,573	3,247,927
MSW Volume Growth Factor	0.0168	0.0168	0.0168	0.0168	0.0168	0.0168	0.0168	0.0168	NA	0.0168	0.0168
Facility AUF (tons/CY)	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	NA	0.95	0.95

APPENDIX H-4
MMSW DIVERSION ANALYSIS - PROPOSED PROJECT

Facility	Burnsville Sanitary Landfill (BSL)	Pine Bend Landfill (PB)	Elk River Landfill (ERL)	Spruce Ridge (SR)	Central Disposal (CD)	Seven Mile Creek (SMC)	Lake Area Sarona (LAS)	Timberline Trail (TT)	French Island RDF Plant (FI)	Dickinson Landfill (DL)	Nobles County Landfill (NC)	Notes
End of Year	**2020**											
MSW Generated in Market Area (CY)	406,500	504,795	519,000	219,915	158,451	445,909	238,777	122,893	NA	37,530	75,351	MSW Generated in "Identified Facilities" Market Areas (includes BSL) (CY)
Year-End Remaining Airspace (CY)	886,008	4,936,141	4,277,913	1,609,369	30,586,386	5,006,139	5,468,847	4,019,425	NA	4,706,043	3,172,576	Remaining Airspace in "Identified Facilities" (includes BSL) (CY)
MSW Diverted To:												
BSL	318,993											CY Disposed
PB		504,795										CY Disposed
ERL	16,399		519,000									CY Disposed
SR	24,896			219,915								CY Disposed
CD	46,212				158,451							CY Disposed
SMC						445,909						CY Disposed
LAS							238,777					CY Disposed
TT								122,893				CY Disposed
FI												CY Disposed
DL										37,530		CY Disposed
NC											75,351	
CY Diverted	87,506	0	0	0								CY Diverted
Tons Diverted	83,131	0	0	0								Tons Diverted
Ton-Miles Diverted	13,562,573	0	0	0								Ton-Miles Diverted
Diversion Transport Hours	12,980	0	0	0								
Transfer-Load Cost	$665,047	$0	$0	$0								
Transportation Cost	$1,776,697	$0	$0	$0								Ton-Miles Cost
Tipping Fee Difference	-$1,680,859	$0	$0	$0								
Total Diversion Cost	$760,885	$0	$0	$0								
Local Taxes/Fees on BSL Market MMSW	$1,312,180	$0	$77,894	$0								local taxes/fees
County Taxes/Fees on BSL Market MMSW	$3,263,781	$0	$70,104	$82,778								county taxes/fees
State Taxes/Fees on BSL Market MMSW	$2,018,272	$0	$103,754	$157,514								state taxes/fees
End of Year	**2021**											
MSW Generated in Market Area (CY)	413,207	513,124	527,564	223,544	161,066	453,267	242,717	124,921	NA	38,149	76,595	MSW Generated in "Identified Facilities" Market Areas (includes BSL) (CY)
Year-End Remaining Airspace (CY)	561,751	4,423,017	3,733,681	1,360,519	30,378,346	4,552,872	5,226,130	3,894,505	NA	4,667,894	3,095,981	Remaining Airspace in "Identified Facilities" (includes BSL) (CY)
MSW Diverted To:												
BSL	324,257											CY Disposed
PB		513,124										CY Disposed
ERL	16,669		527,564									CY Disposed
SR	25,306			223,544								CY Disposed
CD	46,975				161,066							CY Disposed
SMC						453,267						CY Disposed
LAS							242,717					CY Disposed
TT								124,921				CY Disposed
FI												CY Disposed
DL										38,149		CY Disposed
NC											76,595	
CY Diverted	88,950	0	0	0								CY Diverted
Tons Diverted	84,503	0	0	0								Tons Diverted
Ton-Miles Diverted	13,786,364	0	0	0								Ton-Miles Diverted
Diversion Transport Hours	13,194	0	0	0								
Transfer-Load Cost	$676,021	$0	$0	$0								
Transportation Cost	$1,806,014	$0	$0	$0								Ton-Miles Cost
Tipping Fee Difference	-$1,708,594	$0	$0	$0								
Total Diversion Cost	$773,440	$0	$0	$0								
Local Taxes/Fees on BSL Market MMSW	$1,333,831	$0	$79,179	$0								local taxes/fees
County Taxes/Fees on BSL Market MMSW	$3,317,634	$0	$71,261	$84,143								county taxes/fees
State Taxes/Fees on BSL Market MMSW	$2,051,573	$0	$105,466	$160,113								state taxes/fees

APPENDIX H-4
MMSW DIVERSION ANALYSIS - PROPOSED PROJECT

Facility	Burnsville Sanitary Landfill (BSL)	Pine Bend Landfill (PB)	Elk River Landfill (ERL)	Spruce Ridge (SR)	Central Disposal (CD)	Seven Mile Creek (SMC)	Lake Area Sarona (LAS)	Timberline Trail (TT)	French Island RDF Plant (FI)	Dickinson Landfill (DL)	Nobles County Landfill (NC)	Notes
End of Year	**2022**											
MSW Generated in Market Area (CY)	419,914	521,453	536,127	227,172	163,680	460,624	246,657	126,948	NA	38,768	77,838	MSW Generated in "Identified Facilities" Market Areas (includes BSL) (CY)
Year-End Remaining Airspace (CY)	232,230	3,901,563	3,180,614	1,107,630	30,166,929	4,092,248	4,979,473	3,767,556	NA	4,629,125	3,018,143	Remaining Airspace in "Identified Facilities" (includes BSL) (CY)
MSW Diverted To:												
BSL	329,520											CY Disposed
PB		521,453										CY Disposed
ERL	16,940		536,127									CY Disposed
SR	25,717			227,172								CY Disposed
CD	47,737				163,680							CY Disposed
SMC						460,624						CY Disposed
LAS							246,657					CY Disposed
TT								126,948				CY Disposed
FI												CY Disposed
DL										38,768		CY Disposed
NC											77,838	
CY Diverted	90,394	0	0	0								CY Diverted
Tons Diverted	85,874	0	0	0								Tons Diverted
Ton-Miles Diverted	14,010,154	0	0	0								Ton-Miles Diverted
Diversion Transport Hours	13,408	0	0	0								
Transfer-Load Cost	$686,995	$0	$0	$0								
Transportation Cost	$1,835,330	$0	$0	$0								Ton-Miles Cost
Tipping Fee Difference	-$1,736,329	$0	$0	$0								
Total Diversion Cost	$785,995	$0	$0	$0								
Local Taxes/Fees on BSL Market MMSW	$1,355,482	$0	$80,464	$0								local taxes/fees
County Taxes/Fees on BSL Market MMSW	$3,371,487	$0	$72,418	$85,509								county taxes/fees
State Taxes/Fees on BSL Market MMSW	$2,084,875	$0	$107,178	$162,712								state taxes/fees
End of Year	**2023**											
MSW Generated in Market Area (CY)	426,622	529,783	544,691	230,801	166,295	467,982	250,597	128,976	NA	39,388	79,081	MSW Generated in "Identified Facilities" Market Areas (includes BSL) (CY)
Year-End Remaining Airspace (CY)	22,507,258	3,371,781	2,635,923	876,829	30,000,634	3,624,266	4,728,876	3,638,580	NA	4,589,738	2,939,061	Remaining Airspace in "Identified Facilities" (includes BSL) (CY)
MSW Diverted To:												
BSL	426,622											CY Disposed
PB		529,783										CY Disposed
ERL			544,691									CY Disposed
SR				230,801								CY Disposed
CD					166,295							CY Disposed
SMC						467,982						CY Disposed
LAS							250,597					CY Disposed
TT								128,976				CY Disposed
FI												CY Disposed
DL										39,388		CY Disposed
NC											79,081	
CY Diverted	0	0	0	0								CY Diverted
Tons Diverted	0	0	0	0								Tons Diverted
Ton-Miles Diverted	0	0	0	0								Ton-Miles Diverted
Diversion Transport Hours	0	0	0	0								
Transfer-Load Cost	$0	$0	$0	$0								
Transportation Cost	$0	$0	$0	$0								Ton-Miles Cost
Tipping Fee Difference	$0	$0	$0	$0								
Total Diversion Cost	$0	$0	$0	$0								
Local Taxes/Fees on BSL Market MMSW	$1,754,908	$0	$0	$0								local taxes/fees
County Taxes/Fees on BSL Market MMSW	$4,364,979	$0	$0	$0								county taxes/fees
State Taxes/Fees on BSL Market MMSW	$2,699,235	$0	$0	$0								state taxes/fees

APPENDIX H-4
MMSW DIVERSION ANALYSIS - PROPOSED PROJECT

Facility	Burnsville Sanitary Landfill (BSL)	Pine Bend Landfill (PB)	Elk River Landfill (ERL)	Spruce Ridge (SR)	Central Disposal (CD)	Seven Mile Creek (SMC)	Lake Area Sarona (LAS)	Timberline Trail (TT)	French Island RDF Plant (FI)	Dickinson Landfill (DL)	Nobles County Landfill (NC)	Notes
End of Year	**2024**											
MSW Generated in Market Area (CY)	433,329	538,112	553,254	234,430	168,909	475,339	254,537	131,004	NA	40,007	80,325	MSW Generated in "Identified Facilities" Market Areas (includes BSL) (CY)
Year-End Remaining Airspace (CY)	22,073,929	2,833,669	2,082,669	642,399	29,831,725	3,148,926	4,474,340	3,507,577	NA	4,549,731	2,858,737	Remaining Airspace in "Identified Facilities" (includes BSL) (CY)
MSW Diverted To:												
BSL	433,329											CY Disposed
PB		538,112										CY Disposed
ERL			553,254									CY Disposed
SR				234,430								CY Disposed
CD					168,909							CY Disposed
SMC						475,339						CY Disposed
LAS							254,537					CY Disposed
TT								131,004				CY Disposed
FI												CY Disposed
DL										40,007		CY Disposed
NC											80,325	
CY Diverted	0	0	0	0								CY Diverted
Tons Diverted	0	0	0	0								Tons Diverted
Ton-Miles Diverted	0	0	0	0								Ton-Miles Diverted
Diversion Transport Hours	0	0	0	0								
Transfer-Load Cost	$0	$0	$0	$0								
Transportation Cost	$0	$0	$0	$0								Ton-Miles Cost
Tipping Fee Difference	$0	$0	$0	$0								
Total Diversion Cost	$0	$0	$0	$0								
Local Taxes/Fees on BSL Market MMSW	$1,782,499	$0	$0	$0								local taxes/fees
County Taxes/Fees on BSL Market MMSW	$4,433,605	$0	$0	$0								county taxes/fees
State Taxes/Fees on BSL Market MMSW	$2,741,672	$0	$0	$0								state taxes/fees
End of Year	**2025**											
MSW Generated in Market Area (CY)	440,036	546,441	561,818	238,058	171,524	482,697	258,476	133,032	NA	40,626	81,568	MSW Generated in "Identified Facilities" Market Areas (includes BSL) (CY)
Year-End Remaining Airspace (CY)	21,633,893	2,287,228	1,520,851	404,341	29,660,201	2,666,229	4,215,863	3,374,545	NA	4,509,105	2,777,169	Remaining Airspace in "Identified Facilities" (includes BSL) (CY)
MSW Diverted To:												
BSL	440,036											CY Disposed
PB		546,441										CY Disposed
ERL			561,818									CY Disposed
SR				238,058								CY Disposed
CD					171,524							CY Disposed
SMC						482,697						CY Disposed
LAS							258,476					CY Disposed
TT								133,032				CY Disposed
FI												CY Disposed
DL										40,626		CY Disposed
NC											81,568	
CY Diverted	0	0	0	0								CY Diverted
Tons Diverted	0	0	0	0								Tons Diverted
Ton-Miles Diverted	0	0	0	0								Ton-Miles Diverted
Diversion Transport Hours	0	0	0	0								
Transfer-Load Cost	$0	$0	$0	$0								
Transportation Cost	$0	$0	$0	$0								Ton-Miles Cost
Tipping Fee Difference	$0	$0	$0	$0								
Total Diversion Cost	$0	$0	$0	$0								
Local Taxes/Fees on BSL Market MMSW	$1,810,089	$0	$0	$0								local taxes/fees
County Taxes/Fees on BSL Market MMSW	$4,502,231	$0	$0	$0								county taxes/fees
State Taxes/Fees on BSL Market MMSW	$2,784,109	$0	$0	$0								state taxes/fees

APPENDIX H-4
MMSW DIVERSION ANALYSIS - PROPOSED PROJECT

Facility	Burnsville Sanitary Landfill (BSL)	Pine Bend Landfill (PB)	Elk River Landfill (ERL)	Spruce Ridge (SR)	Central Disposal (CD)	Seven Mile Creek (SMC)	Lake Area Sarona (LAS)	Timberline Trail (TT)	French Island RDF Plant (FI)	Dickinson Landfill (DL)	Nobles County Landfill (NC)	Notes
End of Year	**2026**											
MSW Generated in Market Area (CY)	446,744	554,770	570,381	241,687	174,138	490,055	262,416	135,059	NA	41,245	82,811	MSW Generated in "Identified Facilities" Market Areas (includes BSL) (CY)
Year-End Remaining Airspace (CY)	21,187,149	1,732,458	950,469	162,654	29,486,063	2,176,175	3,953,447	3,239,486	NA	4,467,860	2,694,358	Remaining Airspace in "Identified Facilities" (includes BSL) (CY)
MSW Diverted To:												
BSL	446,744											CY Disposed
PB		554,770										CY Disposed
ERL			570,381									CY Disposed
SR				241,687								CY Disposed
CD					174,138							CY Disposed
SMC						490,055						CY Disposed
LAS							262,416					CY Disposed
TT								135,059				CY Disposed
FI												CY Disposed
DL										41,245		CY Disposed
NC											82,811	
CY Diverted	0	0	0	0								CY Diverted
Tons Diverted	0	0	0	0								Tons Diverted
Ton-Miles Diverted	0	0	0	0								Ton-Miles Diverted
Diversion Transport Hours	0	0	0	0								
Transfer-Load Cost	$0	$0	$0	$0								
Transportation Cost	$0	$0	$0	$0								Ton-Miles Cost
Tipping Fee Difference	$0	$0	$0	$0								
Total Diversion Cost	$0	$0	$0	$0								
Local Taxes/Fees on BSL Market MMSW	$1,837,680	$0	$0	$0								local taxes/fees
County Taxes/Fees on BSL Market MMSW	$4,570,857	$0	$0	$0								county taxes/fees
State Taxes/Fees on BSL Market MMSW	$2,826,546	$0	$0	$0								state taxes/fees
End of Year	**2027**											
MSW Generated in Market Area (CY)	453,451	563,099	578,945	245,316	176,753	497,412	266,356	137,087	NA	41,865	84,055	MSW Generated in "Identified Facilities" Market Areas (includes BSL) (CY)
Year-End Remaining Airspace (CY)	20,733,698	1,169,358	371,524	-82,662	29,309,310	1,678,762	3,687,091	3,102,399	NA	4,425,995	2,610,303	Remaining Airspace in "Identified Facilities" (includes BSL) (CY)
MSW Diverted To:												
BSL	453,451											CY Disposed
PB		563,099										CY Disposed
ERL			578,945									CY Disposed
SR				245,316								CY Disposed
CD					176,753							CY Disposed
SMC						497,412						CY Disposed
LAS							266,356					CY Disposed
TT								137,087				CY Disposed
FI												CY Disposed
DL										41,865		CY Disposed
NC											84,055	
CY Diverted	0	0	0	0								CY Diverted
Tons Diverted	0	0	0	0								Tons Diverted
Ton-Miles Diverted	0	0	0	0								Ton-Miles Diverted
Diversion Transport Hours	0	0	0	0								
Transfer-Load Cost	$0	$0	$0	$0								
Transportation Cost	$0	$0	$0	$0								Ton-Miles Cost
Tipping Fee Difference	$0	$0	$0	$0								
Total Diversion Cost	$0	$0	$0	$0								
Local Taxes/Fees on BSL Market MMSW	$1,865,270	$0	$0	$0								local taxes/fees
County Taxes/Fees on BSL Market MMSW	$4,639,483	$0	$0	$0								county taxes/fees
State Taxes/Fees on BSL Market MMSW	$2,868,984	$0	$0	$0								state taxes/fees

APPENDIX H-4
MMSW DIVERSION ANALYSIS - PROPOSED PROJECT

Facility	Burnsville Sanitary Landfill (BSL)	Pine Bend Landfill (PB)	Elk River Landfill (ERL)	Spruce Ridge (SR)	Central Disposal (CD)	Seven Mile Creek (SMC)	Lake Area Sarona (LAS)	Timberline Trail (TT)	French Island RDF Plant (FI)	Dickinson Landfill (DL)	Nobles County Landfill (NC)	Notes
End of Year	**2028**											
MSW Generated in Market Area (CY)	460,158	571,429	587,509	248,944	179,367	504,770	270,296	139,115	NA	42,484	85,298	MSW Generated in "Identified Facilities" Market Areas (includes BSL) (CY)
Year-End Remaining Airspace (CY)	20,273,540	597,929	-215,984	-331,606	29,129,943	1,173,993	3,416,795	2,963,284	NA	4,383,511	2,525,005	Remaining Airspace in "Identified Facilities" (includes BSL) (CY)
MSW Diverted To:												
BSL	460,158											CY Disposed
PB		571,429										CY Disposed
ERL			587,509									CY Disposed
SR				248,944								CY Disposed
CD					179,367							CY Disposed
SMC						504,770						CY Disposed
LAS							270,296					CY Disposed
TT								139,115				CY Disposed
FI												CY Disposed
DL										42,484		CY Disposed
NC											85,298	
CY Diverted	0	0	0	0								CY Diverted
Tons Diverted	0	0	0	0								Tons Diverted
Ton-Miles Diverted	0	0	0	0								Ton-Miles Diverted
Diversion Transport Hours	0	0	0	0								
Transfer-Load Cost	$0	$0	$0	$0								
Transportation Cost	$0	$0	$0	$0								Ton-Miles Cost
Tipping Fee Difference	$0	$0	$0	$0								
Total Diversion Cost	$0	$0	$0	$0								
Local Taxes/Fees on BSL Market MMSW	$1,892,861	$0	$0	$0								local taxes/fees
County Taxes/Fees on BSL Market MMSW	$4,708,109	$0	$0	$0								county taxes/fees
State Taxes/Fees on BSL Market MMSW	$2,911,421	$0	$0	$0								state taxes/fees
End of Year	**2029**											
MSW Generated in Market Area (CY)	466,866	579,758	596,072	252,573	181,982	512,127	274,236	141,143	NA	43,103	86,541	MSW Generated in "Identified Facilities" Market Areas (includes BSL) (CY)
Year-End Remaining Airspace (CY)	19,806,675	18,172	-812,057	-584,179	28,947,962	661,865	3,142,559	2,822,142	NA	4,340,408	2,438,464	Remaining Airspace in "Identified Facilities" (includes BSL) (CY)
MSW Diverted To:												
BSL	466,866											CY Disposed
PB		579,758										CY Disposed
ERL			596,072									CY Disposed
SR				252,573								CY Disposed
CD					181,982							CY Disposed
SMC						512,127						CY Disposed
LAS							274,236					CY Disposed
TT								141,143				CY Disposed
FI												CY Disposed
DL										43,103		CY Disposed
NC											86,541	
CY Diverted	0	0	0	0								CY Diverted
Tons Diverted	0	0	0	0								Tons Diverted
Ton-Miles Diverted	0	0	0	0								Ton-Miles Diverted
Diversion Transport Hours	0	0	0	0								
Transfer-Load Cost	$0	$0	$0	$0								
Transportation Cost	$0	$0	$0	$0								Ton-Miles Cost
Tipping Fee Difference	$0	$0	$0	$0								
Total Diversion Cost	$0	$0	$0	$0								
Local Taxes/Fees on BSL Market MMSW	$1,920,451	$0	$0	$0								local taxes/fees
County Taxes/Fees on BSL Market MMSW	$4,776,734	$0	$0	$0								county taxes/fees
State Taxes/Fees on BSL Market MMSW	$2,953,858	$0	$0	$0								state taxes/fees

APPENDIX H-4
MMSW DIVERSION ANALYSIS - PROPOSED PROJECT

Facility	Burnsville Sanitary Landfill (BSL)	Pine Bend Landfill (PB)	Elk River Landfill (ERL)	Spruce Ridge (SR)	Central Disposal (CD)	Seven Mile Creek (SMC)	Lake Area Sarona (LAS)	Timberline Trail (TT)	French Island RDF Plant (FI)	Dickinson Landfill (DL)	Nobles County Landfill (NC)	Notes
End of Year	**2030**											
MSW Generated in Market Area (CY)	473,573	588,087	604,636	256,202	184,596	519,485	278,176	143,170	NA	43,722	87,785	MSW Generated in "Identified Facilities" Market Areas (includes BSL) (CY)
Year-End Remaining Airspace (CY)	19,333,102	-569,916	-1,416,693	-840,381	28,763,366	142,380	2,864,383	2,678,971	NA	4,296,686	2,350,679	Remaining Airspace in "Identified Facilities" (includes BSL) (CY)
MSW Diverted To:												
BSL	473,573											CY Disposed
PB		588,087										CY Disposed
ERL			604,636									CY Disposed
SR				256,202								CY Disposed
CD					184,596							CY Disposed
SMC						519,485						CY Disposed
LAS							278,176					CY Disposed
TT								143,170				CY Disposed
FI												CY Disposed
DL										43,722		CY Disposed
NC											87,785	
CY Diverted	0	0	0	0								CY Diverted
Tons Diverted	0	0	0	0								Tons Diverted
Ton-Miles Diverted	0	0	0	0								Ton-Miles Diverted
Diversion Transport Hours	0	0	0	0								
Transfer-Load Cost	$0	$0	$0	$0								
Transportation Cost	$0	$0	$0	$0								Ton-Miles Cost
Tipping Fee Difference	$0	$0	$0	$0								
Total Diversion Cost	$0	$0	$0	$0								
Local Taxes/Fees on BSL Market MMSW	$1,948,042	$0	$0	$0								local taxes/fees
County Taxes/Fees on BSL Market MMSW	$4,845,360	$0	$0	$0								county taxes/fees
State Taxes/Fees on BSL Market MMSW	$2,996,295	$0	$0	$0								state taxes/fees

Diversion Totals	BSL		PB	ERL	SR	CD	Total
Tons BSL Market MMSW Disposed	4,344,871		0	47,507	72,123	133,877	4,598,379
Tons Diverted	253,508		0	0	0	0	253,508
Ton-Miles Diverted	41,359,092	NA	NA	NA	NA	NA	41,359,092
Diversion Transport Hours	39,581	NA	NA	NA	NA	NA	39,581
Transfer-Load Cost	$2,028,063	NA	NA	NA	NA	NA	2,028,063
Transportation Cost	$5,418,041	NA	NA	NA	NA	NA	5,418,041
Tipping Fee Difference	-$5,125,783	NA	NA	NA	NA	NA	(5,125,783)
Total Diversion Cost	$2,320,321	NA	NA	NA	NA	NA	2,320,321
Local Taxes/Fees on BSL Market MMSW	$18,813,291		$0	$237,537	$0	NA	19,050,828
County Taxes/Fees on BSL Market MMSW	$46,794,259		$0	$213,783	$252,430	NA	47,260,473
State Taxes/Fees on BSL Market MMSW	$28,936,840		$0	$316,399	$480,339	NA	29,733,578

Attachment I

Future Permitting Needs

Attachment I
Future Permitting Needs

Future Permitting Needs for BSL Expansion Project

During the BSL SEIS preparation process, the MPCA identified potential additional Project impacts and/or information needs that must be addressed during the course of permitting/project decision making, but are beyond what is legally required to be included in the SEIS by the Final Scoping Decision Document (Scope) adopted by the MPCA on September 30, 2019.

The purpose of this document is to identify those additional potential Project issues and information needs and describe how they will be addressed and resolved by the MPCA during the Project's permitting process.

Air Quality Impacts

BSL is currently operating under Air Emission Permit No. 03700192-004. BSL's air quality permit regulates the facility's air emissions. BSL needs an air quality permit amendment for the Project because it will increase potential air emissions from the landfill. On October 10, 2019, BSL submitted an application for an air quality major permit amendment to the MPCA. In addition to the expansion Project, the application also indicated that BSL is considering pursuing the *option* of transferring waste from the nearby Freeway Landfill to its landfill. BSL's application also indicated that this option would include construction of a new unpaved road between the two landfills in order for trucks to haul waste between the two facilities.

The BSL SEIS does not include an evaluation of potential impacts of transferring Freeway Landfill waste (or waste from any other source) to BSL because it was not required by the BSL SEIS Scope. The waste source analysis was not part of the Scope because the purpose of the Project is not to take waste from any specific source, but instead to increase BSL's ultimate design capacity so they can continue operation into the future, whatever the waste source.

BSL's air quality major permit amendment application indicates that the proposed unpaved road would increase particulate matter (dust) emissions over and above the amount of emissions currently expected from the Project. The MPCA will therefore require BSL to conduct an appropriate analysis of the air quality impacts (e.g., air dispersion modeling) of the unpaved road option. This analysis will be done as part of BSL's air quality permitting process (i.e., not part of the BSL SEIS process), if and when the facility proposes to construct the unpaved road. BSL will not be permitted to pursue the unpaved road option without proper air dispersion modeling and any needed changes to its air quality permit to ensure protection of ambient air quality.

The BSL SEIS Scope requires that the BSL SEIS include an analysis of the air quality impacts of BSL's proposed landfill expansion Project.

The Scope includes a requirement that the air quality impacts associated with landfill gas emissions be evaluated using U.S. Environmental Protection Agency's (EPA) Landfill Air Emissions Estimation Model (Model). The purpose of the Model is to predict the quantity of air pollutant emissions generated at a

landfill for use in subsequent air dispersion modeling, which, in turn is used to determine if a landfill will be in compliance with applicable national and state ambient air quality standards.

During the BSL DSEIS preparation process, air dispersion modeling was conducted to evaluate BSL's Project. The resultant air dispersion modeling predicted that BSL's Project would comply with all applicable national and state ambient air quality standards (after an increase of 10 feet in height of the electrical generating unit's (EGU) stacks).

The results of the air dispersion modeling are included in section 6.5 of the BSL DSEIS, which was published for public comment on June 1, 2021 (public comment period ended on July 31, 2021).

Water Quality Impacts

BSL is currently operating under Solid Waste Permit Number SW-56, which includes requirements in order to protect water quality (e.g., groundwater monitoring, intervention limits, and required actions if limits are exceeded).

BSL needs a permit modification for the Project because it will increase the facility's solid waste disposal capacity. On April 15, 2019, the MPCA received BSL's application for a major modification to its solid waste permit for the proposed landfill expansion. The following items will be addressed by the MPCA during the solid waste permit modification process required for BSL's expansion Project:

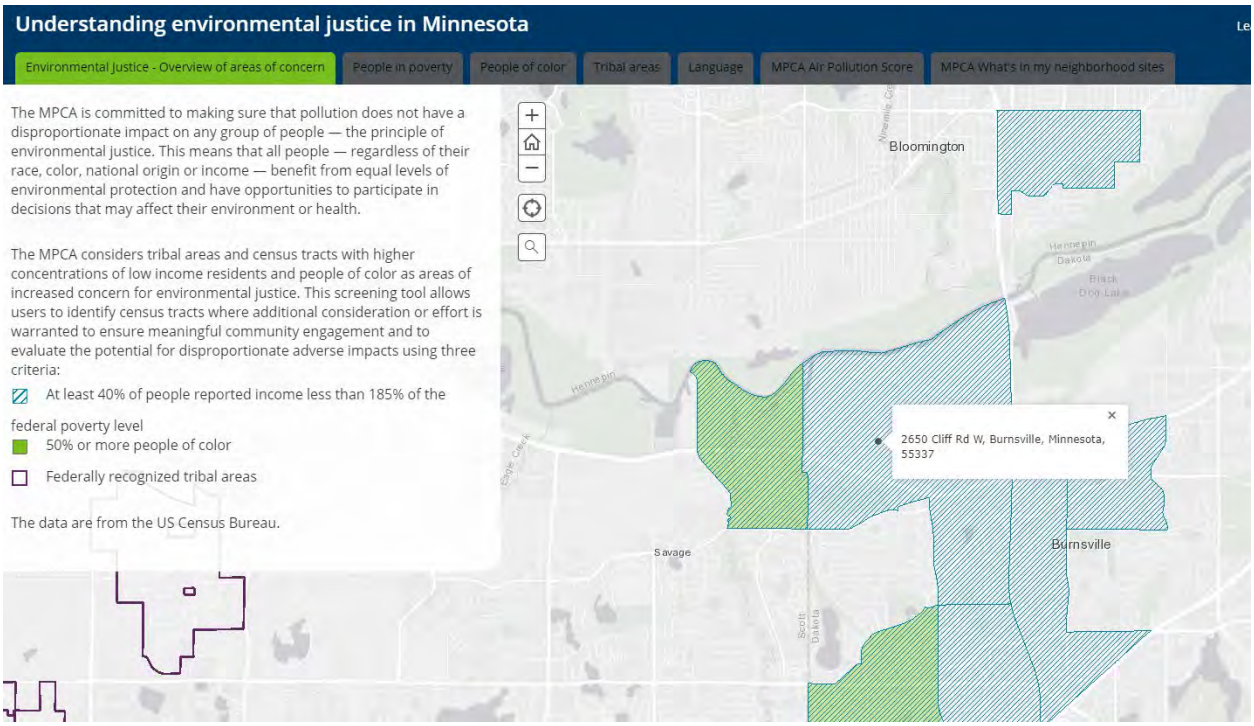
1. Establishment of a compliance boundary based on drinking water standards where water (surface or ground) is used as drinking water, such as the Minnesota River;
2. The MPCA will require, during Project permitting, that BSL update its groundwater Sampling and Analysis Plan to include current standard parameters, monitoring limits based on Health Risk Limits or equivalent health standard, and additional contaminants of concern based on information obtained from groundwater monitoring in the Project area. The specific contaminants of concern that will be evaluated during the permitting process for potential inclusion into BSL's permit include PFAS and 1, 4 dioxane;
3. An updated Environmental Monitoring Plan that details the ground water monitoring network at the facility and any additional wells needed in order to identify potential contaminant release;
4. A Geotechnical stability analysis for in-place waste based on the increased mass and height of the proposed expansion including an analysis of any leachate held within the in-place waste;
5. An analysis of in-situ leachate in the unlined waste cell to identify potential contaminates that could be introduced to groundwater that could threaten human health and the environment;
6. A Contingency Action Plan that details actions the Project proposer must undertake in the event groundwater contamination or other potential environmental impacts are detected at the facility;
7. Detailed Technical Specifications that describe construction methods and materials that will be used to establish environmental controls;
8. A Financial Assurance Plan that will establish a mechanism to provide funding in the event of any necessary future contamination clean-up or operational changes at the facility;
9. A Closure Plan that specifies steps that will be taken to close out the facility in an environmentally protective way after the facility reaches its final capacity; and
10. A Post-Closure Care Plan that describes maintenance and environmental controls that will provide long-term environmental protection at the facility after it closes.

Attachment J

Environmental Justice

Attachment J
Environmental Justice

The BSL Project area is an area of concern for environmental justice because it is located within a U.S. Census tract where at least 40% of people report a household income less than 185% of the federal poverty level. The BSL DSEIS sourced this information from the MPCA and environmental justice webpage. The webpage includes a link to a map of Areas of Environmental Concern. The MPCA used this map and BSL's address to determine that BSL is located in an EJ area of concern, as shown in the following screenshot.



Because the Project is located within an area of concern for environmental justice, the environmental impacts associated with the Project that were outlined in the Final Scoping Decision Document for the BSL SEIS were assessed within the context of whether said impacts would result in disproportionate exposure to pollution within the identified area of environmental justice concern. The assessment indicated that no such disproportionate exposures would be expected to result from the Project. The assessment only relied on the information contained within the BSL DSEIS.

The following sections of the BSL DSEIS provide details for each EJ finding:

- Groundwater Quality/Water Supplies – Section 6.1.3.8
- Erosion/Sedimentation from Extreme Storm Event – Section 6.2.1.5
- Erosion of Liner and Leachate Collection System – Sections 6.3.2.4 and 6.3.4.4
- Visual Impacts – Section 6.4.2.1
- Air Quality – Section 6.5.9

Attachment K

DNR Natural Heritage Letter

Minnesota Department of Natural Resources
Division of Ecological & Water Resources
500 Lafayette Road, Box 25
St. Paul, MN 55155-4025

April 26, 2019
Correspondence # ERDB 20190297

Mr. Jim de Lambert
Carlson McCain, Inc.
15650 36th Ave. N, Ste 110
Plymouth, MN 55446

RE: Natural Heritage Review of the proposed Burnsville Sanitary Landfill - Annex Development Area, T27N R24W Section 32; Dakota County

Dear Mr. de Lambert,

As requested, the Minnesota Natural Heritage Information System has been queried to determine if any rare species or other significant natural features are known to occur within an approximate one-mile radius of the proposed project. Based on this query, rare features have been documented within the search area (for details, please visit the Rare Species Guide Website for more information on the biology, habitat use, and conservation measures of these rare species). Please note that the following rare features may be adversely affected by the proposed project:

Ecologically Significant Areas

- A portion of the project is within an area the Minnesota Biological Survey (MBS) has identified a Site of *High* Biodiversity Significance. Sites of Biodiversity Significance have varying levels of native biodiversity and are ranked based on the relative significance of this biodiversity at a statewide level. Sites ranked as *High* contain very good quality occurrences of the rarest species, high quality examples of the rare native plant communities, and/or important functional landscapes. (GIS shapefiles of MBS Sites of Biodiversity Significance can be downloaded from the MN Geospatial Commons. Please contact me if you do not have access to the appropriate mapping services.) Although some of the area has changed land use since the Site was delineated, the areas that remain intact likely still have ecological significance. We encourage you to consider project alternatives that would avoid or minimize disturbance to this ecologically significant site. Actions to minimize disturbance may include, but are not limited to, the following recommendations:
    - Minimize vehicular disturbance in the area (allow only vehicles/equipment necessary for construction activities);
    - Do not park equipment or stockpile supplies in the area;

- Do not place spoil within MBS Sites or other sensitive areas;
- Use effective erosion prevention and sediment control measures;
- Inspect and clean all equipment prior to bringing it to the site to prevent the introduction and spread of invasive species;
- As much as possible, operate within already-disturbed areas;
- Revegetate disturbed soil with native species suitable to the local habitat as soon after construction as possible; and
- Use only weed-free mulches, topsoils, and seed mixes. Of particular concern are birdsfoot trefoil (*Lotus corniculatus*) and crown vetch (*Coronilla varia*), two invasive species that are sold commercially and are problematic in prairies and disturbed open areas.

- If the Wetland Conservation Act (WCA) is applicable to this project, please note that wetlands within High MBS Sites of Biodiversity Significance may qualify as "rare natural communities" under this Act. Minnesota Rules, part 8420.0515, subpart 3 states that a wetland replacement plan for activities that modify a rare natural community must be denied if the local government unit determines the proposed activities will permanently adversely affect the natural community.

- Multiple calcareous fens have been documented in the vicinity of the proposed project area. Black Dog Lake Fens A, B, and C (ID # 32941, 14373, and 31929, respectively) are located east of the project and contain the following state-listed plants:

  - Sterile sedge (*Carex sterilis*) – Threatened
  - Tuberous Indian-plantain (*Arnoglossum plantagineum*) – Threatened
  - Edible valerian (*Valeriana edulis* var. *ciliate*) – Threatened
  - Whorled nutrush (*Scleria verticillata*) – Threatened
  - Hair-like beak rush (*Rhynchospora capillacea*) – Threatened
  - Twig rush (*Cladium mariscoides*) – Special Concern
  - Small white lady's-slipper (*Cypripedium candidum*) – Special Concern

  Savage Fen (ID# 241) is located to the west of the project and contains the following state-listed species:

  - Sterile sedge (*Carex sterilis*) – Threatened
  - Beaked Spikerush (*Eleocharis rostellata*) – Threatened
  - Edible valerian (*Valeriana edulis* var. *ciliate*) – Threatened
  - Whorled nutrush (*Scleria verticillata*) – Threatened
  - Hair-like beak rush (*Rhynchospora capillacea*) – Threatened
  - Twig rush (*Cladium mariscoides*) – Special Concern
  - Small white lady's-slipper (*Cypripedium candidum*) – Special Concern

  A calcareous fen is a rare and distinctive peat-accumulating wetland that is legally protected in Minnesota. The Wetlands Conservation Act, authorized by *Minnesota Statutes*, section 103G.223, states that calcareous fens may not be filled, drained, or otherwise degraded, wholly or partially, by any activity, except as provided for in a management plan approved by the commissioner of the Department of Natural Resources. Many of the unique characteristics of calcareous fens result from the upwelling of groundwater through calcareous substrates. Because of this dependence on groundwater hydrology,

calcareous fens can be affected by nearby activities or even those several miles away. For more information regarding calcareous fens, please see the Calcareous Fen Fact Sheet.

The DNR would have concerns regarding any activities that might affect groundwater flows, including groundwater pumping or discharge. The EAW should adequately address potential effects to these fens. If you have any questions regarding calcareous fen regulations, please contact Doug Norris, Wetlands Program Coordinator, at 651-259-5125 or Doug.Norris@state.mn.us.

If it is determined that the project will adversely affect the fens in any way, including indirect impacts through the alteration of hydrological conditions, you will need to contact Lisa Joyal, the Endangered Species Environmental Review Coordinator, at lisa.joyal@state.mn.us or 651-259-5109, before the project is initiated to discuss rare species survey process (see attached). Surveys must follow the standards contained in the attached Rare Species Survey Process and Rare Plant Guidance. Project planning should take into account that any botanical survey needs to be conducted during the appropriate time of the year, which may be limited. Minnesota's endangered species law (*Minnesota Statutes*, section 84.0895) and associated rules (*Minnesota Rules*, part 6212.1800 to 6212.2300 and 6134) prohibit the taking of threatened or endangered species without a permit.

State-listed Species

- Several state-listed fish, mussels, and amphibians have been documented in the Minnesota River in the vicinity of the proposed project. These species are particularly vulnerable to deterioration in water quality, especially increased siltation. As such, the project should not be allowed to negatively affect the water quality of the Minnesota River. A buffer of vegetation should remain between the landfill and the river, and sound erosion and sediment control practices should be implemented and maintained for the duration of the project. **Please contact me if the proposed project will impact the river or its water quality,** as further action may be needed.

- Blanchard's cricket frog (*Acris blanchardi*), state-listed as endangered, has been documented recently in the vicinity of the project. This species inhabits shallow wetlands, lakes, streams, or rivers. They typically occupy areas along the water's edge, and prefer open areas with muddy shorelines and abundant emergent vegetation. This species remains near water during the summer, but may travel overland to find new habitat during dry spells. They emerge from winter dormancy in late April, and breeding occurs from late May to July. The tadpoles metamorphose into adults in early August and enter winter dormancy in late September. The life expectancy of this species is about four months, with only 5% of the population surviving the winter.

  Despite intensive survey efforts, the Blanchard's cricket frog is only known from a few isolated locations in the state. Their limited geographic distribution, along with their short life span, makes populations of this species very vulnerable to disturbance. Potential impacts include changes in wetland hydrology and decreases in water quality due to runoff, erosion, or pollution from fertilizers and other chemicals. Actions to minimize disturbance to this species include, but are not limited to, avoiding wetlands and aquatic habitat, limiting construction to winter months, and restricting the use of pesticides and fertilizers. **Please coordinate with the DNR Regional Nongame Specialist, Erica Hoaglund (651-259-5772 or Erica.Hoaglund@state.mn.us), to ensure avoidance of this species.**

Federally Protected Species

- The rusty patched bumble bee (*Bombus affinis*), a federally-listed endangered species, was documented in the vicinity of the proposed project. The rusty patched bumble bee typically occurs in grasslands and urban gardens with flowering plants from April through October. This species nests underground in abandoned rodent cavities or in clumps of grasses. Please reference the guidance at the USFWS rusty patched bumble bee website to determine if the project has the potential to impact this protected species.

Environmental Review and Permitting

- The Environmental Assessment Worksheet should address whether the proposed project has the potential to adversely affect the above rare features and, if so, it should identify specific measures that will be taken to avoid or minimize disturbance. Sufficient information should be provided so the DNR can determine whether a takings permit will be needed for any of the above protected species.

- Please include a copy of this letter in any state or local license or permit application. Please note that measures to avoid or minimize disturbance to the above rare features may be included as restrictions or conditions in any required permits or licenses.

The Natural Heritage Information System (NHIS), a collection of databases that contains information about Minnesota's rare natural features, is maintained by the Division of Ecological and Water Resources, Department of Natural Resources. The NHIS is continually updated as new information becomes available, and is the most complete source of data on Minnesota's rare or otherwise significant species, native plant communities, and other natural features. However, the NHIS is not an exhaustive inventory and thus does not represent all of the occurrences of rare features within the state. Therefore, ecologically significant features for which we have no records may exist within the project area. If additional information becomes available regarding rare features in the vicinity of the project, further review may be necessary.

For environmental review purposes, the results of this Natural Heritage Review are valid for one year; the results are only valid for the project location (noted above) and the project description provided on the NHIS Data Request Form. Please contact me if project details change or for an updated review if construction has not occurred within one year.

The Natural Heritage Review does not constitute review or approval by the Department of Natural Resources as a whole. Instead, it identifies issues regarding known occurrences of rare features and potential effects to these rare features. If needed, please contact your DNR Regional Environmental Assessment Ecologist to determine whether there are other natural resource concerns associated with the proposed project. Please be aware that additional site assessments or review may be required.

Thank you for consulting us on this matter, and for your interest in preserving Minnesota's rare natural resources. An invoice will be mailed to you under separate cover.

Sincerely,

Samantha Bump
Natural Heritage Review Specialist
Samantha.Bump@state.mn.us

Enc. Rare Species Survey Process

Links: Rare Species Guide
http://www.dnr.state.mn.us/rsg/index.html
DNR Regional Environmental Assessment Ecologist Contact Info
http://www.dnr.state.mn.us/eco/ereview/erp_regioncontacts.html
MBS Sites of Biodiversity Significance
http://www.dnr.state.mn.us/eco/mcbs/biodiversity_guidelines.html
DNR Native Plant Communities
http://www.dnr.state.mn.us/npc/index.html
MN Geospatial Commons
https://gisdata.mn.gov/
BWSR Native Vegetation/Seed Mixes
http://www.bwsr.state.mn.us/native_vegetation/
USFWS Rusty Patched Bumble Bee
https://www.fws.gov/midwest/endangered/insects/rpbb/guidance.html
Calcareous Fen Fact Sheet
https://files.dnr.state.mn.us/natural_resources/water/wetlands/calcareous_fen_fact_sheet.pdf

Cc: Becky Horton
Leslie Parris
Erica Hoaglund
Doug Norris
Kit Elstad-Haveles

Attachment L

Cultural Resources Management – Phase I Investigation 2003

MINNESOTA HISTORICAL SOCIETY

January 27, 2003

Dr. Amy Ollendorf
HDR Engineering
6190 Golden Hills Drive
Minneapolis, MN 55416-1567

Re: Proposed West and North Development Areas, Burnsville Sanitary Landfill
Dakota and Hennepin Counties
SHPO Number: 2002-3567

Dear Dr. Ollendorf:

We last wrote you on 21 October 2002 regarding the above referenced project. In that letter, we recommended archaeological surveys for areas #1 and #3.

We have now received and reviewed the results of the archaeological survey you have conducted of these areas, as well as information on the standing structures located adjacent to the sites.

On the basis of this information, we conclude that no properties listed on or eligible for listing on the National Register of Historic Places will be affected by this project.

Please note that this review finding applies only to sites #1 and #3. Sites #2 and #4 were eliminated earlier in the planning process, and have not been addressed in the final stages of review.

Contact us at 651-296-5462 with questions or concerns.

Sincerely,

Dennis A. Gimmestad
Government Programs & Compliance Officer

cc: Brad Johnson, COE
Jim Sitken, McCain and Associates

Final Report

Cultural Resources Management

Proposed West and North Development Areas, Burnsville Sanitary Landfill, Dakota and Hennepin Counties, Minnesota Phase I Investigation

Prepared For

McCain and Associates

SHPO # 2002-3567

By

Amy Ollendorf, Ph.D.
Erika Palmer
Donna Stubbs, M.A.
and
Daniel R. Pratt, M.A.

HDR
Employee Owned

Project No. 12005-001-164-01
December 12, 2002

Management Summary

McCain and Associates, on behalf of Waste Management and Burnsville Sanitary Landfill, Inc., retained HDR Engineering, Inc. (HDR) to provide cultural resource management (CRM) services in support of wetland-creation projects associated with future development at Burnsville Sanitary Landfill. At this time, two areas are under consideration for development (Areas 1 and 3).

Dr. Amy Ollendorf was the Project Manager and Co-Principal Investigator for this CRM investigation. Donna Stubbs, Co-Principal Investigator (for archaeology), conducted archival research at the Minnesota Historical Society (MHS) and the SHPO on September 12, 2002. Field work commenced on November 7, 2002 and was completed on November 8, 2002. Donna Stubbs also completed the photo-documentation of standing structures on November 8, 2002; Daniel Pratt provided the narrative description. The purpose of the photo-documentation was to assist the SHPO in the determination of whether or not to recommend a formal standing structures survey for the present project.

Donna Stubbs served as the Field Supervisor for the field work. Field crewmembers included Erika Palmer, Dylan Eigenberger, and Brandy Stearns. Daniel Pratt, a federally qualified architectural historian, was the project's Co-Principal Investigator (for architectural history). Erika Palmer wrote substantial portions of the report along with the three principal investigators.

Area 1 is north of State Highway 13 directly off Washburn Avenue on undeveloped land to the north and to the west of the existing landfill. It consists of ca. 89 ha (220 ac) in Sections 29 and 32, Township 27 North, Range 24 West, Dakota County. Approximately 5 ha (12 ac) will be directly impacted by excavations, and another ca. 17 ha (43 ac) are slated for infilling by landfill development. Area 1 presently consists of floodplain forest and marshland, and surface visibility was poor. Excavations will not exceed 91-cm (3-ft) depth, so the maximum depth of subsurface tests was 90 cm below the ground surface (cmbs) (2.9 ft). The subsurface tests documented typical alluvial deposits, but no cultural horizons were encountered.

A geomorphological assessment conducted independently by James Aiken of McCain and Associates indicated the depositional environment of Area 1 is similar to those found upriver from the project area within the Minnesota River Wildlife Refuge. In his estimation, the archaeological potential of Area 1 is low at depths greater than those attained by HDR's hand excavations. HDR recommends no further archaeological testing in this area.

Area 3 is south of U.S. Highway 212 on agricultural land with excellent surface visibility. Therefore, no subsurface testing was needed and the proposed impact areas were covered by pedestrian reconnaissance. Only ca. 0.4 ha (7 ac) will be directly affected by using plowzone soils to create berms around the northern perimeter of the site. No cultural materials were noted during the surface survey, and HDR recommends no further archaeological testing in Area 3.

Residential, commercial, and industrial standing structures also were photographed within 0.8 km (0.5 mi) of the proposed landfill development (Area 1) and within 0.8 km (0.5 mi) of the proposed wetland creation (Area 3). HDR concludes that no historic standing structures eligible or potentially eligible for nomination to the National Register of Historic Places (NRHP) will be physically or visually impacted by the proposed landfill development in Area 1 and wetland creation in Areas 1 and 3.

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Acknowledgments

The authors would like to thank the following for their assistance with this project (in alphabetical order):

Burnsville Sanitary Landfill, Inc.
Mike Niewind

Graham Environmental Services, Inc.
Mike Graham

McCain & Associates, Inc.
James Aiken
Todd Hartleben
John McCain

State Historic Preservation Office
Dr. Scott Anfinson
Tom Cinadr
Dennis Gimmestad
Kelly Gragg-Johnson

Waste Management
Debra McDonald

Introduction

McCain and Associates, on behalf of Waste Management and Burnsville Sanitary Landfill, Inc., retained HDR Engineering, Inc. (HDR) to provide cultural resource management (CRM) services in support of wetland-creation projects associated with future development at Burnsville Sanitary Landfill. At this time, two areas are under consideration for development (Areas 1 and 3). Overviews of these areas are shown on the attached USGS topographic quadrangles (Figures 1 and 2) and aerial photographs (Figures 3 and 4).

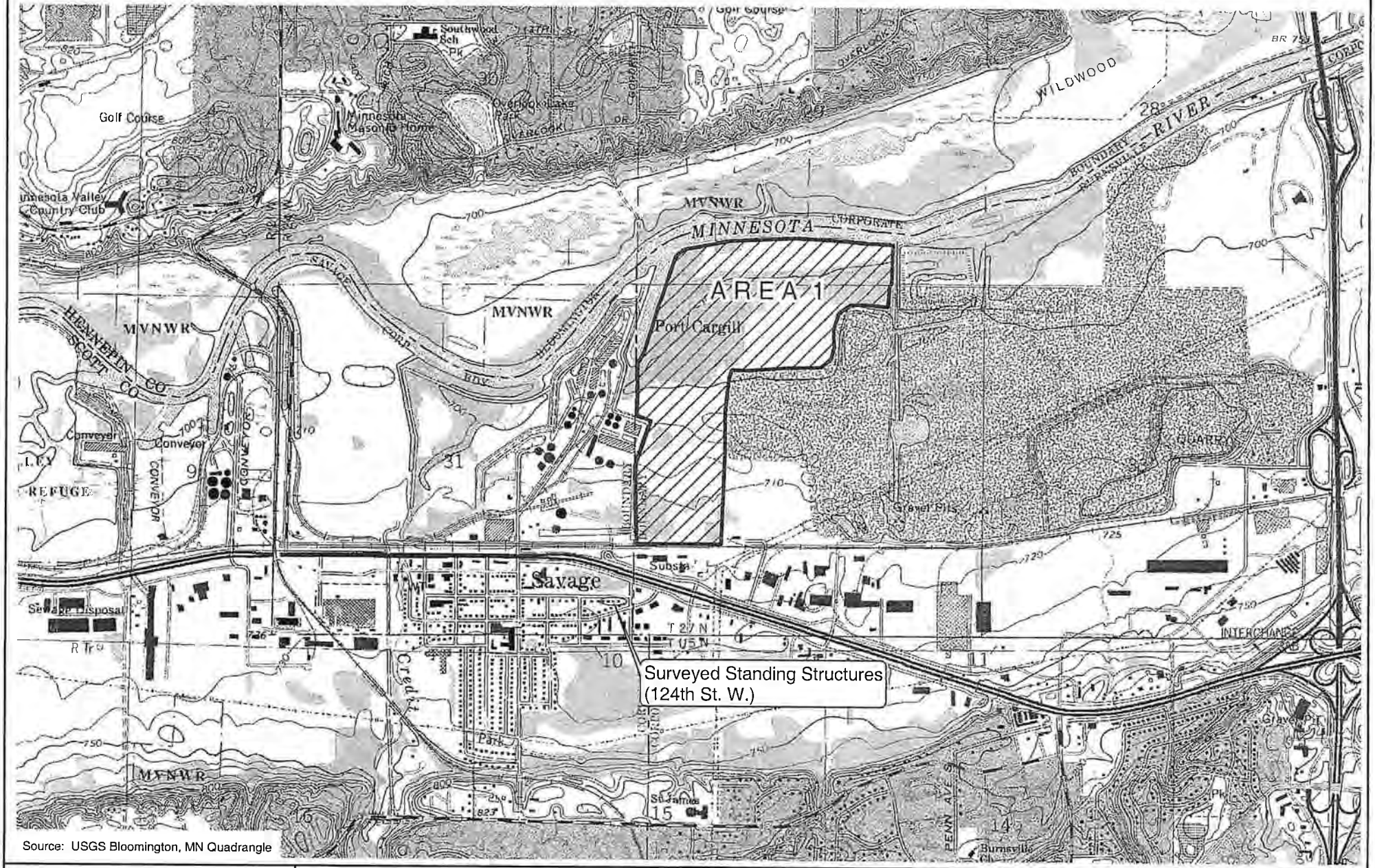
Dr. Amy Ollendorf was the Project Manager and Co-Principal Investigator for this CRM investigation. Donna Stubbs was Co-Principal Investigator (for archaeology) and Field Supervisor, and Daniel Pratt was the project's Co-Principal Investigator (for architectural history). Erika Palmer wrote substantial portions of the report along with the three principal investigators.

Area 1

This area is north of State Highway 13 directly off Washburn Avenue on undeveloped land to the north and to the west of the existing landfill. Future landfill development and wetland creation would occur within Area 1. This area consists of ca. 89 ha (220 ac) in Sections 29 and 32, Township 27 North, Range 24 West, Dakota County (Figure 1). Excavations to a depth of up to 92 cm (3 ft) will directly impact approximately 5 ha (12 ac). Another ca. 17 ha (43 ac) are slated for infilling by landfill development.

Figure 3 shows where the landfill development would take place (each is labeled "Fill Area"). The rest of Area 1 is an existing wetland that will remain as such. Portions of the upland in the northwestern corner would be excavated as part of the planned wetland creation (Figure 3). Also, three excavation areas in the southwestern portion would be restored as wetlands (Figure 3).

For HDR's archaeological survey, the northern tier of Area 1, consisting of ca. 6 ha (14 ac) was divided into three subsections (Figure 5). The first is in the extreme eastern end of this area (1.4 ha or 3.5 ac). It has been used as a dredge area, and the current ground surface is higher than the surrounding area because of dredge piles. Consequently, HDR did not test in this location. Subsection A (Figure 5), consisting of ca. 3 ha (7 ac) in the middle of the northern tier, was also a dredge area. Because most of the dredge spoil had been removed and the land surface was lower than the surrounding area at the time of HDR's survey, soil probes were placed within Subsection A to determine if any intact original soils remained (See the **Results** section, below). Subsection B, in the northwest corner of Area 1, consisted of ca. 4 ha (10 ac) of floodplain forest with mostly intact soils. This subsection was tested during the current investigation.



Feet

0 1,000 2,000 3,000

N

Area 1 & Surveyed Standing Structures (124th St. W.)
Proposed Burnsville Landfill Expansion
Burnsville, Dakota County, Minnesota

HDR

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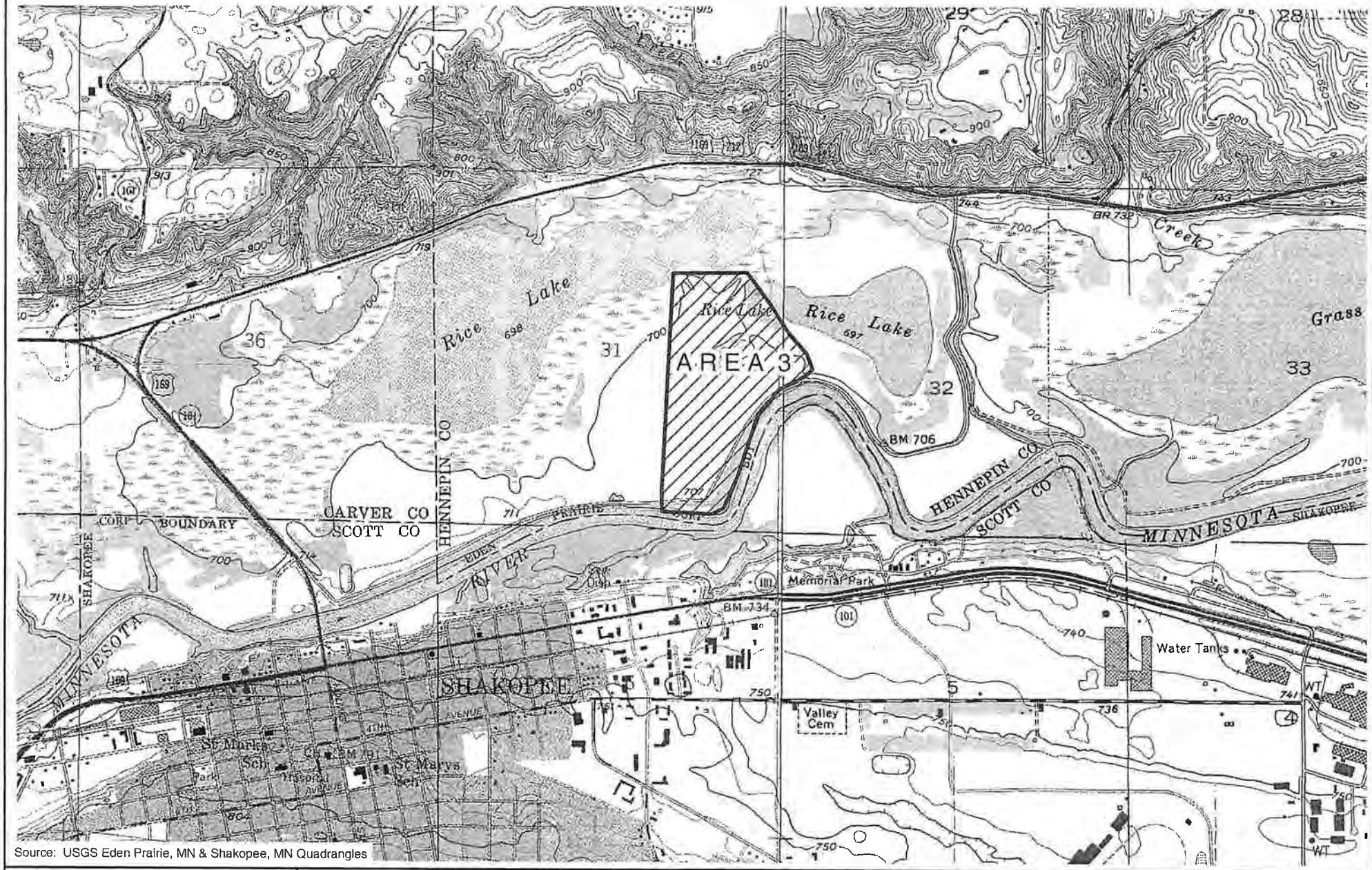
PM: AO	
Proj No.: 12005-001-164	
File: fig1.mxd	
Figure No. 1	SHEET OF



Source: USGS Eden Prairie, MN & Shakopee, MN Quadrangles

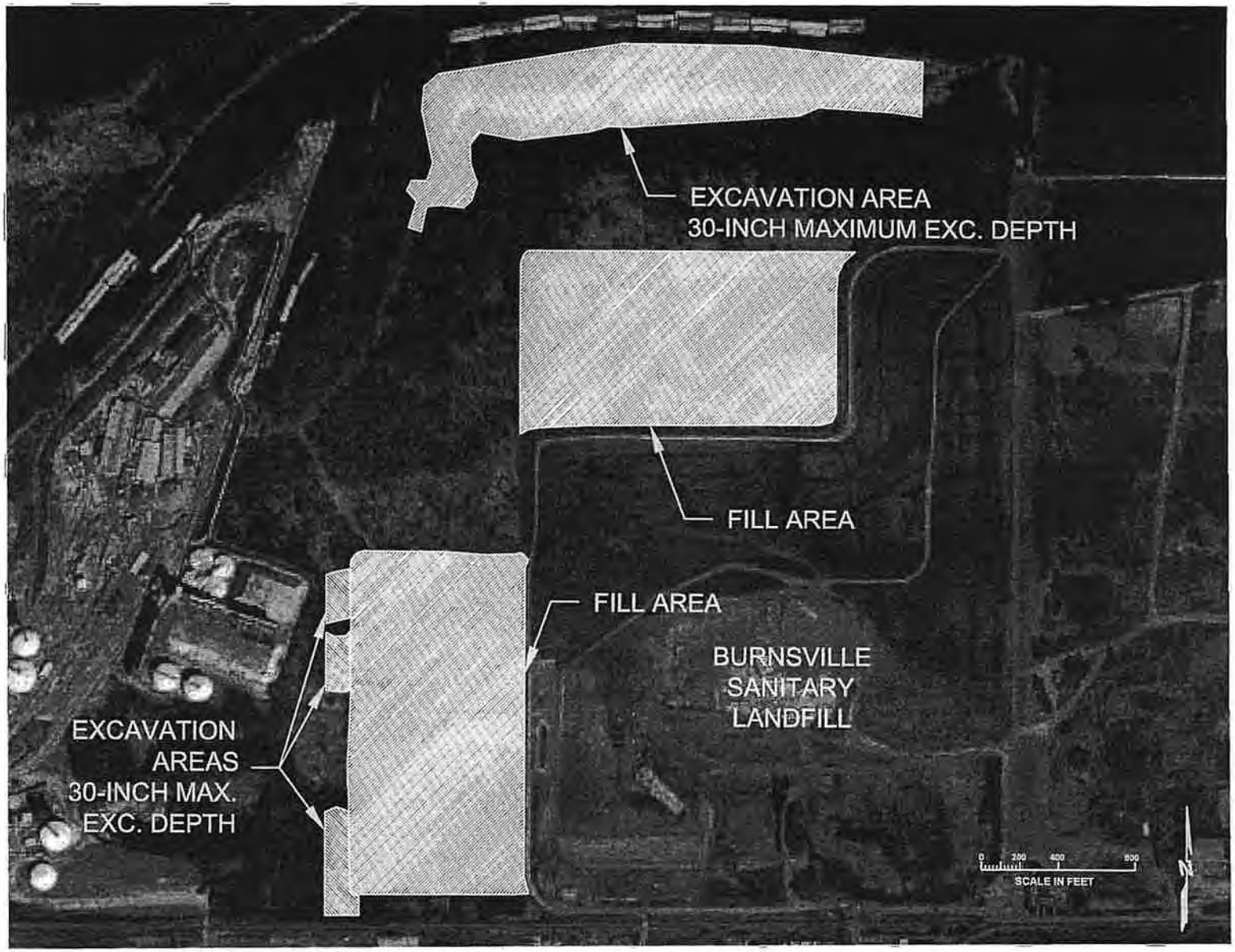
Feet
0 1,000 2,000 3,000

N

Area 3
Proposed Burnsville Landfill Expansion
Eden Prairie, Hennepin County, Minnesota

HDR

GIS: DPS	Date:12/02/02
PM: AO	
Proj No.: 12005-001-164	
File: fig1.mxd	
Figure No. 2	SHEET OF



GES
Graham Environmental Services, Inc.
P.O. Box 178 Howard, Wisconsin 54311

McCain and Associates, Inc.
434 2nd Street
Excelsior, MN 55331
ph 952-470-1611
fx 952-470-0728

FIGURE 3
GRADING AREAS - AREA 1
BSLI PROPERTY
BURNSVILLE SANITARY LANDFILL, INC.

P:\Active\CADD_drawings\01003 WETLANDS\HDR FIG 3.dwg, 12/04/02 05:07:43 PM

GES
Graham Environmental Services, Inc.
P.O. Box 139 Ellsworth, Wisconsin 54011

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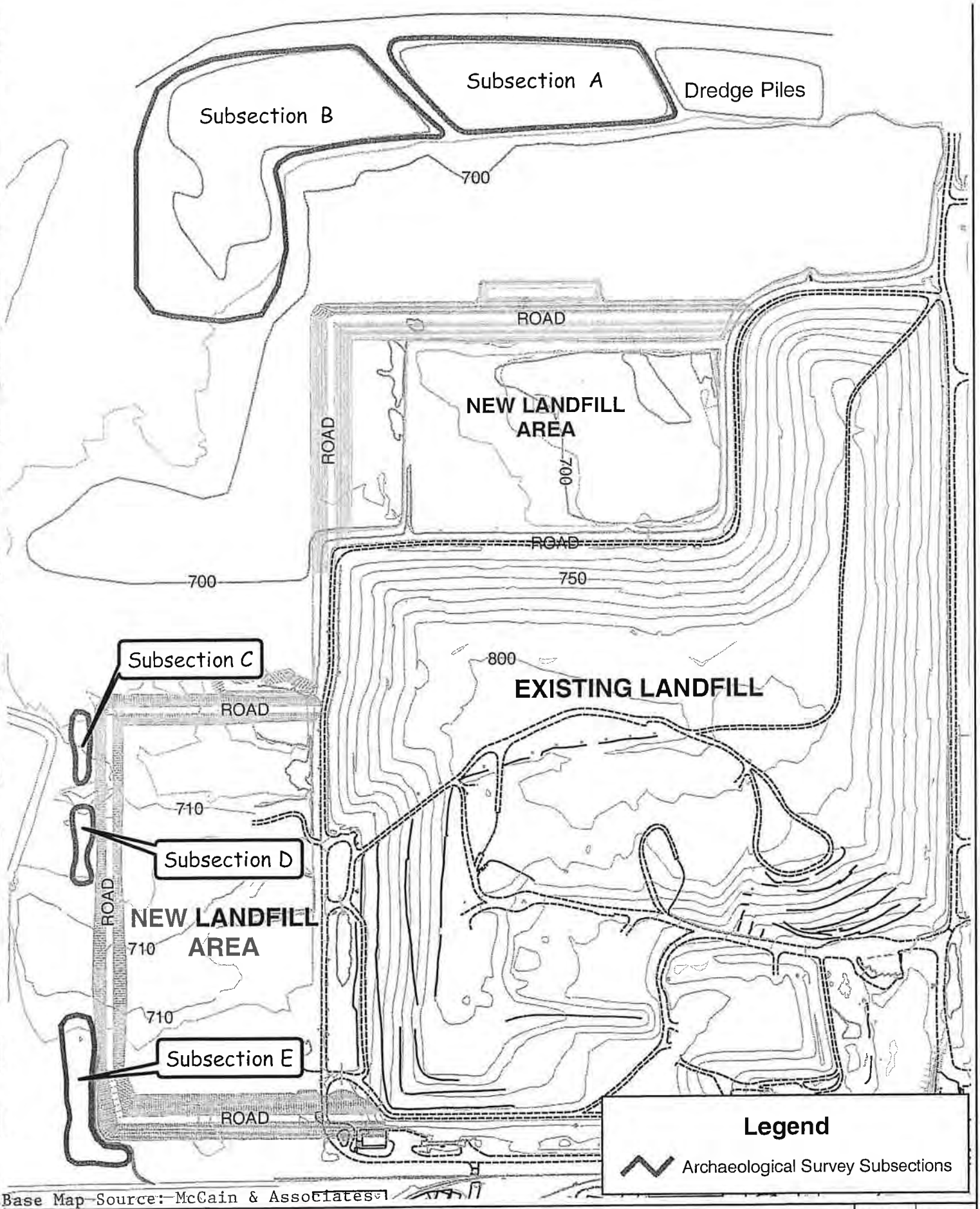
FIGURE 4
GRADING AREAS - AREA 3
PETERSON PROPERTY
BURNSVILLE SANITARY LANDFILL, INC.

P:\Active\CADD_drawings\SEVER PETERSON WETLANDS\HDR FIG 4.dwg, 12/05/02 09:17:41 AM



Base Map Source: McCain & Associates

Feet
0 250 500

Area 1 Subsections A-E
Proposed Burnsville Landfill
Burnsville, Dakota County, Minnesota

HDR

GIS: DPS	Date:12/02/02
PM: AO	
Proj No.: 12005-001-164	
File: fig1.mxd	
Figure No. 5	SHEET OF

Subsections C and D, in the lower southwest portion of Area 1 (Figure 5), consisted of ca. 0.32 ha (0.79 ac) and ca. 0.37 ha (0.92 ac), respectively, of meadow and marshlands with mostly intact soils. HDR tested these subsections.

Subsection E, in the southwest corner of Area 1, (Figure 3), consisted of ca. 0.8 ha (2 ac) of wooded area, containing mostly shrubs and scrub brush. Soils in the area were mostly intact. This subsection was tested during the current investigation.

Area 3

This area is south of U.S. Highway 212 on agricultural land with excellent surface visibility. It consists of approximately 180 acres in Sections 31 and 32, Township 116 North, Range 22 West, Eden Prairie, Hennepin County (Figure 2). This is another proposed location for wetland creation.

Only ca. 0.4 ha (7 ac) will be directly impacted by borrow areas for berms (Figure 4). The plan is to construct a low-head berm around the northern perimeter of the site in the agricultural field to retain floodwaters from draining north through ditch systems to wetland complexes north of the site. The berm would be several thousand feet in length and would use only plowzone soils. Excavation for material to construct the berm will take place next to the south side of the berm and would be approximately wide 15 m (50 ft). The excavated material would then be pushed up and graded to form the berm.

Environmental Background

The project area is located along the Minnesota River floodplain in east-central Minnesota within the Big Woods and Southern Oak Plains ecosystems of the Southeastern Minnesota Savanna. According to the U.S. Geological Survey (USGS) Northern Prairie Wildlife Research Center (1998), the Big Woods subsection itself has irregular, hilly topography with many lakes and wetlands. Oak woodland and maple-basswood forest were the most common vegetation types before Euro-American settlement. Much of the Southern Oak Plains is a rolling plain of loess-mantled ridges over sandstone and carbonate bedrock and till. The pre-settlement vegetation was primarily bur oak savanna, but also included tall-grass prairie and maple-basswood forest (USGS 1998).

The project area consists of mostly poorly drained alluvial soils (Table 1). Area 1 soils are in the Colo-Algansee-Minneiska and Waukegan-Wadena-Hawick association (Hundley 1983). Soil types include Minneiska loam, which are poorly drained soils that formed in calcareous alluvium on floodplains of major rivers. These soils are located in Subsections A and B of Area 1. Within Subsections C, D and E of Area 1 the soils consist of Faxon silty clay loam. This poorly to very poorly drained soil formed in glacial drift and is found on bedrock terraces along floodplains of major rivers (Hundley 1983).

Area 3 soils are in the Mixed Alluvial-Marsh-Chaska Association (Lueth and Chamberlain 1974). Soils include Dorchester loams and Chaska clay loams. The Dorchester series is comprised of well-drained and moderately well drained soils that formed in alluvium on broad flats along the Minnesota River. Typically, it is found between areas of mixed alluvial land, which occurs next to the river and areas of Chaska soils, which are found further back from the river. Chaska clay loams consist of poorly drained soils that formed in deep, recent, calcareous loamy alluvium on floodplains. Native vegetation consists of prairie grasses, sedges and patches of willow and poplar (Lueth and Chamberlain 1974).

In addition to the officially named soil series, both Area 1 and Area 3 of the project area also include subareas with moderately shallow Entisols, and ponded Mollisols and Histosols.

Table 1. Soils in the APE

Series	Suborder	Order
Chaska	Aeric Fluvaquents	Entisols
Dorchester	Typic Udifluvents	Entisols
Oshawa	Fluvaquentic Endoaquolls	Mollisols
Faxon	Typic Endoaquolls	Mollisols
Minneiska, occasionally flooded	Mollic Udifluvents	Entisols

Archaeological and Historical Background

Native Americans have utilized the Minnesota region through time, especially the higher elevations near the plentiful lakeshores and riverbanks. Before Le Sueur's expedition to the Mankato areas in September 1700, Native Americans had been living in the Minnesota River Valley for more than 10,000 years. The following paragraphs provide a brief overview of the cultural traditions, as recognized by archaeologists. In general, these archaeological traditions show the change in aboriginal lifestyles from small, nomadic hunting and gathering groups to comparatively sedentary, complex societies who met the first Europeans who explored the region.

Although there are a few surface finds of **Paleoindian (ca. 12,000 - 8,000 yr B.P.)** fluted and lanceolate projectile points in what is now Minnesota, few intact sites are known. Migratory groups of people settled upon the grasslands, hunting native herding animals such as bison and the now extinct megafauna such as the mastodon, and likely exploiting available small game, fish, and plant resources. Throughout much of this period, the climate was becoming successively warmer and drier. No Paleoindian sites have been documented in the project area.

The **Archaic Tradition (ca. 8,000 to ca. 2,800 yr B.P.)** represents a continuation of semi-nomadic hunting and gathering, likely in a seasonal round of resource procurement. A wider range of resources was utilized during the period, generally reflecting the increasingly rich environment of the early to middle Holocene, although bison was probably of local importance. Characteristic of the Archaic period is continued reliance on large game hunting (e.g., bison) and increasingly diversified technologies associated with hunting, trapping, fishing, foraging, wood working, and plant processing. The

diversification of culture and associated technologies reflects more highly regionalized adaptations to specific or local environmental conditions as climatic trends shifted to a cooler, wetter configuration, a pattern that continues to this day. No Archaic sites have been documented in the project area.

The **Woodland Tradition (ca. 2,800 - 900 yr B.P.)** is characterized by the initial appearance of ceramic vessels and the construction of earthen mounds. The broad elements of the Woodland Tradition include the development of regional resources, the appearance of additional distinctive artifact styles, and steadily increasing population. No Woodland sites have been documented in the project area.

The **Late Prehistoric Period (ca. 1,000 yr B.P. - A.D. 1200)** continued until the time of initial contact between Native Americans and European and American explorers. Several major trends are apparent during this period, including the intensification of food production. The Plains Village culture, one manifestation of late prehistoric groups, is associated with the Cambria site, which is located on the Minnesota River near Mankato. No Late Prehistoric sites have been documented in the project area.

By the mid-1800s, the fur trade era had ended and was followed by the intensification of Euro-American settlement, which resulted in a depletion of native animal populations and the displacement of the Native Americans. The treaties of 1805 and 1837 removed the Dakota from their ancestral lands. The Sisseton, Wahpeton, Wahpekute, and Mdewakanton bands of the Dakota along with agents of the U.S. Government signed the Treaty of Traverse des Sioux in 1851. This treaty established reservations for the Dakota bands on tracts along the upper and lower Minnesota River.

For descriptions of previously documented archaeological sites and historic standing structures in the vicinity of the project area, as well as land use of the project area during the Historic Period, the reader is directed to the informational packet submitted by HDR on behalf of McCain and Associates (October 7, 2002) to the State Historic Preservation Office (SHPO) for review. This packet includes project area overlays on the 1957, 1970, and 2000 aerial photographs for Area 1 and the 1937, 1964, and 2000 aerial photographs for Area 3.

Previous Investigations

Most of the verified archaeological sites in the region are located on the bluff edges along the Minnesota River. Some sites and site leads, however, have been documented in and around the proposed project area. The majority of architectural structures that have been inventoried in the vicinity of the project area are in the cities of Savage or Shakopee. To HDR's knowledge, no traditional cultural properties (TCPs) have been inventoried in the project area. The known cultural resources in the vicinity of the project area are summarized in the informational packet submitted by HDR on behalf of McCain and Associates (October 7, 2002) to the SHPO for review.

This packet also includes a geomorphological assessment of Area 1 by James Aiken of McCain and Associates so it is not repeated herein. In summary, Aiken found that the geology of Area 1 suggests a depositional environment (i.e., marshes, bog swamps, and floodplain lakes) similar to those found upriver from the project area within the Minnesota River Wildlife Refuge. Area 3 is slated for neither deep excavations nor thick overburden deposition, so it was excluded from geomorphological assessment.

Methods

Archival Research

Donna Stubbs conducted archival research at the Minnesota Historical Society (MHS) and the SHPO on September 12, 2002. The twofold purpose of this research was to compile information about known cultural resources in and near the project area as well as to identify locations within the project area that might contain cultural resources.

Stubbs searched the SHPO archaeological sites database and maps in addition to the historic standing structures database and maps. She also located and photocopied relevant portions of previous investigators' CRM reports. She furthermore examined historic plat maps, historic mining maps, and early explorer's maps as part of this research.

Field - Archaeology

Field work commenced on November 7, 2002 and was completed on November 8, 2002. Donna Stubbs served as the field supervisor with off-site guidance by Dr. Amy Ollendorf for the field work. Field crewmembers included Erika Palmer, Dylan Eigenberger, and Brandy Stearns.

HDR's field methods followed the Minnesota SHPO's *Manual for Archaeological Projects in Minnesota* (Anfinson 2001). Divergences from these guidelines are described below. Field methods included pedestrian (surface) survey, shovel testing, and soil probing. USGS topographic maps and aerial photographs were used to determine areas for shovel tests and soil probes. HDR staff completed standard field notes, shovel test forms, and photo-documentation in the field.

Area 1

Subsurface testing was conducted to locate buried cultural deposits and to determine soil conditions in this area since surface visibility was inadequate. Shovel test diameters averaged 30-40 cm (12-16 in), whereas the soil probe has a diameter of 3.8 cm (1.5 in). Shovel tests and soil probes were spaced along the approximate centerline of each subsection at 20-m (65-ft) intervals. Shovel tests alternated with soil probes.

HDR staff excavated shovel tests to an average depth of 50 cm (20 in), whereas soil probes were excavated typically to 80 cmbs (31.5 in). Shovel tests were excavated in 10-cm (4-in) thick levels. Shovel testing ceased when subsoil was reached, or until the depth precluded further hand-excavation.

Sediments removed from the shovel tests were sieved through ¼-inch (6.4 mm) hardware mesh screens, while soil removed from probing was noted but not screened. All soil descriptions employed U.S. Department of Agriculture (USDA) soil terminology and Munsell color descriptions. Soil stratigraphy, locational information, artifact content, and other pertinent data for each subsurface test were recorded on standardized forms. Each subsurface test was backfilled after HDR documented its soil profile and attributes.

Area 3

Since surface visibility was adequate, HDR staff completed surface reconnaissance of the entire proposed excavation footprint in this area. The pedestrian survey was conducted at approximately 10 m intervals. Visibility within the plowed field was 100%, whereas visibility within the bean field was only 30-50%. Due to the comparatively low visibility in the bean field, crewmembers cleared a small portion of the ground surface at 10 m intervals until surface visibility reached 100%.

Field - Architectural History

Residential, commercial, and industrial standing structures were photographed within 0.8 km (0.5 mi) of the proposed landfill development (Area 1) and within 0.8 km (0.5 mi) of the proposed wetland creation (Area 3). The purpose of the photo-documentation was to assist the SHPO in the determination of whether or not to recommend a formal standing structures survey for the present project. Donna Stubbs completed the photo-documentation on November 8, 2002 and Daniel Pratt provided the narrative description in Appendix A.

Archaeological Results

Since HDR did not complete a formal architectural inventory of historic standing structures, this section describes only the results of the archaeological investigation. A brief architectural history narrative is provided in Appendix A to assist the SHPO in determining whether or not to recommend a formal inventory.

Area 1

The results of HDR's archaeological investigation of this area are summarized on a subsection by subsection basis. See the **Introduction** (above) for a description of each subsection.

Subsection A was a large dredge area. Three soil probes, with an average depth of 70 cm (26 in) and a maximum depth of 90 cm (35 in), were placed within the disturbed area at 50-m (164-ft) intervals to determine the presence of any intact soils (Figure 6). HDR staff encountered a pond at the end of the probe transect, linking Subsections A and B. Subsection A's soils consisted of mottled silty clay to silty sandy clay, with clay loam in some areas. The top 30 cm (12 in) consisted of very dark gray (10 YR 3/1) silty clay to silty sandy clay. From this depth to the bottom of the probes, the soils were very dark grayish brown (10 YR 3/2) silty sandy clay to sandy clay. No intact buried soils or cultural materials were noted in the soil probes in this subsection.

Shovel testing began with two transects on a north-south axis in the northwesternmost portion of Subsection A. Four shovel tests were completed on a 20-m-by-20-m grid (Figure 6). The average depth for the tests was 50 cm (20 in) and the maximum depth was 60 cm (24 in). Soils ranged from black (10 YR 2/1) silty loam to very dark gray (10 YR 3/1) clay loam to very dark grayish brown (10 YR 3/2) sandy clay loam within the top 10-40 cm (4-16 in), and mottled black to very black (10 YR 2/1) to very dark grayish brown (10 YR 2/1-10 YR 3/2) silty clay to very dark grayish brown (10 YR 3/2) clay loam below 40 cmbs (16 in). No intact buried soils or cultural materials were encountered in the four shovel tests.

Subsection B was a wooded area with heavy grass cover and leaf litter (Plate 1). Due to disturbed soils across adjacent Subsection A, HDR placed one transect on an east-west axis and one transect on a north-south axis through the center of Subsection B. Shovel tests alternated with soil probes every 20 m (65 ft) (Figure 6). The east-west transect consisted of six shovel tests with an average depth of 55 cm (22 in) and a maximum depth of 65 cm (26 in) and six soil probes with an average depth of 80 cm (31 in) and a maximum depth of 89 cm (35 in). The north-south transect consisted of six shovel tests with an average depth of 55 cm (22 in) and a maximum depth of 65 cm (26 in) and six soil probes with an average depth of 80 cm (31 in) and a maximum depth of 89 cm (35 in). Most tests in Subsection B contained high concentrations of shell (small bi-valve and snail) and gravel. Soils consisted of black to very dark gray (10 YR 2/1-10 YR 3/1) silty clay loam within the first 30 cmbs (12 in), transitioning to very dark grayish brown (10 YR 3/2) silty clay.

Shovel Test T4 220 produced a single piece of green plastic at 20 cmbs (8 in). The plastic fragment was noted but not collected. This shovel test was located within heavy tree-fall, and miscellaneous boards with nails were lying on the ground surface nearby. Since HDR crewmembers did not observe any indications of previous structures (i.e., no depressions or structural remnants, no former structures on plat maps), the boards with nails are interpreted as secondary deposits from springtime flooding of the Minnesota River.

Base Map Source: McCain & Associates

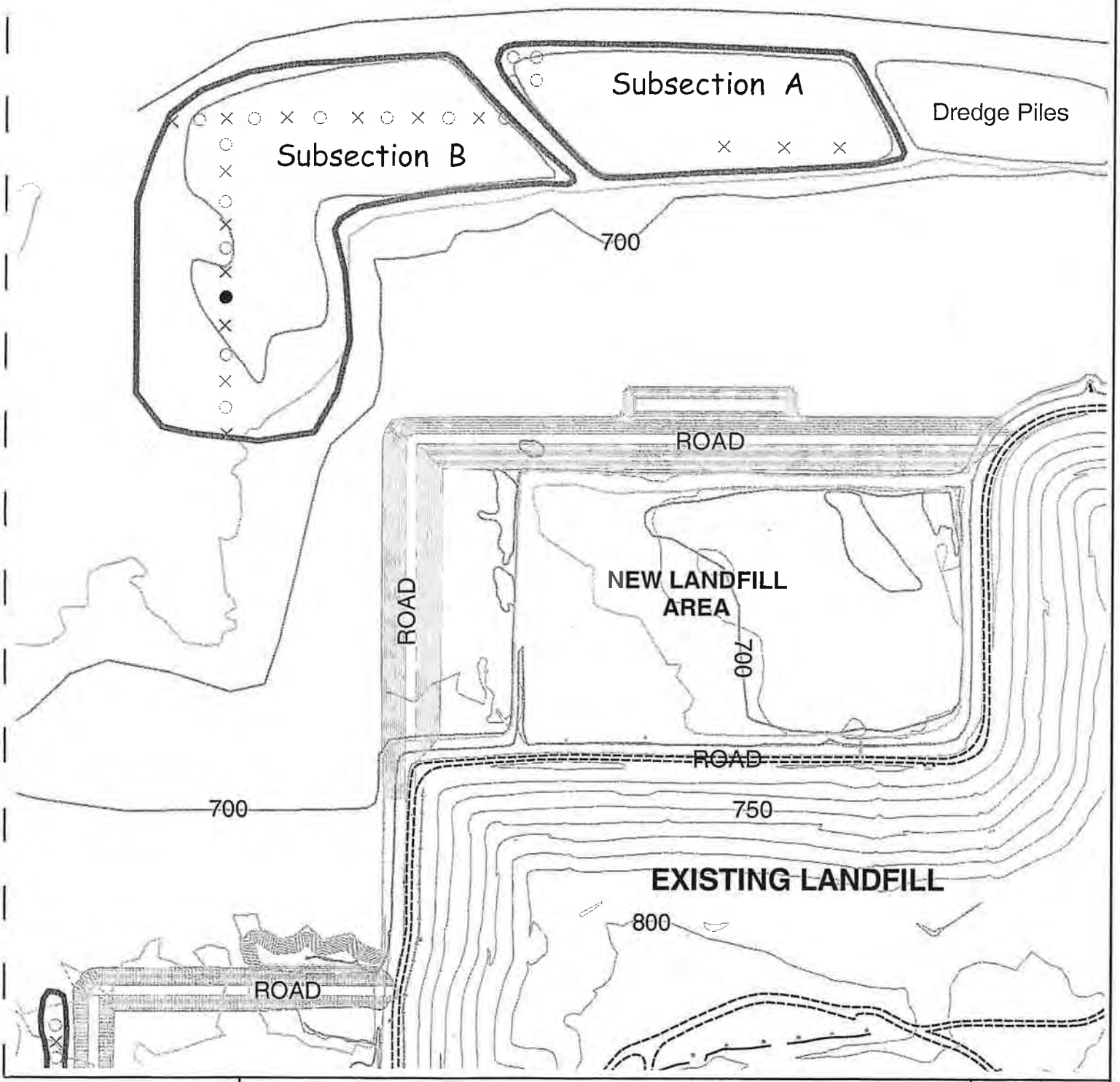
Legend

Archaeological Survey Subsections

Survey Type

× Soil Probe

○ Shovel Test



Feet

0 100 200 400

Area 1: Subsections A & B Survey Areas
Proposed Burnsville Landfill
Burnsville, Dakota County, Minnesota

HDR

GIS: DPS	Date:12/02/02
PM: AO	
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Plate 1. Overview of Area 1, Subsection B, facing north, showing ground cover.

Subsection C was a mixture of grassland and woods (Plate 2, Figure 7). Only two shovel tests and two soil probes were completed along a single north-south transect before HDR crewmembers encountered a wetland, at which time testing stopped. Both shovel tests reached 50 cmbs (20 in) and the soil probes ended at 35 cmbs (14 in) and 45 cmbs (18 in), respectively. Soils consisted of black (10 YR 2/1) sandy clay in the top 40 cmbs (16 in) and very dark gray (10 YR 3/1) silty clay with gravel near the base of each of the shovel tests. Previous geomorphological testing had encountered bedrock at a depth of 1.8 m (6 ft). High percentages of gravel and larger rock fragments were noted in the subsurface tests. However, no cultural materials were encountered in Subsection C.

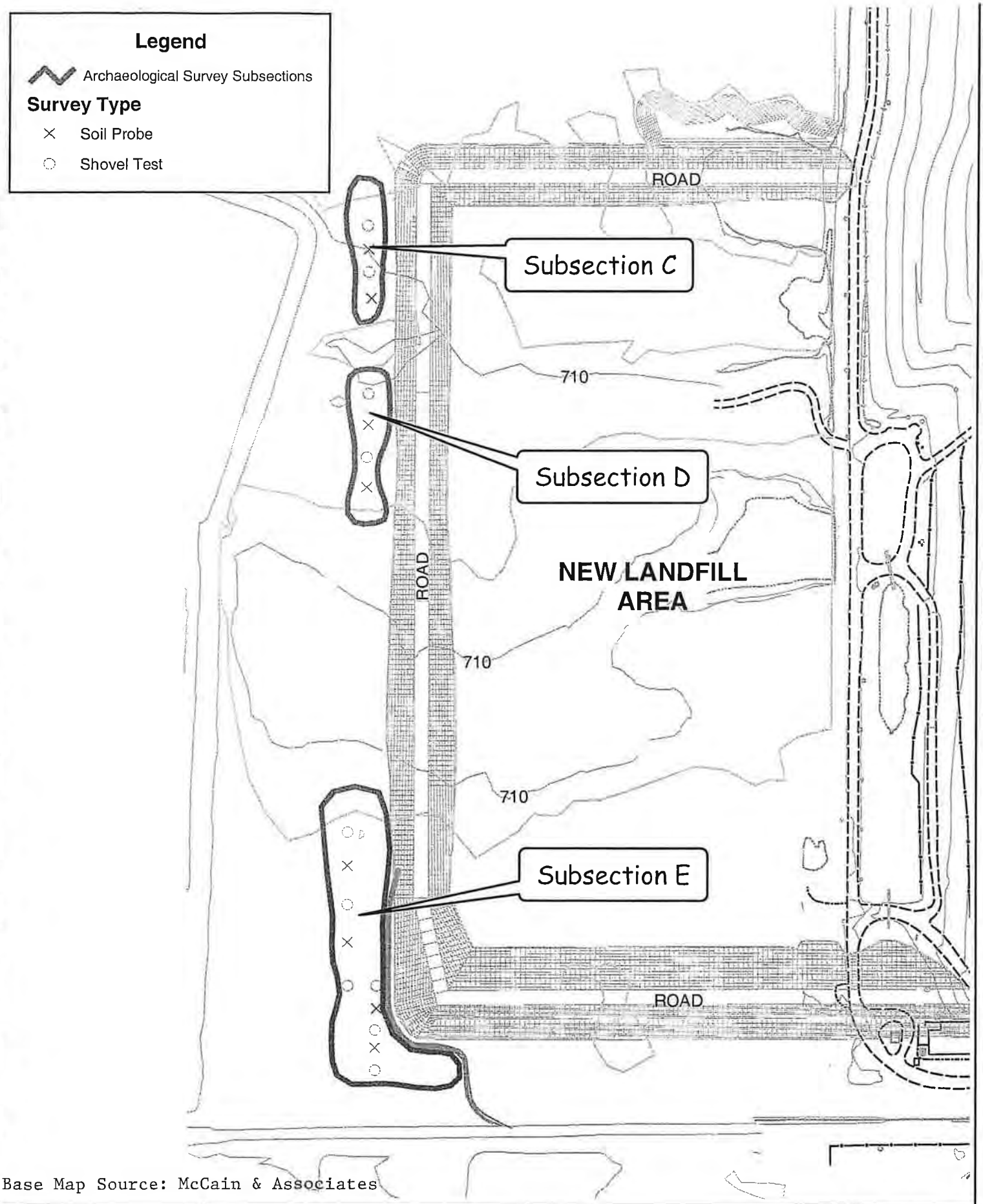
Subsection D was a mixture of grassland and woods (Plate 3, Figure 7). Two shovel tests and two soil probes were excavated along a single north-south transect. Shovel tests reached 40 cmbs (16 in) and 47 cmbs (19 in), respectively, whereas soil probes were excavated to 37 cmbs (15 in) and 52 cmbs (20 in), respectively. The depth at which large rock fragments and gravel made hand-excavation impassable determined the depth of the shovel tests and soil probes in Subsection D. Bedrock in the area previously has been documented at a depth of 1.8 m (6 ft). Soils in the area were extremely dark and organic, consisting mostly of black (10 YR 2/1) silty loam and very dark gray (10 YR 3/1) silty clay. No cultural material was observed in Subsection D.

Plate 2. Overview of Area 1, Subsection C, facing south, showing ground cover.

Subsection E was located near the railroad tracks within an area of dense buckthorn-shrub growth and many large rocks. Two north-south transects were placed in this area. The first consisted of three shovel tests and two soil probes (Figure 7). The second transect was offset 40 m (131 ft) from the first to follow the terrain. The second transect of subsurface tests also consisted of three shovel tests and three soil probes. Both types of subsurface tests were shallow because high gravel content in the soils and large buried rocks. The average shovel test depth was 40 cmbs (16 in) with a maximum depth of 50 cm (20 in). Soil probes reached an average depth of 40 cm (16 in) with a maximum depth of 76 cm (30 in). Soils generally consisted of black (10 YR 2/1) silty loam within the top 40 cm (16 in), then changed to a brown (10 YR 5/3) clay loam from 45 cm to 70 cm (18-28 in) and light gray (10 YR 7/2) sand from 70 cm to 76 cm (28-30 in). No cultural materials were observed in Subsection E.

Area 3

A corn and bean field, part of which had been plowed recently (Plate 4), characterized this area. No cultural materials or features were noted during the pedestrian survey in this area.



Base Map Source: McCain & Associates

Feet
0 75 150 300

Area 1: Subsections C, D, & E Survey Areas
Proposed Burnsville Landfill
Burnsville, Dakota County, Minnesota

HDR

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Plate 3. Overview of Area 1, Subsection D, facing north.

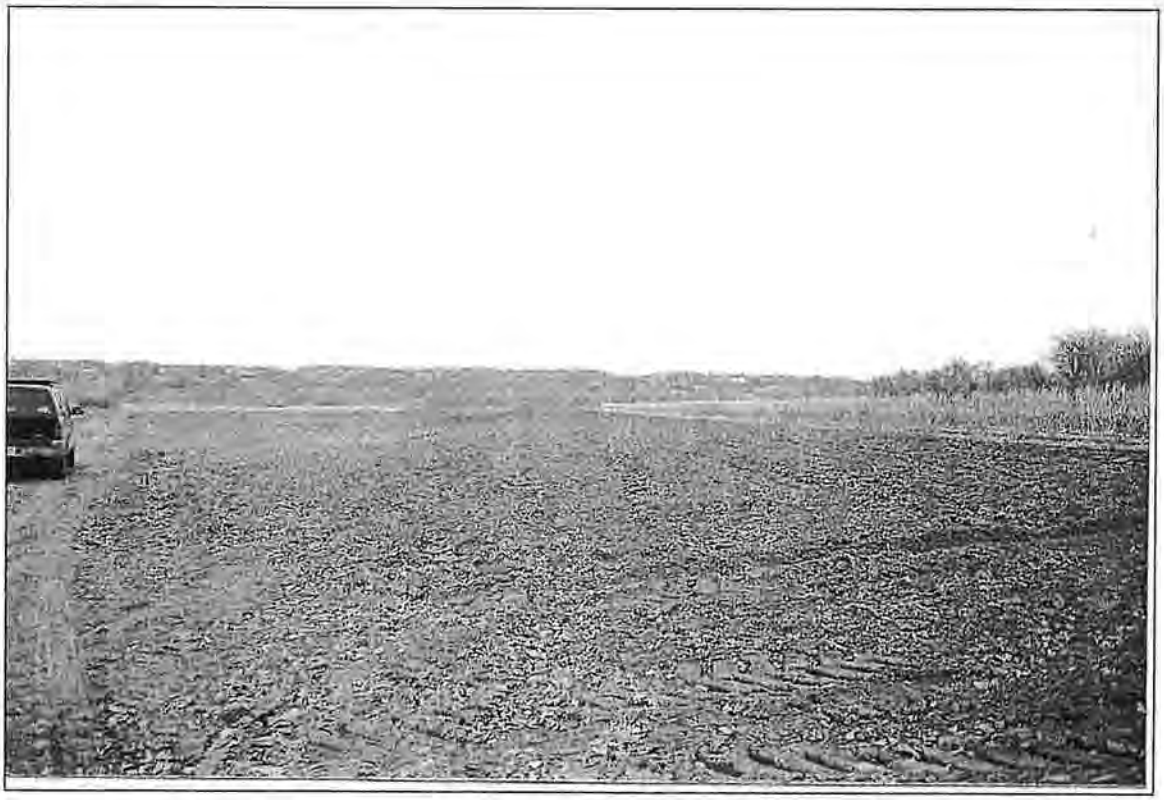

Plate 4. Overview of Area 3, facing northeast.

Conclusions and Recommendations

Excavations in Area 1 are planned to not exceed 91-cm (3-ft) depth. Shovel tests and soil probes extending 90 cm (2.9 ft) documented alluvial deposits. No cultural horizons were noted during the testing. In addition, a geomorphological assessment conducted independently by James Aiken of McCain and Associates indicated the depositional environment of Area 1 is similar to those found upriver from the project area within the Minnesota River Wildlife Refuge. In his estimation, the archaeological potential of Area 1 is low at depths greater than those attained by HDR's hand excavations. Based on HDR's investigation, further archaeological testing is not recommended in Area 1.

Area 3 is currently agricultural land with excellent surface visibility. Therefore, no subsurface testing was needed and the proposed impact areas were covered by pedestrian reconnaissance. Only ca. 0.4 ha (7 ac) will be directly affected by using plowzone soils to create berms around the northern perimeter of the site. No cultural materials were noted during the surface survey, and based on HDR's investigation of the area, no further archaeological testing is recommended in Area 3.

Plate 5. Another Overview of Area 3, facing north.

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Appendix A. Standing Structures

Area 1

Industrial buildings immediately adjacent to Area 1 include the Cargill Co. Port Facility to the west; commercial buildings (numerous small businesses) are south of Area 1 and the existing landfill. State Highway 13 is flanked by numerous large commercial establishments, such as Menard's, Cub Foods, and McDonald's (ca. 1970 - 2000), and small establishments such as a locally-owned car wash and furniture store (ca. 1970 – 2000). There are no residential buildings on State Highway 13 within 0.5 miles of the project area. There is a recently constructed (late 1990s) apartment complex on Chowen Avenue, south of State Highway 13.

The only older residential structures within view of the proposed landfill development are five Ranch-style houses located on 124th Street West (Figure 1). On the basis of general style and construction, these houses date from ca. 1955 - 1965 (Plate 6). Since they are not associated with significant historical contexts (NRHP Criterion A), do not embody historically significant design or construction methods (Criterion C), and do not meet the 50-year age threshold for historical significance specified by the NRHP, these buildings are not eligible for listing in the NRHP.

The other the Ranch-style residences on 124th Street West are screened from the proposed landfill development by apartment buildings and existing commercial development along State Highway 13. Adjacent neighborhoods in the City of Savage are likewise screened from visual impact by intervening commercial development on State Highway 13. Thus, no historic properties will be physically or visually impacted by the proposed landfill development.

Area 3

There are no structures within 0.5 miles of Area 3. A possibly historic field road runs along the eastern edge of the area, but will not be impacted by the construction of the wetland. No potentially eligible NRHP properties will be physically or visually impacted by the proposed wetland creation.

Plate 6. Typical Ranch House at 4009 124th Street West.

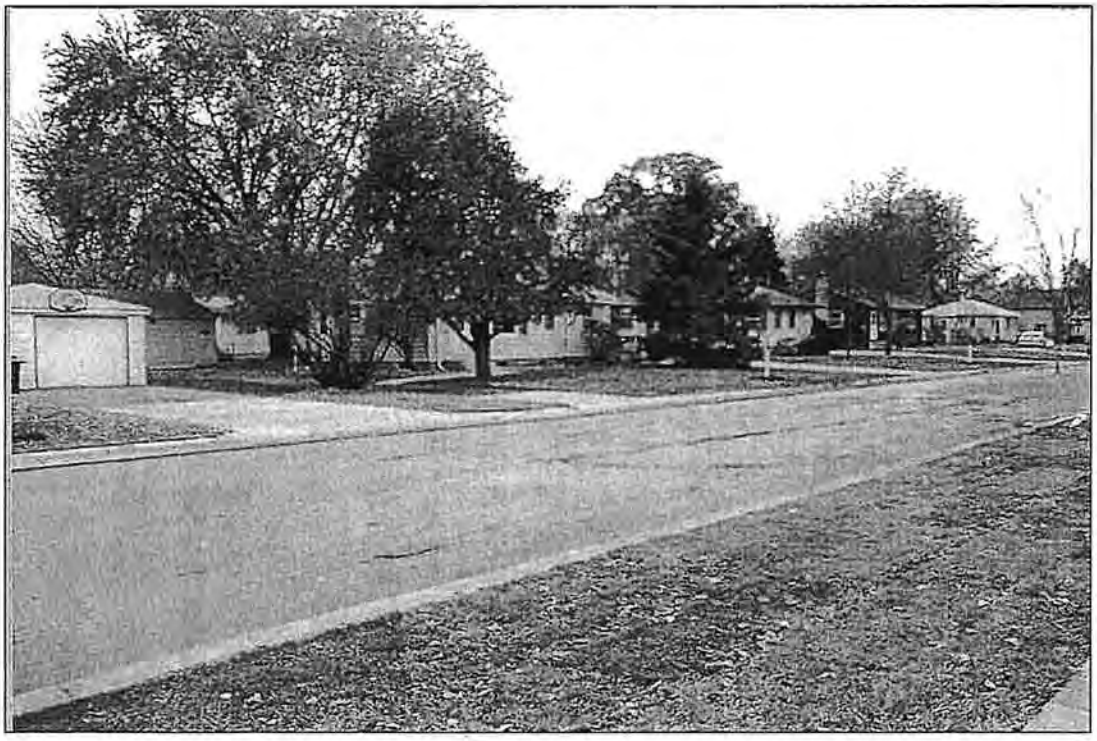

Plate 7. Ranch Houses on South Side of 124th Street West.

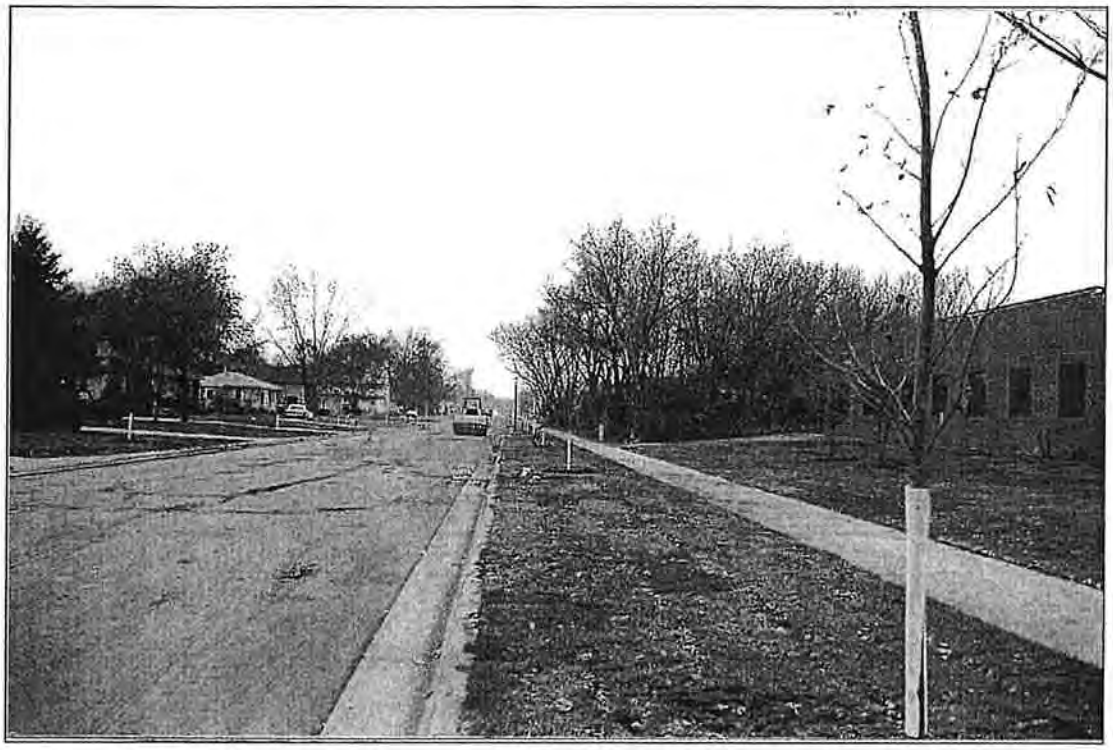

Plate 8. Apartment Building Screening Visual Effects of Proposed Landfill Development – North Side of 124th Street West.

Attachment M

Transcript of Public Comments from BSL DSEIS Public Meeting

PUBLIC COMMENTS

WEDNESDAY, JUNE 23, 2021

7:00 P.M.

Minnesota Pollution Control Agency - Draft Supplemental Environmental Impact Statement (DSEIS) for Burnsville Sanitary Landfill (BSL) Meeting

Meeting held remotely via:

Webex

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MR. KIRK KOUDELKA: Well, thank you, everyone. I know it's a nice night outside, I appreciate you spending the time with us today. Hopefully you're here for the Burnsville Sanitary Landfill Supplemental Environmental Impact Statement meeting.

My name is Kirk Koudelka, and I'm just going to welcome you here. I'm Assistant Commissioner at the Minnesota Pollution Control Agency, and just give out a couple high-level remarks, and then send it over to Steve Sommer, who is going to lead most of the conversation this evening.

So for those that may be following along, we've had a number of meetings this summer regarding solid waste in the Metropolitan area, and so we have a couple meetings that we've had. Each year, 3.3 million tons of waste are generated in the Metropolitan area. That's about a ton per person that we create. So we've been having a series of conversations with individuals and in communities on how do we handle that.

Some of the earliest conversations were around our Metropolitan Solid Waste Policy Plan, which really looks at what do we do with the waste

that's created in the Metro area, how do we do waste prevention, how do we do recycling, organic? And then when there is something that does need to be disposed of, how do we handle that, either waste energy or landfill need.

Last week we had a conversation about when we do get to that choice and the waste has now gone to those areas, what landfills in the Metro area would be receiving that waste, and that's the certificate of need process.

And then if we keep going down and funnel down to even more specific, tonight's meeting is about the Burnsville Sanitary Landfill owned by Waste Management in Burnsville, and we'll be doing the environmental review impact statement conversation.

This is a document, really, to get us to collect information for decisionmakers on a number of decisions that have to occur on the state and local permitting process moving forward.

Just one last thing before I send it over to Steve, we are recording the meeting this evening. I just want to make folks aware of that so that we can post it later. We've had a few requests for people wanting to be able to see who couldn't make

the meeting tonight. So with that, welcome.

And Steve, do you want to introduce yourself and take it on -- in from here?

MR. STEVE SOMMER: Thank you, Kirk.

I'm Steve Sommer. I work with the MPCA Environmental Review Unit, and I'm the project manager for the Burnsville Sanitary Landfill Draft Supplemental EIS, which we're going to be talking about tonight.

And the next thing we're going to do in a moment is we're going to play a presentation, a PowerPoint, and it's going to go over the environmental review process and the major findings of the draft EIS and explain Burnsville Sanitary Landfill's project in a little detail. After that we're going to open up the meeting to the public comments and questions.

So with that, I'm going to start the PowerPoint.

(Presentation playing.)

MR. STEVE SOMMER: Hello, my name is Steve Sommer of the Minnesota Pollution Control Agency. I am the project manager for the Burnsville Sanitary Landfill Draft Supplemental Environment Impact Statement. For this presentation, I will be

referring to the Draft Supplemental Environmental Impact Statement as the DSEIS.

This presentation will provide the following: A summary of the state's environmental review process, both generally and as it pertains to BSL's project, a brief description of BSL's proposed project, a discussion of the major findings of the DSEIS, a summary of the presentation, and an explanation of how you can provide the MPCA with your comments on the DSEIS.

Environmental review analyzes the environmental impacts associated with a project and explores methods to mitigate them. The information gained through environmental review is used by decisionmakers as a guide in issuing, amending, and denying permits for a project.

Environmental review does not approve a project or ensure that it will not have an environmental impact. The purpose of an environmental review is to provide information about a project to the public and decisionmakers.

There are two main types of environmental review. The first type is called an environmental assessment worksheet, or EAW. The second type is called an environmental impact statement, or EIS.

The following are the major differences between EAWs and EISs: EAWs are shorter and less detailed documents than EISs. EAWs are done to determine if a project has the potential for significant environmental effects, and if so, it would result in the recommendation that an EIS be prepared for the project.

EAWs do not include the scoping process, but EISs do. Scoping reduces the size of an EIS so that it only covers the potentially significant environmental impacts of a project.

EAWs do not analyze alternatives to a project, but EISs do. The EIS alternatives analysis must at least include an environmental analysis of not building the project, also called the no-build option. But it may also include analysis of additional alternatives, like a smaller project or building a project in an alternative location.

EAWs do not investigate socioeconomic impacts, but EISs do. Socioeconomic impacts mean impacts on things like recreational resources, jobs, and the economy.

An EIS is being prepared for BSL's proposed landfill expansion project because the project would be an expansion of a mixed municipal

solid waste disposal facility which exceeds the mandatory EIS threshold in state rules which requires preparation of an EIS for an expansion by 25 percent or more of previous capacity of a mixed municipal solid waste disposal facility for 100,000 cubic yards or more of waste filled per year.

The BSL draft SEIS and final SEIS supplement an EIS that the MPCA prepared for BSL in 2005, and that's why it's called a supplemental EIS.

The DSEIS public comment period began on June 1st and will end on July 31st. Following the DSEIS public comment period, the MPCA will do the following: Respond to public comments on the DSEIS and prepare and publish a final BSL SEIS.

The public will have ten business days to comment on the adequacy of the final SEIS. The MPCA Commissioner will then make a determination of adequacy of the final SEIS.

The final SEIS will be determined to be adequate if it meets the following three criteria: One, if it covered all the issues required by the BSL SEIS final scoping document; two, if it responded to all substantive public comments on the draft SEIS for the scoped issues; and three, it followed the state's administrative rules for the

EIS process.

If the SEIS is determined to be not adequate, the MPCA must prepare an adequate EIS within 60 days. If the SEIS is adequate, the EIS process is done and final project approvals and permits can be issued. I want to note that no final project permits and/or approvals can be made prior to the completion of the SEIS process.

This slide shows a map of the location of the BSL. BSL is located on the south side of the Minnesota River, west of I-35W and north of Highway 13 in Burnsville.

This slide shows an aerial view of the existing BSL site and adjacent facilities. The BSL is shown at the bottom of the photo. The Kraemer Quarry, freeway landfill, and freeway dump are located east of BSL.

I am now going to point out some key features of the current BSL site and the Kraemer Quarry site as we will be discussing those in upcoming slides.

Let's talk about BSL first. The BSL site includes both the original unlined, open dump area from 1962 and the newer solid waste disposal area which meet current landfill design requirements to

include a liner and leachate collection system.

This area in red I'm showing (indicating) is the area that is originally the unlined waste area, and the area here (indicating) is the current area that is being used to dispose of waste, and it includes a liner and leachate collection system.

Again, the unlined area doesn't include a liner/leachate collection system because it was developed before federal rules required such a system. The unlined waste area is now closed and capped with clay or a synthetic membrane.

Let's move on now to the Kraemer Quarry. The Kraemer Quarry is used to mine limestone. In order to do that, it must pump out groundwater that seeps into the area that they are mining, otherwise it would become underwater.

Pumping groundwater at the quarry lowers the water table both at the Kraemer Quarry and in the adjacent areas, including the area of BSL's buried, unlined waste.

This slide shows the history of the BSL site. As I mentioned previously, in 1962 the facility, which is currently BSL, began as an open, unlined dump. In 1971, the MPCA issued the first solid waste permit to BSL.

In 1992, BSL stopped disposing solid waste in the unlined waste cells. In 2005, BSL proposed an expansion of its mixed municipal solid waste disposal capacity, and the MPCA in response prepared an EIS in 2005 for that proposed project.

In 2011, BSL's current solid waste permit was issued, which allows them to dispose of mixed municipal solid waste, industrial waste, and construction and demo debris.

In 2019, BSL proposed an expansion of its mixed municipal solid waste capacity, and the MPCA began the current process of preparing the BSL supplemental EIS. While -- the supplemental EIS means that this EIS is supplementing the 2005 EIS. In 2021, where we're at now, we put out for public comment the draft version of the BSL SEIS.

The following slide is an overview of BSL's proposed project. The project would increase BSL's permitted mixed municipal solid waste disposal capacity by about 23.6 million cubic yards. It would result in a taller landfill by approximately 262 feet at peak height. It would actually reduce the footprint of the solid waste disposed at the facility site from 216 total acres down to 204.

It would still remain outside the

100-year floodplain of the Minnesota River. It actually is pulled back from the floodplain compared to what is currently permitted at the facility, and it would extend the operating life of the mixed municipal solid waste of the landfill by about 40 years. So it should allow them to operate to approximately the year 2062.

This slide shows BSL's current and proposed waste disposal footprints. The black line shows BSL's property boundary, the blue-dashed line shows the area in which BSL is currently permitted to dispose waste. The most northerly part of this area is called the north development area, or NDA, and that area is not developed yet.

The red-dashed line shows the area in which BSL would like to be permitted to dispose waste as part of its proposed project. The northwest part of the area is called the annex development area, or ADA, and it is currently undeveloped.

The proposed expansion would involve modifying the currently permitted waste limit by eliminating all but the southern-most portion of the NDA and instead developing the ADA. This would result in a decrease in total waste disposal area at

BSL from 216 down to 204 acres.

Okay. Now we're going to move on to the major findings of the draft SEIS, and we'll start with groundwater impacts. Groundwater monitoring has been conducted at BSL and has not identified any landfill impacts to groundwater quality.

However, during permitting, BSL will be required to update its groundwater sampling and analysis plan to include current standard parameters and monitoring limits because the solid waste permit is ten years old. And that would include an evaluation during the permitting process of whether or not to have monitoring and limits for PFASs and 1,4-Dioxane.

In this slide I will discuss the impacts on BSL from the Kraemer Quarry and BSL's proposed project impacts to groundwater. With respect to the Kraemer Quarry, as I discussed earlier, the quarry pumps out groundwater from its limestone pits to keep them dry. If the quarry was to cease this pumping, the groundwater table would rise in the surrounding area, including at the area of the BSL's old unlined waste.

This would result in the groundwater under the unlined waste rising up and coming into

contact with the unlined waste. The impact of this unlined waste and groundwater coming into contact with one another is currently unknown, at least partially because it depends on how the Kraemer site and the surrounding area are redeveloped in the future and those plans have not been finalized yet.

In order to gain more information about this issue during solid waste permitting of the project, the MPCA will be considering what additional groundwater monitoring should be required of BSL.

It is important to note that the Kraemer Quarry operation and any changes in groundwater pumping there are completely separate from BSL's proposed project, but they were included in the DSEIS because of the potential impacts on groundwater quality in the area.

Moving on now to the potential impacts of BSL's actual proposed project, the DSEIS determined that the project is not expected to adversely impact groundwater quality. This result is based on the fact that the project would not change the groundwater levels or impact the existing unlined waste at BSL.

The project would have one potential

indirect impact on the unlined waste. If it was ever determined that BSL's unlined waste must be dug up for some reason, it would make it more difficult if additional waste associated with the proposed project was placed on top of the existing unlined waste.

This slide discusses the DSEIS findings on drinking water supplies in the area, both at the Kraemer Quarry water supply and at nearby wells. Part of the Kraemer Quarry site includes a drinking water supply for the cities of Burnsville and Savage. The DSEIS reviewed information on the quality of this water supply and determined that it has not been adversely impacted by the landfill. In addition, the BSL's proposed project is not expected to have any adverse impact on the quarry water supply in the future.

The DSEIS also reviewed the project's potential impacts to water supply wells in the area and has determined that the project is not predicted to adversely impact water supply wells.

This slide discusses the DSEIS findings related to how storm and flood events would impact the project itself and how the project would impact storm water runoff from the BSL site. The DSEIS

analyzed impacts from two- and ten-year storm events and determined that they would not result in adverse impacts on surface water runoff from the project site.

In addition, the DSEIS analyzed impacts from a 500-year flood event and determined that it would result in adverse erosion-related impacts to both BSL as it is currently permitted and as it would be permitted for the proposed landfill expansion project.

Impacts from an extreme flood event, such as a 500-year flood, could be mitigated by redesigning the project to have a larger surface water control system and by upgrading BSL's emergency response plan.

The DSEIS also assessed the project's potential to impact nearby wetlands. The DSEIS determined that the project would result in a decrease in the acreage of wetland disturbance from 29.6 to 29 acres and that the project would not adversely impact those wetlands.

This slide discusses the DSEIS findings related to the liner and leachate collection system for the proposed project. The DSEIS determined that the project would result in a liner and leachate

collection system that meets applicable state and federal requirements which are designed to be protective of the environment.

The liner and leachate collection system would be made of a geomembrane layer and a clay layer, and it is expected to last in the order of hundreds of years.

The DSEIS analyzed the impact of Minnesota River flooding on the liner and leachate collection system. It determined that under normal river flow conditions no adverse impacts are expected. Under 500-year flood event conditions, adverse impacts are predicted with or without the project.

Surface water impacts include river water overtopping the landfill's flood levy, erosion of the levy, and instability of the levy. Mitigation measures could include adding sandbags to the levy to prevent river water from inundating the liner and leachate collection system.

Another potential impact from a 500-year flood event is that during the time from initially placing the liner at the landfill to the time it becomes covered with some waste, the liner could be damaged from groundwater uplift from beneath the

liner during flooding conditions. Mitigation could include placement of additional soils in the cells and increase pumping of the Kraemer Quarry during this period.

This slide discusses the DSEIS findings related to visual impacts from the proposed project. The DSEIS determined that the project would result in a 262-foot-taller landfill that would be more visible than is currently permitted. The DSEIS includes renderings that show how the increase in landfill height would affect views from a number of different vantage points.

The DSEIS included modeling of the intensity of lighting from the project and determined that it would not result in an adverse impact because the use of nighttime lighting is limited and its intensity would not increase with the project.

This slide discusses the DSEIS findings related to air quality impacts from the proposed project. The DSEIS included air dispersion modeling of the proposed project and its potential to impact air quality. The DSEIS and the associated air dispersion modeling determined that the project would meet all applicable air quality regulations

that would not result in an adverse impact to air quality.

This slide discusses the DSEIS findings related to the project's potential impacts on climate change. The DSEIS found that the project would result in an increase in greenhouse gas emissions at BSL. The impacts from these increased emissions would be mitigated by BSL by capturing a portion of its landfill gas and combusting it to make electricity.

This process would mitigate climate change in two ways. One, the combustion of methane would change it to carbon dioxide, which is a less powerful greenhouse gas. And two, the production of electricity at BSL would reduce its electrical demand on other sources of electricity that use fossil fuels.

The MPCA can quantify greenhouse gas emissions from the project, but it is not yet possible to quantify the specific project impacts on climate change.

This slide discusses the DSEIS findings related to the project's potential sociological impacts. The DSEIS determined that the project is not expected to adversely impact the following:

One, the usability of existing nearby recreational resources, or two, the safety of aircraft flying over BSL due to bird-plane interactions.

This slide discusses the DSEIS findings related to the impacts of increased recycling and preprocessing rates in the Twin Cities Metropolitan area on BSL's proposed project. The DSEIS determined that if recycling and preprocessing rates were to increase and meet the state of Minnesota goals that BSL's proposed expansion could be smaller in size and height.

For example, if the 75 percent recycling rate goal was to be achieved, the landfill's expansion could be reduced from 23.6 to 11.9 million cubic yards. This would also reduce the peak height of the landfill from 1,082 to 862 feet above mean sea level.

This slide discusses the DSEIS findings related to the impacts of the BSL project map being approved. The DSEIS determined that if the BSL project were not approved, that BSL would need to stop accepting mixed municipal solid waste in a few years. In that case, the waste that would have went to BSL for the project would instead go to the Pine Bend landfill in Inver Grove Heights and to the

Central Disposal Landfill in Iowa.

This slide discusses the DSEIS findings related to the economic impacts of BSL's project not being approved. The DSEIS determined that if BSL's project is not approved that the waste would flow to the facilities mentioned in the previous slide, and that there would be an adverse impact to the city of Burnsville, Minnesota; Dakota County; and the state of Minnesota. There would also be positive economic impacts to the city of Inver Grove Heights; Lake Mills, Iowa; Winnebago County, Iowa; and the state of Iowa.

In this and in the following slide, I will summarize the information that I have presented. BSL's project requires environmental review in the form of a supplemental EIS, otherwise known as SEIS. The SEIS process does not approve or deny the project, but instead provides information on the project's impacts and potential methods to mitigate those impacts.

The information in the SEIS will be used during the permitting phase of the project. The draft SEIS is on public notice from 4:30 p.m. on July 31st, 2021. This means that the MPCA will accept your written comments on the DSEIS up until

that time. Any comments that you make during the meeting tonight are considered written comments because they will be recorded by a court reporter who will turn them into a transcript of the meeting.

Following the draft SEIS public comment period, the MPCA will prepare and publish the final SEIS. The final SEIS will include a response to the public's written comments on the draft SEIS. The final SEIS will include a ten-day public comment period on its adequacy.

The MPCA Commissioner will then make a determination of adequacy on the BSL final SEIS. If it's not adequate, the MPCA has 60 days to prepare an adequate SEIS. And if it is determined to be adequate, then the final SEIS process is done and permitting may continue. Final permits and approvals cannot be made prior to the MPCA's SEIS determination of adequacy.

This slide explains how you can provide your comments on the draft SEIS. Please provide your written comments to me, Steve Sommer, by 4:30 p.m. on July 31st, 2021. And, again, only written comments will be responded to. I can be contacted via e-mail at Steve.Sommer@state.mn.us, or via regular mail at 520 Lafayette Road, St. Paul,

Minnesota 55155.

Again, any comments that you provide to the court reporter at tonight's meeting are considered written comments since they will appear in the transcript that will be made of this meeting.

This concludes my presentation. Thank you for attending tonight's meeting.

(End of presentation.)

MR. MATT CROASTON: All right. We'll now shift to the comments and questions portion of the meeting. To do so, we have a number of technical staff on hand tonight to help answer questions. So if you're interested in making a comment or asking a question, all you do is simply go to the bottom of your screen, there's a smiley face icon, you can either click on that and click the raise hand function, or find your name or phone number in the participants list and raise your hand that way, and we will go through and make sure we get to everybody. So why don't folks -- we'll open up to public comments right now.

Jamie, why don't you go ahead.

MS. JAMIE BOJADO: Yes, hello. Thank you. My question has to do with exceeding state -- current state rules, I didn't see that in that

report, what the difference in that is. And I'm curious about how the secular research is conducted.

My main concern with the -- with this expansion of the landfill is property values for the neighboring communities. I'm worried about Burnsville making money at the expense of property owners, and the health equity of residents, as well as the water issues and the water table in general.

So I saw that in the research that they had written about in Pennsylvania that property values weren't affected during the planning process. Was that -- is this -- this is like your comprehensive report, correct?

MR. STEVE SOMMER: This is Steve Sommer, and this is our environmental impact statement that does cover all the items that were required to be covered in the draft -- or excuse me, the scope. We went through a scoping process and had a public participation process with that. And yes, this is one of the elements that was brought up during the scoping process, and this is the information that we found, correct.

MS. JAMIE BOJADO: So I am worried about the environment -- or property values only during the planning process, or is it more of a concern of

the actual build?

MR. STEVE SOMMER: We looked at the information that was available for any of the facilities, landfills with mixed municipal solid waste, and it wasn't just narrowed down to -- like you said, it was just what information was there. There was a limited amount of information out there, so we used what was available.

And of course we didn't -- and it's almost impossible to find a one-to-one correspondence between what BSL wants to do with its project and another project in a different area, but we used the best information available to us.

MS. JAMIE BOJADO: Just taking a moment, the impacts said two percent effected of the lowering of property values with a smaller landfills to (indiscernible) --

MR. STEVE SOMMER: You were kind of cutting out, but you mentioned, I heard two percent property value change, but you did want to add more to that?

MS. JAMIE BOJADO: Two percent of decreased property value within the five-kilometer radius of taller landfills. This landfill is expected to exceed state guidelines for existing

landfills. The data that I found (indiscernible).

MR. STEVE SOMMER: Yeah, again, the information --

THE REPORTER: Jamie, this is -- Jamie, this is Christine Simons, I'm the court reporter tonight. You were -- your line was cutting out again.

MS. JAMIE BOJADO: Oh, I apologize.

THE REPORTER: That's okay. You were talking about, this landfill is expected to exceed guidelines, and then it cut out on my end, if you could repeat that part. Thank you.

MS. JAMIE BOJADO: Sure. So the two percent decrease was in -- was to refer to smaller landfills, and then the 12.9 percent decrease was in a diameter of five kilometers from the -- that's what the data is that I found, from -- five kilometers from the larger landfill.

I would say, and I think you would agree, that this would count as a larger landfill, especially since it exceeds the state -- current state requirements for landfills.

MR. STEVE SOMMER: I'm not -- yeah, I do agree that there is a difference between the proposed project at BSL, and the information that we

were able to find. I mean, there's never going to be -- like I said, whatever happens somewhere else isn't going to have all of the same factors associated with it as this one, and yes, there definitely is a difference, so --

MS. JAMIE BOJADO: That is where a lot of these "expected to," you're not expecting to have issues with air and water pollution because you aren't able to find a one-to-one ratio to this landfill specifically?

MR. STEVE SOMMER: No, that's a different issue. I was speaking purely to the economic issues for -- with respect to property values. So that, there is no way we could tell exactly what will happen to property values in the area surrounding BSL based on other reports of other landfills. So therefore, we can't do that, so that's what I was speaking to.

With respect to environmental impacts of the BSL, we looked in detail for the impacts to groundwater, surface water, air quality, et cetera, and we had data that was specific to BSL, so there is a one-to-one correspondence there.

It's not just looking at some other landfill and saying, well, if groundwater wasn't

affected there in Pennsylvania, so it shouldn't be affected here. No, that's not what we did. We used actual monitoring data and predictive modeling to come up with the impacts that we expect from this landfill.

MS. JAMIE BOJADO: Okay. And I also wanted to ask, what is the financial assurances that you have reserved in your plan? And how exactly is a deal with the poisoning of water and air in the local area?

MR. STEVE SOMMER: Okay. With respect to financial assurance, that's a permitting-type question, and the EIS does not go into that. There is a public participation process with the solid waste permitting if the project does move forward. And, again, this EIS doesn't say, yes, you can go forward with the project, it just provides information.

But when the time comes, as the project moves forward, there would be a solid waste permit, and there will be a public participation where you can bring up your questions regarding a financial assurance. But we did not look at that in the EIS because it wasn't part of what was scoped into this through the public participation process.

And then could you repeat your other part about pollution? I think I want to make sure I'm clear on what you were saying.

MS. JAMIE BOJADO: So with other research about, basically, pollution is that the landfills, especially larger landfills, like, such as this, where it found for neighboring residents cancer, low birth rates, and birth defects. Who would be responsible in the case that these were an issue after this build?

MR. STEVE SOMMER: Yeah, that isn't something that the EIS process looks at and didn't look at, and so I'm not able to answer that question. But if you want to -- you know, also think about what you said and try to provide it with some more information than I can provide tonight.

MS. JAMIE BOJADO: Okay. Because I did read in there that the scoping decision, where assessed in the context of whether said impacts would result in disproportionate exposure to -- and no -- to pollution, and that you did not -- that the assessment indicated no such disproportionate exposures. So that was what my question was, it's under 1.4 Environmental Justice.

MR. STEVE SOMMER: Right. We did take a

look at, as you said, if there was any disproportionate impacts to environmental justice areas of concern, which people call -- or well, actually in this particular case, I was talking more broadly.

But in this particular case the BSL did a census tract that is considered low income, and therefore, we looked at the impacts of the lens of environmental justice. And the actual impacts that we did find were more widespread and not disproportionately going to impact the environmental justice community.

MS. JAMIE BOJADO: So you're speaking in relation to color of skin and, like, wealth versus wealth equity?

MR. STEVE SOMMER: Yeah. In this case what we were looking at with environmental justice, the area, as I said, of the Burnsville Sanitary Landfill is considered an environmental justice area of concern because it is considered a lower income area.

It's got 40 percent of the median income for a house -- 185 percent of the median household -- 40 percent of the people in that census tract are below 185 percent of the median income of

the area, so that's why it's an environmental justice area.

And like I said, we looked at whether or not any impacts were disproportionately going to fall on the EJ community, and we did not find that to be the case.

MS. JAMIE BOJADO: So the cancer, low birth rates, and birth defects are not included in the report because -- associated with the larger landfills because they don't have to do with economic status or race?

MR. STEVE SOMMER: No. You're talking about cancer or any other potential negative health consequences. We looked at, not cancer per se, or any particular health impact. Specifically what we looked at was, for instance, with water quality and what, if any, impact the landfill had on groundwater. We looked at what particular pollutants were being detected by the groundwater monitoring system, and we compared them to applicable regulatory thresholds that are meant to be protective of health.

So if a facility is able to show that they actually meet the regulatory standards that are protective of health, and it's implied that it's not

known to be something that would cause the negative impacts that you're talking about.

MS. JAMIE BOJADO: Okay. So if I'm understanding this correctly, you used the data that you have available from the existing landfills to create this document for the speculative research for the future landfill?

MR. STEVE SOMMER: We used -- part of it was, as you state, we used information from the specific site, like again, going to the groundwater example. The facility has groundwater monitoring wells, both up-gradient and down-gradient of the site. So as water -- groundwater crosses through the site, we can see if there's any impact of the ground -- you know, if the groundwater is potentially coming into contact with any waste, and so that was real data of that real site.

And then in addition to that, we also did predictive modeling of where the groundwater would move if there was a change in the pumping at the nearby Kraemer Quarry and what impacts that might have on groundwater quantity, flow, direction, and quality.

So it's a number of different pieces of information. There's a lot of lines of data that we

use to come up with what we -- or in our findings, it wasn't just one thing.

If you look at the references section of the EIS you'll see the documents that we relied on, and that should give you a better idea of, like, the amount of information that was looked at in this EIS to come to the conclusions that we come to in the draft version of the EIS.

And, again, I want to point out, this is just the draft. We're not at the final stage yet. So if we missed something, that's what we're here tonight to hear about. If you think we missed something, we want to hear your comments. So that if you think we need to go back and do something more, we can do it.

However, anything that we do needs to be -- follow whatever was already scoped out back in 2019. So we're not going to change the scope now, but if you feel like we didn't do what the scope required us to do, then we would certainly want to hear that comment.

And I want to make sure, you know, you understand the difference. We're not going to expand the scope of what was required, but if you think we didn't do what was required by that final

scoping document, that is what we want to hear comments about tonight and through July 31st.

MS. JAMIE BOJADO: Okay. I definitely think that the research on property values was woefully incomplete and is insufficient, or just really poorly executed, I'm not sure which.

And then I was a little confused about the percentages of recycling because it did have a point in there about how much recycling was possible and then other quotes later on about the percentages. And I wasn't sure if it meant the percentage of the public or the percentage of the total amount that is recyclable or the percentage of total garbage and waste in general.

I just felt like that could be more specific to address and, you know, work with the community to make these landfills safer for citizens, as well as lucrative for our city.

MR. STEVE SOMMER: Yeah, that's a very good comment, and we will -- we have that recorded, and I will respond to that comment in the response-to-comments document that will be associated and attached to the final EIS, so I will respond to that.

MS. JAMIE BOJADO: And just lastly, the

health equity is, like, probably the highest-in-priority issue for everyone. And I know that you detailed extensively about the pollution of the air and water and the things and how much that would be scientifically, but tying that in with the health effects I think is crucial to have everyone be on the same page of what exactly we're talking about and how this directly impacts the community for environmental justice areas.

And then also, I'm guessing this socioeconomic data mentioned earlier, those issues as well because I know that those will definitely effect the community in those ways, so thank you.

MR. STEVE SOMMER: Thank you.

MS. JAMIE BOJADO: I look forward to reading the completed version.

THE REPORTER: And Jamie, before -- Jamie, before you hang up, I want to make -- this is Christine, the court reporter. I can see on the screen, but --

MS. JAMIE BOJADO: Yeah.

THE REPORTER: -- is your last name, Bojado, B-O-J-A-D-O?

MS. JAMIE BOJADO: Bojado, yes.

THE REPORTER: Okay. Thank you.

And then for future commenters --

MS. JAMIE BOJADO: Is that a question?

THE REPORTER: And then for future commenters, if you could just state and spell your name for the record that would be very helpful. Thank you.

MS. JAMIE BOJADO: My name is written, can you -- you can read it though?

THE REPORTER: Yes, I can see it, I wanted to make sure I had it right though.

MS. JAMIE BOJADO: Okay, great.

MR. MATT CROASTON: All right. Rachael, why don't you go ahead, state your name and spell it, please.

MS. RACHAEL HUEMPFNER: Oh, boy, really? Okay. Sure. My name is Rachael Huempfner, R-A-C-H-A-E-L, H-U-E-M-P-F-N-E-R.

I had a question about the quarry. It was stated there was a -- that there could be a potential impact if they were ever to stop pumping, however, that's independent of the quarry activities from BSL.

Is there a timeline that you would set to reevaluate that potential impact or quarry activities, and how that would impact on the BSL in

the future?

MR. STEVE SOMMER: Well, with respect to the EIS, we would not be reopening the EIS because the EIS is just for this project. But the MPCA is aware of the issue of the quarry pumping and -- as well as the city of Burnsville, and we would be taking that all into consideration in our permitting process, which is a public process. So that we make sure that if the pumping were to be changed that it wouldn't result in the issues that we found and have identified in the EIS.

So yes, there will be followup. It wouldn't be through the EIS process that I can see, but it will be through alternative beings and potentially including permitting.

So part of it, you know, I don't want to go too much into detail because a lot of what the city wants to do with respect to redevelopment of that site is just unknown at this time, but I can say it's definitely on our radar. We've had meetings with the city, we know what's going on, and we're not going to forget about that.

MS. RACHAEL HUEMPFNER: Okay. And then continuing on with groundwater, you included an expansion of the sampling and analysis plan for BSL

that may include PFAS. Is -- I know in Wisconsin they're doing a little bit more research into what standards and limits they're going to have, is the MPCA currently undergoing any kind of evaluation of PFAS's effect on groundwater and health of the community?

MR. STEVE SOMMER: Yeah. The agency has more of a -- it's an agency-wide initiative to look at PFAS. That is beyond what was looked at, as you probably can tell. In the EIS, we're just pointing out the fact that it's needed to -- a facilities permit, it's always a need to look at these issues including whether PFAS needs to be monitored and the limits associated with it, but we didn't look at that.

But I don't know if Kirk or somebody else would be able to speak more than I can on the current status of what we're planning to do with the PFAS. I personally don't have enough knowledge to answer that. I want to see if Kirk knows, if he can provide any information. If not, I will definitely be responding in writing.

MR. KIRK KOUDELKA: Thanks, Steve.

I can answer a little bit because the larger question is, what are we doing looking at

groundwater in PFAS? We work with the Department of Health. It created five health-based values specific to five types of PFAS and its impact on drinking water that we use on our work in groundwater. They're working on a sixth.

We have a much larger effort on PFAS that we partner with our Minnesota Department of Health, DNR, and the Department of Ag, and then looking at PFAS in a number of areas, from air, land to water. And that's called our Minnesota PFAS Blueprint that outlines some of the things that we're doing.

So as noted earlier too by Steve, PFAS is one of the things specific to this landfill we'll look at more in the permitting process also.

MS. RACHAEL HUEMPFNER: Okay. Thank you.

Jumping topics real quick, I had a question about, you talked about socioeconomic impacts to the expansion. I'm expecting then the increased capacity also means increased tons per day or cubic yards per day. Has that -- a traffic analysis been looked at for the possible impact to Highway 13 or the surrounding communities or truck routes through that area?

MR. STEVE SOMMER: The EIS itself did not because it wasn't scoped into that. I mean, that's

something that could be looked at, you know, the local authorities could look at that.

I'm not certain that we know that the actual mixed municipal solid waste flow per day is going to really increase. I think this is more about allowing the facility to operate more years than to actually have more per day. That's what I -- my understanding is.

So no, it wasn't looked at. I don't expect that to be an issue, but it could be something that is looked at through, as I said, local authorities potentially if they wanted to do so.

MS. RACHAEL HUEMPFNER: Okay. And as far as the -- you mentioned the FAA a few times in the presentation. It says in the text document it's not expected to result in significant impacts with airplanes and bird activity.

However, there is a letter in Attachment G that is says the FAA is actually not -- is not confident in that this will not impact the bird interactions. That text just seems to be a little bit misleading if you don't go the actual letter from the FAA, and there's an elusion to that.

MR. STEVE SOMMER: Yeah, I think you're

right, it could have been clearer on that. I mean, with respect to the airport, the closest airport, six and a half miles away, MSP, and the regulations for EPA only -- you know, don't go out that far. In other words, the landfill is further away than the EPA regulations or FAA regulations go.

So really the only regulation that is applicable is to -- the landfill needs to notify the FAA of what they're planning to do, which they did, and the FAA also responded, like you said, with that letter. And it's asking the city of Burnsville, if I recall -- if I recall correctly, to work with Minnesota -- Metropolitan Airport Commission and the USDA Wildlife Services to look into it further.

But with respect to what we looked at in the EIS, we did not see information that would lead us to believe that there would be a concern with respect to air traffic and bird collisions because of the fact that the airport is so far away and the flights are much higher than the birds are at that location. So we're not close to an airport where the flights are coming in for a landing or taking off and at a lower elevation.

So that doesn't mean that's the end of the story, that's just the information that we found

in the EIS. And like you said, there is that letter that the FAA sent to the city of Burnsville, and the city can go ahead and contact those folks and work with them to see if the landfill design needs to be modified in any way to try to reduce or mitigate the potential for impact, but we didn't find any in the EIS. I hope that answers that.

MS. RACHAEL HUEMPFNER: Okay, yeah. The last thing is this is setting a pretty high standard, no pun intended, for vertical development and expansion of existing landfills. Is this expected to impact any future permitting on state landfills and how that process will go about vertical expansion?

MR. STEVE SOMMER: You know, that is something that's beyond what we looked at in the EIS, that's a permitting-type question, and I would suggest that if you -- well, I'll respond to it. There's no response really to have for you right now. I'm not aware of anything, any precedent or whatever that would be set, but I don't know the answer because I'm not in the permitting program. So I'd like to basically get back to you in the response-to-comments.

MS. RACHAEL HUEMPFNER: All right.

Thanks.

MR. STEVE SOMMER: Yeah.

MR. MATT CROASTON: All right. Are there other folks that would like to raise their hand and make a comment or offer a question? Just a reminder, all you need to do is go down to the smiley face and click, and there will be an option to raise your hand, or otherwise find your name in the participants list. Anybody else willing to -- or interested in making a comment or asking a question?

Obviously we have the slide up still if you prefer to offer that in writing. The instructions are to send an e-mail to Steve, or you can send a letter by regular mail to the agency here at 520 Lafayette Road in St. Paul.

MR. KIRK KOUDELKA: I'll just put a few more comments in here. As Matt mentioned, the public comment period for the environmental review process here, there were a number of comments today also about recycling, organics, and waste prevention in general, and so I just want to remind folks, too, we do have an open hearing right now for the Metro Solid Waste Policy Plan where we're looking at some of those more global issues affecting all of the

Metro area.

If folks would like to comment on that, there's still a couple of weeks left on that. If you go to our main web page, PCA.state.mn.us, there's a link on the first story about managing Metro waste, which includes more information about the environmental review with that process, too, to submit comments.

Matt, I don't know if there's anyone else with comments? Do you see anymore hands?

MR. MATT CROASTON: I'm not seeing anyone with their hand raised. In case anybody joined late, just a reminder, if you'd like to make a comment, all you have to do is raise your hand. You may do so by -- there's a button at the bottom of your screen with a smiley face, you click on that, and there will be an option to raise your hand. Otherwise, find your name in the participants list and hover over it and there will be an option to raise your hand there.

So you can hang out for a few more minutes, but if folks -- oh, Jamie, it looks like you've got your hand raised. Jamie, go ahead.

MS. JAMIE BOJADO: All right. Thank you. I was just asking in the chat for the link, and it

was left there, so thank you so much.

MR. PEDER SANDHEI: I just want to clarify, that's the link for the Metro Policy Plan, is that the one you wanted, or do you want the link to the SEIS?

MS. JAMIE BOJADO: The -- what you were just mentioning for the general -- dealing with waste in the Metropolitan, is that the --

MR. PEDER SANDHEI: Perfect, that's the right link then.

MS. JAMIE BOJADO: All right. Thank you.

MR. PEDER SANDHEI: You're welcome.

MR. MATT CROASTON: I don't see anyone else with their hand raised. So I guess if folks want to get off to their -- enjoy the rest of this beautiful evening, I guess we can do that.

Kirk, I don't know if you want to have any last remarks?

MR. KIRK KOUDELKA: I just want to thank everyone for attending tonight, and as Matt and Steve had mentioned, there are resources on our website and ways to be able to send us comments, too. If you have a question or comment, if you wake up tomorrow and wished you had asked today, we still have these other avenues for you to be able to share

information with us. And thank you for your time, I know it's valuable.

MR. STEVE SOMMER: Thank you.

MR. MATT CROASTON: Thanks, folks.

(Meeting concluded at 8:05 p.m.)

STATE OF MINNESOTA)
) ss.
COUNTY OF RAMSEY)

REPORTER'S CERTIFICATE

I, Christine Simons, do hereby certify that the above and foregoing transcript, consisting of the preceding 46 pages is a correct transcript of my stenographic notes, and is a full, true and complete transcript of the proceedings to the best of my ability.

Dated June 28, 2021.

/s/Christine Simons

CHRISTINE SIMONS
Registered Professional Reporter
Registered Merit Reporter

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Attachment N

Response to Public Comments from BSL DSEIS Public Meeting

Minnesota Pollution Control Agency

Burnsville Sanitary Landfill (BSL) Expansion Project (Project)
Supplemental Environmental Impact Statement (SEIS)

RESPONSES TO COMMENTS ON THE BSL DRAFT SEIS (DSEIS)
JUNE 23, 2021, PUBLIC INFORMATIONAL MEETING (MEETING) TRANSCRIPT COMMENTS

1. Comments by Jamie Bojado

Comment 1-1: The commenter stated that they did not see information in the "report" [DSEIS] regarding exceeding state rules and how the "secular research" is conducted. Transcript Page (TP) 23-24

Response: Answered at the Meeting, all information required by the BSL Final Scoping Decision Document (Scope) was included in the DSEIS. The DSEIS includes information on the rules and regulations that are applicable to the Project. The DSEIS also analyzed whether or not the Project will meet applicable regulatory requirements. Section 8.0 of the DSEIS provides a list of reference materials (research) used in developing the DSEIS. TP 24

Comment 1-2: The commenter expressed concern with the Project's impact on property values and the comprehensiveness of the DSEIS on this matter. TP 24

Response: The final BSL SEIS scoping decision document (Scope) for the DSEIS describes the information required to be included regarding the Project's impacts on property values. Specifically, the Scope requires the following:

The SEIS will review existing studies, reports and other information of MSW landfills within the five state area as it relates to their impact on property values within a 2-mile radius of the landfill. The review will also include information on the change in property values resulting from an expansion of an existing MSW landfill.

As required by the Scope, the BSL DSEIS includes a literature review of existing information on the impact that mixed municipal solid waste (MMSW) landfills have on property values. This information is in Section 7.3.4 of the DSEIS.

Comment 1-3: The commenter expressed worry about the health equity of the residents. TP 24

Response: The Project is located within an area of concern for environmental justice. For that reason, the environmental impacts associated with the Project that were outlined in the Scope were assessed within the context of whether said impacts would result in disproportionate exposure to pollution within the identified area of environmental justice concern. The assessment indicated that no such disproportionate exposures would be expected to result from the Project.

Comment 1-4: The commenter expressed concern about water issues and the water table in general. TP 24

Response: As required by the Scope, the DSEIS contains information about the Project's potential impacts to groundwater, surface water, and the water table. These impacts are summarized in the following sections of the DSEIS:

Section 1.1.2.1 Groundwater Impacts

- Groundwater Monitoring during the period from 2014 through 2019 has not identified impacts to groundwater for the monitored parameters (as per the 2015 permit modification) resulting from the BSL. Manganese detections above the Intervention Limit (IL) and Health Risk Limit (HRL) have been detected at both upgradient and downgradient monitoring wells and appear to be related to naturally occurring manganese and/or background concentrations. There were no other IL exceedances reported during the monitoring period. Sporadic detections of Volatile Organic Compounds (VOCs) have been observed at concentrations lower than applicable ILs.
- As part of the solid waste permitting process, the MPCA will require that BSL update its groundwater Sampling and Analysis Plan to include current standard parameters and monitoring limits based on Minnesota Department of Health (MDH) HRLs or similar health standards, as appropriate, and evaluate additional contaminants of concern for potential inclusion into BSL's permit. The specific contaminants of concern that will be evaluated during the permitting process may include per- and polyfluoroalkyl substances (PFAS) and 1,4-dioxane. Additional permitting requirements include identifying contingency actions to be taken if groundwater impacts are detected, as well as establishment of financial assurance that will provide funding for contingency actions and/or mitigation activities.
- Predictive modeling indicates the potential for the water table to be in contact with the base of the unlined area at BSL if dewatering at the neighboring Kraemer Mining and Materials quarry ceases in the future. Potential groundwater quality impacts associated with this condition are unknown at least in part due to plans for the future quarry lake being unknown. However, water level monitoring at BSL has shown the water table periodically exceeds the base elevation of the unlined area during periods of flooding on the Minnesota River, and no significant changes in groundwater quality are evident for the monitored parameters following flood events. The proposed Project does not change the depth or span of the unlined area relative to currently permitted conditions, so the Project would not result in increased potential for impacts from the unlined area related to future water table conditions. However, if future groundwater monitoring indicates corrective action is needed related to the unlined area, having new waste on top of the unlined area may impede corrective action
- Potential impacts to water supplies are as follows:
    - a. Quarry Water Supply - There are currently no identified landfill-related impacts to the existing quarry water supply, nor are there impacts observed at the quarry dewatering outfall (or downgradient monitoring wells) based on permit-required monitoring. Impacts to the existing quarry water supply are not expected as a result of the Project. Under a future scenario with the post-mining quarry lake at elevation 690, some groundwater from underneath the BSL is predicted to discharge to the anticipated future quarry lake. Potential impacts from the BSL to a future quarry lake are not known, for reasons such as indeterminate municipal plans for the future quarry lake, but will be further investigated through the permitting process.
    - b. Water Supply Wells – Existing and future groundwater flow scenarios do not result in groundwater flow from the landfill towards any other known potable water supply wells.

1.1.2.2 Surface Water

The following major findings were identified during analysis of the surface water impacts associated with the Project:

- The Project would result in an increase in stormwater runoff volume from the landfill of 3.7% and a 47% increase in peak discharge rate from a 500-year storm event because the post-Project design has more sloped area that is less conducive to infiltration. This would lead to increased erosion and sediment load discharged from the site compared to pre-expansion conditions. There would be no significant change in runoff volume, and decreases in peak discharge rates and sediment discharge from the site for smaller storm events.
- No adverse impacts are expected to result from the post-Project buildout compared to the pre-expansion buildout for the 2-year and 10-year storm events.
- The increased sediment capture rate in post-Project conditions would likely necessitate more frequent maintenance (i.e. sediment removal) in the sedimentation ponds over the life of the landfill.
- The 500-year storm event produces runoff volumes, rates, and velocities that exceed the design basis (i.e., the 100-year storm event) of the surface water control system, and would result in erosion-related impacts under both pre-expansion and post-Project conditions.
- Mitigation for impacts related to the 500-year storm would include redesigning the surface water control system with higher sideslope berms, deeper downslope structures, larger culverts, and additional engineered erosion control products.
- Mitigation measures targeted at minimizing the post-event effects consist of conducting regular inspections of the surface water control system, and being prepared to implement emergency response actions to contain and repair adverse effects.
- The following changes in drainage to wetlands B and C, which are adjacent to the north and west of the landfill (see Figure 6-5), are predicted as a result of the Project:
    - Wetland B will experience similar inflow rates and total volumes for both the pre-expansion and post-Project conditions.
    - Wetland C will receive a larger total volume of water and lower inflow rate under the post-Project condition than in the pre-expansion condition.
- The discharge of stormwater ponds to adjacent wetlands for the 2-year, 10-year and 25-year storm events does not exceed any local, state or federal threshold, and the changes in drainage are not expected to result in significant impacts to the wetlands.

Comment 1-5: The commenter asked if potential property value impacts are more of a concern during planning or during the actual build. TP 24-25

Response: Answered at the meeting, as required by the Scope, the MPCA reviewed existing information regarding landfills impacts on property value. The Scope did not require information regarding a difference in property value impacts between planning and actual build and no information was found. TP 25

EQB rules (Minn. R. 4410.2100, subp. 8) do not allow a RGU (in this case, the MPCA) to amend the scope of an EIS after the scoping decision is made without the agreement of the proposer unless substantial changes are made in the proposed project that affect the potential significant environmental effects of the project or substantial new information arises relating to the proposed project that significantly

affects the potential environmental effects of the proposed project or the availability of prudent and feasible alternatives to the project.

Comment 1-6: The commenter stated, "Sure. So the two percent decrease was in –- was to refer to smaller landfills, and then the 12.9 percent decrease was in a diameter of five kilometers from the – five kilometers from the larger landfill. I would say, and I think you would agree, that this would count as a larger landfill, especially since it exceeds the state – current state requirements for landfills. TP 26

Response: Answered at the meeting, yes there is a difference in size between BSL and the landfills for which we were able to find out information regarding property value impacts. The literature on this subject is limited, and the MPCA used the information that was available to it. TP 26-27

Comment 1-7: The commenter stated, "That is where a lot of these "expected to", you're not expecting to have issues with air and water pollution because you aren't able to find a one-to-one ratio to this landfill specifically?" TP 27

Response: Answered at the meeting, no, unlike the property value impacts analysis, which used information from other landfills (as allowed by the Scope), the MPCA's analysis of potential air and water quality impacts used information specific to BSL's Project. TP 27

Comment 1-8: The commenter stated, "And I also wanted to ask, what is the financial assurances that you have reserved in your plan? And how exactly is a deal with the poisoning of water and air in the local area?" TP 28

Response: Answered at the meeting, financial assurance is a permitting issue and is not part of the Environmental Review process. There will be opportunity for the public to comment on financial assurance requirements during the permitting phase of the Project. TP 28

As part of their solid waste permit, landfills are required to set aside financial assurance, and this financial assurance includes funds for contingency actions that may arise from emergencies or contamination.

Comment 1-9: The commenter stated, "So with other research about, basically, pollution is that the landfills, especially larger landfills, like, such as this, where it found for neighboring residents cancer, low birth rates, and birth defects. Who would be responsible in the case that these were an issue after the build?" TP 29

Response: This answer to this question is outside the Scope of the DSEIS. The DSEIS process did not include a requirement for an epidemiological study or health impact assessment (HIA). The MPCA has no information on which to respond to this comment. TP 29

EQB rules (Minn. R. 4410.2100, subp. 8) do not allow a RGU (in this case, the MPCA) to amend the scope of an EIS after the scoping decision is made without the agreement of the proposer unless substantial changes are made in the proposed project that affect the potential significant environmental effects of the project or substantial new information arises relating to the proposed project that significantly affects the potential environmental effects of the proposed project or the availability of prudent and feasible alternatives to the project.

Comment 1-10: The commenter stated, “Okay. Because I did read in there that the scoping decision, where assessed in the context of whether said impacts would result in disproportionate exposure to – and no to pollution, and that you did not – that the assessment indicated no such disproportionate exposures. So that was what my question was, it’s under 1.4 Environmental Justice”. TP 29

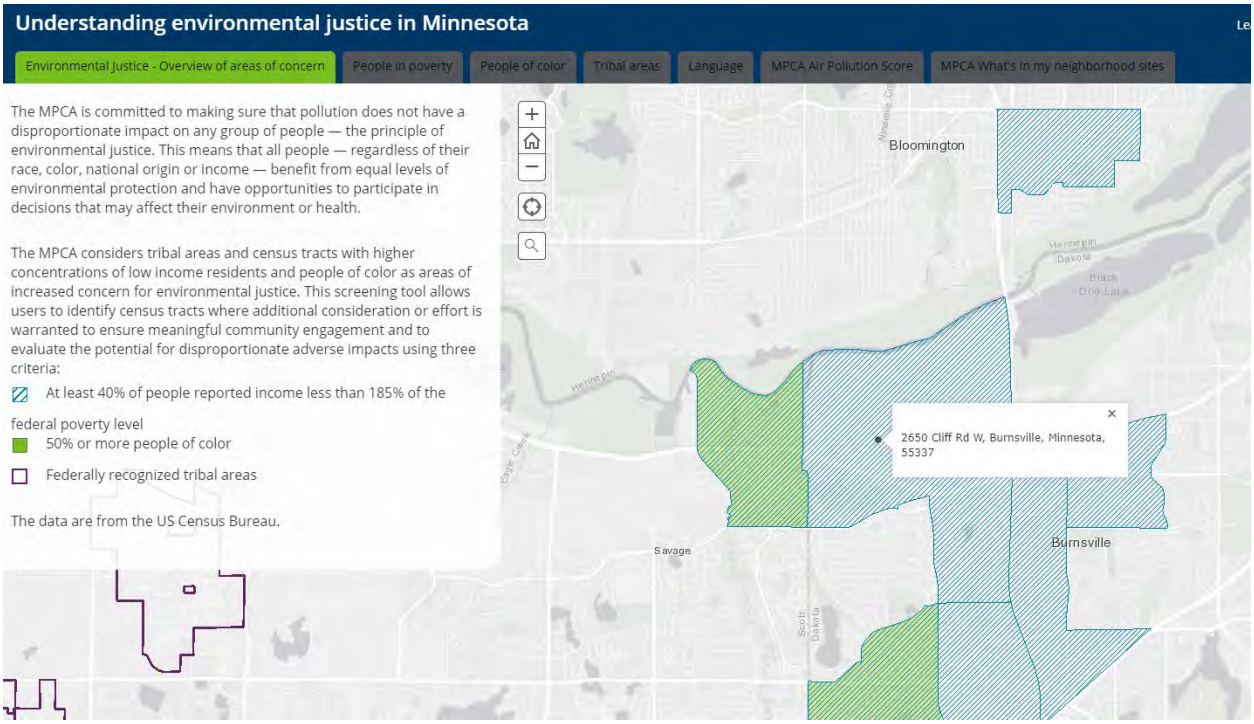
Response: Yes, the DSEIS did assess the Project’s potential for disproportionate environmental impacts to the environmental justice community of concern. Please also see response to comment 1-3 above.

Comment 1-11: The commenter asked about the criteria used to determine that the BSL area is an environmental justice area of concern. TP 30

Response: Answered at the meeting, the BSL area is considered an environmental justice area of concern because it is in a US census tract with a median income lower than the environmental justice threshold. TP 30

The following information provides more detail regarding the commenter's question:

The BSL Project area is an area of concern for environmental justice because it is located within a U.S. Census tract where at least 40% of people report a household income less than 185% of the federal poverty level. The BSL DSEIS sourced this information from the MPCA and environmental justice webpage (https://www.pca.state.mn.us/about-mpca/mpca-and-environmental-justice). The webpage includes a link to a map of Areas of Environmental Concern. The MPCA used this map and BSL’s address to determine that BSL is located in an environmental justice area of concern, as shown in the following screenshot.



Because the Project is located within an area of concern for environmental justice, the environmental impacts associated with the Project that were outlined in the Final Scoping Decision Document for the BSL SEIS, were assessed within the context of whether said impacts would result in disproportionate exposure to pollution within the identified area of environmental justice concern. The assessment indicated that no such disproportionate exposures would be expected to result from the Project. The assessment only relied on the information contained within the BSL DSEIS.

The following sections of the BSL DSEIS provide details for each disproportionate impact finding:

- Groundwater Quality/Water Supplies – Section 6.1.3.8
- Erosion/Sedimentation from Extreme Storm Event – Section 6.2.1.5
- Erosion of Liner and Leachate Collection System – Sections 6.3.2.4 and 6.3.4.4
- Visual Impacts – Section 6.4.2.1
- Air Quality – Section 6.5.9

The FSEIS will include an attachment that provides the information contained within this response to comments.

Comment 1-12: The commenter stated, “So the cancer, low birth rates, and birth defects are not included in the report because – associated with the larger landfills because they don’t have to do with economic status or race?” TP 31

Response: Please see response to comment 1-9 above.

Comment 1-13: The commenter stated, “Okay. So if I’m understanding this correctly, you used the data that you have available from the existing landfills to create this document for the speculative research for the future landfill?” TP 32

Response: Answered at the meeting, the MPCA used BSL site-specific information in order to determine the potential environmental effects of the project. TP 32-33

Comment 1-14: The commenter stated that they thought that the research on property values was “woefully incomplete and is insufficient or just really poorly executed, I’m not sure which”. TP 34

Response: The BSL DSEIS contains all of the BSL SEIS Scope-required information regarding the Project’s potential impacts on property values.

Comment 1-15: The commenter stated, “And then I was a little confused about the percentages of recycling because it did have a point in there about how much recycling was possible and then other quotes later on about the percentages. And I wasn't sure if it meant the percentage of the public or the percentage of the total amount that is recyclable or the percentage of total garbage and waste in general. I just felt like that could be more specific to address and, you know, work with the community to make these landfills safer for citizens, as well as lucrative for our city.” TP 34

Response: The Minnesota State Legislature created a goal to recycle 75% of solid waste in the seven-county metro area by 2030. We have not reached that goal yet, and it is unlikely that 75% will be achieved by 2030, so other (lower) recycling rates were analyzed as part of this assessment to see what

impacts meeting, or not meeting the goal would be. An obvious impact of not meeting that goal is that more waste ends up in the landfill.

Comment 1-16: The commenter stated that, "And just lastly, the health equity is, like, probably the highest-in-priority issues for everyone. And I know that you detailed extensively about the pollution of the air and water and the things and how much that would be scientifically, but tying that in with the health effects I think is crucial to have everyone be on the same page of what exactly we're talking about and how this directly impacts the community for environmental justice areas. And then also, I'm guessing this socioeconomic data mentioned earlier, those issues as well because I know that those will definitely effect the community in those ways, so thank you." TP 34-35

Response: See the response to comment 1-9 above.

2. Comments by Rachael Huempfner

Comment 2-1: The commenter asked if there is a timeline that the MPCA would set to re-evaluate the potential impact of the quarry discontinuing pumping on the water table and unlined BSL waste. TP 36-37

Response: Answered at meeting, the MPCA will not re-open the SEIS in the future to re-evaluate this potential impact of changes of pumping at the quarry because the SEIS is just for the proposed Project at BSL, not the quarry. However, the MPCA has and will continue to work with the local stakeholders, including the City of Burnsville and Dakota County, on this issue through the BSL permitting process, as appropriate. Current solid waste permits are issued for a period of ten years, and the status of the groundwater elevations and groundwater quality will be evaluated during each reissuance. TP 37

Comment 2-2: The commenter asked if the MPCA is currently undergoing any kind of evaluation of PFAS's effect on groundwater and health of the community. TP 37-38

Response: Answered at the meeting, state agencies have and are continuing to develop health-based values and standards for PFAS. State agencies have created the Minnesota PFAS Blueprint, which can be found on MPCA's PFAS Blueprint webpage (https://www.pca.state.mn.us/waste/minnesotas-pfas-blueprint). It summarizes state agencies and others efforts in ten categories TP 38-39

Comment 2-3: The commenter asked if a traffic analysis has been done for the Project. Commenter expected that the increased landfill capacity associated with the Project would result in more truck traffic on Highway 13 or in the surrounding area. TP 39

Response: Answered at the meeting, the DSEIS did not include an analysis of truck traffic related to the Project since that was not part of the Scope. This issue was not part of the Scope because the landfill expansion would allow the facility to operate more years, which does not necessarily mean that the daily amount of waste disposed of, will increase. The local authorities can look into a traffic analysis if they believe that it is necessary. TP 39-40

EQB rules (Minn. R. 4410.2100, subp. 8) do not allow a RGU (in this case, the MPCA) to amend the scope of an EIS after the scoping decision is made without the agreement of the proposer unless substantial

changes are made in the proposed project that affect the potential significant environmental effects of the project or substantial new information arises relating to the proposed project that significantly affects the potential environmental effects of the proposed project or the availability of prudent and feasible alternatives to the project.

Comment 2-4: The commenter cited the Federal Aviation Administration (FAA) letter in the DSEIS (Attachment G) which expressed concern about the potential to create a wildlife hazard attractant near the Minneapolis-St. Paul International Airport (MSP) and the potential adverse impact on airport safety. The commenter indicated that they thought that the text of the DSEIS seems "a little bit misleading if you don't read the FAA's actual letter. TP 40

Response: Answered at the meeting, the MPCA agrees that the DSEIS could have been clearer by providing more detail regarding the FAA's letter (to the city of Burnsville) in the actual text of the DSEIS. TP 40-42

Although the DSEIS found that the Project is not expected to result in significant impacts resulting from bird interactions with airplanes when compared to pre-expansion conditions, the FAA did express concerns about this issue in its letter to the city of Burnsville (Attachment G of DSEIS). The FAA letter stated that it defers judgement for hazardous wildlife issues to the U.S. Department of Agriculture (USDA WS) since their agency is considered a subject matter expert. The FAA encouraged the city of Burnsville to work with the Metropolitan Airports Commission (MAC) and the USDA WS to design and manage the landfill expansion in a way that can minimize hazardous wildlife activity.

Comment 2-5: The commenter stated, "The last thing is this is setting a pretty high standard, no pun intended, for vertical development and expansion of existing landfills. Is this expected to impact any future permitting on state landfills and how that process will go about vertical expansion?" TP 42

Response: All applications that are submitted to modify landfill permits are evaluated on a case-by-case basis during the permitting process. Each of those evaluations are conducted per the requirements in the Minnesota Solid Waste Rules, and applicants must show that the proposed modification meets engineering principles and design elements to protect human health and the environment. Additionally, most facilities that submit an application to expand a landfill by 25% or more would require a mandatory Environmental Impact Statement.

Attachment O

Written Public Comments on BSL DSEIS

-----Original Message-----
From: Roz Peterson <RozP@cerron.com>
Sent: Tuesday, June 1, 2021 3:21 PM
To: Sommer, Steve (MPCA) <steve.sommer@state.mn.us>
Subject: BV Sanitary Landfill

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_____

Will the expansion of the Burnsville Sanitary Landfill accommodate any of the Freeway Landfill?

Why is the acreage decreasing from 216 to 204? I'd rather they keep the acreage to keep the height down or for future growth.

Thank you!

Roz Peterson, CCIM
Cerron Commercial Properties
Rozp@cerron.com 612.708.5281

From: Tworzyanski, Jennifer (ADM)
To: Sommer, Steve (MPCA)
Subject: Burnsville Sanitary Landfill SEIS Comments
Date: Wednesday, June 16, 2021 12:06:25 PM
Attachments: OSA Comments Burnsville SEIS.pdf

Steve,

Attached is a comment letter from the Office of the State Archaeologist concerning the Burnsville Sanitary Landfill SEIS. Let me know if you have any questions or comments.

Thanks,
-Jennifer

Jennifer Tworzyanski
Assistant to the State Archaeologist
Office of the State Archaeologist
328 West Kellogg Blvd
St Paul, MN 55102
651.201.2265

DEPARTMENT OF ADMINISTRATION
STATE ARCHAEOLOGIST

June 16, 2021

Steve Sommer
Project Manager
Minnesota Pollution Control Agency
520 Lafayette Road North
St Paul, MN 55155-4194
Steve.sommer@state.mn.us

RE: Burnsville Sanitary Landfill Expansion Project Draft SEIS

Steve Sommer:

I appreciate being given the opportunity to comment on the above listed draft supplemental environmental impact statement. While there are no previously recorded archaeological or cemetery sites located within the proposed landfill expansion, there are numerous archaeological site and site leads, as well as cemetery sites, in the immediate vicinity of the proposed project. Additionally, the proposed project area has high archaeological potential because it is situated on as terrace of the Minnesota River. Therefore, I recommend a qualified archaeologist conduct a phase I archaeological reconnaissance survey to determine if the proposed project will impact previously unrecorded archaeological or cemetery sites. The Minnesota Historical Society maintains a list of archaeologists at: http://www.mnhs.org/preservation/directory.

Please contact me if you have any questions or concerns.

Sincerely,

Jennifer Tworzyanski
Assistant to the State Archaeologist
Kellogg Center
328 West Kellogg Blvd
St Paul, MN 55102
651.201.2265
Jennifer.tworzyanski@state.mn.us

-----Original Message-----
From: Susan Dieseth <susandieseth@gmail.com>
Sent: Monday, June 21, 2021 10:38 PM
To: Sommer, Steve (MPCA) <steve.sommer@state.mn.us>
Subject: Burnsville landfill

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Hi Steve,

Am I correct in thinking more garbage will be dumped next to the river and on an aquifer? Why is the garbage not being removed from the area? Anything short of total garbage removal seems quite dangerous to humans, animals and the water supply. Wasn't this area at one time considered a superfund site? I don't get the thinking on this at all. Hopefully I have totally misread the information. Otherwise this is really a stupid idea. I'd like my grandchildren to have clean water.
Susan Dieseth

Subject: FW: Comments on Proposed Burnsville Sanitary Landfill Expansion
Date: Tuesday, August 3, 2021 2:19:47 PM

From: Jo H. <joshmo712@hotmail.com>
Sent: Friday, July 9, 2021 10:06 AM
To: Sommer, Steve (MPCA) <steve.sommer@state.mn.us>
Subject: Comments on Proposed Burnsville Sanitary Landfill Expansion

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Hi Mr. Sommer,

I am writing to oppose the expansion of the Burnsville Sanitary Landfill. I am an East Bloomington resident, and I live within 4 miles of the existing landfill.

In reading about the plans for the landfill, it's very hard to imagine anything worse than a literal, looming mound of garbage, which would become the highest point in the area, located immediately next to the Minnesota River. It truly represents an apocalyptic vision into our future, if we are unable to do anything to mitigate the amount of trash we generate.

The extreme risk that the expansion poses to the area cannot be understated. As mentioned, the landfill is incredibly close to the river. It's been noted that parts of the landfill are unlined, and with extreme weather conditions increasing in frequency and severity, it is highly likely that flooding events would bring the water level up to the unlined portion of the landfill, leaking hazardous landfill leachate into our local source of fresh water.

Additionally, air quality concerns must not be taken lightly. Air pollution already accounts for tens of thousands of deaths each year -- and even more chronic respiratory diseases -- and estimates of how much landfill gas would enter the air are significant and must not be ignored. Poor air quality disproportionately affects already-vulnerable populations, many of whom live near me in East Bloomington, one of the closest communities to the landfill.

As Greta Thunberg has aptly said, we are currently stealing our children's future from them, and every day that we continue to do so has significant impacts for the future of the planet, and our

quality of life in the coming years. This landfill expansion is a temporary, bandage solution to a much larger problem that we can no longer afford to ignore, or take half-measures to address. We simply cannot keep buying stolen time to figure out what to do with our waste by expanding the Burnsville landfill into a literal mountain of trash.

The good news is that we already have solutions at our fingertips that can help reduce the amount of landfill space we need - those solutions need to be brought to higher awareness among the general public and funded more robustly, even as we develop new solutions to help decrease waste in even more efficient and effective ways. To be sure, recycling and organics composting will not solve all of our problems, but they can help decrease the flow of materials to the Burnsville landfill, when used by both residents and commercial businesses at a much higher rate than we're seeing at present.

I urge you to discontinue exploring the expansion of this landfill. It will only create more problems, and leave future generations with an even heavier burden to carry and try to fix.

Thank you,
Johanna Holub
9640 15th Ave. S.
Bloomington, MN 55425

Subject: FW: Please Do Not Approve the Burnsville Sanitary Landfill Expansion
Date: Tuesday, August 3, 2021 2:20:07 PM

From: Sara Grasmon <sagrasmo@gmail.com>
Sent: Friday, July 9, 2021 10:15 AM
To: Sommer, Steve (MPCA) <steve.sommer@state.mn.us>
Subject: Please Do Not Approve the Burnsville Sanitary Landfill Expansion

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Hello Mr. Sommer,

I recently learned about the Burnsville Sanitary Landfill expansion from a colleague who lives near the site, and I am deeply concerned about this potential plan.

As a community, and state, Minnesota is known as a place of natural beauty, and abundant resources such as our lakes, rivers and wetland areas, not to mention our clean, fresh air. Should this project move forward, our ecosystem would be at risk. For something that would just be a temporary solution to a larger issue, these are risks/consequences not worth taking. We must protect our resources for future generations and find solutions that do not compromise the health and safety of our neighbors and our natural resources.

I oppose this expansion project and ask that you find a solution that does not compromise our community's water, land, reputation and natural beauty. Please do not move forward with this expansion.

Thank you,
Sara Grasmon

Subject: FW: Burnsville Sanitary Landfill Expansion Project
Date: Tuesday, August 3, 2021 2:30:50 PM

From: Adam Spears <aspears@qbp.com>
Sent: Monday, July 12, 2021 2:44 PM
To: Sommer, Steve (MPCA) <steve.sommer@state.mn.us>
Subject: Burnsville Sanitary Landfill Expansion Project

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Mr. Sommer,

I hope this message finds you doing well.

I would like to reach out to you today in regard to the Burnsville Sanitary Landfill Expansion Project. As a resident of the City of Bloomington as well as working in the outdoor industry in the City of Bloomington, I have significant concerns about the expansion including visual impact, locating additional waste in a sensitive ecological area, noise, odor, escaping trash, among others. While I do realize that waste has to go somewhere, I strongly feel that the proximity to both the River and the 5th largest city in the state is far from ideal.

Thanks for your time and consideration.

Best,

QUALITY BICYCLE PRODUCTS

Adam Spears | Proprietary Brands Sales Manager

45NRTH | Teravail | Whisky | MSW | Problem Solvers

From: Anne Franklin
To: Sommer, Steve (MPCA)
Subject: Landfull expansion
Date: Tuesday, July 13, 2021 12:29:38 PM

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Steve, this puts landfill right next to the River! The banks are unstable, it has a history of flooding, and there is an absolute guarantee that toxins will arrive in the River. Either from direct run off or by underground seepage. This is the worst possible location.
Please choose a spot that is a rational choice, not this one. There will be problems in the future and they will all look back and blame you.
Please think of another spot that isn't so close to the river. Sincerely
Anne Franklin

From: Lower Minnesota River Watershed District
To: Sommer, Steve (MPCA)
Cc: permit@lowermnriverwd.org
Subject: Burnsville Sanitary Landfill EIS Comments | LMRWD No. 2021-024
Date: Wednesday, July 14, 2021 6:49:05 PM
Attachments: LMRWD_EIS Review_Burnsville Landfill_12Jul2021.pdf

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Good evening Mr. Sommer,

Thank you for providing the Lower Minnesota River Watershed District (LMRWD) with the opportunity to review the draft Environmental Impact Statement (EIS) for the Burnsville Sanitary Landfill Expansion Project. The LMRWD comments on the draft EIS are attached. Please do not hesitate to contact us at this email address with any questions or concerns.

Thank you,
LOWER MINNESOTA RIVER WATERSHED DISTRICT
112 E. 5th Street, #102
Chaska, Minnesota 55318
Email: permit@lowermnriverwd.org

Young Environmental Consulting Group, LLC

Technical Memorandum

To: Linda Loomis, Administrator
Lower Minnesota River Watershed District

From: Kaci Fisher, Environmental Specialist
Katy Thompson, PE, CFM

Date: July 12, 2021

Re: Burnsville Sanitary Landfill Expansion Environmental Impact Statement Review

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Burnsville Sanitary Landfill, Inc. (BSL) proposes to expand its mixed municipal solid waste disposal facility by 23.6 million cubic yards and raise the top elevation of the landfill by 260 feet within the Annex Development Area (ADA) which is located in the City of Burnsville (Figure 1) and is within the Lower Minnesota River Watershed District (LMRWD or District).

On June 1, 2021, the Minnesota Pollution Control Agency (MPCA) published the Draft Supplemental Environmental Impact Statement (EIS) for the Burnsville Sanitary Landfill Expansion Project (Project) for public comment. Young Environmental Consulting Group, LLC reviewed the EIS for potential applicable District rules.

The project is not located within the High Value Resource Areas or Steep Slopes Overlay Districts, but it is in the 100-year FEMA floodplain. The project appears to trigger *Rule B—Erosion and Sediment Control*, *Rule C—Floodplain and Drainage Alteration,* and potentially *Rule D—Stormwater Management*. The City of Burnsville does not have an approved municipal permit, so an Individual Project Permit will be required for this project. A project summary and comments on the EIS are provided below.

Project Summary

Project Name:	Burnsville Sanitary Landfill, Inc.

Purpose:	Expanding existing landfill
Project Size:	204 acres
Location:	2650 Cliff Road West, Burnsville, MN 55337
Applicable LMRWD Rules:	*Rule B—Erosion and Sediment Control* *Rule C—Floodplain and Drainage Alteration* *Rule D—Stormwater Management*
Recommended Board Action:	No action; information only

Comments on the EIS

Rule B—Erosion and Sediment Control

The LMRWD regulates land-disturbing activities that affect one acre or more outside of the special overlay districts. The proposed expansion area, labeled as ADA in the EIS, appears to be more than 20 acres. The project will require a District permit for erosion and sediment control.

Rule C—Floodplain and Drainage Alteration

The proposed expansion appears to be entirely within the 100-year floodplain of the Minnesota River as seen on the Flood Insurance Rate Map (FIRM) panel 27053C0462F, effective November 4, 2016. To meet the minimum requirements of Rule C, the LMRWD individual project permit application should include the amount of fill within the floodplain as well as a no-rise certification.

Additionally, the EIS mentions realigning the levee, referencing Figure 6-5. However, the levee location in this figure does not appear to be represented. Is it BLS's intent to realign the existing levee to go around the ADA? If so, we recommend early coordination with both the Minnesota Department of Natural Resources (MnDNR) and FEMA.

Rule D—Stormwater Management

The LMRWD requires stormwater management for projects that create one or more acres of new impervious surfaces. Rule D necessitates that proposed runoff rates for 2-, 10-, and 100-year events do not exceed existing conditions. Table 1, taken directly from the draft EIS and shown below, does not include the 100-year rates. To receive a LMRWD permit, the applicant must confirm that the 100-year event does not exceed existing runoff rates.

Table 1. Runoff Rates Summary from Draft EIS

Storm Event	Peak Runoff Rates (cu. ft./sec.)		Percent Change Post-Project to Pre-Expansion
	Pre-Expansion	Post-Project	
2-year	55.10	22.71	-58.8%
10-year	148.96	63.62	-57.3%
500-year	962.33	1,413.70	+46.9%

The project proposes to overlay capped unlined areas with new lined waste up to approximately 31.75 acres. Additionally, a new liner will be added to the ADA, which is approximately 22 acres. The LMRWD recommends considering the final landfill cover system as a quasi-impervious layer that may have the same effects as an impervious layer unless BSL can prove otherwise.

Additional Considerations

The proposed landfill cap and liner system may be similar to an artificial turf system. Both systems provide an upper media layer that can filter or infiltrate stormwater, but both are limited by a lower impervious layer. In addition, water that filters through the upper media is collected in a drainage system and discharged elsewhere to prevent it from infiltrating the underlying aquifer.

Rather than considering the proposed landfill cap and liner entirely impervious or entirely pervious, we propose three alternative methods for determining the final hydrology for the site:

1. Using a modified SCS curve number that accounts for the maximum water retention available within the final cover system (if the cover soil's moisture-storage capacity and other necessary soil properties are known) as well as the final landfill slopes
2. Modeling the final cover system and drainage layer in a method consistent with artificial turf methodology[1]
3. Utilizing the Hydrologic Evaluation of Landfill Performance (HELP) program[2] to evaluate the evapotranspiration, infiltration, and filtration of the final cover

[1] https://www.hydrocad.net/curvenumber.htm

[2] https://www.epa.gov/land-research/hydrologic-evaluation-landfill-performance-help-model

Recommendations

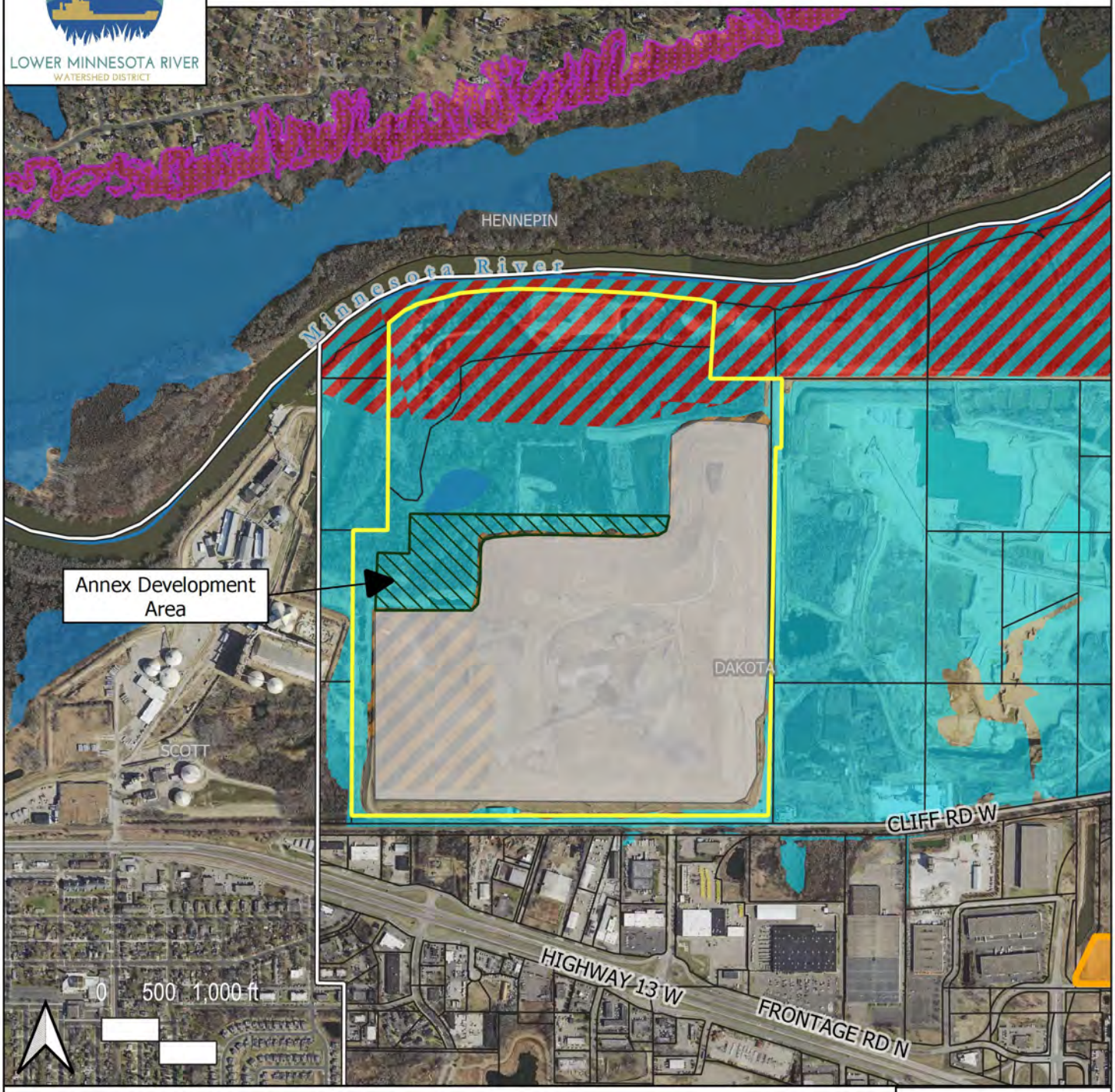
No Board action is required at this time. This memo will also be submitted to MPCA as part of the EIS comment period, with the following initial feedback:

- The proposed project appears to trigger Rules B, C, and D. BSL must obtain an LMRWD Individual Project Permit for the applicable rules before the start of construction activities until such time as the City of Burnsville receives its municipal permit from the LMRWD.
- As presented, the applicant will need to provide documentation that the proposed floodplain fill will not cause an increase in water surface elevations (i.e., a no-rise certification).
- If the existing levee will be modified as part of this project, we recommend early coordination with the MnDNR and FEMA.
- The proposed cap and liner are considered impervious by the LMRWD, and stormwater management will be needed on-site to manage discharge rates and protect water quality of downstream receiving waters.

Attachment:

- Figure 1. Burnsville Sanitary Landfill Project Location Map

Figure 1: Burnsville Sanitary Landfill Project Location



LEGEND

- Project Location
- Burnsville Sanitary Landfill
- Proposed Expansion
- Burnsville Sanitary Landfill
- Public Waterways
- Public Waters
- County Boundaries
- Dakota Co. Parcels
- High Value Resource Area Overlay District
- Steep Slopes Overlay District [SSOD]
- 100-yr Floodplain
- Floodway
- Reduced Flood Risk Due to Levee

LMRWD Watershed Location Map

Young Environmental Consulting Group, LLC

From: Markegard, Glen <gmarkegard@BloomingtonMN.gov>
Sent: Thursday, July 15, 2021 10:13 AM
To: Sommer, Steve (MPCA) <steve.sommer@state.mn.us>
Cc: Sandhei, Peder (MPCA) <peder.sandhei@state.mn.us>; Koudelka, Kirk (MPCA) <kirk.koudelka@state.mn.us>; Benke, David J (MPCA) <david.j.benke@state.mn.us>; Croaston, Matt (MPCA) <matt.croaston@state.mn.us>
Subject: RE: City of Bloomington Comments - Burnsville Sanitary Landfill Draft SEIS

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MPCA Team,

Please find attached Bloomington's comment letter on the Draft SEIS for the proposed Burnsville Sanitary Landfill Expansion. Please let me know if you have any questions or if any additional public meetings are scheduled.

Thanks in advance for your consideration and thanks again for attending the City Council meeting Monday.

Glen

CITY OF BLOOMINGTON MINNESOTA

GLEN MARKEGARD, AICP
Planning Manager
PH: 952-563-8923 **CELL:** 952-388-4606

From: Markegard, Glen
Sent: Tuesday, July 13, 2021 2:50 PM
To: 'peder.sandhei@state.mn.us' <peder.sandhei@state.mn.us>; 'Koudelka, Kirk (MPCA)' <kirk.koudelka@state.mn.us>; 'david.j.benke@state.mn.us' <david.j.benke@state.mn.us>; 'steven.sommer@state.mn.us' <steven.sommer@state.mn.us>; Croaston, Matt (MPCA) <matt.croaston@state.mn.us>
Subject: City of Bloomington Comments - Certificate of Need Preliminary Determination

MPCA Team,

Thanks for attending the Bloomington City Council meeting last night! Your presence was very helpful and

greatly appreciated.

I'll attach Bloomington's comment letter on the Certificate of Need Preliminary Determination as approved by the City Council last night. We'll also be submitting comments soon on the Draft SEIS.

Thanks,

Glen

GLEN MARKEGARD, AICP | Planning Manager
Pronouns: (he/him/his)
PH: 952-563-8923 **CELL:** 952-388-4606 **EMAIL:** gmarkegard@bloomingtonmn.gov
1800 West Old Shakopee Road, Bloomington, MN 55431

CITY OF
BLOOMINGTON
MINNESOTA

July 15, 2021

Steve Sommer
Minnesota Pollution Control Agency
520 Lafayette Road N.
St. Paul, MN 55155

RE: Burnsville Sanitary Landfill (BSL) Expansion – Comments on the Draft Supplemental Environmental Impact Statement (SEIS)

Dear Mr. Sommer,

Thank you for requesting comments on the Draft SEIS for the Burnsville Sanitary Landfill Expansion. Waste Management is proposing to expand the landfill by 23.6 million cubic yards, a volume that the SEIS estimates will accommodate 21.9 million tons of waste. Based on the MPCA's reported 2021 generation rates, it would take twenty years for the entire seven county metro area to generate that staggering amount of waste.

The expansion is proposed to increase the height of the landfill to an elevation of 1,082 feet above mean sea level, which is 389 feet above the nearby Minnesota River. The top of the mound will be higher than Mount Gilboa, Bloomington's highest elevation in Hyland Ski Area. The top of the landfill mound will be more than 340 feet higher than the nearest residence in Burnsville, which is approximately 1,000 linear feet from the base of the mound and 250 feet higher than the nearest residence in Bloomington, which is approximately 3,400 linear feet from the base of the mound. If approved, the Burnsville Sanitary Landfill will become the dominant and defining visual feature of this portion of the Minnesota River Valley.

If approved, 23.6 million cubic yards of additional waste will be placed in a sensitive ecological area adjacent to a major river, adjacent to a National Wildlife Refuge, near the water supplies of large cities and within the City of Burnsville Drinking Water Protection Overlay District, in a floodplain, in an area that requires wetland fill, and in a high profile location near hundreds of homes.

If approved, 23.6 million cubic yards of additional waste will be placed in an area flagged by the state as having environmental justice concerns even though other three existing and proposed landfills currently under consideration for Certificates of Need do not have similar concerns. Very little outreach has occurred to date. Local residents and the surrounding communities have not been sufficiently involved in the environmental review and Certificate of Need processes. Local residents and the surrounding communities will need to be more extensively involved in any future permitting approval processes.

MAYOR AND CITY MANAGER
1800 W. OLD SHAKOPEE ROAD, BLOOMINGTON MN 55431-3027
PH 952-563-8780 FAX 952-563-8754 TTY 952-563-8740

AN AFFIRMATIVE ACTION/EQUAL OPPORTUNITIES EMPLOYER

Because of these significant concerns, the City of Bloomington requests that the MPCA address the following items and propose the following mitigation when preparing the Final SEIS:

1. **Waste Composition**. The Draft SEIS notes that, as of December 2019, 69 percent of the waste being landfilled at BSL is recoverable. That includes organics and recyclables. Bloomington requests that the Final SEIS recommend mitigation during permitting to require the landfill owner and its affiliated haulers to aggressively remove organics and recyclables from the waste stream in order to meet the legislatively mandated 75% recycling goal. Requirements to remove recoverable waste should come with a corresponding reduction in the volume of waste allowed under any permit, which in turn would reduce the impacts of the expansion.

2. **Groundwater Impacts**. Of great concern, the Draft SEIS points out that parts of the BSL are unlined and that the water table rises to interact with the unlined portions of the landfill during flooding events along the Minnesota River. The Draft SEIS also predicts a discontinuance of dewatering at the adjacent Kraemer Quarry will result in regular interaction between waste in the unlined portions of the landfill and the water table. Having waste below the water table could cause far reaching groundwater and surface water contamination. Bloomington requests that the Final SEIS recommend mitigation measures as a condition of permitting that:
    a. Requires waste in the unlined portions of the landfill to be relocated to portions of the site that are sufficiently lined. The MPCA is proposing this approach to mitigate interaction of the water table with the waste in the nearby unlined Freeway Landfill and Freeway Dump, also in Burnsville.
    b. Requires regular groundwater monitoring by the MPCA and, in the event of detection of any groundwater contamination, results in prohibition of further expansion.

3. **Surface Water Impacts**. The Draft SEIS notes that in a 500-year storm, the proposed expansion will increase the peak storm water runoff discharge rate from the site by 47% due to the increase in landfill slope proposed with the expansion. A significant increase in peak runoff rates will cause substantial negative impact to people and property downstream during a major rainfall event, which is the time at which more water downstream is most damaging. Bloomington requests that the Final SEIS recommend mitigation during permitting to reduce the landfill slopes so that peak storm water runoff rates do not exceed current runoff rates. In addition to protecting people and property during a major rainfall event, the proposed mitigation would also have the added benefit of reducing the landfill height and corresponding visual impact.

4. **Lighting Impacts**. The Draft SEIS does not analyze the impacts of blinking lights required by the Federal Aviation Administration (FAA) for features over 200 feet in height. Bloomington requests that analysis of these lights and specific proposed mitigation measures be included in the Final SEIS.

5. **Visual Impacts and Associated Property Value.** The Draft SEIS includes reference to a property value study completed for a landfill in Dunmore, Pennsylvania. Bloomington requests additional justification for why this study is relevant to the BSL. Bloomington requests that more than one study of property values be considered in the Final SEIS and

that at least one of these studies include a landfill located in a similar scenic location as the Minnesota River Valley.

6. **Environmental Justice.** The Draft SEIS states that the project is located within an area of concern for environmental justice and vaguely states that documents were assessed within the context of disproportionate exposure. Bloomington requests that those documents, the demographics, sources, and the assessment be included as an attachment to the Final SEIS so that the public can review this information.

7. **Air Quality.** The Draft SEIS estimates that, at buildout, the landfill will generate 5,863 standard cubic feet of landfill gases **every minute**. Of that volume, 75 percent is planned to be captured and 25 percent will escape into the atmosphere. Roughly half of the captured gases will be flared on site. As a direct result of the expansion, the Draft SEIS reports that volatile organic compounds will increase by 10.2 tons/year and hazardous air pollutants will increase by 5.4 tons/year. Bloomington requests that permitting entities closely consider the proximity of nearby residential uses when considering where to permit landfills with their associated air quality impacts and how to appropriately dispose of the captured gases. The Final SEIS should describe the location of the proposed flare(s) as well as the visual and noise impacts of the flare(s).

8. **Aviation Impacts**. Landfills are notorious for attracting large birds. During a recent visit to the perimeter of the BSL, Bloomington City staff observed numerous eagles, gulls and other large birds. The birds attracted to landfills and corresponding concerns regarding mid-air collisions with birds are the primary reason the FAA has serious concerns about placing landfills near airports. The Burnsville Sanitary Landfill expansion is proposed near MSP International and Flying Cloud Airports and directly underneath a very frequently used flyway departing MSP, one of the nation's busiest airports. The increased height of the landfill and corresponding orographic lift will bring birds closer to aircraft and may present special concerns.

   Attachment G of the Draft SEIS is a letter from the FAA to the City of Burnsville. In that letter, an FAA representative states: *"Based on our review and utilizing the criteria in AC's 150/5200-33B, the FAA is concerned with the initial proposed project given the location, and potential to create a wildlife hazard attractant near the Minneapolis-St. Paul International Airport (MSP)."*

   Given the documented FAA concern, prior to completion of the Final SEIS, Bloomington requests that:
   a. The BSL submit and the FAA complete Form 7460 for the FAA's review. The SEIS should not be finalized until the FAA review process is complete and the FAA has had a chance to rule on whether or not a major landfill expansion of this height will present an impact to aviation; and
   b. Following the Form 7460 review, the issue of aviation impacts be reviewed by the Metropolitan Airports Commission so that their concerns can be flagged as mitigation measures if needed in the Final SEIS.
   c. In the event the FAA requires modification to any flight paths due to the proposed landfill, Bloomington requests that the Final SEIS fully model the noise impacts

of the new flight paths and recommend any appropriate mitigation.

9. **Size Reductions**. The Draft SEIS states: "*If a 75% recycling and preprocessing rate is achieved by year 2030, the size of the expansion could be reduced from 23.6 million cubic yards to 11.9 million cubic yards resulting in a reduction in height of the expansion to elevation 862 feet using the same expansion footprint*." It also states: "*Shredding of waste prior to disposal in the landfill could reduce the waste volume by up to 75% according to manufacturers of shredding equipment*". Bloomington requests that the Final SEIS recommend mitigation measures as a condition of permitting that require:
    a. a 75 percent recycling and preprocessing rate by the year 2030;
    b. shredding of remaining waste prior to disposal; and
    c. a corresponding reduction in the volume of waste allowed under any permit.

10. **Economic Impacts**. Discussion of economic impacts of the landfill should include an analysis of the total impact to property values in Bloomington, Burnsville and Savage and corresponding impacts on property taxes.

11. **Public Input**. Prior to finalization of the SEIS, Bloomington requests that the MPCA perform robust outreach and gather input from nearby residents, surrounding cities, and adjacent counties to identify potential impacts. Those impacts should be fully addressed in the Final SEIS. Outreach and input is particularly important given that the expansion is proposed in an area flagged by the state for environmental justice concerns.

Thank you in advance for considering the above comments. We look forward to better understanding the impacts and remain extremely concerned about placing this volume of additional waste in a high profile and environmentally sensitive location.

Sincerely,

Tim Busse
Mayor

copy via e-mail: Bloomington City Council Members
Bloomington Legislative Delegation
Debbie Goettel, Hennepin County Commissioner
Sarena Selbo, Manager, Minnesota Valley National Wildlife Refuge
Peter Tester, Temporary Commissioner, MPCA

From: Edward Murczek
To: Sommer, Steve (MPCA)
Subject: I oppose the Burnsville extension of the landfill
Date: Thursday, July 15, 2021 4:30:12 PM

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...for the following reasons:1) the national wildlife is nearby and landfill
disposal will be disruptive to the visual integrity of the refuge and its wildlife, and especially so as the height increases to be the highest point locally . 2) fear of the contamination of the nearby Minnesota River. 3) I'm surprised you want to increase the size of the landfill at the expense of the refuge and it's wildlife.

Ed Murczek
3400 Ne Klickitat St.
Portland, Oregon 97212

PS: I spent about four years in Mpls, MN before moving to Portland, OR and always thought MN took it's environment seriously, however this proposal makes me think otherwise. I sincerely hope you will NOT seriously consider this proposal.
Sent from my iPhone

From: Jeff Olson
To: Sommer, Steve (MPCA)
Subject: Comment on Burnsville Sanitary Landfill expansion project
Date: Friday, July 16, 2021 12:01:18 AM

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I am writing to express my concerns about the proposed Burnsville Sanitary Landfill expansion project as outlined at https://www.pca.state.mn.us/regulations/burnsville-sanitary-landfill-expansion-project.

Allowing this expansion to move forward is, in my opinion, a mistake, for the following reasons:

- A landfill should not be located in the river valley where it can potentially cause pollution to the river and the surrounding water table.
- The proposed height of the landfill will make it 372 feet above the surrounding grade, 250 feet higher than the river bluff, and 60 feet higher than the highest point in Bloomington. This will make this mound the most visually prominent feature of this area of the river valley. This does not seem wise.

I urge the MPCA to not permit this expansion to move forward.

Thanks,
Jeff

Jeff Olson
jeff@olsonzoo.com

10833 Nord Ave S
Bloomington, MN 55437

612.202.1535

From: karen boomfan.com
To: Sommer, Steve (MPCA)
Subject: Burnsville Landfill Expansion EIS
Date: Monday, July 19, 2021 5:42:46 PM

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Dear Sir,
As a citizen of Bloomington who lives in an area near Dwan Golf Course, I am very concerned about the winter sight-line impact of the proposed landfill expansion. The EIS report does not ease my concern as it appears we'll have a clear view of the landfill and also potentially be exposed to other environmental factors including noise, smell and potentially loose waste near a vital waterway. I am not in favor of this site expansion, despite the obvious need to accept waste somewhere. We need to seek alternatives that are not as close to waterways and within site patterns of so many close residents.
Thank you for consideration of my comment and point of view.
Best,
Karen Hohertz-Jacobs
11018 Glen Wilding Lane, Bloomington
Karen@Boomfan.com

From: Pliska Family
To: Sommer, Steve (MPCA)
Subject: Burnsville trash landfill expansion -
Date: Monday, July 19, 2021 6:57:17 PM

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Good Evening Steve,

I am just writing to express my opposition to the proposed expansion of the Burnsville landfill. I live in Bloomington, not far from the river front and think our rivers are so valuable as a resource. Further development alongside the river would be better to be residential or community use than enlarging an already large landfill. Thank you,

Justine Pliska

From: Samantha Collins
To: Sommer, Steve (MPCA)
Subject: BSL Draft Questions and Comments
Date: Tuesday, July 20, 2021 4:24:47 PM

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Good Evening, Steve,

My name is Samantha Collins and I am a resident of Bloomington, MN, and soon to be a resident of Eden Prairie, MN.

I have some questions that were not addressed at all, or some were vaguely addressed during the presentation of the EIS of the Burnsville Sanitary Landfill.

1. Your research has shown that if the Kraemer quarry ceases production or decreases the pumping of groundwater, it will directly negatively impact BSL and the community; What has been done to ensure that this symbiotic relationship continues? Does anyone know how long the quarry is expected to produce at its current rate? How will communication be upheld and/or required between the state, the city of Burnsville, BSL, and the quarry? I spoke to David Oslie at Kraemer Mining and Materials, and he said "dependent upon market conditions, Kraemer could easily operate the quarry for another 30 years." He also wasn't aware of this relationship between BLS and the quarry.

2. Overall alternatives, you all mentioned using other landfills as an alternative, rather than implementing a different area. Why is that? Is there no other area that seems fitting for the project?

One could argue that an alternative would be increasing recycling and preprocessing of waste, as per your research it could decrease the volume of waste by almost half, and height up to 220 feet. How can this be possible, meaning, who upholds, regulates, and ensures that this happens?

Overall this project is a short-term plan for the next 1-2 generations at best. It is not addressing the true issue of poor regulation of waste management. What can I do, as a citizen to ensure that lawmakers, the EPA, MDH, and other appropriate boards and organizations address that? Do you know if the state is looking to address that in the next generation?

4. Concerns of AQI: In regards to air pollution, are there AQI monitors in the surrounding area, if so where and how many? Is there an AQI monitor at the BSL site? How does BSL ensure worker safety regarding air quality?
From your presentation, the air quality was suspected to be satisfactory, even with the increase in waste and green house gas emission, what was this based on? The AQI categories of good, moderate, etc from airnow.gov? If so, those categories are not specific enough. For example, it does not include pregnant people apart of their sensitive group category, thus not taking into consideration the recent research that has came out in the last 5 years, showed negative pregnancy outcomes at less than the EPA's AQI guidelines. Those pollutants

included large and small particulate matter, Nitrous dioxide, and sulfur dioxide and directly impacted birth weight, preterm birth, increase NICU admission, and pregnancy-related complications like pregnancy-induced hypertension and gestational diabetes.

5. Are there additional reports that the EIS, City of Burnsville, Waste Management, or MDH are not sharing? If so, is this because it is not required? How can the public access this information?

6.You mentioned that you all are unable to change your scope for this proposal. If the scope isn't serving the community, why are you using it? Why can't there be addendums?

7. Waste Management and MDH should be required to address how they will address an extreme environmental impact or emergency plan of contamination or water or air quality. Does the EIS provide this for them? If not, who does?

Thank you for your time reviewing my questions.

Kindly,
Samantha Collins

From: Patricia mullen
To: Sommer, Steve (MPCA)
Cc: tbusse@bloomingtonmn.gov
Subject: Burnsville Sanitary Landfill-Bloomington Resident Comments!
Date: Tuesday, July 20, 2021 5:09:01 PM

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Dear Mr. Sommer

I am a 30 year Bloomington resident and home owner. **Why would any decision-makers choose to expand the Burnsville Sanitary Landfill in a river valley near public water supplies?** The impact to the environment and the Minnesota River can be predicted. Water supply will be tainted and will impact wildlife and humans! There has to be a better solution than approving this site for expansion. Residents and contractors alike can reduce the amount of garbage that they produce through new recycle and compost strategies. A for-profit company like **FoodMaven**, an agriculture-tech startup founded in 2015 and based in Colorado Springs, has been successful with a mission of keeping food out of landfills. In fact, 40% of food produced by farmers was wasted previous to FoodMaven developing a supply system to redirect this food to restaurants, etc. FoodMaven leaders even interviewed farmers to find out why they were struggling with their chicken and beef overproduction/waste. As a result FoodMaven bought a beef processing plant. Now the food that used to go to a landfill is redirected to feed hungry US citizens. This is one example of a company that took on the difficult task of building a better system to redirect what was previously tossed as waste!

Why wouldn't Burnsville and Bloomington decision-makers explore more innovative solutions to the garbage challenge? I volunteer my energies to support the design of new ways to redirect what goes into a landfill. We all have to live in this environment, drink the water and breathe the air. Let us work harder to get all residents and businesses invested in reducing waste.

As a Bloomington resident and taxpayer, I am adamantly opposed to the expansion of the Burnsville Sanitary Landfill. Let's instead replicate the innovative thinking of a company like **FoodMaven** and other companies that have reduced garbage waste. Let's apply innovative thinking to implement more effective systems in Burnsville and Bloomington to reduce garbage.

Respectfully submitted,

Dr. Patricia Mullen, MA. & Psy.D.
Bloomington Resident

From: Kevin Peters
To: Sommer, Steve (MPCA)
Subject: Burnsville/Bloomington Landfill Project
Date: Wednesday, July 21, 2021 9:54:47 AM

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I would like to state for the record that I completely oppose putting a landfill in such a dense urban area next to a vital waterway. The landfill should be located outside of the Twin Cities metro. Thank you,
K. Peterson

From: Randy Peterson
To: Sommer, Steve (MPCA)
Subject: Burnsville Landfill Expansion Project
Date: Sunday, July 25, 2021 12:44:20 PM

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Hello,

I am writing in regard to the open comment period set to end July 31 as it pertains to the Burnsville Sanitary Landfill Expansion Project.

I imagine a situation such as this one is entirely complex with many factors that I am surely unaware of, so I'll keep my concerns brief and subjective.

I reside in Bloomington, right off the Dwan Golf Course on Drew Avenue. At minimum, I have concern regarding the increase in elevation of this landfill and how that affects the aesthetic for everyone who can see this from their homes. I imagine that may have some negative effects on property values in the future as well.

My main concern, though, is the proximity of the landfills to the river and drinking water supply. I've read that there are issues (or potential for) with contamination from the freeway landfill and freeway dump. While I'm sure the state looks at the environmental effects of these projects in detail, I can't help but to feel dumbfounded that we would further risk the local and downstream dependents related to an expansion in this area.

I don't know what alternative there is beyond reducing, reusing, and recycling, for which, I am proud to do my part while encouraging others to do the same.

Thank you for reading,

Randy Peterson

From:	Brian Smith
To:	Sommer, Steve (MPCA)
Cc:	Rochon Bergevin-Smith
Subject:	Opposed to Burnsville Sanitary Landfill expansion project
Date:	Sunday, July 25, 2021 2:21:21 PM

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July 25, 2021

Hello Steve Sommer:

We are responding to the proposed Burnsville Sanitary Landfill expansion project as publicized here: https://www.pca.state.mn.us/regulations/burnsville-sanitary-landfill-expansion-project

As homeowners in Savage for 34 years and lifelong Scott County residents, we are writing in **strong opposition to the proposed landfill expansion project** for significant concerns not limited to:

- **Groundwater Contamination**
  The Savage Pacer July 24th edition explains the Burnsville and Savage water supply "artificially suppresses the area's water table" temporarily avoiding inevitable contamination. Lined or not, we must prioritize and protect our water supply over the convenience and profit of exploiting an existing landfill.

- **Recreational and Environmental Impact**
  An expansion guarantees the landfill will become the ironic "centerpiece" of the Minnesota Valley National Wildlife Refuge and destroy recreational use of these popular destinations:
  - Minnesota Valley State Trail, Bloomington
  - Minnesota Riverfront Park, Burnsville
  - Cliff Fen Park, Burnsville
  - Blackdog Park, Burnsville

  An expansion will also increase the flocks of seagulls currently attracted to this food source and consequently transport pollution to bodies of water beyond the Minnesota Valley. As noted at nih.gov in *The biogeochemical implications of massive gull flocks at landfills*: "We conclude that mega-flocks of landfill gulls are common and widespread, and that their capacity to transport nutrients may be contributing to the eutrophication of aquatic ecosystems and water supplies."

- **Community Life and Tourism**
  Erecting a "hill" of waste eclipsing the Hyland Hills and Buck Hill ski areas will become the unwanted signature landmark of this area with its footprint, height, and inescapable nauseous smell.

Our thriving communities, health, aesthetics, and property values will sink as the landfill expands.

We implore the MPCA to stop pursuing this inertial expansion, contain the growth and impact of the landfill, and identify other strategies for long-term waste management.

Respectfully,

Brian & Rochon Bergevin-Smith
8928 W 137th St
Savage, MN 55378
brianbsmith@hotmail.com
rochonbs@hotmail.com

From: Mia Olson
To: Sommer, Steve (MPCA)
Subject: Please Protect Our Water
Date: Monday, July 26, 2021 8:38:20 AM

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Dear Mr. Sommer,

In our beautiful state of 10,000 + lakes, rivers & streams we should be doing all that we can to protect them. They are our way of life, and factually …water IS life. Please do all that you can to be a water protector.

Say No to the river location/expansion of the landfill.

Thank you,
Mia Olson

Concerned Minnesotan who happens to be from Bloomington

Sent from my iPhone

From: Roth, Ann R
To: Sommer, Steve (MPCA)
Subject: opposition to increasing size of Burnsville landfill
Date: Monday, July 26, 2021 1:49:47 PM

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Hi,

I am writing to ask for your consideration to deny the request to increase the size of the Burnsville landfill managed by Waste Management. The landfill would be a massive eyesore and a pollution risk with its location on the river. We need to look for better solutions for waste management that don't provide such a risk to the environment and water safety. Thanks for your consideration!

Ann Roth
Sr. Financial Systems Analyst
HealthPartners
Cell Phone: 952-457-3134 or contact via MS Teams

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From: Christy Warner
To: Sommer, Steve (MPCA)
Subject: Burnsville Sanitary Landfill expansion
Date: Monday, July 26, 2021 4:48:12 PM

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Hi Steve--

So you are the lucky person who gets these messages; thank you for being on the firing line.

I live in Bloomington, just across the river from the Freeway landfill, and I am extremely concerned about the environmental impact of the expansion/proposed development so near the river. I think we should never be putting landfills near rivers. Something like this would be devastating to the natural area of 9 mile creek, which flows into the river nearby and is used year around. It's an oasis in the city and it would be horrible to wreck it by putting a landfill so close by. Sure, this will destroy my property value, but I think the destruction of the natural area is a far worse consequence. Burnsville must have plenty of unused (uglier!) space where this thing could go.

Please, please do not put this landfill in this spot!

Thank you
Christy Warner
11056 Glen Wilding Lane
Bloomington 55431
952-540-7027

From: Johnny H
To: Sommer, Steve (MPCA)
Subject: Burnsville MN River landfill
Date: Tuesday, July 27, 2021 11:20:18 PM

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I (along with everyone else living in Bloomington) take issue with the concept of building a mountain of trash right beside the Minnesota river, it would without a doubt turn that section of the river into the ugliest place in Minnesota, in addition to the obvious ecological consequences.

Thanks,
Johnny Horstman

From: Glenn w
To: Sommer, Steve (MPCA)
Subject: Burnsville dump expansion
Date: Wednesday, July 28, 2021 11:14:06 AM

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Sir,

I have a concern about the environmental impact on expanding the Burnsville dump. With the location so close to the water which may have long term impact. What about the additional noise, odor, escaping trash and visual impact? I hope you have the vision to look long-term rather than short. I appreciate your consideration of my concerns.

Thanks!

Glenn

****
** Glenn Wong **
** explorer15@hotmail.com &nbs

From: Marc Smith
To: Sommer, Steve (MPCA)
Subject: We OPPOSE the proposed Burnsville Landfill expansion
Date: Wednesday, July 28, 2021 1:43:39 PM

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To Steve Sommer, MPCA --

This is a quick note to tell you we OPPOSE the proposed expansion to the Burnsville Landfill. We read the following article in the TwinCities.com/Pioneer Press:

https://www.twincities.com/2021/07/25/burnsville-landfill-expansion-draws-opposition-from-bloomington-officials/

We find it extremely difficult to believe that the proposed expansion is being pursued as the "best" option, when the current landfill already threatens drinking water in Burnsville and Savage, and expansion will only compound the problem for the next 40 years. We also find it hard to believe the MPCA would seriously entertain a proposal to allow the landfill to expand UPWARD by 262 feet "... and the trash mound would stand taller then both the Hyland Hills Ski Area and Buck Hill". How can that possibly be a responsible option?

Maybe this proposal is just the "easiest" from an administrative standpoint? But doesn't it just create a ticking time-bomb?

This quote from the Pioneer Press article resonated with us:

"Bloomington Sustainability Commissioner Tim Sandry asked why the "absolutely worst option" of expanding a landfill in an environmentally-sensitive area is the only proposal being discussed."

We live in the South Metro. My brother and his family live in Savage. A lot of good people are living in Savage and Burnsville. Please do NOT threaten the health of these residents by pursuing this expansion proposal. Instead, **PLEASE investigate other options** -- several reasonable-sounding alternatives are noted in the TwinCities.com/Pioneer Press article.

Thank you for sincerely considering this feedback.

Marc & Julie Smith
3369 Wildwood Trl NW
Prior Lake, MN 55372

From: Mike Hayes
To: Sommer, Steve (MPCA)
Subject: Burnsville Sanitary Landfill
Date: Wednesday, July 28, 2021 1:49:29 PM
Attachments: Outlook-mgpavlht.jpg
Burnsville Landfill - MPCA Letter - July 2021.pdf

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Good afternoon Steve!

Attached with this email is a letter expressing our concern regarding the Burnsville Sanitary Landfill. Please let me know if you have any questions or need anything else from me.

Thank you for your consideration!

Michael Buckingham-Hayes
Buckingham Companies
5980 Credit River Road SE
Prior Lake, MN 55372
952-226-6441 - Office
www.buckinghamcompanies.com

The Buckingham COMPANIES
5980 Credit River Road
Prior Lake, MN 55372
952-226-6441

Steve Sommer
Minnesota Pollution Control Agency
520 LaFayette Rd. N
St. Paul, MN 55155

RE: Comments on Burnsville Sanitary Landfill SEIS

Dear Mr. Sommer:

Buckingham Trucking, Inc. submits the following comments regarding the Burnsville Sanitary Landfill proposed expansion project and Supplemental Environmental Impact Statement (SEIS).

We urge the MPCA to prioritize and complete the SEIS, permitting and Certificate of Need (CON) processes for the Burnsville Sanitary Landfill. The continued operation of the Burnsville Sanitary Landfill is vital to our business and we are concerned that the dwindling capacity at Burnsville Sanitary Landfill will negatively impact our business, our customers and the environment.

- Transportation costs are a major factor in the collection of waste. If the Burnsville Sanitary Landfill were to close, or reduce the amount of waste accepted to lengthen the timeframe for the landfill to stay open, our business would have to seek other, more distant transfer stations or landfills to dispose of mixed municipal solid waste (MMSW) , including potential disposal facilities located in Greater Minnesota and/or out of state. This scenario would ultimately result in businesses and residents within Minnesota paying more for the collection and disposal of waste.

- Increased transportation distances adversely impact the environment. Longer distances results in increased fuel use and increased emissions.

Burnsville Sanitary Landfill is rapidly running out of its remaining capacity, having a projected remaining capacity of 14-18 months. We urge the MPCA to expediently move the remainder of this process forward.

Sincerely,

Buckingham Trucking, Inc.

From: Dorothy Hruska
To: Sommer, Steve (MPCA)
Subject: Stop Burnsville expansion
Date: Wednesday, July 28, 2021 4:35:04 PM

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Find a way to recycle, reuse, etc.

Sent from the all new AOL app for Android

From: Dorothy Hruska
To: Sommer, Steve (MPCA)
Subject: Why I Do Not Want Landfill
Date: Wednesday, July 28, 2021 5:01:36 PM

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1) Environmental issues....the river and ground water
2) unsightly to Bloomington residents which includes my home on Upton Ave S
3) find ways to dispose of couches and mattresses and of course other items
4) educate people to buy less and take care of things and give away what you don't need or want
Ken and Dorothy Hruska
952-884-1718

Sent from the all new AOL app for Android

From: GraggJohnson, Kelly (ADM)
To: Sommer, Steve (MPCA)
Subject: SHPO No. 2021-1957 Draft SEIS - Burnsville Sanitary Landfill Expansion Project
Date: Wednesday, July 28, 2021 5:52:14 PM
Attachments: 2021-1957.pdf

Good Afternoon,

Here is the SHPO comment letter for this project.

Best Regards,

Kelly

Kelly Gragg-Johnson (she/her*) **| Environmental Review Specialist**
State Historic Preservation Office
Minnesota Department of Administration
50 Sherburne Avenue, Suite 203
Saint Paul, Minnesota 55155
(651) 201-3285
kelly.graggjohnson@state.mn.us

*Why this matters.

The SHPO office is closed to visitors and unable to accommodate in-person research and deliveries. Mail is being delivered to the office via USPS, FedEx and UPS. Our office will continue to take file search requests via DataRequestSHPO@state.mn.us. Check SHPO's webpage for the latest updates and we thank you for your continued patience.

DEPARTMENT OF ADMINISTRATION
STATE HISTORIC PRESERVATION OFFICE

July 28, 2021

Steve Sommer
Resource Management and Assistance Division
Minnesota Pollution Control Agency
520 Lafayette Road North
St. Paul, MN 55155-4194

RE: Burnsville Sanitary Landfill Expansion Project
Burnsville, Dakota County
SHPO Number: 2021-1957

Dear Steve Sommer:

Thank you for providing this office with a copy of the Draft Supplemental Environmental Impact Statement (DSEIS) for the above-referenced project.

Based on our review of the project information, we conclude that there are no properties listed in the National or State Registers of Historic Places and no known or suspected archaeological properties in the area that will be affected by this project.

Please note that this comment letter does not address the requirements of Section 106 of the National Historic Preservation Act of 1966 and 36 CFR § 800. If this project is considered for federal financial assistance, or requires a federal permit or license, then review and consultation with our office will need to be initiated by the lead federal agency. Be advised that comments and recommendations provided by our office for this state-level review may differ from findings and determinations made by the federal agency as part of review and consultation under Section 106.

Please contact Kelly Gragg-Johnson in our Environmental Review Program at kelly.graggjohnson@state.mn.us if you have any questions regarding our review of this project.

Sincerely,

Sarah J. Beimers
Environmental Review Program Manager

From: Chad Johnson
To: Sommer, Steve (MPCA)
Subject: my families Bloomington experience and the burnsville dump
Date: Wednesday, July 28, 2021 7:20:52 PM

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Hello Sir

Placing a dump up wind of any city is poor planning. Expanding a dump up wind from a city to these heights is irresponsible and negligent. We live on Johnson ave and overlook dr. My property taxes are a cool 100K more than I can get for my house even in this market. what do I win? The dump right in smelling distance. Who is going to pay for the "Value" insurance policy for our neighborhood once you can smell it all summer long? Because I will tell you with temps rising, it will affect the air. And homes dont sell where it stinks. Plus aesthetically what the hell are you thinking? The expansion is preposterous.

YIMBE right.... but up wind?... Thats just stupid.

I am willing to pay more on my garbage. Where the hell is my compost option?

Just want you guys to lead and make smart decisions. Please help us citizens

--

Chad Johnson CPPM,CPT,CES,MMACS,WFS
Founder and lead coach at Fitness Bodhi

M 612-207-1899 **E** FitnessCoachChad@gmail.com
W www.fitnessbodhi.com

From: Tom Wenisch
To: Sommer, Steve (MPCA)
Subject: Burnsville landfill
Date: Thursday, July 29, 2021 8:00:55 AM

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Dear sir ,
My name is Tom Wenisch,I live just across the river from the Burnsville landfill an d I'm very concerned with the proposed expansion! Needless to say I don't want it. There has to be a better alternative . The height of it worries me. I would pay more for garbage service if nessesary.

Tom Wenisch

Sent from my iPad

From: Caljsar
To: Sommer, Steve (MPCA); deb.garross@burnsvillemn.gov
Subject: Burnsville Sanitary Landfill Expansion Project
Date: Thursday, July 29, 2021 8:38:12 AM

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Good morning Steve and Deb,

I'm writing this email to express my opposition to the Burnsville Sanitary Landfill expansion project. I'm a lifelong resident of Bloomington, and I now own a home northwest of Dwan Golf Course. I'm concerned that the landfill expansion will be unsightly and negatively impact the the Minnesota River Valley's current appeal. I grew up biking, hiking, and fishing along the Minnesota River, and I still enjoy all of these activities down in the river valley. The Minnesota River is already an urban thoroughfare for barge traffic, but the wooded shorelines still provide a sense of natural wilderness. Drastically increasing the height of the existing landfill will ruin that charm forever.

I understand that the city of Burnsville is dependent on the revenue from the landfill, but expanding the size of the landfill is really only a temporary solution as there is still a finite limit on it's size. Burnsville should deal with the issue at hand instead of kicking the can down the road for another generation to deal with.

Please do not support the landfill expansion. It's a decision being driven entirely by money, and it is not a good solution for the environment and the Minnesota River.

Sincerely,
Calvin Sargent

From: Kevin Foreman
To: Sommer, Steve (MPCA)
Subject: A note regarding the Burnsville waste poject
Date: Thursday, July 29, 2021 12:26:12 PM

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Hello,

My name is Kevin Foreman and I am a Bloomington resident. I'd like to express my opinion on the Burnsville sanitary landfill project.

Is there another plan being pursued regarding adding another landfill site for the Twin Cities? I read about organic recycling, as well as the issues with our current recycling programs, with avid interest. But realistically speaking, people won't change habits much in the short term and we need a place to put the waste from the Twin Cities metro area. But a mountain of waste on the north side of Burnsville is a bad idea.

I have selfish reasons for avoiding this monster. Three years ago, my wife and I bought a home directly north of where this project will sit, about 3 blocks north of the Minnesota River bluffs. To imagine that the dominant vision in our area would be a garbage mountain is not what we bargained for. When communities have major projects, we usually put up with the cost and inconvenience as part of the greater community good, and generally rising property values. The thought that ours could be stifled due to a visual eyesore and olfactory nuisance, gives us enough pause to wonder if another move may be necessary. This just shouldn't be a reason to move.

I went to some Burnsville City council meetings and it was clear to me that the additional fees that Burnsville will receive for this project are too large to ignore, and would be difficult to replace via other funding sources. But Burnsville is reaping the benefit, and sticking Bloomington residents with the downside since most of this won't affect the residential areas of Burnsville. And based on the videos, it won't really be all that visible from the south.

I'm frustrated that I'm not hearing about other options to this project, which makes me think there's nothing that's going to stop it. I like to have civic pride in my community, and it saddens me that one of the first things people will see, when visiting from the south via 35, will be a garbage mountain in a river valley. With weather patterns changing, I'm also skeptical that today's drought might turn into the next decade's "unforeseen" floods. The risk of a garbage dump seeping into the water supplies of all the Americans living downriver seems like a bad idea as well. We all know that water is becoming more valuable every year, and sticking it to the south central US so Burnsville can get more funding is very irresponsible and speaks to poor leadership from the state level.

So I wholeheartedly disagree with the scope of the current plans for the Burnsville Sanitary

Waste project. Shrinking it would be a great start, and finding another couple sites to share the region's garbage load would be the responsible thing to do. And to get the whole project out of a river valley seems like a very good idea as well, though it's likely much too late for that.

Thanks, and please let me know if you have any thoughts or questions for me.
Kevin Foreman

From: John Crampton and Associates, INC
To: Sommer, Steve (MPCA)
Cc: John Crampton
Subject: Comments About Burnsville Sanitary Landfill
Date: Thursday, July 29, 2021 2:45:45 PM
Attachments: Garbage Mountain_ver2.docx

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Hi Steve,

Here are my comments (see attached) about the Burnsville Sanitary Landfill draft environmental review.

Please let me know that you receive them. Thanks a lot.

John Crampton
612-396-6010

July 29, 2021
Steve Sommer
Minnesota Pollution Control Agency
520 Lafayette Road N.
St. Paul, MN 55155

RE: Burnsville Sanitary Landfill (BSL) Expansion – Comments on the Draft Supplemental Environmental Impact Statement (SEIS)

Dear Mr. Sommer,

My name is John Crampton. My wife and I live at 1401 W. 102nd St in Bloomington, approximately 1 mile north of the proposed Burnsville Sanitary Landfill (BLS) site.

I currently serve as the Vice President of the Minnesota Division of the Izaak Walton League of America. We are a conservation organization that has been working in the Minnesota River Valley since the building of the Izaak Walton Bass Ponds in 1927.

I strongly object to the Draft Supplemental Environmental Impact Statement, because it is proposing a project that will be an environmental catastrophe of monumental proportions.

BSL Height: The height of the proposed BSL "garbage mountain" will make it over 23 stories (250 ft.) higher than any residence in Bloomington**. It will become the dominant, defining visual feature in the Minnesota River Valley**.

It will pose serious hazards to aircraft on approach to MSP and Flying Cloud Airport. It will attract scavenger birds at these higher elevations that will crash into planes and foul up jet engines as they prepare to land, thus endangering the safety of both

passengers and people on the ground. Constantly blinking aircraft lights will be required on BSL "garbage mountain", which will be a constant nuisance to people in our communities who want to go outside of their homes in the evening.

"Garbage mountain" will also be a terrible noise generator, positioned high above surface levels at the epicenter of the ear-horn shaped delta and valley of Nine Mile Creek. I suggest you reference the noise levels that the proposed Freeway Landfill Amphitheater project would have generated in the early 2000s. The proposed BSL landfill will be an even worse generator of noise pollution with garbage trucks hauling their waste and font end loaders pushing it around at all hours of day and night. (If you don't think this is a problem, come out and measure the noise levels of big trucks coming up out of the valley going north on 35W…."Garbage mountain" will be a much steeper climb!)

Storm water runoff: To construct the proposed "garbage mountain" will require steep slopes that will facilitate gigantic run-off rivers flowing down and carving out huge ravines underneath the so-called caps. They will carry roaring streams of polluted waters into the floodplain lakes, the Minnesota River, and the Mississippi River. With increasing climate change this will happen quite often as 3"-4" rainfalls become the norm. Deluges of Biblical proportions will not be out of the realm of possibility, as we just witnessed in Zhengzhou, China….24" of rain in 24 hours!

If this proposed BSL project is built, it will require an exponentially bigger footprint so the height is much lower and runoff rates do not exceed the current runoff rates. As basic geometry indicates, this bigger footprint will cause terrific problems in terms of

encroachment on wetlands, floodplain lakes and environmentally sensitive areas.

Greenhouse Gas Emissions: It is estimated that the BSL will generate 5,863 standard cubic ft of landfill gases **per minute**. 25% (**1,465 cubic ft./minute**) of that will be permitted to escape into the air, which will make it one of the largest emitters of methane and C02 in this area. This is unacceptable in terms of its climate impact, particularly since 69% of the existing waste being re-landfilled is recoverable. You could probably burn the captured methane gases to power the reprocessing of the existing waste. (You could probably even mine the copper that's in there.) This, reprocessing coupled with a standard of 75% recycling goal by 2030 could significantly reduce the amount of waste in and size of the proposed BSL landfill.

Ecologically sensitive areas: The proposed BSL landfill is located in ecologically sensitive area. Unlined segments of the existing landfill are close to groundwater levels. You are now proposing to add the new waste on top of the old waste sitting on unlined portions? This is short sighted and dangerous! This will be exacerbated by the imminent closure of Kramer Quarry that will stop the pumping of water out of the quarry, thus causing water levels to rise close to the lowest levels of the landfill. Once contaminated, the groundwater will flow everywhere and be a major threat to water supplies for Savage and Burnsville and other communities that use the aquifer.

I suggest that you explore all possible alternatives and solutions to these serious deficiencies in your Draft Supplemental EIS, including:

- A robust analysis of climate change impacts on this proposed project that was "hatched" long before climate change became recognized as an existential threat.
- This analysis must include different greenhouse gas emission levels, global warming temperature increases, extreme weather events, groundwater and surface water pollution as our waters are continually stressed by increasing drought/flooding regimes.
- What would be required to implement dramatically increased recycling and pre-processing of waste?
- Shredding the remaining waste from the existing landfills to allow for greater compaction
- Limiting the amount of waste to be landfilled in the future.
- A complete economic analysis of the economic impact of this project in terms of property values, taxes and, potentially, tremendous **clean up costs** for Bloomington, Burnsville, and Savage along with state and federal governments?
- An analysis of reprocessing and moving the waste to landfills areas that are less ecologically sensitive and less populated.
- Impacts on the Minnesota Valley National Wildlife Refuge and other natural areas in adjacent areas that provide education, recreation and habitat for generations of people, plants, trees, soils, water and animals.

I suggest you open the review process up to reach the widest populations of citizens on this issue…. Not just Burnsville but also Bloomington, Savage, Eden Prairie, Eagan, Richfield and all the other people who live, work, and recreate in the Minnesota Rive Valley. We are the ones who will be on the hook for trying to clean up this mess when the proposed "garbage mountain" project fails, so we should have a major say in <u>if/when/how this project moves forward</u>.

Sincerely,

John and Mary Crampton
1401 W. 102nd St.
Bloomington, MN 55431
612-396-6010
jcrampt48@gmail.com

From: Lucinda MaDonald
To: Sommer, Steve (MPCA)
Subject: Waste Management landfill Expansion in Burnsville
Date: Thursday, July 29, 2021 7:03:09 PM

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Mr. Sommer,
As a long time resident of Bloomington, it has come to my attention that your department is evaluating the possibility of expanding the landfill area in Burnsville. As a realtor, I have concerns for property values in Burnsville and Bloomington, and consider this a rather dramatic change to the scenery of the two cities.

Most Minnesotans are proud of the waterways, lakes and natural beauty of our homeland. This atrocity would detract from that. Besides the visual implications, I am concerned that this would create potential problems in ground water and run off into the river. As a child, I remember the 1965 flood, which devastated the Minnesota River Valley. Standing on the Bloomington river bluffs, I could see the flooding stretched all the way to the railroad track and Hwy 13 in Savage. Obviously, this area is a part of this flood plain and would be impacted again if there was ever a large flood to rival '65. I am sure lesser floods would still impact this area and create the possibility of contamination.

Yes, the existing landfill was approved in the past. But, this does not mean that we must continue making the same mistakes going forward. Please consider this an opportunity to reverse some of the damage that has been done in the past by putting a halt to an expansion and even consider shutting down this facility in the future in order to preserve the river named after our state.

Thank you for your attention to my concerns.

Sincerely,
Lucinda MacDonald

Sent from Mail for Windows 10

From: DaleJ
To: Sommer, Steve (MPCA)
Subject: Burnsville landfill expansion
Date: Friday, July 30, 2021 7:32:11 AM

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Hello,

In addition to the problems with expanding this landfill I would add that in the summer months the wind is usually from the South, SouthWest and sometimes SouthEast. This would cause the dust that is created by the bulldozers pushing this material around to blow into Bloomington. I live not far from the bluff and I can see where people near the edge of the bluff overlooking the Minnesota river would get a good dusting of garbage dust and smell. I think this is a very bad idea. Why couldn't a garbage recycling/burning plant be constructed like the one in Minneapolis. The garbage could be burned and turned into energy to power electric generators. How about connecting it will Blackdog power plant. I didn't know about the blinking light for airplanes, I guess eventually this thing is going to be a huge mountain of garbage if approved.

I'm not in favor of a mountain of garbage in that location.

Those are my comments

Dale Johnson
10515 Penn Ave
Bloomington, Minnesota

From:	Edward Crozier
To:	Sommer, Steve (MPCA)
Subject:	Comments on Draft Supplemental Environmental Impact Statement for Burnsville Sanitary Landfill Expansion
Date:	Friday, July 30, 2021 10:25:26 AM
Attachments:	Comments on Draft Valley EIS PDF.pdf

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Mr. Steve Sommer:

Here in a PDF format is the same statement just sent to you as a regular email. Sending to insure its delivery.

Ed Crozier

Comments on Draft Supplemental Environmental Impact Statement for Burnsville Sanitary Landfill Expansion (7/29/2021)

My name is Edward Crozier. My wife, Caryl, and I live at 60 Oak Shore Drive, Burnsville, MN. 55306. We are 50 plus year residents of Burnsville. The Burnsville Sanitary Landfill (BLS) site is 7.3 miles north of our home.

We oppose the proposal to expand the Burnsville Sanitary Landfill and therefore object to the Draft Supplemental Environmental Impact Statement, because it is proposing a project which will have severe negative impact on the Minnesota River Valley, the adjacent communities, the Twin Cities Metropolitan Area and the Minnesota and Mississippi River Systems.

I am a founder of the 14,000-acre Minnesota Valley National Wildlife Refuge (MNVNWR), which is within a stone – throw of the Burnsville Sanitary Landfill and the first Manager of the MNVNWR. I was a member of the Burnsville Environmental Council that advised the Burnsville City Council not to renew the operational permit of the Freeway Landfill in the early 1970's. The City Council ignored this recommendation so it could continued receiving the landfill revenue and the Freeway Landfill continued to accept hazardous waste for years until it closed. Now there is a multi-million dollar need to clean up that mess and in the process of cleaning up after past bureaucratic mistakes, officials are proposing to create a new monster in the valley.

Devastating Visual Impact: The proposed height of the landfill expansion (Garbage Mountain) will dominate the south metro area, as it will be the highest landscape feature seen from Lakeville to Richfield and a highly visible feature in much of the Minnesota River Valley. Its visual impact should be described in the EIS. The expanded Burnsville Sanitary Landfill will be particularly in view of much of the adjacent Bloomington City Parklands in the valley and the federal Minnesota Valley National Wildlife Refuge, incidentally one of the few urban National Wildlife Refuges. Public visitation to these natural recreation areas will forever be blemished, reducing the visitor experience. It will be extremely shortsighted for the citizens of today to leave such a lasting negative landmark for generations to come. It will be a disastrous, highly visible symbol of our present-day civic leadership that favors financial greed and disastrous fixes of problems of their own past making. If today's State and Community decision makers wish to leave a lasting "LEGACY" of their own making, then this "Garbage

Mountain will be it – not something I would wish to leave for my future descendants.

Potential for contaminating the Minnesota and Mississippi Rivers:
The Burnsville Sanitary Landfill is located in the original Minnesota River Floodplain, but now presumed to be separated from the River by a dike or a separation barrier, but there are immediately adjacent to the landfill, wetlands that can become directly connected to the river proper in flood stages and thus convey contaminants to the river proper. There can be no assurance that Minnesota River floodwaters will not at some point in time directly inundate portions of the landfill material and thus pollute the Minnesota River and the Mississippi River all the way to the Gulf of Mexico. With climate change, flood levels throughout the world are increasing and there can be no assurance that the future flood levels will not connect with the landfill pollutants and contaminate our nation's greatest river systems. This aspect should be elaborated on in the EIS.

Groundwater Contamination Potential: Portions of the existing landfill are already close to groundwater levels and new waste is proposed to be piled on top. Once Kramer Quarry is closed and the quarry fills with water levels that will be close to the lowest levels of the landfill there is the possibility that there will be a direct connection between the contaminated landfill and the south of the river groundwater. Once contaminated, the groundwater will be a major threat to water supplies for Savage and Burnsville and other communities. This too should be described in the EIS.

Favoring potential increased city revenue over sensible environmental decisions: The dumping of hazardous waste for years into the Freeway Landfill was a result of Burnsville city leaders favoring a continued revenue stream into the city from the Freeway Landfill over closing a contamination-making operation. Now, the city leaders are again taking that shortsighted decision path by proposing to extend/expand the life and size of the Burnsville Sanitary Landfill with its related increased revenue payments to the City. In addition, with the proposed relocation of the waste (including the hazardous material) from the now closed Freeway Landfill to the Proposed Burnsville Sanitary Landfill that will theoretically free up "Developable Land" around the flooded Kramer Quarry that will probably be advertised by Burnsville as "High End" business sites and maybe even residential potential sites, presumably with water views of the new "Quarry Lake". If this happens then future state and local governments will

continually be faced with providing more flood protection of those areas – areas with potential groundwater pollution too. The aspect of increasing flood plain developments and thus city revenue should be exposed in the EIS.

Hidden Impacts – There isn't a thorough or complete analysis of the total environmental impact i.e. the increase in extreme weather conditions resulting in more extreme flooding and how items such as how storm water runoff and greenhouse gas emissions, will be handled or the economic impact on adjacent communities and the impact on the adjacent park and wildlife areas. And, there doesn't seem to be consideration for an increase in recycling. Again, the EIS should discuss these aspects.

Psychological Impact – Within the EIS there should be a psychological evaluation made on the effects of having a garbage mountain being the dominant feature that daily looms over the residents that live in the south metro area. Living in pleasant surroundings is known to be beneficial to mental health whereas daily seeing a mountain of garbage would have the opposite effect.

Creating an Inconsistent Land Feature (Legacy) – Creating a "Garbage Mountain" that will dominate the metropolitan landscape over approximately a 15 - mile space from Hwy I-494 in Bloomington south to Hwy 42 in Burnsville will be a preeminent land feature that can be compared in size to the Egyptian Pyramids, only in a negative manner. Making a governmental decision of that magnitude with such forbidding aspect would seemingly be an extremely negative tag that present day decision makers would not want to be their legacies. This needs to be told in the EIS.

From: Kathy Anderson
To: Sommer, Steve (MPCA)
Subject: Burnsville sanitary landfill expansion. Opposed.
Date: Friday, July 30, 2021 11:21:52 AM

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Hello Steve Sommer:

We are responding to the proposed Burnsville Sanitary Landfill expansion project as publicized here: https://www.pca.state.mn.us/regulations/burnsville-sanitary-landfill-expansion-project

As homeowners in Savage for 34 years and lifelong Scott County residents, we are writing in **strong opposition to the proposed landfill expansion project** for significant concerns not limited to:

- **Groundwater Contamination**
  The Savage Pacer July 24th edition explains the Burnsville and Savage water supply "artificially suppresses the area's water table" temporarily avoiding inevitable contamination. Lined or not, we must prioritize and protect our water supply over the convenience and profit of exploiting an existing landfill.

- **Recreational and Environmental Impact**
  An expansion guarantees the landfill will become the ironic "centerpiece" of the Minnesota Valley National Wildlife Refuge and destroy recreational use of these popular destinations:
  - Minnesota Valley State Trail, Bloomington
  - Minnesota Riverfront Park, Burnsville
  - Cliff Fen Park, Burnsville
  - Blackdog Park, Burnsville

  An expansion will also increase the flocks of seagulls currently attracted to this food source and consequently transport pollution to bodies of water beyond the Minnesota Valley. As noted at nih.gov in *The biogeochemical implications of massive gull flocks at landfills*: "We conclude that mega-flocks of landfill gulls are common and widespread, and that their capacity to transport nutrients may be contributing to the eutrophication of aquatic ecosystems and water supplies."

- **Community Life and Tourism**
  Erecting a "hill" of waste eclipsing the Hyland Hills and Buck Hill ski areas will become the unwanted signature landmark of this area with its footprint, height, and inescapable nauseous smell.

Our thriving communities, health, aesthetics, and property values will sink as the landfill expands.

We implore the MPCA to stop pursuing this inertial expansion, contain the growth and impact of the landfill, and identify other strategies for long-term waste management.
Thank you,
Greg and Kathleen
Anderson

From: Paul Erdmann
To: Sommer, Steve (MPCA)
Subject: Burnsville Sanitary Landfill expansion project- Public Comment
Date: Friday, July 30, 2021 11:55:41 AM

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Dear Mr. Sommer-

I am opposed to the expansion of the Burnsville Sanitary Landfill as currently proposed. This landfill should not be allowed to expand next to the already highly impaired Minnesota River, that many people and many funds have worked to clean up and restore for the last 20 or so years. This proposed expansion is a direct threat to environmental and human health. It would also severely impact recreation and the aesthetics of the region. There must be better places and better solutions for our garbage than this proposal.

Thank you for your time today,

Paul Erdmann
7515 Izaak Walton Road W
Bloomington, MN 55438

From: Regina Dean
To: Sommer, Steve (MPCA)
Cc: Jenni Faulkner; Melanie Lee; Deb Garross; Daryl Jacobson; Ryan Peterson
Subject: RE: DSEIS Comments-From City of Burnsville
Date: Monday, August 2, 2021 4:09:18 PM
Attachments: City of Burnsville Comment Letter.pdf

Apologies to all. I didn't scan the final letter correctly on Friday. Please see the attached comment letter.

Regina Dean| Assistant Community Development Director
100 Civic Center Parkway | Burnsville, MN | 55337
952-895-4453 (office) | www.burnsvillemn.gov

From: Sommer, Steve (MPCA) <steve.sommer@state.mn.us>
Sent: Monday, August 2, 2021 3:36 PM
To: Regina Dean <Regina.Dean@Burnsvillemn.gov>
Cc: Jenni Faulkner <Jenni.Faulkner@burnsvillemn.gov>; Melanie Lee <Melanie.Lee@burnsvillemn.gov>; Deb Garross <Deb.Garross@burnsvillemn.gov>; Daryl Jacobson <Daryl.Jacobson@burnsvillemn.gov>; Ryan Peterson <Ryan.Peterson@burnsvillemn.gov>
Subject: RE: DSEIS Comments-From City of Burnsville
Importance: High

Hi Regina,

I'm wondering if some pages are missing from the city's comment letter. I see item 1 and then 10. There is no 2-9. Also, are the attached memo's part of the city's comments? Is that info referenced in the missing items? The document doesn't show a footer with page numbering, so I don't know if any pages are missing. Please let me know. Thanks.

From: Regina Dean <Regina.Dean@Burnsvillemn.gov>
Sent: Friday, July 30, 2021 1:23 PM
To: Sommer, Steve (MPCA) <steve.sommer@state.mn.us>
Cc: Jenni Faulkner <jenni.faulkner@burnsvillemn.gov>; Melanie Lee <Melanie.Lee@burnsvillemn.gov>; Deb Garross <Deb.Garross@burnsvillemn.gov>; Daryl Jacobson <Daryl.Jacobson@burnsvillemn.gov>; Ryan Peterson <Ryan.Peterson@burnsvillemn.gov>
Subject: DSEIS Comments-From City of Burnsville

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Steve,

Attached is the City of Burnsville comment letter on the DSEIS related to the Burnsville Sanitary Landfill Expansion

Project.

Also, in addition to the referenced attachments here is the link to the City's Sustainability Plan referenced in Comment #1.
Burnsville Sustainability Plan Link: https://burnsvillemn.gov/DocumentCenter/View/1287/Sustainability-Guide-Plan?bidId=

If you have questions or need additional information, please contact Deb Garross, City Planner at 952-895-4446 or deb.garross@burnsvillemn.gov

Thank you for the opportunity to comment. Have a great weekend!

Regina Dean| Assistant Community Development Director
100 Civic Center Parkway | Burnsville, MN | 55337
952-895-4453 (office) | www.burnsvillemn.gov

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City Of Burnsville
952-895-4400
100 Civic Center Parkway • Burnsville, Minnesota 55337-3817
www.burnsvillemn.gov

July 30, 2021

Sent by email: Steve.Sommer@state.mn.us

Mr. Steve Sommer
Minnesota Pollution Control Agency
Environmental Review
520 Lafayette Road
St. Paul, MN 55155

RE: City of Burnsville Comments for the Draft Supplemental Environmental Impact Statement for the Burnsville Sanitary Landfill Expansion Project at 2650 Cliff Road West

Dear Mr. Sommer,

Thank you for the opportunity to provide comments and questions for the Draft Supplemental Environmental Impact Statement (DSEIS) for the proposed expansion of the Burnsville Sanitary Landfill (BSL) proposal to expand the landfill located at 2650 Cliff Road West in Burnsville.

The City of Burnsville is supportive of the capacity expansion at the landfill per the attached Findings of Fact approved by the City Council on March 5, 2019. The City is also supportive of the remediation of the nearby Freeway Landfill and Freeway Dump that results with remediation to occur off-site per the attached Resolution 19-6618 Supporting Closure of Freeway Landfill. It is our understanding that a Certificate of Need (CON) is not needed for the remediation of Freeway Landfill or Freeway Dump waste to move to the BSL. A permit allowing for the expansion of the BSL will be needed from the Minnesota Pollution Control Agency (MPCA) and this DSEIS is the environmental process necessary to consider expansion of the existing permit. The current Freeway Landfill and Freeway Dump remediation scenarios include a possibility that they be remediated off-site to BSL due to efficiencies of proximity. Therefore, several of the questions below related to addressing and ensuring said proposed expansion of the BSL can accommodate the waste from a remediation of Freeway Landfill and Freeway Dump. We believe the following considerations should be part of the DSEIS.

1. The City has an adopted Sustainability Plan which can be found at the following link: Sustainability Plan. One of our main goals is to reduce greenhouse gas emissions for our own operations and for operations in the City as a whole. The introduction section of our Plan describes our goals and measured reductions of City operations to date. The DSEIS indicates an increase in greenhouse gas emissions as described by showing an increase in Total Carbon Dioxide Equivalent comparing a build/no build scenario. We would like to see measures taken to reduce emissions to the greatest extent possible to help us meet our greenhouse gas reductions within the City.

    a. What is the plan for long term mitigation of excess methane gas from the expansion, particularly following closure of the landfill and also after the post closure period?

    b. Who is responsible for methane gas mitigation following formal closure of the landfill?

c. What happens to the methane gas to recovery system if it cannot accommodate increased gas from the expanded landfill?

d. What are the impacts to emissions and odor if the methane recovery to electricity plant is limited or shut down in the future?

e. The emissions information addresses direct impacts from landfilling activity itself. It is not addressing the emissions impacts from the trucks hauling at increased rates or for longer periods of time (years that the landfill will be open). What are the emissions from the trash haulers at the landfill and on Highway 13, Interstate 35W, Cliff Road West, Washburn Avenue and future interchange at Chowen Avenue?

    i. We do understand that having a local area to place waste will intrinsically reduce emissions when considering how many emissions are given off if the waste is hauled long distances. Can this potentially be quantified?

2. Please refer to the attached Memorandum from Brad Woznak, S.E.H. dated July 26, 2021 for additional comments to be addressed in the DSEIS.

3. Page 79 of the DSEIS is missing references to Minnesota Valley Wildlife Refuge and Black Dog Park.

4. Final cover for the landfill slopes is required by the City to be a wildflower mix approved by the City's Natural Resources Department.

5. What changes and/or improvements are needed at BSL to take waste from Freeway Landfill and Freeway Dump (i.e. specialized liner, additional or different type of leachate system, special cells, different monitoring equipment etc., especially because of the hazardous materials)?

6. What are the impacts of additional waste (including hazardous waste), on the longevity, durability and operation of the leachate collection system?

7. The City of Burnsville remains concerned over the potential impacts to groundwater and the lack of existing landfill liners. Please accept the attached Memorandum "Burnsville Area Water Study" from Black & Veatch dated July 19, 2021 for the City's concern in this area. The City is supportive of all of the measures listed in the DSEIS regarding the permitting for groundwater impacts and that the potential for higher groundwater elevations must be considered when evaluating the permitting.

8. The City will be evaluating the project further at the time the Development Stage Planned Unit Development is submitted to ensure Burnsville's Water Resources Management Plan requirements are met.

9. The City will be evaluating the project further at the time of Development Stage Planned Unit Development to ensure the Burnsville Wetlands Management Plan and all wetlands related mitigation regulations are met.

10. The information concerning the Environmental Justice Areas should be reevaluated regarding visibility and odors as they will be more prominent closer to the landfill and thus within the identified area. How can those impacts be mitigated?

Thank you for the opportunity to provide input to the DSEIS process. If you have questions or need additional information regarding the information contained herein, please contact Deb Garross, City Planner at 952-895-4446 or deb.garross@burnsvillemn.gov

Regards,

Melanie Mesko Lee
City Manager

ATTACHMENTS:

BSLI Findings of Fact for Concept Stage Planned Unit Development
Resolution No. 19-6618 Supporting closure of Freeway Landfill
07-26-2021 SEH Memorandum – Floodplain Comments
07-19-2021 Black & Veatch Burnsville Area Water Study Comments

CITY OF BURNSVILLE

DAKOTA COUNTY, MINNESOTA

IN RE:
Application of Burnsville Sanitary Landfill Inc., for Concept Planned Unit Development (PUD) Amendment to allow expansion of the existing landfill located at 2650 Cliff Road West.

FINDINGS OF FACT AND DECISION

FINDINGS OF FACT

On March 5, 2019, the Burnsville City Council met at its regularly scheduled meeting to consider the above application of Burnsville Sanitary Landfill Inc., for Concept Planned Unit Development (PUD) Amendment to allow for expansion of the existing landfill located at 2650 Cliff Road West.

The Planning Commission held a public hearing on February 25, 2019 on the application. The Applicant was present and the Planning Commission heard testimony from any and all interested persons wishing to speak at the meeting.

The City Council now makes the following Findings of Fact and Decision:

1. The site is zoned CRD/PUD, Commercial Recreation District/Planned Unit Development.

2. The site is guided by the Comprehensive Land Use Plan as MRQ, Minnesota River Quadrant.

3. The existing landfill is currently owned by Burnsville Sanitary Landfill, Inc., a wholly owned subsidiary of Waste Management Co.

4. The existing landfill was approved under a PUD dated August 1994 with prior approvals and amendments dating to 1971. The landfill has been existing since the 1950's.

5. In 1992 the Metropolitan Council processed an Environmental Impact Statement (EIS) for Edward Kraemer and Sons, Inc. (now KMM), for expansion of the Burnsville Sanitary Landfill to add 63 acres to the 98.4 acre landfill.

6. In 1993 the MPCA issued a Certificate of Need or CON for the West Development Area (WDA) area of the landfill which authorized construction of 6,125,000 cubic yards of MSW capacity.

7. In 1994, the City approved a substantial PUD for KMM that included an expansion of the limestone quarry as well as an expansion to the current Burnsville Sanitary Landfill. That PUD established an end-use plan for the west area of the MRQ which envisioned expansions of the intense land uses and an end use plan for mixed use development.

8. In 1997, KMM sold Burnsville Landfill to US Waste, who shortly thereafter sold to Waste Management.

9. In 2003, the City approved a substantial expansion to the Burnsville Sanitary Landfill under the Waste Management ownership. This PUD articulated many public benefits and established an end-use plan of a championship golf course. Also in 2003, Dakota County processed a Voluntary Environmental Assessment Worksheet (EAW) for North Development Area (NDA) of the landfill and a Negative Declaration was made indicating the project did not have the potential for significant environmental effects. Also in 2003, the Federal Emergency Management Agency (FEMA) issued a Conditional Letter of Map Revision (CLOMR) for the NDA and WDA expansions.

10. In 2005, the MPCA processed an EIS for the West Development Area (WDA) and height modification to allow sculpted areas of future golf course between 814 and 820 feet above mean sea level. MPCA issued an adequacy determination on the EIS for the proposed WDA and Vertical Expansion for MSW. Also in 2005, MPCA approved 10 year CON for 3,000,000 cubic yards of new disposal capacity for the WDA and noted additional CON will likely be necessary in the future.

11. In 2006 the City approved the Development Stage PUD that established an average elevation and peak height for the landfill of 814'– 820' above mean sea level, with the end-use plan of an 18-hole championship golf course. Consideration for future roads, trails, park dedication, Host Agreement and wetland impacts were also agreed upon as part of the Development Stage PUD process.

12. The 2006 approval included platting the property as Outlot A and Lot 1, Block 1, BSLI Addition. The original intent was to give Outlot A to the City for public open space, trails and parks. The City gave concessions including reduction in park dedication fees for the plat based on the golf course end use plan and use of Outlot A. After the plat was approved, BSLI found that they were not able to convey Outlot A to the City due to pre-existing deed restrictions and instead, a conservation easement was provided over Outlot A, allowing the City to install trails and parks but not actually own the Outlot.

13. This Concept Stage Planned Unit Development Amendment recognizes the need for environmental review and mitigation. This will be completed prior to Development Stage PUD approval.

14. The MRQ Study indicates land surrounding the existing landfill to the north and west is not viable industrial and/or commercial sites. Open space and recreation are the only alternative land use.

15. The Concept PUD Amendment will allow for future recreation, public access and open space on the property.

16. Public access, open space, trails, and other recreational uses are feasible end uses.

17. The existing landfill and proposed expansion is an interim use within this PUD. The permanent end use will be open space, and/or recreational.

18. The interim use (Landfill) and end use (recreation, public access and open space) are appropriate land uses for the site.

DECISION

Applicant's request for a Concept Stage PUD Amendment, to expand the landfill to increase total disposal capacity to allow up to 26 million cubic yards of MSW; increase the height of the landfill from an average elevation 814 – maximum 820 feet above mean sea level (to allow for golf course sculpting), to elevation 1082 feet above mean sea level; decrease the Industrial and DEM/COM waste capacity; eliminate the 18-hole golf course end use plan and modify the footprint of the landfill to reduce it from 216 to 204 acres is hereby approved, with the following items and in accordance with the plans reviewed, modified, and approved based on the March 5, 2019 City Council Background and Minutes. The following items must be considered and addressed as part of the Development Stage PUD process:

1. All required approvals and permits shall be obtained (FEMA, Wetland, CUP, Corps of Engineers, Watershed District, Department of Natural Resources, Metropolitan Airports Commission, MPCA and any other agency/jurisdiction).
2. All required environmental reviews shall be completed/approved.
3. A copy of the MPCA CON for the expansion will need to be provided to the City.
4. The park dedication fees shall be reevaluated based on the changes proposed with this Concept Stage PUD Amendment.
5. A number of agreements were executed outlining the private use of right-of-way (platted 124th Street East and Golf Drive) until landfilling ceases, trail easements, City Garbage Agreement, Storm Water Agreement, Host Agreement and others will need to be reevaluated.
6. The terms of the December 11, 2007 Performance and Encroachment Agreement allowing the maintenance building and parking lot on the south side of the landfill to temporarily encroach into the 124th Street West right-of-way shall continue to remain in full force and effect.
7. A Comprehensive Plan Amendment will need to be done concurrent with the Development Stage PUD application (to modify the End Use Plan from golf course to other recreational uses approved by the City.
8. As a benefit for the PUD Amendment consider developing an area wide plan for district electric, heating, solar, wind power or other use for the Minnesota River Quadrant.
9. A plan must be submitted detailing specific dates for staged filling cells (phased over time) to ensure capacity exists to take waste from Freeway Landfill and Freeway Dump.
10. As a public benefit for the proposed Concept Stage PUD expansion, consideration should be given to lining the unlined area of the BSLI landfill.
11. CUP approval from the City is needed to allow work within the floodplain and floodway of the Minnesota River and to allow the landfill use (in the Annex Development Area).
12. Federal Emergency Management Agency CLOMR/LOMR for the levee system to be signed off by the City and approved by MNDNR and FEMA.
13. The wetland delineation and mitigation plan must be approved.
14. The Army Corps of Engineers permit must be updated.

15. The existing conservation easement legal description must be amended so that it stays outside of the landfill expansion.
16. Access must be provided to the conservation easement via a separate trail or access easement.
17. The conservation easement allows for the City to conduct wildlife management activities within the easement. The applicant must allow these activities to continue and provide access to the conservation easement.
18. The proposed trail location must be reviewed to ensure that it is not routed through wetlands and that it is constructible. This includes providing a more detailed design and assurances it will be built shortly after successful landfill closure.
19. A Tree Removal Permit including updated Woodland Survey and Woodland Evaluation Sheets shall be provided prior to grading or improvements to the landfill to implement the expansion.
20. Final cover to include wildflower mix subject to the approval of the City Natural Resources Department.
21. Provide an Alta Survey showing existing conditions, existing easement locations, existing utilities, and locations where the landfill is unlined.
22. Provide an estimated rate of leachate discharge with the expansion so that existing sewer pipe infrastructure may be evaluated.
23. The applicant must connect directly into the Metropolitan Council sanitary sewer interceptor and disconnect from the City sanitary sewer. This can be accomplished by the applicant petitioning the City to do the work and the property owner being assessed for all of the project costs (including design, construction, construction administration, permits, etc.). Alternatively, the applicant may complete the work with their own contractor and obtain appropriate City and Metropolitan Council permits.
24. The watermain adjacent to BSLI along Washburn Avenue experiences pressure fluctuations and it is recommended to construct a 12-inch watermain loop. In order to provide benefits including reduction in water hammering and pressure fluctuations, increase in fire flows, and providing water service redundancy, staff will be including BSLI in discussions, including potential cost sharing, on water main looping in the Kraemer Mining and Materials parcel.
25. Stormwater management plan must be updated based on the proposed landfill configuration.
26. Future plans must include proposed TH-13 frontage road and 118th Street to Golf Road.
27. Provide documentation indicating expansion over the top of unlined areas is suitable and proof that the unlined areas are not going to have a negative effect on ground water in the future.
28. Renegotiation of the Host Fee Agreement with the City of Burnsville shall be completed concurrently or prior to the City of Burnsville's Development Stage approval for landfill expansion.
29. 2006 Development Stage PUD – PUD Agreement/Dev Contract Conditions shall be evaluated and appropriately modified if necessary.
30. A defined Closure Plan approved by MPCA must be submitted.
31. An End Use Plan detailing final uses for all of the property must be submitted. The plans will need to indicate the location of roads, future buildings, trails, structures etc. and schedule for the timing of improvements.
32. An Escrow Deposit of $25,000 shall be provided to the City by June 1, 2019 to cover staff/consultant time related to the items listed herein that will need to be completed prior to Development Stage PUD.
33. At the time of Development Stage PUD application, an escrow in the amount of $25,000 shall be provided with the application fee.

34. The following comments from SEH shall be addressed:
    a. Page 3 of 11, 2.0 Description Of Proposed Site Development, "The proposed development would increase capacity at the Facility by reconfiguring the waste limits and raising the top elevation of the landfill, resulting in an overall decrease in the Facility's future footprint compared with the areas currently permitted to accept waste."
        i. *Comment: The reduced footprint would provide the opportunity that approximately 9 acres of land could be available for future use other than landfilling.*
    b. The proposed development would provide additional disposal capacity for up to 26 million cubic yards of MSW, in part by converting approximately 6.9 million cubic yards of permitted industrial / C&D capacity to MSW. Using anticipated future disposal rates, this capacity increase would result in continued waste acceptance at the Facility through the year 2048.
        i. *Comment: How might ongoing geotechnical, and hydrologic and hydraulic design affect the projected volumes?*

    c. Page 3 of 11, 2.1.2 Landfill Height, "The top elevation of the landfill will increase to a maximum height of 1,082 feet above mean sea level, or approximately 260 feet above the currently permitted maximum height."
        i. *Comment: Of note are the discrepancies between the peak landfill elevation, a future quarry lake shore and existing land elevations of the City of Bloomington. The potential peak landfill elevation of 1,082 is approximately 350 higher that a future shore elevation if the quarry is flooded in the future. Also of note is that elevations in residential areas across the river in Bloomington range from 800 – 825 above mean sea level.*

    d. Page 3 of 11, 2.1.2 Landfill Height, ... "The final side slopes will be constructed at a maximum of one vertical foot per three horizontal feet, or 33 percent, and will include stormwater diversion berms to control surface water runoff, which is consistent with the Minnesota Pollution Control Agency (MPCA) landfill slope guidance document."
        i. *Comment: Minnesota solid waste rules require 5:1 slope design. Slopes of 3:1 are acceptable with terrace design as noted by referencing the MPCA landfill slope guidance document, but will require a regulatory variance and additional geotechnical slope integrity analysis. Turf and erosion control maintenance of 3:1 slopes requires unique considerations. These will be the responsibilities of BSLI but will add complexities to the permitting process and future operations and maintenance.*

    e. Page 4 of 11, 2.2.2 Engineered Environmental Protection Systems, 2nd paragraph, "When final fill elevations are reached, the landfill will be covered by an engineered final cover system consisting of a polyethylene geomembrane and cover soils, and/or an evapotranspirative soil cap."
        i. *Comment: If this statement insinuates that an evapotranspirative soil cap will be used in place of polyethylene geomembrane, a permit variance will be required. The evapotranspirative cover alone would not provide landfill gas (LFG) containment commensurate with a polyethylene geomembrane. The LFG system would need to be designed to*

compensate for capturing gas near the surface of the final closure surface to ensure adequate LFG containment. Similar to the previous comment, these can be accommodated for with proper additional design and permitting protocols.

f. Page 9 of 11, 3.2 Community Benefits, 2nd set of bullet points, "BSLI also provides other benefits to the City, including: - Facilitates development of the Minnesota River Quadrant by providing a potential option for relocation of Freeway Landfill waste."
    i. *Comment: May include relocation of Freeway Landfill as well as Freeway "Dump" waste.*

g. Page 10 of 11, 4.0 Permitting Process, Required Permits Table, Letter of Map Revision, to remove development area from the flood plain.
    i. Comment: For re-establishing flood plain boundaries, the landfill project will require close coordination between a number of different stakeholders, two of which are the Cities of Bloomington and Burnsville. Both cities have adopted a Minnesota DNR-approved floodplain ordinance, and therefore, it is the cities' responsibility to regulate floodplain activities. Burnsville's Floodway District ordinance states that "...the technical analysis must assume equal conveyance or storage loss on both sides of the stream." BSLI may have to receive a variance from the Cities of Burnsville and Bloomington on the equal conveyance loss rule of the floodway ordinance.

h. Page 10 of 11, 4.0 Permitting Process, Required Permits Table
    i. Comment: Notifications of proposed landfill height and location will be needed to be made to Metropolitan Airport Commission (MAC) and Federal Aviation Administration (FAA).

35. Update the end use plan for the site, including narrative describing operations and ownership plans, the timing of public use for recreation and trails, and consider the following end uses:
    a. Mountain bike skills course
    b. Dog park
    c. Fully accessible playground
    d. Large picnic shelters and a community building
    e. Athletic turf fields
    f. Adult fitness park
    g. Walking and biking trails
    h. An observation area
    i. Natural habitats

Adopted this 5th day of March, 2019.

CITY OF BURNSVILLE

By: _____
Elizabeth B. Kautz, Mayor

ATTEST:

_____
Macheal Collins, City Clerk

Planning Case File#	DEV2018-0038
PID#	021527501010
Address#	2650
Street Name	Cliff Road West
Lot#	1
Block#	1
Subdivision Name	BSLI Addition

Planning Case File#	DEV2018-0038
PID#	021527500010
Address#	2650
Street Name	Cliff Road West
Lot#	Outlot A
Subdivision Name	BSLI Addition

RESOLUTION NO. 19-6618

CITY OF BURNSVILLE, MINNESOTA

RESOLUTION SUPPORTING CLOSURE OF FREEWAY LANDFILL

WHEREAS, the City supports efforts for the closure of the Freeway Landfill, a federal Superfund site and Freeway Dump; and

WHEREAS, the Minnesota Pollution Control Agency is the responsible agency for regulating proper landfill clean-up through the Closed Landfill Program; and

WHEREAS, the State would take over the management of the landfills to protect human health and the environment under the Closed Landfill Program; and

WHEREAS, the Closed Landfill Program is a cost-effective alternative to the litigious process that accompanies the federal Superfund program; and

WHEREAS, the MPCA has begun the design and cost estimating process of clean-up options in preparation of bidding process; and

WHEREAS, the design options to date call for on-site remediation; and

WHEREAS, cost of the landfill cleanup based on preliminary designs are estimated in the $93-116 million range; and

WHEREAS, the Minnesota State Legislature will be considering its budget during the 2019 Legislative Session; and

WHEREAS, an alternative design to on-site remediation, that would remediate the trash off-site, has emerged that would consolidate three landfills in Burnsville into one and provide significant development potential; and

WHEREAS, the taxpayers at the State, County and City will benefit from increased tax base that comes with development at the site; and

WHEREAS, providing some non-bond funded sources will allow for development earlier than 37 ½ years; and

WHEREAS, consideration of creative closure options, such as design-build or bid alternates, that meet the goals of protecting the environment can be more cost-effective and produce increased tax base and jobs for the landfill property.

NOW, THEREFORE, BE IT RESOLVED that the City of Burnsville supports a funding request to the State Legislature that allows for trash to be remediated off-site and maximizes development in order to clean-up the Freeway Landfill property under the MPCA's Closed Landfill Program. The City of Burnsville also supports such funding to include resources other than bond funds, in order to expedite the development at the property to the benefit of taxpayers.

Passed and duly adopted by the City Council of the City of Burnsville, Minnesota this 22nd day of January, 2019.

Elizabeth B. Kautz, Mayor

ATTEST:

Macheal Collins, City Clerk

Building a Better World for All of Us®

MEMORANDUM

TO: Deb Garross, Planner
City of Burnsville

FROM: Brad Woznak, PE,PH,CFM (Lic. MN,WI,IA,NE,CO,SD,IN)
SEH

DATE: July 26, 2021

RE: Burnsville Sanitary Landfill SEIS
SEH No. BURNS 133248 Task 20.0 14.00

We have reviewed the Supplemental Environmental Impact Statement (SEIS) obtained from the MPCA website for the Waste Management – Burnsville Sanitary Landfill Inc. proposed landfill expansion project. The intent of the review was to verify compliance with Burnsville City Code (Title 10, Chapter 10) and general FEMA floodplain regulations.

REVIEW

A key item to note is that the original project fill footprint for the North Development Area (NDA), from the 2002 Conditional Letter of Map Revision (CLOMR) (Attachment 1), encroached into the Minnesota River floodplain very near the regulatory Floodway and in one location the levee fill appeared truncated at the Floodway. The revised footprint shown in the SEIS (Attachment 2) depicts the proposed levee fill footprint set back from the regulatory Floodway by approximately 700 feet. Due to this, the SEIS footprint as shown should have less hydraulic effects on the Minnesota River than demonstrated with the 2002 CLOMR alignment.

While we concur with the results that demonstrate a vegetative cover on the face of the levee provides sufficient protection from erosive forces during that of the 500-year flood event on the Minnesota River, we recommend utilizing the hydraulic model and results associated with that of the effective FEMA Flood Insurance Study to verify the Minnesota River hydraulic characteristics versus the overly simplified methodologies utilized in the SEIS. A cursory review of the effective model depicts slightly higher average channel velocities than that of the SEIS, although they still appear to be within the realm in which vegetative cover is still an effective means of erosion protection.

RECOMMENDATIONS

We recommend revising all wording in the SEIS to remove the term “floodway fringe” and replace it with “flood fringe.” This may help avoid misinterpretations of “floodway” regulations versus “flood fringe” regulations and will also correspond to more typical definitions found in local, state, and federal floodplain regulations.

We recommend updating the erosion protection analysis to, at a minimum, include a discussion of how the simplified methods utilized in the SEIS compare to that given in the effective FIS and associated hydraulic modeling.

Lastly, although not specific to the proposal in the SEIS, it is recommended that the Lower Minnesota River Watershed District (LMRWD) requirements, specifically the compensatory storage requirements, be addressed. The original project was approved prior to the Lower Minnesota River Watershed District (LMRWD) current rules, and it is not clear if this will be “grandfathered in” and exempt from any additional regulations. The layout in the SEIS appears to reduce the floodplain storage footprint. The LMRWD compensatory storage requirement would essentially prohibit a development such as, because providing an equivalent volume of compensatory floodplain storage would not be feasible due to the project size. Since the proposed project falls entirely within the flood fringe area (Attachment 3), any increase in the Base Flood Elevation (BFE) is allowable under FEMA, state, and City floodplain regulations.

btw
Attachment
c: Ryan Peterson – City of Burnsville
c:\users\bwoznak\onedrive - short elliott hendrickson inc\documents\1project\burns\bsli seis\seis floodplain review.docx

MINNESOTA RIVER

EXISTING LANDFILL

FLOODWAY LINE

LEVEE FOR NORTH DEVELOPMENT AREA. SEE SHEET 4.

LEVEE FOR WEST DEVELOPMENT AREA. SEE SHEET 3.

PROPERTY LINE

CARGILL SLIP

0 100 200 400
SCALE IN FEET

REV.	DATE	BY	DESCRIPTION
0	10/01/02	JRM	ISSUED FOR CLOMR APPLICATION

I HEREBY CERTIFY THAT THIS PLAN WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MINNESOTA.

JOHN R. MCCAIN

SIGNATURE

DATE 10/2/02 REG. NO. 21835

McCain and Associates, Inc.
434 2nd Street
Excelsior, MN 55331
ph 952-470-1611
fx 952-470-0723

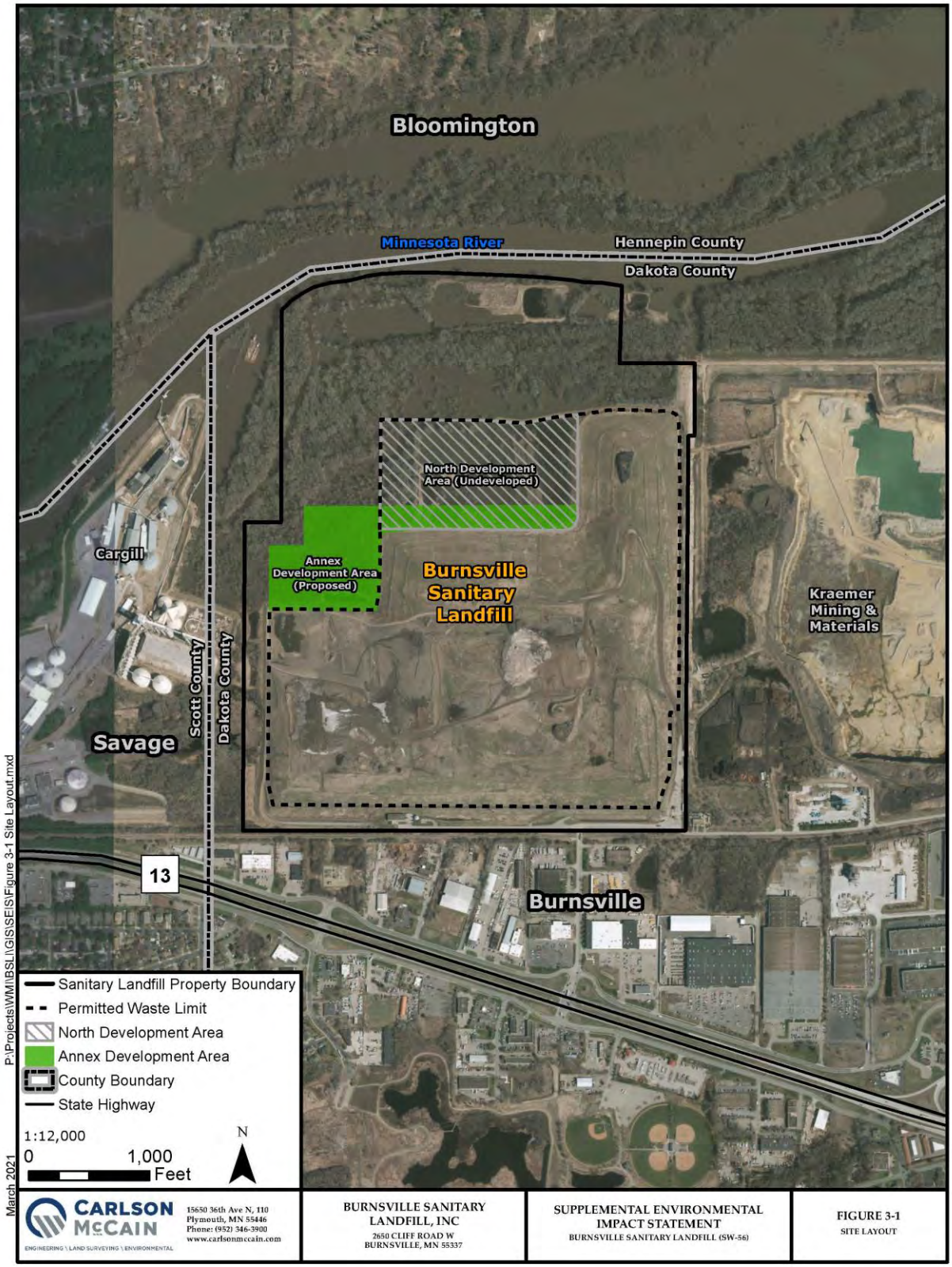
DWN JRM	DATE 10/01/02
DGN'R JRM	CHK'D DSS
PROJECT NO.	BLF02--14
DRAWING NO.	FEMA DRAWING.DWG

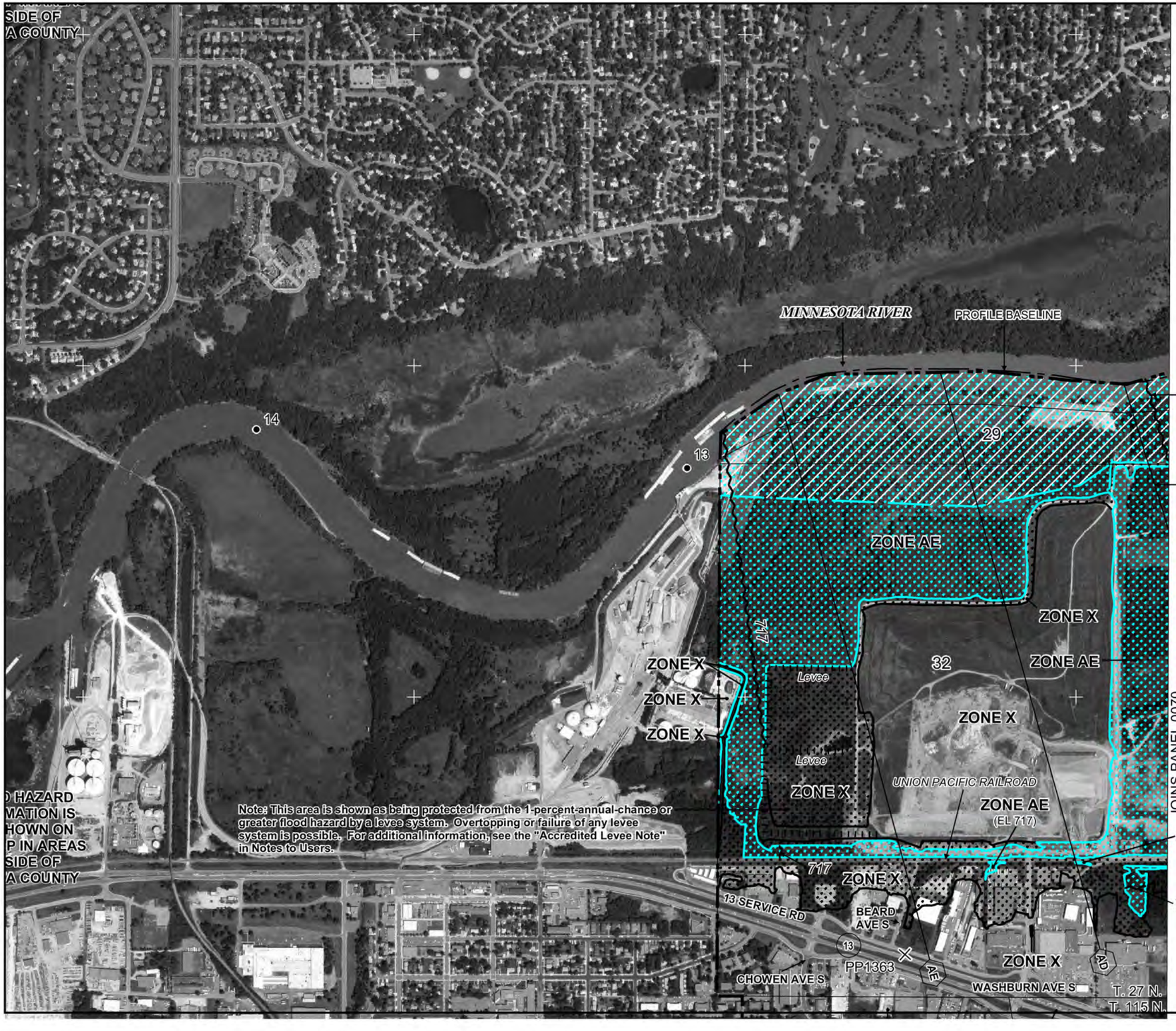
EXISTING CONDITIONS AND GENERAL LAYOUT FOR PROPOSED LEVEES

BURNSVILLE SANITARY LANDFILL LEVEE CONSTRUCTION

BURNSVILLE SANITARY LANDFILL, INC.

P:\Active\CADD_drawings\BLF02-TEMP1 FLOOD PLAIN\FEMA DRAWINGS.dwg, 10/02/2002 12:10:10 PM


Bloomington
Minnesota River
Hennepin County
Dakota County
North Development Area (Undeveloped)
Annex Development Area (Proposed)
Burnsville Sanitary Landfill
Cargill
Kraemer Mining & Materials
Scott County
Dakota County
Savage
13
Burnsville
Sanitary Landfill Property Boundary
Permitted Waste Limit
North Development Area
Annex Development Area
County Boundary
State Highway
1:12,000
0
1,000
Feet
N
P:\Projects\WM\BSL\GIS\SEIS\Figure 3-1 Site Layout.mxd
March 2021
CARLSON McCAIN
ENGINEERING \ LAND SURVEYING \ ENVIRONMENTAL
15650 36th Ave N, 110
Plymouth, MN 55446
Phone: (952) 346-3900
www.carlsonmccain.com
BURNSVILLE SANITARY LANDFILL, INC
2650 CLIFF ROAD W
BURNSVILLE, MN 55337
SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT
BURNSVILLE SANITARY LANDFILL (SW-56)
FIGURE 3-1
SITE LAYOUT



MAP SCALE 1" = 1000'

500 0 1000 2000 FEE

NFIP NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0065E

FIRM

FLOOD INSURANCE RATE MAP

DAKOTA COUNTY, MINNESOTA
AND INCORPORATED AREAS

PANEL 65 OF 525

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
BURNSVILLE, CITY OF	270102	0065	E

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
27037C0065E

EFFECTIVE DATE
DECEMBER 2, 2011

Federal Emergency Management Agency

This is an official copy of a portion of the above referenced flood map. It was extracted using F-MIT On-Line. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For the latest product information about National Flood Insurance Program flood maps check the FEMA Flood Map Store at www.msc.fema.gov

MEMORANDUM

City of Burnsville, MN
Burnsville Area Water Study
Burnsville Landfill SEIS Review - Final

B&V Project 190289
B&V File 40.9
July 19, 2021

To: Ryan Peterson, City Engineer – City of Burnsville, MN

From: Bo Johnston, Engineering Manager - Black & Veatch

Prepared By: Brian Ortega, Project Geologist - Black & Veatch

CC: Tony White, Utilities Superintendent – City of Burnsville, MN
Jeff Radick, Public Works Director – City of Burnsville, MN
File

Background

The Burnsville Sanitary Landfill (BSL) sits on the East Side of the Kraemer Quarry located in Burnsville, MN south of the Minnesota River and to the west of Interstate 35W. The City of Burnsville currently utilizes the South Quarry Reservoir (see figure A) for the source water for the City's Surface Water Treatment Plant (SWTP). Kraemer Mining & Materials, Inc. (KMM) has mining operations for limestone in the quarry and has dewatering pumping operations on the north side of the quarry to facilitate mining.

Figure A: Area Map

In 2021, the Minnesota Pollution Control Agency (MPCA) and BSL provided a Draft Supplemental Environmental Impact Statement (DSEIS) for review by local stakeholders. The City of Burnsville requested Black & Veatch review the document on behalf of the City specifically with respect of the groundwater sections and in reference to the source water for the City's SWTP. This memorandum documents those comments and should be reviewed and passed along to the MPCA as part of the Public Comment.

Abbreviations

- BSL – Burnsville Sanitary Landfill
- DSEIS – Draft Supplemental Environmental Impact Statement
- EIS – Environmental Impact Statement
- FSEIS – Final Supplemental Environmental Impact Statement
- KMM – Kramer Mining & Materials
- MPCA – Minnesota Pollution Control Agency
- PFAS – Per- and polyfluoroalkyl substances
- SWTP – Surface Water Treatment Plant
- VOC – Volatile Organic Compounds

SEIS Comments

Black & Veatch reviewed the *Draft Supplemental Environmental Impact Statement for Burnsville Sanitary Landfill Expansion Project* on behalf of the City of Burnsville during the public comment period from June 1st, 2021 through July 31st, 2031. The Groundwater Impacts Analysis (Attachment B) was evaluated for errors, omissions, methodology, data interpretation, and data gaps in order to verify presented conclusions. Overall, there were no major issues noted.

The groundwater analysis provides four conclusions which are summarized below:

- Groundwater monitoring from 2014 to 2019 has not identified impacts to groundwater exceeding Intervention Limits except for manganese. Sporadic detections of VOCs have been observed.
- Since no groundwater quality impacts following periods of flooding in the unlined landfill area were observed, and the planned expansion does not change the depth or span of the unlined area, there is not an increased potential for impacts due to landfill expansion.
- There are currently no identified landfill related impacts to the existing quarry water supply, and future impacts will be investigated through the permitting process. Based on existing and future groundwater flow scenarios, groundwater from the landfill will not affect any know potable water supply wells.
- The additional weight of the landfill expansion will not impact groundwater quality since the waste has already undergone over 30 years of settlement.

Based on the information provided in the analysis, Black & Veatch agrees with the rationale and conclusions of the last two bullets regarding the potential impacts to water supplies and landfill settlement. Comments for the first two conclusions are provided below.

Presented in Appendix D is a list of future permitting action items to be addressed during the solid waste permit modification process. These 10 action items specifically address regulatory limits, environmental monitoring and controls, financial assurance, and closure plans designed to ensure long-term environmental protection. It is Black & Veatch's opinion that implementing these items provides enough provisions, data, and oversight to minimize future groundwater impacts and mitigate potential quarry lake impacts if implemented under the scenario with elevated groundwater levels (i.e. quarry full water levels). While it is not anticipated that landfill expansion will negatively impact groundwater quality, any potential future impacts will also be addressed by these action items.

Comments:

Section 3.3, page 11 of 30, Second Paragraph; Section 4.1.1, Page 12 of 30, Bulleted List; and Figure 5. Section 3.3 indicates the Prairie du Chien-Jordan Aquifer is the "hydrogeologic unit of concern" at the landfill. Section 4.1.1 describes the different well depths corresponding to the different geologic units beneath the landfill. Figure 5 indicates there are four well locations on the eastern perimeter of the landfill. While the Prairie du Chien unit is noted as the most likely to be impacted, the alluvial unit where present may also be impacted. Monitoring wells for these units should be present at all four monitoring locations. However, it does not appear that the alluvium is being monitored at locations 231 and 247, or the Prairie du Chien is being monitored at locations 125 and 139. It will be necessary to monitor both units along the length of landfill's eastern perimeter once the quarry lake is present and groundwater flow from the southeastern portion of the landfill is toward the lake.

Section 4.6.2, Conceptual Groundwater Monitoring Plan, Page 25 of 30, First Paragraph. Black & Veatch concurs that PFAS and 1,4-dioxane should be added to the list of monitored parameters since both are emerging contaminants of concern.

Section 4.7, Summary of Groundwater Impacts, Page 26 of 30, First Paragraph. This paragraph states that groundwater monitoring has not identified impacts to groundwater for the monitored parameters other than high background manganese levels and sporadic VOC detections. In order to further validate this conclusion, we have the following questions regarding the groundwater monitoring program:

- Are the "100" series downgradient monitoring wells screened at an elevation near the base of the unlined area, across the water table, or at a reasonable depth to not miss shallow impacts? Depending on the thickness of the alluvium and the well depths, it may be possible to miss contamination.
- How long after flooding events is groundwater data collected? If groundwater data was collected after significant time had passed, higher concentrations may have been missed.
- Do the sporadic VOC detections correlate with flood events? This would suggest there is a leaching issue even if the detections are low.
- Has groundwater directly underneath the unlined area been analyzed? It is important to understand if there is no contamination present, or if some contaminants are leaching but become diluted once they reach the monitoring wells. This would have implications regarding leachability if the water table is allowed to be in contact with the base of the liner.

Section 4.7, Summary of Groundwater Impacts, Page 26 of 30, Second Paragraph. The paragraph suggests that based on multiple flood events exceeding the base of the unlined area and no observed change in water quality, landfill expansion would not result in increased potential for impacts related to future water table conditions. Black & Veatch agrees with the assertion that the landfill expansion will not negatively impact groundwater conditions. However, this is based on current regulations and construction requirements. Impacts to groundwater may still be possible from the unlined area rather than the new expansion. Multiple flood events only represent temporary saturation of the unlined area. The discontinued pumping of the quarry and resulting rise in groundwater levels would allow permanent saturation of the base or higher which has the potential to induce further leaching. While the potential concentrations are unknown, continued monitoring and potential remedial actions should be in place. It appears this will be addressed by the MPCA during the solid waste permit modification process.

Appendix D, Future Permitting Needs. A list of ten future action items is provided. Once complete, these items will provide significant controls to mitigate future groundwater and quarry lake impacts from landfill related contamination. Confirmation is requested that all future permitting needs be conducted under scenarios with elevated groundwater (i.e. quarry full water levels).

From: dloon@mnvalleytrust.org
To: Sommer, Steve (MPCA)
Subject: Comments re Draft SEIS for Burnsville Landfill Expansion
Date: Friday, July 30, 2021 1:26:35 PM
Attachments: MN Valley Trust Comments on DSEIS for Burnsville Landfill Expansion 7.30.21.pdf

This message may be from an external email source.
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Mr. Sommer –

Thank you for the opportunity to review and comment on the draft SEIS for the expansion of the Burnsville Landfill. Please see the attached comments. Contact me with any questions or additional information you may need.

Thanks.
Deb

Deborah Loon, Executive Director
Minnesota Valley Trust, Inc.
612-801-1935 mobile

MINNESOTA VALLEY TRUST
Minnesota Valley National Wildlife Refuge Trust, Inc.

July 30, 2021

Steve Sommer
MPCA
520 Lafayette Road North
St Paul MN 55155-4194

RE: Draft Supplemental Environmental Impact Statement for Burnsville Landfill Expansion Project

Dear Mr. Sommer:

It's time to move away from the practice of landfilling waste in the Minnesota River Valley, an ecologically-significant area that is important to resident and migrating wildlife and the many generations of Minnesotans (both indigenous and immigrant) that live, work and recreate in the river valley. Rather than allow for an expansion of the Burnsville Landfill, the MPCA should motivate Waste Management, Inc. and the local units of government to invest more in alternatives higher on the state's waste management hierarchy, especially recycling and composting.

The Minnesota Valley Trust, a nonprofit partner of the Minnesota Valley National Wildlife Refuge, respectfully submits comments on two significant deficiencies in the draft Supplemental EIS for the expansion of the Burnsville Landfill.

1. The section on "Visual Impacts" provides a cursory consideration of the actual impacts at best. The DSEIS does not really analyze the impact of constructing a mountain of trash over four decades in a river valley.

   First, the DSEIS does not consider whether such an unnatural mountain should even exist in the river valley. It will be much taller than the river bluffs, thereby dominating and forever altering the natural landscape.

   Second, the DSEIS does not consider the visual impact of the process of building the mountain. Large trucks and heavy equipment will operate for decades on the trash mountain as it grows. Open faces of trash will be visible from great distances. The renderings provided in the DSEIS suggest a serene grassy mound, rather than what it will be -- an active industrial operation with heavy equipment and trash visible to everyone from a long distance.

2. The "Alternatives" analysis (and eventual decision on permit) should assume at least the 75% recycling mandate and incorporate organics composting. The waste composition study of waste going into the landfill in December 2019 found that 69% could be recovered (49% composted and 20% recycled). Organics composting is not a new concept; it is being done in significant parts of the

metro area, including the City of Minneapolis. The DSEIS ignores the fact that expansion of organics composting is a significant opportunity to recover waste and reduce the need for landfilling.

The fact that we comment on these two sections of the DSEIS is not intended to imply that we find the balance of the document sufficient. We have significant concerns about surface water, groundwater and air quality impacts of the landfill, but have not retained the technical capacity to comment on those and other sections.

Once the Burnsville Landfill starts growing and becomes a mountain of trash, it will be a permanent scar on the Minnesota River Valley. A landfill is not like a building that can be demolished or moved at will. It is a lasting testament to a society that prefers to take the easiest path and push environmental challenges onto future generations.

Thank you for your consideration of these comments. We look forward to participating in the balance of the process toward determining if Waste Management, Inc. should be permitted to expand the Burnsville Landfill.

Sincerely,

Deborah Loon
Executive Director
612-801-1935
dloon@mnvalleytrust.org

From: Tonsager, Cindy
To: Sommer, Steve (MPCA)
Cc: Workman, Liz; Smith, Matt
Subject: Dakota County comment - Burnsville Sanitary Landfill expansion project
Date: Friday, July 30, 2021 2:15:03 PM
Attachments: Dakota County Comment- Burnsville Landfill Expansion.pdf

Importance:

This message may be from an external email source.
Do not select links or open attachments unless verified. Report all suspicious emails to Minnesota IT Services Security Operations Center.

Good afternoon,
Thank you for the opportunity to review the Environmental Impact Statement (EIS) for the Burnsville Sanitary Landfill expansion project. County Physical Development staff reviewed the document and offer the attached comments for consideration.

Thank you-
Cindy

Cindy Tonsager

Physical Development Division - Administration

P 952-891-7556
W www.dakotacounty.us
A 14955 Galaxie Ave Apple Valley, MN 55124

Note: This email and its attachments may contain information protected by state or federal law or that may not otherwise be disclosed. If you received this in error, please notify the sender immediately and delete this email and its attachments from all devices.

July 30, 2021

Steve Sommer
Minnesota Pollution Control Agency
520 Lafayette Road
Saint Paul, MN 55155

Thank you for the opportunity to review the Environmental Impact Statement (EIS) for the Burnsville Sanitary Landfill expansion project. County Physical Development staff reviewed the document and offer the following comments for consideration.

Environmental Resources

Groundwater-Related Uncertainties

The Burnsville Sanitary Landfill (BSL), Kraemer Quarry water supply, and future Quarry lake are within the Burnsville Drinking Water Protection Overlay District. They are subject to a number of groundwater-related uncertainties that are generally independent of the proposed BSL expansion, but which should be monitored closely in coming years. These uncertainties are specifically related to 1) how the future cessation of mining in the Kraemer Quarry may impact groundwater flow patterns and the contact between groundwater and waste, and 2) PFAS and 1,4 dioxane.

Groundwater Assessment 6.1.3.3, pp. 27-30 - The site was initially developed by Ed Kraemer & Sons and was operated as on open dump between 1962 and 1971. In 1971 development plans were prepared, and between 1971 and approximately 1992 the site accepted MMSW in unlined waste cells. The unlined waste cells include an area of approximately 98.4 acres. The base grade elevation (bottom of the waste) of the unlined landfill area has been estimated at 700 feet based on pre-development mapping, initial development plans, and site investigation reports. Water table measurements indicate that the water table periodically exceeds an elevation of 700 feet in the unlined area during flood events. Based on BSL groundwater monitoring data, there have not been notable impacts to groundwater quality observed following flood events. If the quarry dewatering sump were simply turned off, it is likely that the water level in the quarry would rise to an elevation of 700 feet, or more, depending on the future configuration of the existing flood protection dike and numerous other factors.

Periodic flood events intruding into the unlined wastes areas are not equal or similar to the eventual saturation of unknown wastes in the unlined portion of the landfill. This section of the landfill should be fully evaluated and the potential contaminants of concern be identified and quantified and a mitigation plan prepared before exceedances are identified in groundwater or surface water. The additional waste added from this expansion project over the top of the unlined portion will significantly complicate investigation and mitigation in the future.

Physical Development Division

P 952-891-7000 **F** 952-891-7031 **W** www.dakotacounty.us
A Dakota County Western Service Center • 14955 Galaxie Ave. • Apple Valley • MN 55124

Kraemer Quarry

The potential changes to groundwater flow patterns below BSL from changes in dewatering at Kraemer Quarry are identified in 1.1.2.1 Groundwater Impacts (p.3) and other places in the EIS. Dakota County recommends ongoing monitoring of groundwater levels and potential groundwater contaminants at that time, so any problems can be identified and addressed promptly.

PFAS and 1,4 dioxane

Dakota County recommends that BSL's updated Sampling and Analysis Plan (Plan) include more frequent sampling (such as quarterly) of leachate and groundwater for PFAS and 1,4 dioxane. The Plan should be updated frequently in response to anticipated changes in laboratory analytical methods for PFAS that will allow detection of more compounds at lower detection levels and to anticipated changes and additions to MDH drinking water guidelines. MPCA staff, during their June 3, 2021, on-line "PFAS Monitoring Plan Kick-off Event," reported their monitoring shows, in general, the presence and concentrations of "long-chain PFAS" (such as PFOS and PFOA) are decreasing but "short-chain PFAS" (PFAS compounds taking the place of PFOS and PFOA) are increasing. As a result, it should be assumed that PFAS compounds should be viewed as "forever chemicals," indeed.

Specific to BSL, PFAS are identified under 1.1.2.1 Groundwater Impacts (p.3) and 1.3 (p. 11), Issues To Be Resolved (p. 11). Under 6.1.3.1 Groundwater Quality and Areas of Impact in Vicinity of the Project (p. 26), the EIS reports that MPCA sampled monitoring wells at BSL in 2007 and 2008. PFAS were detected in all four of the monitoring wells sampled, which included three wells down-gradient and one well up-gradient from the landfill. The PFAS concentrations were below the ILs [intervention limits] used at the time the data were collected, but PFAS standards have become more stringent and the concentrations would be above current drinking water standards.

Attachment I, "Future Permitting Needs Document," (second page) says that BSL will be required to update its Sampling and Analysis Plan. Dakota County supports this in light of the considerations described above.

Other Issues

Manganese -- 1.1.2.1 Groundwater Impacts (p.3). Dakota County concurs that the elevated manganese detected in BSL groundwater is likely naturally occurring.

Stormwater/Surface water

The project will expand an existing sedimentation pond and have an erosion control plan in place. According to the SEIS, runoff will only increase for a 500-year event due to the increased steepness of the slopes, but it appears that it will decrease or improve for all smaller events.

Surface water impacts – 6.2 Surface Water Impacts (pp. 33-39). Dakota County recommends the SEIS address the potential for more intense precipitation events in the future.

Air Quality

GHGs and Climate Change – 1.1.2.5, p. 7 - Currently, it is not possible to model the physical impacts of global or regional climate change, such as storm frequency/intensity or temperature increases caused by incremental GHG emissions. In other words, while solid waste landfills contribute to climate change generally, existing scientific tools do not allow the MPCA to quantify the specific impacts of a particular project on climate change.

Dakota County Environmental Resources staff recommends the SEIS address the potential for more evaluation or reassessment of the impacts of GHGs and climate change as the scientific tools advance and information changes in the future.

Physical Development Division

P 952-891-7000 **F** 952-891-7031 **W** www.dakotacounty.us
A Dakota County Western Service Center • 14955 Galaxie Ave. • Apple Valley • MN 55124

Future permitting needs

The MPCA noted future impacts or information needs that were beyond what was legally required in the SEIS scoping decision document, this includes the following:

Air quality impacts

BSL needs an air quality permit amendment for the Project because it will increase potential air emissions from the landfill. In addition to the expansion Project, the application also indicated that BSL is considering pursuing the option of transferring waste from the nearby Freeway Landfill to its landfill. BSL's application also indicated that this option would include construction of a new unpaved road between the two landfills in order for trucks to haul waste between the two facilities.

The BSL SEIS does not include an evaluation of potential impacts of transferring Freeway Landfill waste (or waste from any other source) to BSL because it was not required by the BSL SEIS Scope. The waste source analysis was not part of the Scope because the purpose of the Project is not to take waste from any specific source, but instead to increase BSL's ultimate design capacity so they can continue operation into the future, whatever the waste source. The MPCA will therefore require BSL to conduct an appropriate analysis of the air quality impacts (e.g., air dispersion modeling) of the unpaved road option. This analysis will be done as part of BSL's air quality permitting process (i.e., not part of the BSL SEIS process).

Water quality impacts

BSL needs a permit modification for the Project because it will increase the facility's solid waste disposal capacity.

The following items will be addressed by the MPCA during the solid waste permit modification process required for BSL's expansion Project:

1. Establishment of a compliance boundary based on drinking water standards where water (surface or ground) is used as drinking water, such as the Minnesota River;
2. The MPCA will require, during Project permitting, that BSL update its groundwater Sampling and Analysis Plan to include current standard parameters, monitoring limits based on Health Risk Limits or equivalent health standard, and additional contaminants of concern based on information obtained from groundwater monitoring in the Project area. The specific contaminants of concern that will be evaluated during the permitting process for potential inclusion into BSL's permit include PFAS and 1, 4 dioxane;
3. An updated Environmental Monitoring Plan that details the ground water monitoring network at the facility and any additional wells needed in order to identify potential contaminant release;
4. A Geotechnical stability analysis for in-place waste based on the increased mass and height of the proposed expansion including an analysis of any leachate held within the in-place waste;
5. An analysis of in-situ leachate in the unlined waste cell to identify potential contaminates that could be introduced to groundwater that could threaten human health and the environment;
6. A Contingency Action Plan that details actions the Project proposer must undertake in the event groundwater contamination or other potential environmental impacts are detected at the facility;
7. Detailed Technical Specifications that describe construction methods and materials that will be used to establish environmental controls;
8. A Financial Assurance Plan that will establish a mechanism to provide funding in the event of any necessary future contamination clean-up or operational changes at the facility;
9. A Closure Plan that specifies steps that will be taken to close out the facility in an environmentally protective way after the facility reaches its final capacity; and
10. A Post-Closure Care Plan that describes maintenance and environmental controls that will provide long-term environmental protection at the facility after it closes.

Dakota County Environmental Resources staff agrees with the identified future permitting needs and recommends consideration of our comments presented above relating to groundwater related uncertainties, Kraemer quarry, groundwater flow, groundwater levels and waste interface, emerging COC (PFAS and 1, 4-dioxane), and climate change.

Parks and Greenways

The proposed build-out and end use of the landfill is 41 years. The EAW recognizes the future Minnesota River Greenway as part of a final end use plan for open space and recreation. Will there be an opportunity to develop the continuation of the Minnesota River Greenway through/around the landfill area prior to final buildout? Can trail be constructed on the levy and utilized as a trail in the next 10 years?

If you have any questions relating to our comments, please contact me at 952-891-7007 or Steven.Mielke@co.dakota.mn.us

Sincerely,

Steven C. Mielke, Director
Physical Development Division

cc: Commissioner Liz Workman, District 5
Matt Smith, County Manager

Physical Development Division

P 952-891-7000 **F** 952-891-7031 **W** www.dakotacounty.us
A Dakota County Western Service Center • 14955 Galaxie Ave. • Apple Valley • MN 55124

From: Mary Jo Exley
To: Sommer, Steve (MPCA)
Subject: Landfill expansion protest
Date: Friday, July 30, 2021 3:28:56 PM

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I am against allowing Burnsville to increase the height of the current landfill. It will be an eyesore on the view out my windiw. I am concerned about the flame to burn off excess gas both because of pollution and the smell. I also thunk its irresponsible to have a landfill on the edge of the Minnesota River Valley. It could contaminate ground water and will mist likely cause the death of lots a birds that migrate through the Valley as well as thise that live here. I understand the need for a landfill, but if ElkRiver can close it's landfill why should the excess be dumped in the river Valley. Lights that will be needed to slert planes will also contribute to light pollution. Turn off the lights, don't burn /flame the gass and don't make a mountain of trash the tallest thing on the horizon. STOP THIS NOW. FIND ANOTHER SOLUTION. SAVE THE ENVIRONMENT!!!!
Mary Jo Exley

38 year Bloomington resident.

From: Jim Cox
To: Sommer, Steve (MPCA)
Subject: Burnsville Sanitary Landfill Expansion
Date: Friday, July 30, 2021 3:52:38 PM

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Dear Steve:

Im writing in hopes that the MPCA will not allow the expansion of the Burnsville Landfill. The is already too large and already a possible threat to our drinking water. The landfill threatens the Minnesota Vally National Wildlife Refuge, and two of the states major rivers.
This is not to mention, the odor, noise, and runaway trash that the landfill produces.
Please do not allow this new expansion

Jim Cox
Cologne, Minn

From:	Michael Yung
To:	Sommer, Steve (MPCA)
Subject:	Re: My comments with regards to the BSL DEEIS and have it added to the public record:
Date:	Friday, July 30, 2021 4:12:52 PM

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Hi Steve,

Thank you for taking my call on your day off.

I would like to make my comments with regards to the BSL DEEIS and have it added to the public record:

Blowing debris

Between 1995 and 2006, I drove on Pena Boulevard by *Tower Landfill* (which is located 1 mile west of Denver International Airport) on average a couple of times every other week. What I noticed while driving by was the amount of wind-blown debris lofted above the landfill and gulls and other birds circling the area. This occurred even though the landfill uses large water tankers to constantly spray down the landfill.

An observation of mine (non-scientific) regarding the areas of the Burnsville Landfill and Tower Landfill: living in Minnesota and Colorado, I can tell you that on any given day, it is certainly windier in MN than in CO for these two areas. Doubt that statement? Then try bicycling in those two locations and total the curse words you throw at the prevailing headwinds.

As you build up in height for this proposed landfill, you will also encounter greater velocity of wind speed, further increasing wind-blown debris.

I would think that odors from the landfill will also be able to be smelled further downwind as more of this material will be exposed to the wind then when digging a pit. I sure as heck would not want to have a business or home downwind of this towering landfill.

If the proposed landfill does go through, I guess Burnsville might eventually have bragging rights…"Our towering landfill is taller than your "Tower Landfill".

500-Year Flood

Our family has lived on Crystal Lake for 61 years, and we have seen how water being redirected from surrounding neighborhoods in the Crystal Lake watershed has led to excessive high water levels on Crystal Lake. Until this past June, water had been continually flowing out of Crystal Lake since 2009. Water from Crystal Lake is routed via piping into the Minnesota River. What I am driving at is, think of all the current and future development that is along the Minnesota River Valley where water is eventually routed into the river. When we have excessive rains or periods of high rainfall, my feeling is that a 500 year flood will be much easier to achieve.

- The data that you have for a 500-year flood may be true of the past, but is that what you are projecting for the future?
- And if so, are you taking into account all of the future development surface area where the water will be routed into the Minnesota River Valley instead of being retained in its own locale? You cannot just look at Burnsville and Bloomington, you need to look both upstream and downstream as these areas will also affect

flood levels in this location.

Economic

From an economic standpoint, I would find it hard to believe that the City of Burnsville would be in support of such a project, if they are still in favor of the *Minnesota River Quadrant* redevelopment plan. The link below illustrates a possible concept for this project. It looks like the "18-hole championship" golf course will be built on the proposed 372 foot high landfill. This will make the former Otto's Golf course behind Buck Hill look tamed by comparison!

Minnesota River Quadrant

I wonder why you do not see Edina proposing a 372-foot high landfill along the Southdale development corridor! Heck, St. Paul is not even proposing such an improvement at the *Highland Bridge | Ford Site Redevelopment* project. What is it that Burnsville sees this being a benefit to the community that other cities do not?

Does Burnsville really believe that they will be able to go forward with the *Minnesota River Quadrant* redevelopment plan when your immediate next door neighbor is a tower mountain of trash?

Mike Yung

361 Maple Island Road
Burnsville, MN 55306

Thanks Steve,

Mike Yung

From: Sara Blood
To: Sommer, Steve (MPCA)
Subject: Public Comment on DSEIS
Date: Friday, July 30, 2021 4:35:20 PM
Attachments: MVRF Burnsville Landfill DSEIS Public Response_FINAL.pdf

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Please see attached letter.

--

Sara N. Blood
Executive Director
Minnesota Valley Refuge Friends
763-228-6272
sarablood.mnvrf@gmail.com

Minnesota Valley Refuge Friends
3815 American Blvd. E.
Bloomington, MN 55425
952-858-0737
hello@mnvalleyrefugefriends.org

July 30, 2021

Steve Sommer
MPCA
520 Lafayette Road North
St Paul MN 55155-4194

RE: Response to Draft Supplemental Environmental Impact Statement for Burnsville Landfill Expansion Project

Dear Mr. Sommer:

My name is Sara Blood, and I am executive director of Minnesota Valley Refuge Friends, a nonprofit citizen support group of the Minnesota Valley National Wildlife Refuge headquartered in Bloomington, Minnesota.

The Minnesota Valley Refuge Friends opposes expansion of the Burnsville Sanitary Landfill, located at 2650 West Cliff Road, Burnsville, MN 55337.

In 1975, then U.S. Sen. Walter Mondale introduced S. 2097, which would establish the Minnesota Valley National Wildlife Refuge. It was the wish of Mondale and many other Minnesotans to preserve the Minnesota River Valley from further development, “assuring that our children will be able to use and enjoy this valuable, but fragile resource.”

Since then, Minnesota Valley National Wildlife Refuge has grown to encompass 70 miles of the Minnesota River Valley, from Bloomington to Henderson. More than 400,000 visitors seek refuge in the refuge every year (pre-pandemic figures – which have grown five-fold).

The refuge is a premier urban wildlife refuge, one of just a handful of such gems in our country. It is a place where our Twin Cities residents can connect with nature, watch wildlife and enjoy outdoor recreational activities like hiking, canoeing and fishing. The refuge, according to the Star Tribune, “offers one of the rare spots in the Twin Cities where hikers can make it deep into the stillness of a marsh, or walk through one of the last remaining pockets of oak savannas in the state.”

Minnesota Valley Refuge Friends
3815 American Blvd. E.
Bloomington, MN 55425
952-858-0737
hello@mnvalleyrefugefriends.org

If approved, expansion of the Burnsville Sanitary Landfill will forever ruin the landscape of the Minnesota River Valley that was carved by glaciers. An unnatural mountain of waste will grow and become the dominant feature in this landscape. And while it grows over decades, visitors to the refuge and surrounding area will have to watch and hear truck traffic and heavy equipment moving waste around the landfill.

This is not what the creators of the refuge had envisioned. As stewards of this vision, we must protect the Minnesota Valley from such unnecessary and unwanted development.

Please protect the public's enjoyment of the Minnesota Valley National Wildlife Refuge. Deny the application for expansion of the Burnsville Sanitary Landfill.

Sincerely,

Executive Director
Minnesota Valley Refuge Friends
763-228-6272
sarablood.mnvrf@gmail.com

From:	Collins, Melissa (DNR)
To:	Sommer, Steve (MPCA)
Cc:	mmiller20@wm.com; Harper, Liz (DNR); Pierce, Ann M (DNR)
Subject:	Burnsville Sanitary Landfill Expansion Project DSEIS - DNR Comments
Date:	Friday, July 30, 2021 5:05:22 PM
Attachments:	2021-07-30-BurnsvilleSanitaryLandfillSEIS-DNRcmtltr.pdf 20190297-1a (2).pdf

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Dear Steve Sommer,

Thank you for the opportunity to review the Burnsville Sanitary Landfill Expansion Project DSEIS. Please see the DNR comment letter and attachment included with this email. A confirmation of receipt would be most appreciated.

Thank you,

Melissa Collins
Regional Environmental Assessment Ecologist | Ecological and Water Resources
Pronouns: She/her
Minnesota Department of Natural Resources
1200 Warner Road
St. Paul, MN 55106
Phone: 651-259-5755
Email: melissa.collins@state.mn.us
mndnr.gov

DEPARTMENT OF NATURAL RESOURCES

Division of Ecological and Water Resources
Region 3 Headquarters
1200 Warner Road
Saint Paul, MN 55106

Transmitted by Email

July 30, 2021

Steve Sommer
Resource Management and Assistance Division
Minnesota Pollution Control Agency
520 Lafayette Road North
St. Paul, MN 55155

Dear Steve Sommer,

Thank you for the opportunity to review the Burnsville Sanitary Landfill Expansion Project Draft Supplemental EIS. The DNR recognizes the complex set of issues that must be weighed when evaluating the long-term environmental impacts of such projects with the need for municipal waste disposal. Therefore, we respectfully submit the following comments for your consideration:

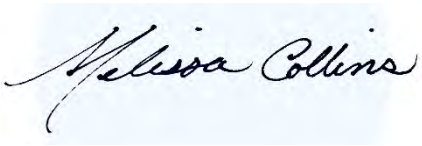
1. Page 3, Summary; 6.1.3 Groundwater Assessment. The DNR appreciates that the Groundwater Sampling and Analysis Plan will be updated to meet current standard parameters and monitoring limits so that additional contaminants of concern are monitored, and so that the occurrence of PFAS detected at the facility can be better monitored and understood.
2. Page 4, Water Supply Wells; 6.1.3.4 Area Water Supplies. The future of the Burnsville municipal water supply is uncertain after Kraemer Quarry ceases mining activities. Whether through continued dewatering or new municipal wells, the potential impact to calcareous fens and trout streams in the area will need to be considered when evaluating future water appropriations.
3. Page 5, 1.1.2.3 Liner/Leachate Collection; 6.1.3.2 Groundwater Flow Conditions. It is unclear in the document text if the potential impacts of 100-year and 500-year storm events were evaluated based on more conservative predicted flooding elevations after the cessation of mining at Kraemer Quarry? Continued dewatering at current levels cannot be assumed.
4. Page 39, 6.2.2 Drainage to Wetlands and Wetland Impact Comparison. It is possible that the proposed annexation development area in Figure 3-1 might overlap with Public Waters Wetland 19-111. *Minnesota Rules* 6115.0190 Subp. 3 prohibits placement of fill to create

upland areas. Please coordinate with the DNR to determine if this project will impact Public Waters.

5. The DNR recommends using the most up to date river flow data to assess the flood risk of this project proposed within the floodplain of the Minnesota River, especially considering the potential rise in the surficial water table after the cessation of mining at Kraemer Quarry.
6. No discussion or evaluation of potential impacts to wildlife, habitat, or state-listed rare features was included within this document. Given the proposal to expand the landfill into a wetland area mapped as a Minnesota Biological Survey Site of High Biodiversity Significance, wildlife impacts should be considered. Please see the attached Natural Heritage letter dated April 26, 2019 that was completed for the project regarding potential impacts to rare features. Please note that Minnesota's Endangered Species Statute (*Minnesota Statutes*, section 84.0895) and associated Rules (*Minnesota Rules*, part 6212.1800 to 6212.2300 and 6134) prohibit the take of threatened or endangered species without a permit.

Thank you so much for the opportunity to review this document, and please let me know if you have any questions.

Sincerely,



Melissa Collins
Regional Environmental Assessment Ecologist | Ecological and Water Resources
Minnesota Department of Natural Resources
1200 Warner Road
St. Paul, MN 55106
Phone: 651-259-5755
Email: melissa.collins@state.mn.us

CC: Michael Miller, Burnsville Sanitary Landfill

Ann Pierce, DNR EWR Deputy Director

Liz Harper, DNR Assistant Regional Manager

Equal Opportunity Employer

Minnesota Department of Natural Resources
Division of Ecological & Water Resources
500 Lafayette Road, Box 25
St. Paul, MN 55155-4025

April 26, 2019
Correspondence # ERDB 20190297

Mr. Jim de Lambert
Carlson McCain, Inc.
15650 36th Ave. N, Ste 110
Plymouth, MN 55446

RE: Natural Heritage Review of the proposed Burnsville Sanitary Landfill - Annex Development Area, T27N R24W Section 32; Dakota County

Dear Mr. de Lambert,

As requested, the Minnesota Natural Heritage Information System has been queried to determine if any rare species or other significant natural features are known to occur within an approximate one-mile radius of the proposed project. Based on this query, rare features have been documented within the search area (for details, please visit the Rare Species Guide Website for more information on the biology, habitat use, and conservation measures of these rare species). Please note that the following rare features may be adversely affected by the proposed project:

Ecologically Significant Areas

- A portion of the project is within an area the Minnesota Biological Survey (MBS) has identified a Site of *High* Biodiversity Significance. Sites of Biodiversity Significance have varying levels of native biodiversity and are ranked based on the relative significance of this biodiversity at a statewide level. Sites ranked as *High* contain very good quality occurrences of the rarest species, high quality examples of the rare native plant communities, and/or important functional landscapes. (GIS shapefiles of MBS Sites of Biodiversity Significance can be downloaded from the MN Geospatial Commons. Please contact me if you do not have access to the appropriate mapping services.) Although some of the area has changed land use since the Site was delineated, the areas that remain intact likely still have ecological significance. We encourage you to consider project alternatives that would avoid or minimize disturbance to this ecologically significant site. Actions to minimize disturbance may include, but are not limited to, the following recommendations:
    - Minimize vehicular disturbance in the area (allow only vehicles/equipment necessary for construction activities);
    - Do not park equipment or stockpile supplies in the area;

- Do not place spoil within MBS Sites or other sensitive areas;
- Use effective erosion prevention and sediment control measures;
- Inspect and clean all equipment prior to bringing it to the site to prevent the introduction and spread of invasive species;
- As much as possible, operate within already-disturbed areas;
- Revegetate disturbed soil with native species suitable to the local habitat as soon after construction as possible; and
- Use only weed-free mulches, topsoils, and seed mixes. Of particular concern are birdsfoot trefoil (*Lotus corniculatus*) and crown vetch (*Coronilla varia*), two invasive species that are sold commercially and are problematic in prairies and disturbed open areas.

- If the Wetland Conservation Act (WCA) is applicable to this project, please note that wetlands within High MBS Sites of Biodiversity Significance may qualify as "rare natural communities" under this Act. Minnesota Rules, part 8420.0515, subpart 3 states that a wetland replacement plan for activities that modify a rare natural community must be denied if the local government unit determines the proposed activities will permanently adversely affect the natural community.

- Multiple calcareous fens have been documented in the vicinity of the proposed project area. Black Dog Lake Fens A, B, and C (ID # 32941, 14373, and 31929, respectively) are located east of the project and contain the following state-listed plants:

  - Sterile sedge (*Carex sterilis*) – Threatened
  - Tuberous Indian-plantain (*Arnoglossum plantagineum*) – Threatened
  - Edible valerian (*Valeriana edulis* var. *ciliate*) – Threatened
  - Whorled nutrush (*Scleria verticillata*) – Threatened
  - Hair-like beak rush (*Rhynchospora capillacea*) – Threatened
  - Twig rush (*Cladium mariscoides*) – Special Concern
  - Small white lady's-slipper (*Cypripedium candidum*) – Special Concern

  Savage Fen (ID# 241) is located to the west of the project and contains the following state-listed species:

  - Sterile sedge (*Carex sterilis*) – Threatened
  - Beaked Spikerush (*Eleocharis rostellata*) – Threatened
  - Edible valerian (*Valeriana edulis* var. *ciliate*) – Threatened
  - Whorled nutrush (*Scleria verticillata*) – Threatened
  - Hair-like beak rush (*Rhynchospora capillacea*) – Threatened
  - Twig rush (*Cladium mariscoides*) – Special Concern
  - Small white lady's-slipper (*Cypripedium candidum*) – Special Concern

  A calcareous fen is a rare and distinctive peat-accumulating wetland that is legally protected in Minnesota. The Wetlands Conservation Act, authorized by *Minnesota Statutes*, section 103G.223, states that calcareous fens may not be filled, drained, or otherwise degraded, wholly or partially, by any activity, except as provided for in a management plan approved by the commissioner of the Department of Natural Resources. Many of the unique characteristics of calcareous fens result from the upwelling of groundwater through calcareous substrates. Because of this dependence on groundwater hydrology,

calcareous fens can be affected by nearby activities or even those several miles away. For more information regarding calcareous fens, please see the Calcareous Fen Fact Sheet.

The DNR would have concerns regarding any activities that might affect groundwater flows, including groundwater pumping or discharge. The EAW should adequately address potential effects to these fens. If you have any questions regarding calcareous fen regulations, please contact Doug Norris, Wetlands Program Coordinator, at 651-259-5125 or Doug.Norris@state.mn.us.

If it is determined that the project will adversely affect the fens in any way, including indirect impacts through the alteration of hydrological conditions, you will need to contact Lisa Joyal, the Endangered Species Environmental Review Coordinator, at lisa.joyal@state.mn.us or 651-259-5109, before the project is initiated to discuss rare species survey process (see attached). Surveys must follow the standards contained in the attached Rare Species Survey Process and Rare Plant Guidance. Project planning should take into account that any botanical survey needs to be conducted during the appropriate time of the year, which may be limited. Minnesota's endangered species law (*Minnesota Statutes*, section 84.0895) and associated rules (*Minnesota Rules*, part 6212.1800 to 6212.2300 and 6134) prohibit the taking of threatened or endangered species without a permit.

State-listed Species

- Several state-listed fish, mussels, and amphibians have been documented in the Minnesota River in the vicinity of the proposed project. These species are particularly vulnerable to deterioration in water quality, especially increased siltation. As such, the project should not be allowed to negatively affect the water quality of the Minnesota River. A buffer of vegetation should remain between the landfill and the river, and sound erosion and sediment control practices should be implemented and maintained for the duration of the project. **Please contact me if the proposed project will impact the river or its water quality,** as further action may be needed.

- Blanchard's cricket frog (*Acris blanchardi*), state-listed as endangered, has been documented recently in the vicinity of the project. This species inhabits shallow wetlands, lakes, streams, or rivers. They typically occupy areas along the water's edge, and prefer open areas with muddy shorelines and abundant emergent vegetation. This species remains near water during the summer, but may travel overland to find new habitat during dry spells. They emerge from winter dormancy in late April, and breeding occurs from late May to July. The tadpoles metamorphose into adults in early August and enter winter dormancy in late September. The life expectancy of this species is about four months, with only 5% of the population surviving the winter.

  Despite intensive survey efforts, the Blanchard's cricket frog is only known from a few isolated locations in the state. Their limited geographic distribution, along with their short life span, makes populations of this species very vulnerable to disturbance. Potential impacts include changes in wetland hydrology and decreases in water quality due to runoff, erosion, or pollution from fertilizers and other chemicals. Actions to minimize disturbance to this species include, but are not limited to, avoiding wetlands and aquatic habitat, limiting construction to winter months, and restricting the use of pesticides and fertilizers. **Please coordinate with the DNR Regional Nongame Specialist, Erica Hoaglund (651-259-5772 or Erica.Hoaglund@state.mn.us), to ensure avoidance of this species.**

Federally Protected Species

- The rusty patched bumble bee (*Bombus affinis*), a federally-listed endangered species, was documented in the vicinity of the proposed project. The rusty patched bumble bee typically occurs in grasslands and urban gardens with flowering plants from April through October. This species nests underground in abandoned rodent cavities or in clumps of grasses. Please reference the guidance at the USFWS rusty patched bumble bee website to determine if the project has the potential to impact this protected species.

Environmental Review and Permitting

- The Environmental Assessment Worksheet should address whether the proposed project has the potential to adversely affect the above rare features and, if so, it should identify specific measures that will be taken to avoid or minimize disturbance. Sufficient information should be provided so the DNR can determine whether a takings permit will be needed for any of the above protected species.

- Please include a copy of this letter in any state or local license or permit application. Please note that measures to avoid or minimize disturbance to the above rare features may be included as restrictions or conditions in any required permits or licenses.

The Natural Heritage Information System (NHIS), a collection of databases that contains information about Minnesota's rare natural features, is maintained by the Division of Ecological and Water Resources, Department of Natural Resources. The NHIS is continually updated as new information becomes available, and is the most complete source of data on Minnesota's rare or otherwise significant species, native plant communities, and other natural features. However, the NHIS is not an exhaustive inventory and thus does not represent all of the occurrences of rare features within the state. Therefore, ecologically significant features for which we have no records may exist within the project area. If additional information becomes available regarding rare features in the vicinity of the project, further review may be necessary.

For environmental review purposes, the results of this Natural Heritage Review are valid for one year; the results are only valid for the project location (noted above) and the project description provided on the NHIS Data Request Form. Please contact me if project details change or for an updated review if construction has not occurred within one year.

The Natural Heritage Review does not constitute review or approval by the Department of Natural Resources as a whole. Instead, it identifies issues regarding known occurrences of rare features and potential effects to these rare features. If needed, please contact your DNR Regional Environmental Assessment Ecologist to determine whether there are other natural resource concerns associated with the proposed project. Please be aware that additional site assessments or review may be required.

Thank you for consulting us on this matter, and for your interest in preserving Minnesota's rare natural resources. An invoice will be mailed to you under separate cover.

Sincerely,

Samantha Bump
Natural Heritage Review Specialist
Samantha.Bump@state.mn.us

Enc. Rare Species Survey Process

Links: Rare Species Guide
http://www.dnr.state.mn.us/rsg/index.html
DNR Regional Environmental Assessment Ecologist Contact Info
http://www.dnr.state.mn.us/eco/ereview/erp_regioncontacts.html
MBS Sites of Biodiversity Significance
http://www.dnr.state.mn.us/eco/mcbs/biodiversity_guidelines.html
DNR Native Plant Communities
http://www.dnr.state.mn.us/npc/index.html
MN Geospatial Commons
https://gisdata.mn.gov/
BWSR Native Vegetation/Seed Mixes
http://www.bwsr.state.mn.us/native_vegetation/
USFWS Rusty Patched Bumble Bee
https://www.fws.gov/midwest/endangered/insects/rpbb/guidance.html
Calcareous Fen Fact Sheet
https://files.dnr.state.mn.us/natural_resources/water/wetlands/calcareous_fen_fact_sheet.pdf

Cc: Becky Horton
Leslie Parris
Erica Hoaglund
Doug Norris
Kit Elstad-Haveles

From: Katherine Mullen
To: Sommer, Steve (MPCA)
Subject: Comments on proposed City of Burnsville landfill expansion
Date: Friday, July 30, 2021 5:30:19 PM

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Dear Steve, MPCA and City of Burnsville,

How is it possible we're having a conversation about expanding a landfill to essentially the height of a 30-story building for all to see, hear, smell and feel for miles around — adjacent to the Minnesota River Valley?

How did it happen that a landfill was sited so close to this beautiful natural resource in the first place?

Where has our Minnesota pride gone? This proposal makes our heart sink and wonder what happened to us as a community of people who used to really care? Everyone coming across the 35W Minnesota River Bridge (some multiple times daily) will experience this landfill. It won't make people feel good about this area that many of us love, protect and care for very much.

We understand the "footprint" of the landfill is not "growing" as if that should make us all happy and comfortable with this whole arrangement. But that's the wrong way to look at this problem. Is the sky and air we breathe "free" space for the taking to pollute for all humans and animals around to breathe? Is that what we're saying here?

Let's be honest about what we're proposing to give up for storing trash. Increased noise levels (yes noise will increase and carry farther the higher this goes)? Landfill dust and trash, swept by winds, ending up in the Minnesota River and in our neighborhoods and in our lungs in the case of dust? As the landfill grows, all this will happen and to pretend otherwise is naive at best.

The volume of waste to be managed on this site will just grow and so will the toxicity of things collected and decaying in it. Eventually it will leak because frankly that's what most landfills eventually do, right? We all know that.

The surrounding area including communities in Bloomington directly across from the Minnesota River and this landfill site will experience the many impacts as this landfill grows into the beautiful sky we seem to think is okay to despoil. Who cares, it's just sky right?!? What about us people who live here? Who cares about us?

Reviewing the EIS and listening to all public comments from the video in July, the research on potential health concerns and property values is very weak (essentially non-existent). This is a *LARGER* vertical landfill than is typical in MN and merits much greater review and priority for the health of all people living within 5 miles of this landfill. This landfill will impact the

surrounding communities and those of us living here within *2 miles as the crow flies*. You need to consider Bloomington residents more closely as some of us are closer to this landfill than even Burnsville residents.

MPCA's use of *limited available data* for comparison as the basis for making any decisions to move forward with this project is insufficient and would be irresponsible. We must look more closely at impacts on the land, air and water and how it impacts people's health over time. The relation to the Quarry and surrounding land use development plans and unknown plans needs to be a bigger consideration given proximity to the Minnesota River and people living *within 2 miles* to this proposed site.

What, for instance, is our community plan in the event of high winds and tornados that generally don't impact lower landfills, but could impact a landfill of this height, sending dangerous debris around our community? As a statewide community, we need to think more carefully of what the risks are of building landfills this high. We're not seeing anything compelling that addresses the impacts of the height of this proposed landfill expansion. With a little common sense alone, it's not hard to imagine potential problems here.

There have to be other, better options than what's being proposed. Government has a duty to care for the people in its community and the environment, and to show more regard to everyone living here than this process and proposal reflect.

We have to get creative and as a community address the growing trash problems in ways that have greater dignity and show better regard for people and the environment our lives depend on.

Someone wisely said "just because you can do it, doesn't mean you should." This sentiment surely applies in this case, so please reconsider this proposed plan before a big mistake is made, one that we will all pay for, *for many years.*

We do wish you well and have faith you will roll up your sleeves, put your heads together and find better solutions than this current proposal.

Sincerely,

Katherine Mullen
Former MPCA and Minnesota Department of Health employee working in environmental sciences
Minnesota Governor's Award winner for environmental hazard work

Richard Cretan
Co-author, West's Encyclopedia of American Law

11008 Glen Wilding Ln
Bloomington, MN

From: Dave Guzzi
To: Sommer, Steve (MPCA)
Subject: Burnsville Landfill Expansion Project.
Date: Friday, July 30, 2021 5:35:18 PM

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July 30, 2021

Steve Sommer
MPCA
520 Lafayette Road North
St Paul MN 55155-4194

RE: Response to Draft Supplemental Environmental Impact Statement for Burnsville Landfill Expansion Project

Dear Mr. Sommer:

My name is Dave Guzzi and I am a resident of Burnsville. I am also vice president of the of Minnesota Valley Refuge Friends' board of directors, a nonprofit citizen support group of the Minnesota Valley National Wildlife Refuge headquartered in Bloomington, Minnesota.

The Minnesota Valley Refuge Friends opposes expansion of the Burnsville Sanitary Landfill, located at 2650 West Cliff Road, Burnsville, MN 55337.

In 1975, then U.S. Sen. Walter Mondale introduced S. 2097, which would establish the Minnesota Valley National Wildlife Refuge. It was the wish of Mondale and many other Minnesotans to preserve the Minnesota River Valley from further development, “assuring that our children will be able to use and enjoy this valuable, but fragile resource.”

Since then, Minnesota Valley National Wildlife Refuge has grown to encompass 70 miles of the Minnesota River Valley, from Bloomington to Henderson. More than 400,000 visitors seek refuge in the refuge every year (pre-pandemic figures – which have grown five-fold).

The refuge is a premier urban wildlife refuge, one of just a handful of such gems in our country. It is a place where our Twin Cities residents can connect with nature, watch wildlife and enjoy outdoor recreational activities like hiking, canoeing and

fishing. The refuge, according to the Star Tribune, “offers one of the rare spots in the Twin Cities where hikers can make it deep into the stillness of a marsh, or walk through one of the last remaining pockets of oak savannas in the state.”

If approved, expansion of the Burnsville Sanitary Landfill will forever ruin the landscape of the Minnesota River Valley that was carved by glaciers. An unnatural mountain of waste will grow and become the dominant feature in this landscape. And while it grows over decades, visitors to the refuge and surrounding area will have to watch and hear truck traffic and heavy equipment moving waste around the landfill.

This is not what the creators of the refuge had envisioned. As stewards of this vision, we must protect the Minnesota Valley from such unnecessary and unwanted development.

On behalf of our members and board of directors, please protect the public’s enjoyment of the Minnesota Valley National Wildlife Refuge. Deny the application for expansion of the Burnsville Sanitary Landfill.

Dave Guzzi
daveguzzi@gmail.com
1217 Summit Oaks Drive
Burnsville MN 55377
952-358-1311
daveguzzi@gmail.com

Sent from my iPhone

From: John Hickman
To: Sommer, Steve (MPCA)
Subject: Burnsville Sanitary Landfill Expansion Project 2019
Date: Friday, July 30, 2021 5:50:41 PM
Attachments: Screen Shot 2021-07-30 at 2.27.55 PM.png

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_____

Dear Mr. Sommer:

Erecting this mountain of garbage would be a mistake of monumental proportions. The magnitude of the visual pollution is hard to imagine, although the City of Bloomington did attempt an illustration.

Please, please do not allow this monstrosity to blight the Minnesota River Valley.

Thank you for your consideration.

John Hickman
Bloomington
952-270-6896

From:	John Hickman
To:	Sommer, Steve (MPCA)
Subject:	Burnsville Sanitary Landfill Expansion Project 2019
Date:	Friday, July 30, 2021 5:50:41 PM
Attachments:	Screen Shot 2021-07-30 at 2.27.55 PM.png

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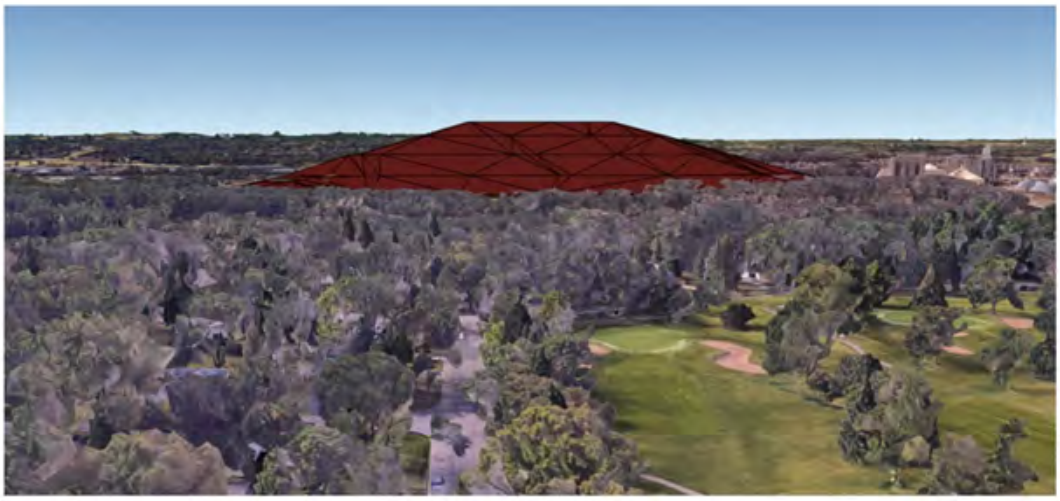
Dear Mr. Sommer:

Erecting this mountain of garbage would be a mistake of monumental proportions. The magnitude of the visual pollution is hard to imagine, although the City of Bloomington did attempt an illustration.



Please, please do not allow this monstrosity to blight the Minnesota River Valley.

Thank you for your consideration.

John Hickman
Bloomington
952-270-6896

From: Kim Kahlhamer
To: Sommer, Steve (MPCA)
Subject: Proposed solid waste expansion in Burnsville, MN
Date: Friday, July 30, 2021 8:09:32 PM

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Mr. Sommer;

I realize everyone wants to "pass the buck" on undesirable elements near there neighborhoods, but outside of the "not in my neighborhood" aspect of things, ***I am very surprised this project is even under consideration given the probable negative impact on sensitive ecosystems and the river environment, in general.*** As we are learning this year, even in the land of ten thousand lakes, clean and abundant water can become scarce. We do not have the right to contaminate water and waste its precious value to many communities - other communities downstream likely will be negatively impacted by contaminated water in and from the river.

I live in Bloomington, across the river, and certainly don't want the mountain of trash in my view, but that is less important than the environmental impact of expanding this site.

Please discontinue this endeavor and seek another site in a less delicate ecosystem.

Sincerely,

Kim Kahlhamer
Paralegal
952-201-3887 (mobile)
kimkahlh@yahoo.com

From: Dan Christensen
To: Sommer, Steve (MPCA)
Subject: Burnsville Sanitary Landfill Expansion Project
Date: Saturday, July 31, 2021 9:44:56 AM

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Mr. Sommer:

I would like to express my desire to have this project stopped or substantially altered.

As currently planned, the project would create an unnatural monstrosity of a landfill that will dwarf all of the surrounding environments. Drivers from all over the country passing through our metro area will be unpleasantly presented with an image resulting from poor planning now.

Additionally and more importantly, as a frequent user of the Minnesota River Valley, I fear the the long-term effects of the pollution generated by a landfill of that magnitude are potentially catastrophic to the Minnesota River and all waters downstream from there.

Yes, there may be greater costs to other solutions that will affect the customers of the waste collection vendors, but such is the result of our own individual lack of insight regarding the way our actions impact the environment.

Respectfully submitted,
Daniel Christensen
8509 Zenith Road
Bloomington, MN 55431
612-670-0906

From: Sue Henens
To: Sommer, Steve (MPCA)
Subject: Comments on Burnsville Landfill
Date: Saturday, July 31, 2021 1:46:06 PM

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Sent from Mail for Windows 10

Steve Sommer
520 LaFayette Rd. N
St. Paul, MN 55155

Dear Mr. Sommer:

Lakers New Prague Sanitary, Inc. submits the following comments regarding the Burnsville Sanitary Landfill proposed expansion project and Supplemental Environmental Impact Statement (SEIS).

We urge the MPCA to prioritize and complete the SEIS, permitting and Certificate of Need(CON) processes for the Burnsville Sanitary Landfill. The continued operation of the Burnsville Sanitary Landfill is vital to our business and we are concerned that the dwindling capacity at Burnsville Sanitary Landfill will negatively impact our business, our customers and the environment.

Transportation costs are a major factor in the collection of waste. If the Burnsville Sanitary Landfill were to close, or reduce the amount of waste accepted to lengthen the timeframe for the landfill to stay open, our business would have to seek other, more distant transfer stations or landfills to Dispose of mixed municipal solid waste (MMSW), including potential disposal facilities located in Greater Minnesota and/or out of state. This scenario would ultimately result in businesses and residents within Minnesota paying more for the collection and disposal of waste.

Increased transportation distances adversely impact the environment. Longer distances results in Increased fuel use and increased emissions.

Burnsville Sanitary Landfill is rapidly running out of its remaining capacity, have a projected remaining Capacity of 14 to18 months. We urge the MPCA to expediently move the remainder of this process
forward.

Sincerely,

Richard Hennes President
Lakers New Prague Sanitary, Inc

From: Carroll Aasen
To: Sommer, Steve (MPCA)
Subject: Burnsville Landfill Expansion EIS comments
Date: Saturday, July 31, 2021 3:14:29 PM

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Steve Sommer
MPCA
520 Lafayette Road North
St. Paul, MN 55155

Steve Sommer, MPCA:

As I have followed and read much on the proposed Burnsville Landfill Expansion, I can only come to the conclusion this proposal is more about money and the loss of tax revenue to the City of Burnsville, Dakota County and the State of Minnesota than what is truly good for the environment and ignores the potential for long term effect likely from contamination of our groundwater by this proposed expansion.

To allow the expansion of this Landfill over an unlined portion of the facility will just move the cost and size of the contamination area further down the road. IMO, this will result in a similar situation as what we have today with the Freeway Landfill.

With my vast civil engineering experience which includes the design and creation of Landfill Expansion plans and knowledge gained from that experience, this proposal makes no sense and should be outrightly rejected.

As per the proposals information, to add up to 262 feet of waste and fill on top of an unlined facility will set up the residents of Burnsville, Savage, Bloomington and the State of Minnesota with an even larger area of contaminated groundwater and thus an even larger cleanup cost years down the road.

Even on the lined portion of the landfill, there is a potential for leakage and contamination from stress and breakage of the liner under that portion due to the weight and compression from adding 23 million cubic yards of waste piled up to 262 feet on top of the existing landfill.

Surely we have other options and sure they may cost more money, the MPCA and all parties involved need to look at the cost potential of removing all this waste due to the groundwater contamination possibilities.

To propose to allow this along the Minnesota River and tributary of the Mississippi River and sending potential contaminants downstream will likely result in much higher future costs from cleanup and remediation of highly likely contamination as well as costs added to filter and cleanup numerous municipal water supplies for all that use the Mississippi River as a source for Municipal Water Supplies.

Please reject this proposal and look at alternatives. IMO, this proposal is a short term thoughtless idea that benefits the owners and government entities that receive the tax revenue in the short-term. Will Waste Management sign a waiver taking all liability for future cleanup and remediation costs, so that the Cities, County and the State will have no cost in a cleanup?

This proposal just due to the groundwater water contamination possibility should be rejected, to say nothing of the Visual Impact of creating Mount Burnsville Dump that will be visible for mile and mile across the Metropolitan Region.

Regards,

Carroll Aasen Jr
112250 Eitel Circle
Chaska, MN 55318

From: KAREN SHRAGG
To: Sommer, Steve (MPCA)
Subject: say no to expansion of Burnsville landfill
Date: Sunday, August 1, 2021 8:24:53 AM

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New laws supporting waste reduction, taxes on packaging and population stabilization are the only things to solve the ever growing garbage in our society. Expanding landfills not only has a detrimental environmental impact, it acts as a release valve for a wasteful world that needs taming from all angles. Build it and it will fill up and the what are you saddling future generations with????

The saying goes, just throw it away, but there is no away. It causes pollution which damages our health and the health of wildlife.

Thanks for listening

Karen Shragg
11307 Rich Circle
Bloomington Mn.

From: pdon pinkham
To: Sommer, Steve (MPCA)
Subject: minor correction to my comment submission saturday
Date: Sunday, August 1, 2021 1:52:33 PM
Attachments: Pdon"s Letter to MPCA_ver4.docx

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Bill Middlecamp was able to get ahold of me and say he would like his reference to be for a "trained En-ROADS facilitator" instead of a meteorologist because he has a degree in meteorology but never practiced it.

included here is an attachment with the change

pax

pdon

July 30, 2021
Steve Sommer
Minnesota Pollution Control Agency
520 Lafayette Road N.
St. Paul, MN 55155

RE: Burnsville Sanitary Landfill (BSL) Expansion – Comments on the Draft Supplemental Environmental Impact Statement (SEIS)

Dear Mr. Sommer,

Here are our comments regarding the **SEIS for the Addition to the Burnsville Landfill.**

We believe having a landfill in an environmentally sensitive area was a mistake for the start.

- We understand there weren't rules at the time so a landfill was put in the floodplain of the river the state is named after.
- There are 3 solutions we currently see:
    1. The landfill be removed as proposed by MPCA for the Freeway landfill thru the Federal Superfund because of its unlined areas.
    2. The landfill be allowed to raise to it current permitted capacity and not used again.
    3. A permit be given so the landfill can have more waste.
- It appears to us it is not in the best interest of Minnesota and America to have the landfill expanded because of human and environmental damage/cost during BLF flooding all the way to the Guff of Mexico forever.
- We believe the BLF should be moved, as proposed for the Freeway landfill, because its environmentally sensitive area will continue to be this way for eternity.
    - Both the freeway landfill and part of the BLF garbage was set on the existing floodplain and therefore are not designed for flooding we will experience in the future.
    - The current SIES appears to be mainly considering the effect of floods during the time the BLF addition is being filled and covers' are not installed instead of considering the total time a landfill will be in the Minnesota river floodplain exposed to flooding.

We believe the SIES should be reopened to Scoping again so a 2021 SIES can truly ascertain the physical, environmental, and social impact of the addition to the BLF for the following reasons:

1. We now have a new United States President and Administration who believe that climate change is a serious problem and willingness to act on it.
2. Flood rules are currently outdated because it is hard to keep up with presidential and legislative changes.
3. More Minnesota and United States citizens believe that climate change is happening and is a serious problem.
4. New research has been done regarding the devastating effects of climate change on future Minnesota's natural resources (air, water, soils, wetlands, and wildlife).
5. George Floyd's murder has greatly increased demands for environmental justice.
5. Increasing numbers and severity of extreme weather events in Minnesota and worldwide.

If new scoping cannot currently be done, please use the comments we make within scoping in the SIES and consider putting the ones which fall outside in appendix L with the other items.

Part 1: Suggested Water related concerns with SIES

1. The SIES indicates under areas of the proposed addition to the BLF there are places where there is no liner and the waste was put on top of the existing floodplain. Therefore, groundwater contamination will occur with landfill waste when the water level gets to 700 ft. The quarry pumping has kept the water well below this so there would be no expectation of contaminated leachate observed in the wells. - as has been found.
    1. If the quarry pumping was turned off what would be expected leachate concentrations found in the wells around the quarry.
    2. How would the proposed figures differer from those found around the freeway landfill causing it to be a Superfund site.
    3. The amount of water/day which has to be pumped out of the quarry per day, the amount of GHG released by this pumping, the effect of the environment of pumping, and a way for us to visualize how much water this is - ie number of Olympic swimming pools.
2. The current SIES doesn't include any mention of the BLF being removed in the future meaning the landfill will exist for thousands of years with possible flooding damage to BLF surrounding area, Mississippi, and the Gulf of Mexico.
    - If the chances of having a 1,000-year flood is 100% certainty in 1000 years, an analysis of the effects of 1,000 year floods on structure, environment, and people down to the Gulf of Mexico be included for the proposed addition.
    - how the structure can be repaired after a 1,000-year magnitude flood.
    - Social justice considerations should be included for entire Mississippi valley and Gulf of Mexico.
    - The effect of the released leachate on the health of people, for the additional landfill content and the unlined base liner part of BLF on people and wildlife.
3. Quantification of waste height below addition
    1. We would like a better explanation of how the height value of 700 feet was determined.
    2. The possible runoff problems with water getting to lower than 700 feet.
    3. Since we are not having runoff now because of quarry pumping more bore holes should be in the study for a more complete picture of what garbage is below 700 feet.
4. The geomembrane part of the composite liner has a half life of 400 years so please include in the SIES:
    1. What a membrane half-life means and the testing done to determine this in the main body of the SIES instead of appendix D with help from a white paper.
    2. How do the membrane and the clay barrier work to keep the landfill contents from leaching and how do they function as a team in a 500 and 1,000-year flood?
    3. Provide more details about how the BLF barrier will hold up to 500 and 1,000-year floods before and after the 400-year membrane life is over.
    4. How can the membrane be fixed when it leaks during thousands of years?
5. How the caps work during continued 500 and 1,000-year flood events and how they would be repaired for thousands of years?
6. The SIES doesn't include the impacts of 100, 500, and 1,000-year floods at the BLF site from heaven rain fall downstream causing BLF flooding because there is no place for the water to go.
7. Future climate change impacts need to be figured into the SIES:
    1. We recognize the problems associated with trying to predict the effects of climate change on natural disasters and therefore why it wasn't included in the scoping requests of 2019. We suggest MPCA try using new simulation tools which have recently been created. A good example of this is the En-ROADS simulator, developed by MIT, and used throughout the world by planners to make decisions concerning the future impacts of global warming.
    - The website is https://www.climateinteractive.org/tools/en-roads/
    - There is a trained En-ROADS facilitator in the area (Bill Middlecamp - billmiddlecamp@gmail.com) if MPCA would desire his help.
        1. Use this data with "Weather Attribution" https://www.worldweatherattribution.org

2. Weather attribution is a technique to answer the question of whether and to what extent the likelihood and intensity of an observed event changed due to the anthropogenic modification of the Earth's climate using a method called "extreme event attribution".
3. With En-ROADS or similar simulation and attribution tools, the MPCA will be able to obtain the likelihood of a 100, 500, and 1000-year floods occurring more often because of climate change.

- Here's how this might work:
    1. Currently the global temperature has increased 1 degree Celsius in the last 250 years.
    2. With the simulator set to our current global warming mitigation strategies, it projects an increase of 2 degree Celsius temperature would be reached in 2050, 3 degree Celsius temperature in 2080, and 3.6 degree Celsius temperature in 2100.
    3. The internet site, "world weather attribution" information about Hurricane Harvey can be extrapolated to estimates of frequency of flooding at the BLF site - to summarize: It was found the hurricane was 3 times more likely and had a 15% higher volume of water because of global warming of 1 degree Celsius.
    4. Therefore with 1 degree Celsius global warming in 2017 the chances of a Hurricane Harvey increased by 3 times over its 1% chance per 9,000 years.
    5. Therefore, the dice came up "heads" in 2017, Harvey occurred, and there will be a 1% chance of occurrence again within 3,000 years with current 1 degree Celsius warming.
- If we use this technique on a 500-year flood with the Minnesota River.
    1. A 500-year flood chance in 2022 would have a 0.2% chance per year because the temperature is 1 degree Celsius higher in 2022 than it has been for the past 500 years.
    2. The En-ROADS simulator forecasts a 2 degree temperature rise by 2050 so there would be a 0.6% chance per year (3 times 0.2%), by 2080 a 1.8% chance per year (3 times 0.6%), and by 2100 a 5.6% chance per year (3 times 1.8%).
- With this data MPCA can confidently include in their SIES, by using best current methods, that a 500-year flood is inevitable in the next 100 years because of the increase in probability created by the simulated global warming. We won't have to wait 500 years to experience a 500-year magnitude flood at the proposed expanded BLF.
-
- **This means when a person born today is 78 they will have a 5.6% chance that year and greater chance every subsequent year, of a magnitude 500 flood.**
-
- **This does not stop with this persons lifetime, it continues for this persons grandchildren and their grandchildren for thousands of years.**
-
- Theses continuing floods for thousands of years will contact the berm, caps, unlined base liner, and garbage put on floodplain to leak today's garbage down the Minnesota and Mississippi Rivers all the way to the Gulf of Mexico - **not a pleasant future to leave for our grandchildren.**
- Another reason for the MPCA believing the 500-year flood will happen more frequently is the SEIS indicates a 100 year magnitude flood has occurred 2 times in the last 70 years.
    1. This would appear to mean the likelihood of a 100 year magnitude flood should now be 35 years.
    2. MPCA should then compute the probability of when a 1,000 year flood should have occurred because of climate warming.

Part 2: Suggested <u>Economic items</u> for discussion in final EIS

1. In section L of the SIES:

1. Information about how the money for continued maintenance, damage caused by BLF during flooding, the continued costs of pumping water out of the land quarry, and costs for leachate disposal, for thousands of years is not discussed.
2. During the addition of landfill waste, now till 2062, we don't see mention of where money will come from for damage during 100, 500, and 1000-year floods.

2. Please estimate the economic costs to people over the next 1,000 years caused by raising the height of landfill 262 feet, continued operation until 2062, and the "forever chance" of leakage on:
   - Home values
   - Tourism
   - Existing businesses values
   - Number and kind of businesses moving into and out of the adjacent areas
   - Winter and summer recreation by Minnesotans.
   - Ongoing efforts to clean up the Minnesota and Mississippi Rivers.

2. What will be the costs to disadvantaged communities along the Mississippi River and Gulf of Mexico for 1,000 years of run-off?
3. Cost and plan to repair the leakage to the surrounding area, Mississippi, and Gulf of Mexico when a 1,000-year magnitude flood occurs.
   1. Please include costs to wildlife, vegetation, drinking water, and farmland irrigation for the Minnesota and Mississippi Rivers down to and including the Gulf of Mexico.
   2. The costs associated with fixing the BLF after a 1,000-year flood.
4. Costs and details on how the suggested recycling and compacting of trash, before it is landfilled in the addition will be accomplished and how the funds for this will be obtained.
5. No build alternative:
   1. Cost of Waste Management building a new 23.6 million ton landfill in a less environmentally sensitive and less populated area.
   2. The difference in costs, of maintaining the BLF over 1,000 years for the proposed addition in the flood plain of the Minnesota river and the new location.
   3. In the future if society feels the landfill should not be in the floodplain of the Minnesota River what would be the cost to remove the additional landfill waste, in today's dollars?
6. Costs associated with a flood going above the berm as the landfill is being filled with climate change impacts of the frequency of 500 and 1,000-year floods.
7. Waste managements plan to pay for upkeep, cleanup, and repair damage associated with BLF's problems, including 1,000-year floods, over the next 1000's of years to assure that the future public is financially protected against the risks of "failures" (our opinion is current citizens dumping large amounts of waste should pay).
   1. Possible examples would be insurance and/or performance bonds to be set aside by Waste Management and their amount.
8. There is no mention of having the landfill removed in the future. - therefore there will be a time in the future when the landfill addition has to withstand a 5,000 and 10,000 year magnitude floods.
   - In todays dollars what would be clean up and repair costs for the Burnsville landfill addition for 5,000 and 10,000 year floods after the landfill is capped?

15. One of the ideas which has been thrown around is to have the Freeway Landfill and Dump wastes moved to the BLF as it is cleaned out using the Superfund dollars.
   - This seems totally weird because taxpayers will pay for this now, because the landfill garbage was dumped without a liner and in future when a 1,000, 5,000, 10,000-year magnitude flood occurs without a liner at parts of BLF.
   - Why not take the freeway landfill contents out of the Minnesota floodplain now rather than having it dumped in the addition's floodplain?
16. How will the addition affect the possible cost of the unlined parts of the landfill clean up efforts for the next 1,000 years? Is it really a good idea to pile the new waste on top of the old, non-protected waste?

Part 3: Suggested above ground emission items for SEIS

1. Greenhouse gas emissions
    1. How would a 1,000-year magnitude flood impact the amount and kind of emissions from the BLF addition during the rest of the filling of the addition and after the addition is capped.
    2. Please include the following sequestering by trees for the addition:
        1. The estimated total number of cu ft of CH4 and CO2, that will be emitted each year including the end of life value.
        2. Convert this to greenhouse gas equivalents each year until 2062 and the year 2063.
        3. Calculation of the number of acres of trees need to be planted each year to sequester these GHG emissions from 2022 till 2062 and the year 2063.
        4. During drought what will be done to insure the forests are not subject to wildfires?
        5. The costs associated with buying the land and planting the trees up until 2062.
        6. Yearly cost of maintaining these trees and adding more land and trees as the landfill continues to emit GHG for a 1,000 years?
2. Other gas emissions
    - How the additions burden of "other gas emissions" can be cleaned up during emission so surrounding communities would not be harmed by them.
        1. What will be the cost?
    - If not cleaned up the additions 262 height increase will allow the emissions to travel farther with the wind affecting more communities and people.
        1. Cost for the health problems to people and the environment associated with these emissions for thousands of years?
        2. Describe the "other gas emissions" which will escape in a 1,000-year magnitude flood initially and each year after for 1,000 years and the health problems and costs associated with these escaped emissions.
    - There is a plan circulating that the Freeway Landfill's dump's contents will be moved to the BLF addition.
        1. Provide information on how this will change the number and amount of other gas emissions from the addition.
        2. Should we have "the continued escape for the next 1,000 years in a populated environmentally-sensitive area or move the waste to a less populated area(s)?
3. Amount of particulate air pollution
    - Particulate matter from garbage and its movement by the wind blowing across the addition should be included with a daily and yearly total as the landfill height rises.
        1. The total amount of particulate matter increase released because of the 262 feet hight increase.
        2. The distances and directions of this increased wind blown material so the total effect to communities can be found.
        3. We feel this information is so important it should be in the main body of the report.
        4. Also, the particulate matter released by garbage on days the landfill is not filled should be included.
    - Based of the number of trucks and heavy equipment, what is the anticipated total amount of exhaust particulate emissions that will be emitted each year and the total till 2062?
        5. The wind speed and direction changes need to be calculated for the 262 feet high increase in the additions hight and what effects this will have on communities.
            1. It would be nice to see this information on a daily and yearly bases up to 2062 with a total accumulation.
    - Given the effects of particulate matter, what will be the health-wise impacts on the ability of people in surrounding communities to work and enjoy life and the costs associated?

4. Please provide discussion about how recycling and compaction will decrease/increase different air emissions.
5. What is the BLF additions' burden in terms of waste material being blown out of the landfill at high elevations on a regular basis? - During high winds and tornados.? Costs associated with cleanup?
6. Effect of lightning on maintenance of landfill during and after filling and associated costs.
7. The additions Light pollution from the operation of BLF and blinking aircraft lights will be a problem because it will be at a much higher elevation than the surrounding land including Bloomington and other communities.
8. What is the current cumulative noise pollution in the area, and how will that be impacted from the addition by trucks going up steep inclines and front-end graders operating at all hours from high atop the expanded BLF?
9. Landfills are know for noxious smelling gases and the higher in elevation the gases are released the higher the wind speed. What is Waste Managements plan and the associated costs to keep the wind from blowing them off the addition for miles into surrounding communities including Bloomington.

Thanks for giving us the opportunity to comment on the draft SEIS. We look forward to your responses.

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Attachment P

Response to Written Public Comments on BSL DSEIS

Minnesota Pollution Control Agency (MPCA)

Burnsville Sanitary Landfill (BSL) Expansion Project (Project)
Draft Supplemental Environmental Impact Statement (DSEIS)

RESPONSES TO COMMENTS RECEIVED ON THE BSL DSEIS

1. Comments by Roz Peterson, Cerron Commercial Properties. Email received June 1, 2021.

Comment 1-1: Commenter stated, "Will the expansion of the Burnsville Sanitary Landfill accommodate any of the Freeway Landfill?"

Response: The answer to the question of whether BSL will receive waste from Freeway Landfill is unknown at this time. As indicated in Attachment I of the BSL DSEIS; The BSL SEIS does not include an evaluation of potential impacts of transferring Freeway Landfill waste (or waste from any other source) to BSL because the BSL SEIS Final Scoping Decision Document (Scope) adopted by the MPCA on September 30, 2019, does not require it. A waste source analysis was not part of the Scope because the purpose of the Project is not to take waste from any specific source, but instead to increase BSL's ultimate design capacity so it can continue operation into the future, whatever the waste source.

Note regarding BSL SEIS Scoping Process –

The state of Minnesota has Environmental Quality Board (EQB) rules that the Responsible Governmental Unit (RGU) must follow when preparing an EIS. The rules require an EIS scoping process be conducted before the preparation of an EIS to identify only those potentially significant issues relevant to the proposed project.

The MPCA followed the EQB scoping process rules during development of the BSL SEIS. The scoping process included preparing a BSL SEIS Draft Scoping Decision Document which included issues that the MPCA determined to be potentially significant relevant to the BSL Project.

The MPCA then provided the public the following opportunities to comment on the draft BSL SEIS Scope:

- June 24-July 24, 2019 – BSL SEIS Draft Scoping Decision Document published for public comment
- July 10, 2019 – MPCA hosted a public informational meeting on the draft BSL SEIS Scope
- September 13-27, 2019 – MPCA published the Draft Final Scoping Decision Document for public comment

The MPCA received multiple comments from the public on the Draft Final Scoping Decision Document. The MPCA considered the public's comments and revised the Draft Final Scoping Decision Document to include those issues for which it agreed were potentially significant. On September 30, 2019, the MPCA adopted the final BSL SEIS Scope.

EQB rules (Minn. R. 4410.2100, subp. 8) do not allow a RGU (in this case, the MPCA) to amend the scope of an EIS after the scoping decision is made without the agreement of the proposer unless substantial

changes are made in the proposed project that affect the potential significant environmental effects of the project or substantial new information arises relating to the proposed project that significantly affects the potential environmental effects of the proposed project or the availability of prudent and feasible alternatives to the project.

Comment 1-2: Commenter stated, "Why is the acreage decreasing from 216 to 204? I'd rather they keep the acreage to keep the height down or for future growth."

Response: The decrease in landfill footprint size from 216 to 204 acres is being proposed by BSL because of unfavorable subsoil conditions (low-strength and compressible soils) found at the 12 acres that were eliminated from the proposed Project. These soils would require stabilization and/or excavation and replacement to avoid potential settlement-related instability of the landfill. The Annex Development Area design pulls back the north edge of the expansion area, which significantly reduces the amount of unfavorable soils that will be encountered during Project construction.

2. Comments by Jennifer Tworzyanski, Assistant to the State Archaeologist, Office of the State Archaeologist. Email received June 16, 2021.

Comment 2-1: Commenter stated, "I appreciate being given the opportunity to comment on the above listed draft supplemental environmental impact statement. While there are no previously recorded archaeological or cemetery sites located within the proposed landfill expansion, there are numerous archaeological site and site leads, as well as cemetery sites, in the immediate vicinity of the proposed project. Additionally, the proposed project area has high archaeological potential because it is situated on as terrace of the Minnesota River. Therefore, I recommend a qualified archaeologist conduct a phase I archaeological reconnaissance survey to determine if the proposed project will impact previously unrecorded archaeological or cemetery sites. The Minnesota Historical Society maintains a list of archaeologists at: http://www.mnhs.org/preservation/directory."

Response: A Phase I archaeological survey was conducted at the BSL site by HDR Engineering in November 2002, based on a recommendations from the Minnesota Historical Society. The results of the study are contained in a report titled, "Cultural Resources Management – Proposed West and North Development Areas, BSL, Dakota and Hennepin Counties, Minnesota Phase I Investigation". The study identified no cultural horizons in the area of the Project and concluded that no properties listed on or eligible for listing on the National Register of Historic Places will be affected by this project". A copy of the study will be included as an attachment to the BSL FSEIS.

The BSL SEIS Scope does not require a new Phase I survey and therefore it will not be part of the BSL FSEIS.

3. Comments by Susan Dieseth. Email received June 21, 2021.

Comment 3-1: Commenter stated, "Am I correct in thinking more garbage will be dumped next to the river and on an aquifer?"

Response: BSL is proposing an expansion of its permitted mixed municipal solid waste (MMSW) disposal capacity by approximately 23.6 million cubic yards. BSL is located nearby the Minnesota River and several regional groundwater aquifers (e.g., Prairie du Chien-Jordan Aquifer). The expansion would increase the existing (built) landfill footprint by approximately 23 acres. However, the expansion would

reconfigure the final waste footprint from the existing permitted conditions and result in the ultimate waste limits being farther away from the river and 12 acres less than the current permit.

Comment 3-2: Commenter stated, "Why is the garbage not being removed from the area? Anything short of total garbage removal seems quite dangerous to humans, animals and the water supply."

Response: The question of why garbage is not being removed from the area is outside the BSL SEIS Scope of the BSL SEIS. The purpose of the BSL SEIS is to investigate potential impacts of the Project, which is the proposed expansion of BSL's landfill, not the removal of garbage from the area.

Comment 3-3: Commenter stated, "Wasn't this area at one time considered a superfund site?"

Response: The BSL facility has never been managed by the Superfund Program.

4. <u>Comments by Johanna Holub. Email received July 9, 2021.</u>

Comment 4-1: Commenter stated, "In reading about the plans for the landfill, it's very hard to imagine anything worse than a literal, looming mound of garbage, which would become the highest point in the area, located immediately next to the Minnesota River. It truly represents an apocalyptic vision into our future, if we are unable to do anything to mitigate the amount of trash we generate."

Response: The overall solid waste management strategy for the Twin City Metro area is generally outside the Scope of the BSL SEIS, however, the MPCA is currently working on the development of the Metro Solid Waste Policy Plan. The primary focus of the plan is developing strategies to minimize our reliance on land disposal facilities. Public input to that process is vitally important so that the Agency can incorporate the concerns of residents in the Twin Cities Metropolitan Area. The next public comment period will be sometime in early 2022, after the initial draft is created. This will be one of the next opportunities for the public to participate in shaping solid waste policy. In addition, the Minnesota Legislature periodically brings up solid waste legislation, and therefore the public can engage their legislators to inform them of their ideas and concerns regarding solid waste management.

Comment 4-2: Commenter stated, "The extreme risk that the expansion poses to the area cannot be understated. As mentioned, the landfill is incredibly close to the river. It's been noted that parts of the landfill are unlined, and with extreme weather conditions increasing in frequency and severity, it is highly likely that flooding events would bring the water level up to the unlined portion of the landfill, leaking hazardous landfill leachate into our local source of fresh water."

Response: The BSL DSEIS includes findings regarding the potential Project impacts on groundwater, surface water, and the leachate collection system, as well as potential mitigation measures.

The following is a summary of the DSEIS findings regarding these issues:

- Section 6.1 **– Groundwater** (including those related to BSL's unlined waste and drinking water supplies)
    - Groundwater Monitoring during the period from 2014 through 2019 has not identified impacts to groundwater for the monitored parameters (as per the 2015 permit modification) resulting from the BSL. Manganese detections above the Intervention Limit (IL) and Health Risk Limit (HRL) have been detected at both upgradient and downgradient

monitoring wells and appear to be related to naturally occurring manganese and/or background concentrations. There were no other IL exceedances reported during the monitoring period. Sporadic detections of Volatile Organic Compounds (VOCs) have been observed at concentrations lower than applicable ILs.

- As part of the solid waste permitting process, the MPCA will require that BSL update its groundwater Sampling and Analysis Plan to include current standard parameters and monitoring limits based on Minnesota Department of Health (MDH) HRLs or similar health standards, as appropriate, and evaluate additional contaminants of concern for potential inclusion into BSL's permit. The specific contaminants of concern that will be evaluated during the permitting process may include per- and polyfluoroalkyl substances (PFAS) and 1,4- dioxane. Additional permitting requirements include identifying contingency actions to be taken if groundwater impacts are detected, as well as establishment of financial assurance that will provide funding for contingency actions and/or mitigation activities.
- Predictive modeling indicates the potential for the water table to be in contact with the base of the unlined area at BSL if dewatering at the neighboring Kraemer Mining and Materials quarry ceases in the future. Potential groundwater quality impacts associated with this condition are unknown at least in part due to plans for the future quarry lake being unknown. However, water level monitoring at BSL has shown the water table periodically exceeds the base elevation of the unlined area during periods of flooding on the Minnesota River, and no significant changes in groundwater quality are evident for the monitored parameters following flood events. The proposed Project does not change the depth or span of the unlined area relative to currently permitted conditions, so the Project would not result in increased potential for impacts from the unlined area related to future water table conditions. However, if future groundwater monitoring indicates corrective action is needed related to the unlined area, having new waste on top of the unlined area may impede corrective action.
- Potential impacts to water supplies are as follows:
  - Quarry Water Supply - There are currently no identified landfill-related impacts to the existing quarry water supply, nor are there impacts observed at the quarry dewatering outfall (or downgradient monitoring wells) based on permit-required monitoring. Impacts to the existing quarry water supply are not expected as a result of the Project. Under a future scenario with the post-mining quarry lake at elevation 690, some groundwater from underneath the BSL is predicted to discharge to the anticipated future quarry lake. Potential impacts from the BSL to a future quarry lake are not known, for reasons such as indeterminate municipal plans for the future quarry lake, but will be further investigated through the permitting process.
  - Water Supply Wells – Existing and future groundwater flow scenarios do not result in groundwater flow from the landfill towards any other known potable water supply wells.

- Section 6.2 - **Surface water** (e.g., Minnesota River), including impacts from a 500-year storm event.
  - The Project would result in an increase in stormwater runoff volume from the landfill of 3.7% and a 47% increase in peak discharge rate from a 500-year storm event because the post-Project design has more sloped area that is less conducive to infiltration. This would lead to increased erosion and sediment load discharged from the site compared to pre-expansion conditions. There would be no significant change in runoff volume, and decreases in peak discharge rates and sediment discharge from the site for smaller storm events.

- No adverse impacts are expected to result from the post-Project buildout compared to the pre-expansion buildout for the 2-year and 10-year storm events.
- The increased sediment capture rate in post-Project conditions would likely necessitate more frequent maintenance (i.e., sediment removal) in the sedimentation ponds over the life of the landfill.
- The 500-year storm event produces runoff volumes, rates, and velocities that exceed the design basis (i.e., the 100-year storm event) of the surface water control system, and would result in erosion-related impacts under both pre-expansion and post-Project conditions.
- Mitigation for impacts related to the 500-year storm would include redesigning the surface water control system with higher sideslope berms, deeper downslope structures, larger culverts, and additional engineered erosion control products.
- Mitigation measures targeted at minimizing the post-event effects consist of conducting regular inspections of the surface water control system, and being prepared to implement emergency response actions to contain and repair adverse effects.
- The following changes in drainage to wetlands B and C, which are adjacent to the north and west of the landfill (see Figure 6-5), are predicted as a result of the Project:
  - Wetland B will experience similar inflow rates and total volumes for both the pre-expansion and post-Project conditions.
  - Wetland C will receive a larger total volume of water and lower inflow rate under the post-Project condition than in the pre-expansion condition.
- The discharge of stormwater ponds to adjacent wetlands for the 2-year, 10-year and 25-year storm events does not exceed any local, state or federal threshold, and the changes in drainage are not expected to result in significant impacts to the wetlands.

- Section 6.3 – **Liner and leachate collection** system (including from a 500-year flood event)
  - The landfill contains lined cells with leachate collection, as well as unlined areas that pre-date federal Resource Conservation and Recovery Act (RCRA) laws and regulations which contain design criteria for Municipal Solid Waste Landfills under 40 CFR Part 258, Subpart D (Subpart D) of the Code of Federal Regulations. Subpart D regulations require solid waste facilities to install composite liners.
  - Final cover has been constructed over portions of the landfill where waste has reached final elevation, including over the unlined area.
  - The Project will involve installation of composite liner and final cover systems conforming to federal and state rules.
  - The unconstructed portion of the flood protection levee around the north and west sides of the landfill will be realigned and moved farther away from the Minnesota River channel.
  - There is no effect on performance of the liner and leachate collection systems from river flow conditions arising from a 100-year storm event as required by design regulations.
  - Potential impacts of the 500-year flood event on the liner and leachate collection system are related to surface water and groundwater.
    - Impacts related to surface water include overtopping of the flood levee, erosion of the flood levee, and instability of the flood levee. Mitigation measures for overtopping the levee include temporarily raising the crest elevation by placing sandbags or installing other flood barrier devices. Mitigation measures for erosional impacts include use of erosion control products such as non-degradable turf reinforcement mat.
    - Impacts related to groundwater include liner uplift due to hydrostatic pressure resulting from a high water table. The weight of the waste on the liner counteracts

the hydrostatic pressure, so the liner uplift is only a concern immediately following liner construction. Mitigation of liner uplift would involve monitoring groundwater levels and implementing emergency actions to counteract the uplift pressure. Such actions could include placement of additional soil in the cell or increasing pumping at quarry dewatering wells.

- The half-life of geomembranes used in the landfill liner is estimated at approximately 400 years, and the clay or geosynthetic barrier layer is not expected to lose effectiveness, barring a significant shift in the landfill foundation soils.
- Major failure of the liner due to slope failure or large tear in the liner at complete buildout is unlikely. Mitigation strategies to limit the impacts of a major liner failure at complete buildout would include ensuring the leachate is contained in the waste disposal area and is continuously maintained at or below the 12-inch regulatory limit above the base liner floor, in order to minimize the volume of leachate that could escape the lined area.

Comment 4-3: Commenter stated, "Additionally, air quality concerns must not be taken lightly. Air pollution already accounts for tens of thousands of deaths each year -- and even more chronic respiratory diseases -- and estimates of how much landfill gas would enter the air are significant and must not be ignored. Poor air quality disproportionately affects already-vulnerable populations, many of whom live near me in East Bloomington, one of the closest communities to the landfill."

Response: Section 6.5 of the DSEIS contains findings regarding the Project's air quality impacts (including from landfill gas), including potential mitigation measures. The BSL DSEIS found that BSL's Project is predicted to meet all applicable Minnesota Ambient Air Quality Standards (MAAQS) and National Ambient Air Quality Standards (NAAQS).

Comment 4-4: Commenter stated, "As Greta Thunberg has aptly said, we are currently stealing our children's future from them, and every day that we continue to do so has significant impacts for the future of the planet, and our quality of life in the coming years. This landfill expansion is a temporary, bandage solution to a much larger problem that we can no longer afford to ignore, or take half-measures to address. We simply cannot keep buying stolen time to figure out what to do with our waste by expanding the Burnsville landfill into a literal mountain of trash."

Response: Comment noted.

Comment 4-5: Commenter stated, "The good news is that we already have solutions at our fingertips that can help reduce the amount of landfill space we need - those solutions need to be brought to higher awareness among the general public and funded more robustly, even as we develop new solutions to help decrease waste in even more efficient and effective ways. To be sure, recycling and organics composting will not solve all of our problems, but they can help decrease the flow of materials to the Burnsville landfill, when used by both residents and commercial businesses at a much higher rate than we're seeing at present."

Response: Please see response to comment 4-1. In addition, section 7.0 of the BSL DSEIS contains an evaluation of BSL SEIS Scope-required alternatives to the Project. These alternatives include a smaller BSL landfill expansion, if legislative recycling goals are achieved.

Please see the note in response to comment 1-1, which explains the BSL SEIS scoping process and how the MPCA determined which issues were included in the final Scope.

Comment 4-6: Commenter stated, "I urge you to discontinue exploring the expansion of this landfill. It will only create more problems, and leave future generations with an even heavier burden to carry and try to fix."

Response: The BSL is a mixed municipal solid waste (MMSW) disposal facility that is proposing to increase its capacity by approximately 23.6 million cubic yards by reconfiguring its existing waste limits and raising the top elevation of the landfill. This proposed BSL expansion Project *requires* preparation of a mandatory Environmental Impact Statement (EIS) under Minnesota Rules (Minn. R.) 4410.4400 subp. 13.E. because it would be an expansion by 25% or more of previous capacity of a MMSW land disposal facility for 100,000 cubic yards or more of waste fill per year.

The purpose of an EIS is to provide information for governmental units, the proposer of the project, and other persons (e.g., the public) to evaluate proposed projects that have the potential for significant environmental effects, to consider alternatives to the proposed projects, and to explore methods for reducing adverse environmental effects. The BSL SEIS identifies potential mitigation measures for adverse environmental effects. The EIS process does not approve or deny a project. All approvals and/or denials of a project occur during the permitting phase of a project, which cannot occur until the BSL SEIS process is complete.

5. <u>Comments by Sara Grasmon. Email received July 9, 2021.</u>

Comment 5-1: Commenter stated, "I recently learned about the Burnsville Sanitary Landfill expansion from a colleague who lives near the site, and I am deeply concerned about this potential plan."

Response: Comment noted.

Comment 5-2: Commenter stated, "As a community, and state, Minnesota is known as a place of natural beauty, and abundant resources such as our lakes, rivers and wetland areas, not to mention our clean, fresh air. Should this project move forward, our ecosystem would be at risk. For something that would just be a temporary solution to a larger issue, these are risks/consequences not worth taking. We must protect our resources for future generations and find solutions that do not compromise the health and safety of our neighbors and our natural resources."

Response: Please see response to comments 4-2 and 4-3.

Comment 5-3: Commenter stated, "I oppose this expansion project and ask that you find a solution that does not compromise our community's water, land, reputation and natural beauty. Please do not move forward with this expansion."

Response: Please see response to comment 4-6.

6. <u>Comments by Adam Spears. Email received July 12, 2021.</u>

Comment 6-1: Commenter stated, "I would like to reach out to you today in regard to the Burnsville Sanitary Landfill Expansion Project. As a resident of the City of Bloomington as well as working in the outdoor industry in the City of Bloomington, I have significant concerns about the expansion including visual impact, locating additional waste in a sensitive ecological area, noise, odor, escaping trash, among

others. While I do realize that waste has to go somewhere, I strongly feel that the proximity to both the River and the 5th largest city in the state is far from ideal."

Response: The following sections of the BSL DSEIS include findings regarding the Project's potential visual and odor impacts as well as potential mitigation measures.

- Section 6.4 – Visual (DSEIS Attachment E includes photo renderings of the Project)
- Section 6.5 – Odor - The DSEIS found that the Project is not expected to cause increased odors relative to current conditions

The BSL DSEIS does not include findings regarding potential noise and/or litter impacts because they were not identified as potentially significant adverse Project impacts during the BSL SEIS scoping process. See response to comment 1-1 for details regarding the BSL SEIS Scoping process.

Noise - BSL is subject to the state of Minnesota's noise pollution control rule, Minn. R. Chapter 7030. The MPCA's Noise Pollution webpage provides information on how noise pollution is regulated in Minnesota.

Litter - BSL is subject to the litter control requirements of its solid waste permit which includes measures such as spreading and compacting solid waste immediately after unloading to reduce blowing litter, application of a daily cover over the waste, utilizing litter control fences to catch blowing litter

7. Comments by Anne Franklin. Email received July 13, 2021.

Comment 7-1: Commenter stated, "Steve, this puts landfill right next to the River! The banks are unstable, it has a history of flooding, and there is an absolute guarantee that toxins will arrive in the River. Either from direct run off or by underground seepage. This is the worst possible location."

Response: Please see response to comment 4-2.

Comment 7-2: Commenter stated, "Please choose a spot that is a rational choice, not this one. There will be problems in the future and they will all look back and blame you. Please think of another spot that isn't so close to the river."

Response: Although the MPCA does not choose a project or its location (Note: The BSL facility was sited before the rule location standards became effective.), the revised landfill footprint for this Project reduces the currently permitted footprint. The new location will require less wetland mitigation due to fewer impacted acres, and includes less of the footprint in close proximity to the Minnesota River.

In addition, please see response to comment 4-6.

8. Comments by Linda Loomis, Administrator, Lower Minnesota River Watershed District. Email received July 14, 2021.

Comment 8-1: Commenter stated,

"Rule B—Erosion and Sediment Control

The LMRWD [Lower Minnesota River Watershed District (LMRWD or District)] regulates land-disturbing activities that affect one acre or more outside of the special overlay districts. The proposed expansion area, labeled as ADA in the EIS, appears to be more than 20 acres. The project will require a District permit for erosion and sediment control."

Response: A Flood Plain Filling Permit from the LMRWD is included in the List of Governmental Approvals in Section 4.0 of the Draft SEIS. With LMRWD's promulgation of new rules in February 2020, the term "Individual Project Permit" (to address requirements of LMRWD Rule B—Erosion and Sediment Control, Rule C—Floodplain and Drainage Alteration, and Rule D—Stormwater Management) should be used rather than the term Floodplain Filling Permit. The Final SEIS will update the List of Government Approvals to use the correct permit name.

Comment 8-2: Commenter stated,

"Rule C—Floodplain and Drainage Alteration
The proposed expansion appears to be entirely within the 100-year floodplain of the Minnesota River as seen on the Flood Insurance Rate Map (FIRM) panel 27053C0462F, effective November 4, 2016. To meet the minimum requirements of Rule C, the LMRWD individual project permit application should include the amount of fill within the floodplain as well as a no-rise certification.

Additionally, the EIS mentions realigning the levee, referencing Figure 6-5. However, the levee location in this figure does not appear to be represented. Is it BLS's intent to realign the existing levee to go around the ADA? If so, we recommend early coordination with both the Minnesota Department of Natural Resources (MnDNR) and FEMA."

Response: BSL has indicated that it will provide the amount of fill within the floodplain and a no-rise certification as part of the Individual Project Permit application to the LMRWD.

BSL SEIS Figures 6-4 and 6-5 will be updated in the BSL FSEIS to identify the levee and 100-year flood elevation. The levee will be realigned from the currently permitted configuration and will be constructed around the ADA, thereby removing the ADA area from the 100-year flood plain. BSL met with the Minnesota Department of Natural Resources (DNR) and the City of Burnsville and its consultant in September 2019 to discuss the new levee configuration, and will apply for a letter of map revision (LOMR) from FEMA for the flood plain alteration.

Comment 8-3: Commenter stated,

"Rule D—Stormwater Management
The LMRWD requires stormwater management for projects that create one or more acres of new impervious surfaces. Rule D necessitates that proposed runoff rates for 2-, 10-, and 100-year events do not exceed existing conditions. Table 1, taken directly from the draft EIS and shown below, does not include the 100-year rates. To receive a LMRWD permit, the applicant must confirm that the 100-year event does not exceed existing runoff rates.

Table 1. Runoff Rates Summary from Draft EIS

Storm Event	Peak Runoff Rates (cu. ft./sec.)		Percent Change Post-Project to Pre-Expansion
	Pre-Expansion	Post-Project	
2-year	55.10	22.71	-58.8%
10-year	148.96	63.62	-57.3%
500-year	962.33	1,413.70	+46.9%

The project proposes to overlay capped unlined areas with new lined waste up to approximately 31.75 acres. Additionally, a new liner will be added to the ADA, which is approximately 22 acres. The LMRWD recommends considering the final landfill cover system as a quasi-impervious layer that may have the same effects as an impervious layer unless BSL can prove otherwise."

Response: The BSL DSEIS does not include an analysis of the 100-year storm event because it is not required by the BSL SEIS Scope. Information regarding the 100-year storm event is included in BSL's solid waste permit application. Alternative methods and assumptions for storm water analysis will be addressed as part of the MPCA and LMRWD permitting processes. BSL will be required to obtain a MPCA NPDES/SDS Construction Stormwater Permit that will require volume control/treatment for the new impervious surface being added.

Please see the note in response to comment 1-1, which explains the BSL SEIS scoping process and how the MPCA determined which issues were included in the final Scope.

Comment 8-4: Commenter stated,

"Additional Considerations
The proposed landfill cap and liner system may be similar to an artificial turf system. Both systems provide an upper media layer that can filter or infiltrate stormwater, but both are limited by a lower impervious layer. In addition, water that filters through the upper media is collected in a drainage system and discharged elsewhere to prevent it from infiltrating the underlying aquifer.

Rather than considering the proposed landfill cap and liner entirely impervious or entirely pervious, we propose three alternative methods for determining the final hydrology for the site:

1. Using a modified SCS curve number that accounts for the maximum water retention available within the final cover system (if the cover soil's moisture-storage capacity and other necessary soil properties are known) as well as the final landfill slopes
2. Modeling the final cover system and drainage layer in a method consistent with artificial turf methodology[1]
3. Utilizing the Hydrologic Evaluation of Landfill Performance (HELP) program[2] to evaluate the evapotranspiration, infiltration, and filtration of the final cover

1 https://www.hydrocad.net/curvenumber.htm
2 https://www.epa.gov/land-research/hydrologic-evaluation-landfill-performance-help-model"

Response: Alternative methods and assumptions for storm water analysis will be addressed as part of the MPCA and LMRWD permitting processes.

9. Comments by Glen Markegard, Planning Manager, City of Bloomington. Email received July 15, 2021 and letter received July 19, 2021.

Comment 9-1: Commenter stated, "Waste Composition. The Draft SEIS notes that, as of December 2019, 69 percent of the waste being landfilled at BSL is recoverable. That includes organics and recyclables. Bloomington requests that the Final SEIS recommend mitigation during permitting to require the landfill owner and its affiliated haulers to aggressively remove organics and recyclables from the waste stream in order to meet the legislatively mandated 75% recycling goal. Requirements to remove recoverable waste should come with a corresponding reduction in the volume of waste allowed under any permit, which in turn would reduce the impacts of the expansion."

Response: The MPCA will include all applicable recycling requirements in BSL's next solid waste disposal permit. The BSL SEIS Scope *does* require that the SEIS include an analysis of the impacts of recycling goals *on the landfill and community*. This analysis is included in section 7.1 of the BSL DSEIS. However, the BSL SEIS Scope does not require an analysis of the Project's impacts on recycling rates and therefore none was completed. This request is beyond the Scope of the BSL SEIS.

Please see the note in response to comment 1-1, which explains the BSL SEIS scoping process and how the MPCA determined which issues were included in the final Scope.

The MPCA is currently working on the development of the Metro Solid Waste Policy Plan. The primary focus of the plan is developing strategies to minimize our reliance on land disposal facilities. Public input to that process is vitally important so that the Agency can incorporate the concerns of residents in the Twin Cities Metropolitan Area. The next public comment period will be sometime in early 2022, after the initial draft is created. This will be one of the next opportunities for the public to participate in shaping solid waste policy. In addition, the Minnesota Legislature periodically brings up solid waste legislation, and therefore the public can engage their legislators to inform them of their ideas and concerns regarding solid waste management.

Comment 9-2: Commenter stated, "Groundwater Impacts. Of great concern, the Draft SEIS points out that parts of the BSL are unlined and that the water table rises to interact with the unlined portions of the landfill during flooding events along the Minnesota River. The Draft SEIS also predicts a discontinuance of dewatering at the adjacent Kraemer Quarry will result in regular interaction between waste in the unlined portions of the landfill and the water table. Having waste below the water table could cause far reaching groundwater and surface water contamination. Bloomington requests that the Final SEIS recommend mitigation measures as a condition of permitting that:

a. Requires waste in the unlined portions of the landfill to be relocated to portions of the site that are sufficiently lined. The MPCA is proposing this approach to mitigate interaction of the water table with the waste in the nearby unlined Freeway Landfill and Freeway Dump, also in Burnsville.
b. Requires regular groundwater monitoring by the MPCA and, in the event of detection of any groundwater contamination, results in prohibition of further expansion."

Response: Groundwater monitoring conducted at BSL from 2014-2019 has not identified impacts to groundwater for the monitored parameters. As part of the solid waste permitting process, the MPCA will require that BSL update its groundwater Sampling and Analysis Plan to include current standard parameters and monitoring limits based on Minnesota Department of Health (MDH) health risk limits or

similar health standards, as appropriate, and evaluate additional contaminants of concern for potential inclusion into BSL's permit. The specific contaminants of concern that will be evaluated during the permitting process may include per- and polyfluoroalkyl substances (PFAS) and 1,4-dioxane. Additional permitting requirements include identifying contingency actions to be taken if groundwater impacts are detected, as well as establishment of financial assurance that will provide funding for contingency actions and/or mitigation activities.

Predictive modeling indicates the potential for the water table to be in contact with the base of the unlined area at BSL if dewatering at the neighboring Kraemer Mining and Materials quarry ceases in the future. Potential groundwater quality impacts associated with this condition are unknown at least in part due to plans for the future quarry lake being unknown. However, water level monitoring at BSL has shown the water table periodically exceeds the base elevation of the unlined area during periods of flooding on the Minnesota River, and no significant changes in groundwater quality are evident for the monitored parameters following flood events. The proposed Project does not change the depth or span of the unlined area relative to currently permitted conditions, so the Project would not result in increased potential for impacts from the unlined area related to future water table conditions. However, if future groundwater monitoring indicates corrective action is needed related to the unlined area, having new waste on top of the unlined area may impede corrective action.

Since the BSL DSEIS did not find that the Project itself has the potential to result in adverse environmental impacts related to existing unlined waste, there is no basis to include the requested mitigation measures as part of recommendations in the BSL Final Supplemental Environmental Impact Statement (FSEIS).

Comment 9-3: Commenter stated, "Surface Water Impacts. The Draft SEIS notes that in a 500-year storm, the proposed expansion will increase the peak storm water runoff discharge rate from the site by 47% due to the increase in landfill slope proposed with the expansion. A significant increase in peak runoff rates will cause substantial negative impact to people and property downstream during a major rainfall event, which is the time at which more water downstream is most damaging. Bloomington requests that the Final SEIS recommend mitigation during permitting to reduce the landfill slopes so that peak storm water runoff rates do not exceed current runoff rates. In addition to protecting people and property during a major rainfall event, the proposed mitigation would also have the added benefit of reducing the landfill height and corresponding visual impact."

Response: The BSL DSEIS did find that the Project would result in an increase in stormwater runoff volume from the landfill of 3.7% and a 47% increase in peak discharge rate from a 500-year storm event because the post-Project design has more sloped area that is less conducive to infiltration. This would lead to increased erosion and sediment load discharged from the site compared to pre-expansion conditions.

As required by the BSL SEIS Scope, the BSL DSEIS did include an examination of mitigation measures from an extreme (over 500-year) storm event at BSL, which are summarized as follows:

- Mitigation for impacts related to the 500-year storm would include redesigning the surface water control system with higher sideslope berms, deeper downslope structures, larger culverts, and additional engineered erosion control products.

- Mitigation measures targeted at minimizing the post-event effects consist of conducting regular inspections of the surface water control system, and being prepared to implement emergency response actions to contain and repair adverse effects.

The BSL SEIS Scope does not require that the SEIS include an investigation of any specific mitigation measure (e.g., reduced landfill slopes), and the mitigation measures assessed for/included in the SEIS do not include changes to proposed slopes. For this reason, the MPCA does not intend to recommend this specific mitigation measure in the BSL FSEIS.

Please see the note in response to comment 1-1, which explains the BSL SEIS scoping process and how the MPCA determined which issues were included in the final Scope.

Comment 9-4: Commenter stated, "Lighting Impacts. The Draft SEIS does not analyze the impacts of blinking lights required by the Federal Aviation Administration (FAA) for features over 200 feet in height. Bloomington requests that analysis of these lights and specific proposed mitigation measures be included in the Final SEIS."

Response: Section 6.4.2 of the BSL DSEIS provides findings regarding the potential significant lighting impacts of the proposed Project as required by the BSL SEIS Scope. Please see the note in response to comment 1-1, which explains the BSL SEIS scoping process and how the MPCA determined which issues were included in the final Scope.

Notice of the Project was provided to the Federal Aviation Administration (FAA) using the FAA's online Obstruction Evaluation screening tool. FAA reviewed the Project and conducted an aeronautical study to determine whether the Project would be a hazard to air navigation. The study determined that the Project will not exceed obstruction standards and would not be a hazard to air navigation provided it is marked with a red obstruction light. The FAA hazard determination letter is attached to this SEIS as Attachment E-3. FAA staff stated that lighting shall consist of a single, steady burning red light of type L-810, which is a low-intensity light. The light shall be installed once the landfill elevation exceeds 1,000 feet above MSL, and shall be positioned such that it is visible from 360 degrees around the landfill (Souchet, 2021).

The obstruction lighting will not be a significant visual impact due to the presence of numerous existing obstruction lights (and other lighting) in the area surrounding the BSL. The BSL is located in an industrial corridor along Highway 13, and there are at least 14 other red obstruction lights at seven locations within two miles of the BSL site, including two tall antenna towers, each with four flashing lights, located less than a mile from the BSL site. These antenna towers are the predominant features in the night sky in this area and can be seen from several miles away. Additional white lighting is also used during both daytime and nighttime hours at the various industrial sites in the Project vicinity, including the Cargill East Elevator adjacent to the west of the BSL and the Kraemer Quarry adjacent to the east of the BSL. Attachment E-4 includes a map showing locations of other red obstruction lights in the vicinity of the BSL, and photos of adjacent industrial activities from the top of the BSL.

Comment 9-5: Commenter stated, "Visual Impacts and Associated Property Value. The Draft SEIS includes reference to a property value study completed for a landfill in Dunmore, Pennsylvania. Bloomington requests additional justification for why this study is relevant to the BSL. Bloomington requests that more than one study of property values be considered in the Final SEIS and that at least one of these studies include a landfill located in a similar scenic location as the Minnesota River Valley."

Response: Section 7.3 of the BSL DSEIS includes all of the economic information required by the BSL SEIS Scope. This includes the analysis of potential impacts to property values from the proposed BSL Project.

Please see the note in response to comment 1-1, which explains the BSL SEIS scoping process and how the MPCA determined which issues were included in the final Scope.

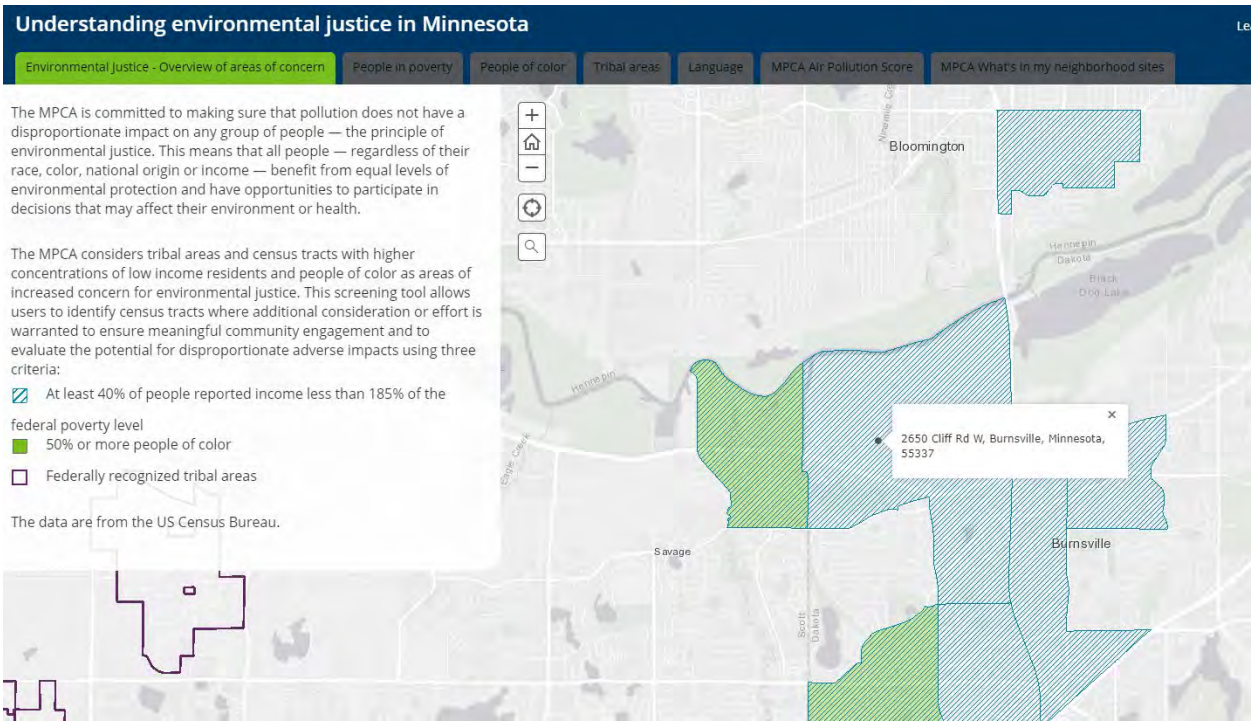
The property value impact study for the expansion of the Keystone Sanitary landfill in Dunmore, PA is relevant to the BSL two reasons. First, the study satisfies the requirements of the Scope in that it provides information on the change in property values resulting from an expansion of an existing MMSW landfill. Second, there are many similarities between the Keystone expansion and the proposed BSL expansion: both landfills have been in operation since the 1960s; both landfills are located in proximity to industrial, commercial, and residential areas; both are large landfills (500+/- acres for Keystone vs. 200+ acres for BSL; and both landfills sought/are seeking vertical expansions (285-foot vertical expansion for Keystone vs. 260-foot vertical expansion for the BSL). There were no substantive property value impact studies identified in the literature search for an expansion of an MMSW landfill in the five-state area.

Since section 7.3.4 includes all required analysis of the Project's potential impacts on property values, no additional analysis will be required in the BSL FSEIS.

Comment 9-6: Commenter stated the following:

"Environmental Justice. The Draft SEIS states that the project is located within an area of concern for environmental justice and vaguely states that documents were assessed within the context of disproportionate exposure. Bloomington requests that those documents, the demographics, sources, and the assessment be included as an attachment to the Final SEIS so that the public can review this information."

Response: The BSL Project area is an area of concern for environmental justice because it is located within a U.S. Census tract where at least 40% of people report a household income less than 185% of the federal poverty level. The BSL DSEIS sourced this information from the MPCA and environmental justice webpage. The webpage includes a link to a map of Areas of Environmental Concern. The MPCA used this map and BSL's address to determine that BSL is located in an EJ area of concern, as shown in the following screenshot.



Because the Project is located within an area of concern for environmental justice, the environmental impacts associated with the Project that were outlined in the Final Scoping Decision Document for the BSL SEIS were assessed within the context of whether said impacts would result in disproportionate exposure to pollution within the identified area of environmental justice concern. The assessment indicated that no such disproportionate exposures would be expected to result from the Project. The assessment only relied on the information contained within the BSL DSEIS.

The following sections of the BSL DSEIS provide details for each EJ finding:

- Groundwater Quality/Water Supplies – Section 6.1.3.8
- Erosion/Sedimentation from Extreme Storm Event – Section 6.2.1.5
- Erosion of Liner and Leachate Collection System – Sections 6.3.2.4 and 6.3.4.4
- Visual Impacts – Section 6.4.2.1
- Air Quality – Section 6.5.9

The FSEIS will include an attachment that provides the information contained within this response to comments.

Comment 9-7: Commenter stated the following:

"Air Quality. The Draft SEIS estimates that, at buildout, the landfill will generate 5,863 standard cubic feet of landfill gases every minute. Of that volume, 75 percent is planned to be captured and 25 percent will escape into the atmosphere. Roughly half of the captured gases will be flared on site. As a direct result of the expansion, the Draft SEIS reports that volatile organic compounds will increase by 10.2 tons/year and hazardous air pollutants will increase by 5.4 tons/year. Bloomington requests that permitting entities closely consider the proximity of nearby residential uses when considering where to permit landfills with their associated air quality impacts and how to appropriately dispose of the

captured gases. The Final SEIS should describe the location of the proposed flare(s) as well as the visual and noise impacts of the flare(s)."

Response: The MPCA will continue to carefully consider BSL's potential air emissions and its potential impacts to residents during the air quality permitting process for the Project.

BSL's Project does not include an additional flare, and that is why it was not included in the BSL DSEIS and will not be included in the BSL FSEIS. As indicated by section 6.5.2 of the BSL DSEIS, if a second flare were needed in the future, BSL's air emissions permit would need to be modified. The permit modification process would include air dispersion modeling to determine an appropriate location and configuration of the additional flare.

Please see response to comment 6-1 for response to noise impacts of the Project.

Comment 9-8: Commenter stated the following:

"Aviation Impacts. Landfills are notorious for attracting large birds. During a recent visit to the perimeter of the BSL, Bloomington City staff observed numerous eagles, gulls and other large birds. The birds attracted to landfills and corresponding concerns regarding mid-air collisions with birds are the primary reason the FAA has serious concerns about placing landfills near airports. The Burnsville Sanitary Landfill expansion is proposed near MSP International and Flying Cloud Airports and directly underneath a very frequently used flyway departing MSP, one of the nation's busiest airports. The increased height of the landfill and corresponding orographic lift will bring birds closer to aircraft and may present special concerns.

Attachment G of the Draft SEIS is a letter from the FAA to the City of Burnsville. In that letter, an FAA representative states: *"Based on our review and utilizing the criteria in AC's 150/5200-33B, the FAA is concerned with the initial proposed project given the location, and potential to create a wildlife hazard attractant near the Minneapolis-St. Paul International Airport (MSP)."*

Given the documented FAA concern, prior to completion of the Final SEIS, Bloomington requests that:

a. The BSL submit and the FAA complete Form 7460 for the FAA's review. The SEIS should not be finalized until the FAA review process is complete and the FAA has had a chance to rule on whether or not a major landfill expansion of this height will present an impact to aviation; and
b. Following the Form 7460 review, the issue of aviation impacts be reviewed by the Metropolitan Airports Commission so that their concerns can be flagged as mitigation measures if needed in the Final SEIS.
c. In the event the FAA requires modification to any flight paths due to the proposed landfill, Bloomington requests that the Final SEIS fully model the noise impacts of the new flight paths and recommend any appropriate mitigation."

Response: As stated in response to comment 9-4, BSL submitted Form 7460-1 to the FAA on September 21, 2021. This submittal has initiated a formal evaluation of the Project by FAA. The FAA's evaluation timeline is unknown and may not be done in time to be included in the BSS FSEIS. If a permitting authority for the BSL Project would like a copy of the FAA's evaluation, they will need to request it from

BSL. Permitting authorities can then take into consideration any FAA findings regarding the Project, during their permitting process.

As indicated by the FAA's letter to the city of Burnsville (BSL SEIS Attachment G), the FAA has already encouraged the city of Burnsville to work with the Metropolitan Airports Commission (MAC) and the USDA Wildlife Services to, "manage the landfill expansion in a way that can minimize hazardous wildlife activity." The FAA indicated in its letter that it is not a subject matter expert regarding the issue of wildlife safety issues, and that is why it encouraged the city to work with MAC and USDA to determine if an actual hazard exists or not.

The MPCA has no evidence to suggest the Project will result in modifications to any flight paths due to the proposed BSL Project and because noise modeling is not required by the BSL SEIS Scope, the issue of noise from modified flight paths will not be included in the BSL FSEIS.

Please see the note in response to comment 1-1, which explains the BSL SEIS scoping process and how the MPCA determined which issues were included in the final Scope.

Comment 9-9: Commenter stated the following:

"Size Reductions. The Draft SEIS states: "If a 75% recycling and preprocessing rate is achieved by year 2030, the size of the expansion could be reduced from 23.6 million cubic yards to 11.9 million cubic yards resulting in a reduction in height of the expansion to elevation 862 feet using the same expansion footprint." It also states: "Shredding of waste prior to disposal in the landfill could reduce the waste volume by up to 75% according to manufacturers of shredding equipment." Bloomington requests that the Final SEIS recommend mitigation measures as a condition of permitting that require:

a. a 75 percent recycling and preprocessing rate by the year 2030;
b. shredding of remaining waste prior to disposal; and
c. a corresponding reduction in the volume of waste allowed under any permit."

Response: The DSEIS did not find that the Project would result in an adverse impact on recycling goals and therefore there is no basis to include mitigation for this issue. The whole seven county metro area is subject to the 75% goal laid out in statute. While shredding may achieve volume reductions, the SEIS further states limitations and operational challenges for implementation of shredding at BSL. Volume reduction strategies will be discussed with the permittee during the permitting process, including shredding.

Comment 9-10: Commenter stated the following:

"Economic Impacts. Discussion of economic impacts of the landfill should include an analysis of the total impact to property values in Bloomington, Burnsville and Savage and corresponding impacts on property taxes."

Response: As indicated in response to comment 9-5 above, the DSEIS addressed all BSL SEIS Scope-required information regarding the Project's potential impact on property value in section 7.3.4 of the DSEIS. The Scope does not include a requirement to analyze the total impact to property values in Bloomington, Burnsville, and Savage and corresponding impacts on property taxes and therefore that will not be included in the BSL FSEIS.

Please see the note in response to comment 1-1, which explains the BSL SEIS scoping process and how the MPCA determined which issues were included in the final Scope.

Comment 9-11: Commenter stated the following:

"Public Input. Prior to finalization of the SEIS, Bloomington requests that the MPCA perform robust outreach and gather input from nearby residents, surrounding cities, and adjacent counties to identify potential impacts. Those impacts should be fully addressed in the Final SEIS. Outreach and input is particularly important given that the expansion is proposed in an area flagged by the state for environmental justice concerns."

Response: The BSL DSEIS public comment period has concluded and therefore the MPCA will not be accepting any more public comments on that document.

The MPCA's public outreach regarding the BSL DSEIS included the following measures:

- Publication of the DSEIS in the EQB Monitor
- Publication of the DSEIS on the MPCA's webpage for the BSL Project
- Notifying media outlets of availability of the DSEIS
    - Savage Pacer
    - Shakopee Valley News
    - Star Tribune
    - Pioneer Press
    - Mpls/St. Paul Business Journal
    - Finance and Commerce
    - Minnpost
    - This Week
    - MPR
- Mailings (either email or U.S. Mail) to all those who commented on the BSL SEIS Scope and governmental units which have authority to permit or approve the proposed Project.
- Social Media
    - Facebook
    - Twitter
    - Linkedin

The next step in the BSL SEIS process is the preparation of the BSL FSEIS. The FSEIS will address the written public comments that MPCA received during the BSL DSEIS public comment period. The BSL FSEIS will be published and notification sent out to the same entities who were sent the BSL DSEIS (see above), and may include targeted outreach within the Environmental Justice Area of Concern surrounding the Project area.

During the BSL FSEIS public comment period, the public will have an opportunity to provide the MPCA with written comments *on the adequacy of the BSL FSEIS.* This comment period is not meant for the public to request additional analysis, beyond what is required by the Scope.

The MPCA Commissioner will take the public's FSEIS comments into consideration when making a determination of adequacy on the BSL FSEIS. The MPCA will provide a notice of determination of adequacy to all persons who received copies of the FSEIS.

10. Comments by Edward Murczek. Email received July 15, 2021.

Comment 10-1: Commenter indicated that they oppose the BSL Project because, "the national wildlife is nearby and landfill disposal will be disruptive to the visual integrity of the refuge and its wildlife, and especially so as the height increases to be the highest point locally."

Response: Please see response to comment 6-1.

Comment 10-2: Commenter indicated that they oppose the BSL Project because, "fear of the contamination of the nearby Minnesota River."

Response: Please see response to comment 4-2.

Comment 10-3: Commenter indicated that they oppose the BSL Project because, "I'm surprised you want to increase the size of the landfill at the expense of the refuge and it's wildlife."

Response: The BSL is proposing the landfill Project, not the MPCA. The MPCA is required by state rules to prepare an EIS for the Project. Please see response to comment 4-6.

Comment 10-4: Commenter stated, "I spent about four years in Mpls, MN before moving to Portland, OR and always thought MN took it's environment seriously, however this proposal makes me think otherwise. I sincerely hope you will NOT seriously consider this proposal."

Response: Please see response to comment 4-6.

11. Comments by Jeff Olson. Email received July 16, 2021.

Comment 11-1: Commenter stated, "A landfill should not be located in the river valley where it can potentially cause pollution to the river and the surrounding water table."

Response: Please see response to comment 4-2.

Comment 11-2: Commenter stated, "The proposed height of the landfill will make it 372 feet above the surrounding grade, 250 feet higher than the river bluff, and 60 feet higher than the highest point in Bloomington. This will make this mound the most visually prominent feature of this area of the river valley. This does not seem wise."

Response: Comment noted.

Comment 11-3: Commenter stated, "I urge the MPCA to not permit this expansion to move forward."

Response: Please see response to comment 4-6.

12. Comments by Karen Hohertz-Jacobs. Email received July 19, 2021.

Comment 12-1: Commenter stated, "As a citizen of Bloomington who lives in an area near Dwan Golf Course, I am very concerned about the winter sight-line impact of the proposed landfill expansion. The EIS report does not ease my concern as it appears we'll have a clear view of the landfill…"

Response: Comment noted.

Comment 12-2: The commenter expressed concern about potential exposure to noise.

Response: Please see response to comment 6-1.

Comment 12-3: The commenter expressed concern about potential exposure to smell.

Response: Please see response to odor comment 6-1.

Comment 12-4: The commenter expressed concern about loose waste near a vital waterway.

Response: Please see response to litter comment 6-1.

Comment 12-5: Commenter stated, "I am not in favor of this site expansion, despite the obvious need to accept waste somewhere. We need to seek alternatives that are not as close to waterways and within site patterns of so many close residents."

Response: The BSL DSEIS includes an analysis of the following Project alternatives as required by the BSL SEIS Scope:

- Section 7.1.2 – Alternative Size of Project
- Section 7.2 – No Build Option

The Scope does not require any other alternative location analysis, and therefore none will be done in the BSL FSEIS. Please see the note in response to comment 1-1, which explains the BSL SEIS scoping process and how the MPCA determined which issues were included in the final Scope.

The overall solid waste management strategy for the Twin City Metro area is generally outside the Scope of the BSL SEIS, however, the MPCA is currently working on the development of the Metro Solid Waste Policy Plan. The primary focus of the plan is developing strategies to minimize our reliance on land disposal facilities. Public input to that process is vitally important so that the Agency can incorporate the concerns of residents in the Twin Cities Metropolitan Area. The next public comment period will be sometime in early 2022, after the initial draft is created. This will be one of the next opportunities for the public to participate in shaping solid waste policy. In addition, the Minnesota Legislature periodically brings up solid waste legislation, and therefore the public can engage their legislators to inform them of their ideas and concerns regarding solid waste management.

13. Comments by Justine Pliska. Email received July 19, 2021.

Comment 13-1: Commenter stated, "I am just writing to express my opposition to the proposed expansion of the Burnsville landfill. I live in Bloomington, not far from the river front and think our

rivers are so valuable as a resource. Further development alongside the river would be better to be residential or community use than enlarging an already large landfill."

Response: Comment noted.

14. Comments by Samantha Collins. Email received July 20, 2021.

Comment 14-1: Commenter stated, "Your research has shown that if the Kraemer quarry ceases production or decreases the pumping of groundwater, it will directly negatively impact BSL and the community; What has been done to ensure that this symbiotic relationship continues? Does anyone know how long the quarry is expected to produce at its current rate? How will communication be upheld and/or required between the state, the city of Burnsville, BSL, and the quarry? I spoke to David Oslie at Kraemer Mining and Materials, and he said "dependent upon market conditions, Kraemer could easily operate the quarry for another 30 years." He also wasn't aware of this relationship between BLS and the quarry."

Response: Please see response to comment 4-2 for the BSL DSEIS findings regarding potential groundwater impacts of the Project, including potential impacts related to the Kraemer Quarry.

Currently, solid waste permits are issued for a period of 10 years, and the status of the regional groundwater management will be considered during each permit reissuance. The solid waste permit also requires regular groundwater monitoring (including groundwater elevations), and any future groundwater impacts identified above regulatory limits during the permit-required monitoring would trigger a response action to address the impacts. Additionally, groundwater data submitted by BSL is and will be evaluated on an annual basis.

Regarding the question of when will Kraemer Quarry stop operating - this is a business decision by the company that will be influenced by how much material is still mineable. It is estimated it could be 20-30 years.

The SEIS has documented these potential issues and noted they will need to be addressed during the permitting process. The purpose of an EIS is to provide information for governmental units, the proposer of the project, and other persons (e.g., the public) to evaluate proposed projects that have the potential for significant environmental effects, to consider alternatives to the proposed projects, and to explore methods for reducing adverse environmental effects. The SEIS has accomplished this task. It is not a decision document.

Comment 14-2: Commenter stated, "Overall alternatives, you all mentioned using other landfills as an alternative, rather than implementing a different area. Why is that? Is there no other area that seems fitting for the project? One could argue that an alternative would be increasing recycling and preprocessing of waste, as per your research it could decrease the volume of waste by almost half, and height up to 220 feet. How can this be possible, meaning, who upholds, regulates, and ensures that this happens?

Response: The purpose of the proposed Project is to increase BSL's ultimate design capacity so they can continue operation into the future. The BSL DSEIS does not include the alternative of having the

expansion occur in a different area because it would not meet the underlying need for or purpose of the Project.

Section 7.0 (Alternatives) of the DSEIS presents an evaluation of a smaller landfill with lower height and capacity. The purpose of that information is to examine the results of preprocessing waste to remove material banned from MMSW and to recover recyclable materials, and estimate the remaining waste to be landfilled and the resulting size and height of BSL after 41 years of operation.

Comment 14-3: Commenter stated, "Overall this project is a short-term plan for the next 1-2 generations at best. It is not addressing the true issue of poor regulation of waste management. What can I do, as a citizen to ensure that lawmakers, the EPA, MDH, and other appropriate boards and organizations address that? Do you know if the state is looking to address that in the next generation?"

Response: The overall solid waste management strategy for the Twin City Metro area is generally outside the Scope of the BSL SEIS, however, the MPCA is currently working on the development of the Metro Solid Waste Policy Plan. The primary focus of the plan is developing strategies to minimize our reliance on land disposal facilities. Public input to that process is vitally important so that the Agency can incorporate the concerns of residents in the Twin Cities Metropolitan Area. The next public comment period will be sometime in early 2022, after the initial draft is created. This will be one of the next opportunities for the public to participate in shaping solid waste policy. In addition, the Minnesota Legislature periodically brings up solid waste legislation, and therefore the public can engage their legislators to inform them of their ideas and concerns regarding solid waste management.

Comment 14-4: Commenter stated, "Concerns of AQI: In regards to air pollution, are there AQI monitors in the surrounding area, if so where and how many? Is there an AQI monitor at the BSL site? How does BSL ensure worker safety regarding air quality? From your presentation, the air quality was suspected to be satisfactory, even with the increase in waste and green house gas emission, what was this based on? The AQI categories of good, moderate, etc from airnow.gov? If so, those categories are not specific enough. For example, it does not include pregnant people apart of their sensitive group category, thus not taking into consideration the recent research that has came out in the last 5 years, showed negative pregnancy outcomes at less than the EPA's AQI guidelines. Those pollutants included large and small particulate matter, Nitrous dioxide, and sulfur dioxide and directly impacted birth weight, preterm birth, increase NICU admission, and pregnancy-related complications like pregnancy-induced hypertension and gestational diabetes."

Response: Section 6.5 of the BSL DSEIS includes a detailed analysis of potential air quality impacts from the Project as required by the BSL SEIS Scope. The DSEIS found that BSL (post-Project) is predicted to comply with all applicable national and Minnesota ambient air quality standards (after an increase of 10 feet in height of the electric generating unit stack height). Please see the note in response to comment 1-1, which explains the BSL SEIS scoping process and how the MPCA determined which issues were included in the final Scope.

Ambient air quality standards are set to be protective of human health and include the following pollutants: particulate matter, nitrogen oxides, and sulfur dioxide.

The DSEIS findings regarding BSL's ability to comply with applicable ambient air quality standards included comprehensive air dispersion modeling. Detailed information regarding the air dispersion modeling conducted for the DSEIS is in section 6.5.5 of the DSEIS.

The Scope does not require information regarding the Air Quality Index (AQI) and therefore none is included in the BSL DSEIS. There is not an AQI monitor at the BSL location. Please see the MPCA's about air quality data for information on the AQI, including monitor locations.

The Scope does not require information regarding how BSL ensures worker safety with respect to air quality; therefore, none was included in the DSEIS. The US Department of Labor's Occupational Safety and Health Administration (OSHA) regulates worker safety.

Comment 14-5: Commenter stated, "Are there additional reports that the EIS, City of Burnsville, Waste Management, or MDH are not sharing? If so, is this because it is not required? How can the public access this information? "

Response: The MPCA has no knowledge of whether or not the city of Burnsville, Waste Management, or the Minnesota Department of Health has prepared any/additional reports pertinent to the Project.

The BSL DSEIS includes all relevant information and reports that were necessary to meet the requirements of the BSL SEIS Scope. Please see the note in response to comment 1-1, which explains the BSL SEIS scoping process and how the MPCA determined which issues were included in the final Scope.

Comment 14-6: Commenter stated, "You mentioned that you all are unable to change your scope for this proposal. If the scope isn't serving the community, why are you using it? Why can't there be addendums? "

Response: Please see the note in response to comment 1-1, which explains the BSL SEIS scoping process and how the MPCA determined which issues were included in the final Scope and why the Scope cannot be changed.

Comment 14-7: Commenter stated, "Waste Management and MDH should be required to address how they will address an extreme environmental impact or emergency plan of contamination or water or air quality. Does the EIS provide this for them? If not, who does? "

Response: The comment regarding the MDH is outside the Scope of the BSL SEIS. Please see the note in response to comment 1-1, which explains the BSL SEIS scoping process and how the MPCA determined which issues were included in the final Scope.

The Scope required BSL to include information on potential impacts from the Project from extreme weather conditions. Sections 6.2 and 6.3 of the DSEIS includes findings regarding impacts from a 500-year storm event and a 500-year flood event. As part of their solid waste permit, landfills are required to set aside financial assurance, and this financial assurance includes funds for contingency actions that may arise from emergencies or contamination.

15. Comments by Dr. Patricia Mullen. Email received July 20, 2021.

Comment 15-1: Commenter stated, "I am a 30 year Bloomington resident and home owner. Why would any decision-makers choose to expand the Burnsville Sanitary Landfill in a river valley near public water supplies? The impact to the environment and the Minnesota River can be predicted. Water supply will be tainted and will impact wildlife and humans! There has to be a better solution than approving this

site for expansion."

Response: The MPCA does not choose a project or its location. Please see response to comment 4-6 for explanation of why a supplemental EIS is being prepared for the Project.

Please see response to comment 4-2 for the Project's potential impacts to surface waters (e.g., Minnesota River) and drinking water supplies.

Comment 15-2: Commenter stated, "Residents and contractors alike can reduce the amount of garbage that they produce through new recycle and compost strategies. A for-profit company like FoodMaven, an agriculture-tech startup founded in 2015 and based in Colorado Springs, has been successful with a mission of keeping food out of landfills. In fact, 40% of food produced by farmers was wasted previous to FoodMaven developing a supply system to redirect this food to restaurants, etc. FoodMaven leaders even interviewed farmers to find out why they were struggling with their chicken and beef overproduction/waste. As a result FoodMaven bought a beef processing plant. Now the food that used to go to a landfill is redirected to feed hungry US citizens. This is one example of a company that took on the difficult task of building a better system to redirect what was previously tossed as waste!

Why wouldn't Burnsville and Bloomington decision-makers explore more innovative solutions to the garbage challenge? I volunteer my energies to support the design of new ways to redirect what goes into a landfill. We all have to live in this environment, drink the water and breathe the air. Let us work harder to get all residents and businesses invested in reducing waste.

As a Bloomington resident and taxpayer, I am adamantly opposed to the expansion of the Burnsville Sanitary Landfill. Let's instead replicate the innovative thinking of a company like FoodMaven and other companies that have reduced garbage waste. Let's apply innovative thinking to implement more effective systems in Burnsville and Bloomington to reduce garbage."

Response: The question, "Why wouldn't Burnsville and Bloomington decision-makers explore more innovative solutions to the garbage challenge?" is beyond the scope of the BSL SEIS. Please see the note in response to comment 1-1, which explains the BSL SEIS scoping process and how the MPCA determined which issues were included in the final Scope.

The overall solid waste management strategy for the Twin City Metro area is generally outside the Scope of the BSL SEIS, however, the MPCA is currently working on the development of the Metro Solid Waste Policy Plan. The primary focus of the plan is developing strategies to minimize our reliance on land disposal facilities. Public input to that process is vitally important so that the Agency can incorporate the concerns of residents in the Twin Cities Metropolitan Area. The next public comment period will be sometime in early 2022, after the initial draft is created. This will be one of the next opportunities for the public to participate in shaping solid waste policy. In addition, the Minnesota Legislature periodically brings up solid waste legislation, and therefore the public can engage their legislators to inform them of their ideas and concerns regarding solid waste management.

16. Comments by Kevin Peterson. Email received July 21, 2021.

Comment 16-1: Commenter stated, "I would like to state for the record that I completely oppose putting a landfill in such a dense urban area next to a vital waterway. The landfill should be located outside of the Twin Cities metro."

Response: Comment noted.

17. Comments by Randy Peterson. Email received July 25, 2021.

Comment 17-1: Commenter stated, "I reside in Bloomington, right off the Dwan Golf Course on Drew Avenue. At minimum, I have concern regarding the increase in elevation of this landfill and how that affects the aesthetic for everyone who can see this from their homes. I imagine that may have some negative effects on property values in the future as well."

Response: Please see section 7.3.4 of the BSL DSEIS for findings regarding the Project's potential impacts to property values within a 2-mile radius of the landfill.

Comment 17-2: Commenter stated, **"**My main concern, though, is the proximity of the landfills to the river and drinking water supply. I've read that there are issues (or potential for) with contamination from the freeway landfill and freeway dump. While I'm sure the state looks at the environmental effects of these projects in detail, I can't help but to feel dumbfounded that we would further risk the local and downstream dependents related to an expansion in this area."

Response: The evaluation of potential issues from the Freeway Landfill and/or Freeway Dump are outside the Scope of the BSL SEIS and therefore will not be included in the FSEIS. Please see the note in response to comment 1-1, which explains the BSL SEIS scoping process and how the MPCA determined which issues were included in the final Scope.

Please see response to comment 4-2 for response to concerns regarding drinking water supplies, groundwater, and surface water.

Comment 17-3: Commenter stated, "I don't know what alternative there is beyond reducing, reusing, and recycling, for which, I am proud to do my part while encouraging others to do the same."

Response: The overall solid waste management strategy for the Twin City Metro area is generally outside the Scope of the BSL SEIS, however, the MPCA is currently working on the development of the Metro Solid Waste Policy Plan. The primary focus of the plan is developing strategies to minimize our reliance on land disposal facilities. Public input to that process is vitally important so that the Agency can incorporate the concerns of residents in the Twin Cities Metropolitan Area. The next public comment period will be sometime in early 2022, after the initial draft is created. This will be one of the next opportunities for the public to participate in shaping solid waste policy. In addition, the Minnesota Legislature periodically brings up solid waste legislation, and therefore the public can engage their legislators to inform them of their ideas and concerns regarding solid waste management.

18. Comments by Brian & Rochon Bergevin-Smith. Email received July 25, 2021.

Comment 18-1: Commenters stated their opposition to the BSL Project.

Response: Comment noted.

Comment 18-2: Commenters stated the following concern regarding "Groundwater Contamination", "The Savage Pacer July 24th edition explains the Burnsville and Savage water supply "artificially

suppresses the area's water table" temporarily avoiding inevitable contamination. Lined or not, we must prioritize and protect our water supply over the convenience and profit of exploiting an existing landfill."

Response: Please see response to comment 4-2.

Comment 18-3: Commenter stated the following concerns regarding "Recreation and Environmental impact", "An expansion guarantees the landfill will become the ironic "centerpiece" of the Minnesota Valley National Wildlife Refuge and destroy recreational use of these popular destinations:

- Minnesota Valley State Trail, Bloomington
- Minnesota Riverfront Park, Burnsville
- Cliff Fen Park, Burnsville
- Blackdog Park, Burnsville

An expansion will also increase the flocks of seagulls currently attracted to this food source and consequently transport pollution to bodies of water beyond the Minnesota Valley. As noted at nih.gov in *The biogeochemical implications of massive gull flocks at landfills*: "We conclude that mega-flocks of landfill gulls are common and widespread, and that their capacity to transport nutrients may be contributing to the eutrophication of aquatic ecosystems and water supplies."

Response: The BSL SEIS Scope required the SEIS to include an inventory of nearby existing and planned recreational resources as well as a description of the Project's potential impacts on those resources. Section 6.6.1 of the DSEIS found that the Project is not expected to cause adverse impacts that would affect the usability of existing nearby recreational resources or hinder the development of planned recreational areas.

The Scope does not require an analysis of the potential for the Project to result in birds transporting nutrients and therefore it will not be included in the BSL FSEIS. Please see the note in response to comment 1-1, which explains the BSL SEIS scoping process and how the MPCA determined which issues were included in the final Scope.

Comment 18-4: Commenter stated the following concerns regarding "Community Life and Tourism", "Erecting a "hill" of waste eclipsing the Hyland Hills and Buck Hill ski areas will become the unwanted signature landmark of this area with its footprint, height, and inescapable nauseous smell. Our thriving communities, health, aesthetics, and property values will sink as the landfill expands."

Response: Please see response to comment 6-1 for response to comments regarding odors and visual impacts (aesthetics). Please see response to comment 17-1 for response to comment regarding property values.

The purpose of an EIS is to provide information for governmental units, the proposer of the project, and other persons (e.g., the public) to evaluate proposed projects that have the potential for significant environmental effects, to consider alternatives to the proposed projects, and to explore methods for reducing adverse environmental effects. The purpose of an EIS is not to conduct research on public health and therefore no such analysis will be included in the BSL FSEIS.

Comment 18-5: Commenter stated, "We implore the MPCA to stop pursuing this inertial expansion, contain the growth and impact of the landfill, and identify other strategies for long-term waste management."

Response: Please see response to comment 4-6 regarding why an EIS is being prepared for the BSL Project. Please see the note in response to comment 1-1, which explains the BSL SEIS scoping process and how the MPCA determined which issues were included in the final BSL SEIS Scope.

The overall solid waste management strategy for the Twin City Metro area is generally outside the Scope of the BSL SEIS, however, the MPCA is currently working on the development of the Metro Solid Waste Policy Plan. The primary focus of the plan is developing strategies to minimize our reliance on land disposal facilities. Public input to that process is vitally important so that the Agency can incorporate the concerns of residents in the Twin Cities Metropolitan Area. The next public comment period will be sometime in early 2022, after the initial draft is created. This will be one of the next opportunities for the public to participate in shaping solid waste policy. In addition, the Minnesota Legislature periodically brings up solid waste legislation, and therefore the public can engage their legislators to inform them of their ideas and concerns regarding solid waste management.

19. Comments by Mia Olson. Email received July 26, 2021.

Comment 19-1: Commenter stated, "In our beautiful state of 10,000 + lakes, rivers & streams we should be doing all that we can to protect them. They are our way of life, and factually …water IS life. Please do all that you can to be a water protector. Say No to the river location/expansion of the landfill."

Response: Please see response to comments 4-2 and 4-6.

20. Comments by Ann Roth. Email received July 26, 2021.

Comment 20-1: Commenter stated, I am writing to ask for your consideration to deny the request to increase the size of the Burnsville landfill managed by Waste Management. The landfill would be a massive eyesore and a pollution risk with its location on the river. We need to look for better solutions for waste management that don't provide such a risk to the environment and water safety."

Response: Regarding request that MPCA deny the BSL Project, please see response to comment 4-6.

The overall solid waste management strategy for the Twin City Metro area is generally outside the Scope of the BSL SEIS, however, the MPCA is currently working on the development of the Metro Solid Waste Policy Plan. The primary focus of the plan is developing strategies to minimize our reliance on land disposal facilities. Public input to that process is vitally important so that the Agency can incorporate the concerns of residents in the Twin Cities Metropolitan Area. The next public comment period will be sometime in early 2022, after the initial draft is created. This will be one of the next opportunities for the public to participate in shaping solid waste policy. In addition, the Minnesota Legislature periodically brings up solid waste legislation, and therefore the public can engage their legislators to inform them of their ideas and concerns regarding solid waste management.

21. Comments by Christy Warner. Email received July 26, 2021.

Comment 21-1: Commenter stated, "I live in Bloomington, just across the river from the Freeway landfill, and I am extremely concerned about the environmental impact of the expansion/proposed development so near the river. I think we should never be putting landfills near rivers. Something like this would be devastating to the natural area of 9 mile creek, which flows into the river nearby and is used year around. It's an oasis in the city and it would be horrible to wreck it by putting a landfill so close by. Sure, this will destroy my property value, but I think the destruction of the natural area is a far worse consequence. Burnsville must have plenty of unused (uglier!) space where this thing could go. Please, please do not put this landfill in this spot!"

Response: Please see response to comments 4-2 and 4-6.

22. Comments by Johnny Horstman. Email received July 27, 2021.

Comment 22-1: Commenter stated, "I (along with everyone else living in Bloomington) take issue with the concept of building a mountain of trash right beside the Minnesota river, it would without a doubt turn that section of the river into the ugliest place in Minnesota, in addition to the obvious ecological consequences."

Response: Comment noted.

23. Comments by Glenn Wong. Email received July 28, 2021.

Comment 23-1: Commenter stated, "I have a concern about the environmental impact on expanding the Burnsville dump. With the location so close to the water which may have long term impact. What about the additional noise, odor, escaping trash and visual impact? I hope you have the vision to look long-term rather than short. I appreciate your consideration of my concerns."

Response: Please see response to comment 4-2 for the DSEIS findings related to the Project's potential groundwater and surface water impacts. Please see response to comment 6-1 for noise, odor, littering, and visual impacts.

24. Comments by Marc and Julie Smith. Email received July 28, 2021.

Comment 24-1: Commenter stated, "This is a quick note to tell you we OPPOSE the proposed expansion to the Burnsville Landfill. We read the following article in the TwinCities.com/Pioneer Press:

https://www.twincities.com/2021/07/25/burnsville-landfill-expansion-draws-opposition-from-bloomington-officials/"

Response: Comment noted.

Comment 24-2: Commenter stated, "We find it extremely difficult to believe that the proposed expansion is being pursued as the "best" option, when the current landfill already threatens drinking water in Burnsville and Savage, and expansion will only compound the problem for the next 40 years."

Response: Project proposers have a legal right to propose (pursue) a project. In this case, the Project requires the preparation of an EIS by the MPCA.

The purpose of an EIS is to provide information for governmental units, the proposer of the project, and other persons (e.g., the public) to evaluate proposed projects that have the potential for significant environmental effects, to consider alternatives to the proposed projects, and to explore methods for reducing adverse environmental effects. The BSL SEIS identifies potential mitigation measures for adverse environmental effects. The EIS process does not approve or deny a project. All approvals and/or denials of the BSL Project occur during the permitting phase of a project, which cannot occur until the BSL SEIS process is complete

Please see response to comment 4-2 regarding potential impacts to drinking water supplies.

Comment 24-3: Commenter stated, “We also find it hard to believe the MPCA would seriously entertain a proposal to allow the landfill to expand UPWARD by 262 feet "... and the trash mound would stand taller then both the Hyland Hills Ski Area and Buck Hill". How can that possibly be a responsible option?

Maybe this proposal is just the "easiest" from an administrative standpoint? But doesn't it just create a ticking time-bomb?”

Response: Please see response to comment 24-2 for explanation of why an EIS is being prepared for the proposed BSL Project.

Comment 24-4: Commenter stated, “This quote from the Pioneer Press article resonated with us:

"Bloomington Sustainability Commissioner Tim Sandry asked why the “absolutely worst option” of expanding a landfill in an environmentally-sensitive area is the only proposal being discussed."

We live in the South Metro. My brother and his family live in Savage. A lot of good people are living in Savage and Burnsville. Please do NOT threaten the health of these residents by pursuing this expansion proposal. Instead, PLEASE investigate other options -- several reasonable-sounding alternatives are noted in the TwinCities.com/Pioneer Press article.”

Response: Please see response to comment 24-2 regarding why an EIS is being prepared for the proposed BSL Project.

Please see section 7.0 of the BSL SEIS, which provides information on Project alternatives as required by the BSL SEIS Scope.

25. <u>Comments by Buckingham Trucking, Inc. Email received July 28, 2021.</u>

Comment 25-1: Commenter urged the MPCA to prioritize and complete the SEIS, permitting and certificate of Need (CON) process due to concern that “dwindling” capacity at BSL will negatively impact their business, their customers, and the environment.

Response: Comment noted.

26. Comments by Dorothy Hruska. Email received July 28, 2021.

Comment 26-1: Commenter stated, "Find a way to recycle, reuse, etc."

Response: The overall solid waste management strategy for the Twin City Metro area is generally outside the Scope of the BSL SEIS, however, the MPCA is currently working on the development of the Metro Solid Waste Policy Plan. The primary focus of the plan is developing strategies to minimize our reliance on land disposal facilities. Public input to that process is vitally important so that the Agency can incorporate the concerns of residents in the Twin Cities Metropolitan Area. The next public comment period will be sometime in early 2022, after the initial draft is created. This will be one of the next opportunities for the public to participate in shaping solid waste policy. In addition, the Minnesota Legislature periodically brings up solid waste legislation, and therefore the public can engage their legislators to inform them of their ideas and concerns regarding solid waste management.

27. Comments by Ken and Dorothy Hruska. Email received July 28, 2021.

Comment 27-1: Commenter stated, "

1) Environmental issues....the river and ground water
2) unsightly to Bloomington residents which includes my home on Upton Ave S
3) find ways to dispose of couches and mattresses and of course other items
4) educate people to buy less and take care of things and give away what you don't need or want"

Response: Please see the following response to comments:

- Groundwater/Surface Water – Response to comment 4-2
- Visual Impacts – Response to comment 6-1

The overall solid waste management strategy for the Twin City Metro area is generally outside the Scope of the BSL SEIS, however, the MPCA is currently working on the development of the Metro Solid Waste Policy Plan. The primary focus of the plan is developing strategies to minimize our reliance on land disposal facilities. Public input to that process is vitally important so that the Agency can incorporate the concerns of residents in the Twin Cities Metropolitan Area. The next public comment period will be sometime in early 2022, after the initial draft is created. This will be one of the next opportunities for the public to participate in shaping solid waste policy. In addition, the Minnesota Legislature periodically brings up solid waste legislation, and therefore the public can engage their legislators to inform them of their ideas and concerns regarding solid waste management.

28. Comments by Sarah Beimers, Environmental Review Program Manager, State Historic Preservation Office. Email received July 28, 2021.

Comment 28-1: Commenter stated, "Based on our review of the project information, we conclude that there are no properties listed in the National or State Registers of Historic Places and no known or suspected archaeological properties in the area that will be affected by this project.

Please note that this comment letter does not address the requirements of Section 106 of the National Historic Preservation Act of 1966 and 36 CFR § 800. If this project is considered for federal financial assistance, or requires a federal permit or license, then review and consultation with our office will need

to be initiated by the lead federal agency. Be advised that comments and recommendations provided by our office for this state-level review may differ from findings and determinations made by the federal agency as part of review and consultation under Section 106."

Response: Comment noted.

29. Comments by Chad Johnson. Email received July 28, 2021.

Comment 29-1: Commenter stated, "Placing a dump up wind of any city is poor planning. Expanding a dump up wind from a city to these heights is irresponsible and negligent. We live on Johnson ave and overlook dr. My property taxes are a cool 100K more than I can get for my house even in this market. what do I win?"

Response: Please see response to comment 4-6 for explanation of why an EIS is being prepared for the proposed BSL Project.

Comment 29-2: Commenter stated, "The dump right in smelling distance. Who is going to pay for the "Value" insurance policy for our neighborhood once you can smell it all summer long? Because I will tell you with temps rising, it will affect the air. And homes dont sell where it stinks."

Response: Please see Section 6.5.8 of the BSL SEIS, which provides information on odors, including odor control protocols.

Section 7.3.4 of the BSL SEIS provides information related to potential impacts on property values.

Comment 29-3: Commenter stated, "Plus aesthetically what the hell are you thinking? The expansion is preposterous.

YIMBE right.... but up wind?... Thats just stupid."

Response: Please see response to comment 4-6 for explanation of why an EIS is being prepared for the proposed BSL Project.

Section 6.4 of the BSL SEIS provides information about the potential visual impacts of the Project. This includes photo renderings showing three different landfill buildout scenarios as viewed from key vantage points.

It is up to the proposer to choose the location of their Project, the MPCA does not choose the location of a proposed project.

Comment 29-4: Commenter stated, "I am willing to pay more on my garbage. Where the hell is my compost option?

Just want you guys to lead and make smart decisions. Please help us citizens"

Response: The overall solid waste management strategy for the Twin City Metro area is generally outside the Scope of the BSL SEIS, however, the MPCA is currently working on the development of the Metro Solid Waste Policy Plan. The primary focus of the plan is developing strategies to minimize our

reliance on land disposal facilities. Public input to that process is vitally important so that the Agency can incorporate the concerns of residents in the Twin Cities Metropolitan Area. The next public comment period will be sometime in early 2022, after the initial draft is created. This will be one of the next opportunities for the public to participate in shaping solid waste policy. In addition, the Minnesota Legislature periodically brings up solid waste legislation, and therefore the public can engage their legislators to inform them of their ideas and concerns regarding solid waste management.

30. Comments by Tom Wenisch. Email received July 29, 2021.

Comment 30-1: Commenter stated, "My name is Tom Wenisch, I live just across the river from the Burnsville landfill and I'm very concerned with the proposed expansion! Needless to say I don't want it. There has to be a better alternative . The height of it worries me. I would pay more for garbage service if nessesary."

Response: Please see response to comment 12-5.

31. Comments by Calvin Sargent. Email received July 29, 2021.

Comment 31-1: Commenter stated, "I'm writing this email to express my opposition to the Burnsville Sanitary Landfill expansion project. I'm a lifelong resident of Bloomington, and I now own a home northwest of Dwan Golf Course. I'm concerned that the landfill expansion will be unsightly and negatively impact the the Minnesota River Valley's current appeal. I grew up biking, hiking, and fishing along the Minnesota River, and I still enjoy all of these activities down in the river valley. The Minnesota River is already an urban thoroughfare for barge traffic, but the wooded shorelines still provide a sense of natural wilderness. Drastically increasing the height of the existing landfill will ruin that charm forever.

I understand that the city of Burnsville is dependent on the revenue from the landfill, but expanding the size of the landfill is really only a temporary solution as there is still a finite limit on it's size. Burnsville should deal with the issue at hand instead of kicking the can down the road for another generation to deal with.

Please do not support the landfill expansion. It's a decision being driven entirely by money, and it is not a good solution for the environment and the Minnesota River."

Response: Comment noted.

32. Comments by Kevin Foreman. Email received July 29, 2021.

Comment 32-1: Commenter stated, "Is there another plan being pursued regarding adding another landfill site for the Twin Cities? I read about organic recycling, as well as the issues with our current recycling programs, with avid interest. But realistically speaking, people won't change habits much in the short term and we need a place to put the waste from the Twin Cities metro area. But a mountain of waste on the north side of Burnsville is a bad idea."

Response: The overall solid waste management strategy for the Twin City Metro area is generally outside the Scope of the BSL SEIS, however, the MPCA is currently working on the development of the Metro Solid Waste Policy Plan. The primary focus of the plan is developing strategies to minimize our

reliance on land disposal facilities. Public input to that process is vitally important so that the Agency can incorporate the concerns of residents in the Twin Cities Metropolitan Area. The next public comment period will be sometime in early 2022, after the initial draft is created. This will be one of the next opportunities for the public to participate in shaping solid waste policy. In addition, the Minnesota Legislature periodically brings up solid waste legislation, and therefore the public can engage their legislators to inform them of their ideas and concerns regarding solid waste management.

Comment 32-2: Commenter stated, "I have selfish reasons for avoiding this monster. Three years ago, my wife and I bought a home directly north of where this project will sit, about 3 blocks north of the Minnesota River bluffs. To imagine that the dominant vision in our area would be a garbage mountain is not what we bargained for. When communities have major projects, we usually put up with the cost and inconvenience as part of the greater community good, and generally rising property values. The thought that ours could be stifled due to a visual eyesore and olfactory nuisance, gives us enough pause to wonder if another move may be necessary. This just shouldn't be a reason to move."

Response: Please see section 6.4 of the BSL SEIS provides information about the potential visual impacts of the Project. This includes photo renderings showing three different landfill buildout scenarios as viewed from key vantage points.

Section 7.3.4 of the BSL SEIS provides information related to potential impacts on property values.

Comment 32-3: Commenter stated, "I went to some Burnsville City council meetings and it was clear to me that the additional fees that Burnsville will receive for this project are too large to ignore, and would be difficult to replace via other funding sources. But Burnsville is reaping the benefit, and sticking Bloomington residents with the downside since most of this won't affect the residential areas of Burnsville. And based on the videos, it won't really be all that visible from the south."

Response: Comment noted. Section 7.3 of the BSL SEIS contains information on the potential economic impacts of the Project, as required by the BSL SEIS Scope.

Comment 32-4: Commenter stated, "I'm frustrated that I'm not hearing about other options to this project, which makes me think there's nothing that's going to stop it. I like to have civic pride in my community, and it saddens me that one of the first things people will see, when visiting from the south via 35, will be a garbage mountain in a river valley. With weather patterns changing, I'm also skeptical that today's drought might turn into the next decade's "unforeseen" floods. The risk of a garbage dump seeping into the water supplies of all the Americans living downriver seems like a bad idea as well. We all know that water is becoming more valuable every year, and sticking it to the south central US so Burnsville can get more funding is very irresponsible and speaks to poor leadership from the state level."

Response: Comment noted. Please see response to comment 32-1 regarding opportunities for the public to provide input on solid waste policy.

Please see response to comment 4-2 for information about the potential for extreme weather, including floods, to impact the Project.

Please see response to comment 4-2 for information about the potential groundwater impacts of the Project.

Please see response to comment 4-6 for explanation of why an EIS is being prepared for the proposed BSL Project.

Comment 32-5: Commenter stated, "So I wholeheartedly disagree with the scope of the current plans for the Burnsville Sanitary Waste project. Shrinking it would be a great start, and finding another couple sites to share the region's garbage load would be the responsible thing to do. And to get the whole project out of a river valley seems like a very good idea as well, though it's likely much too late for that."

Response: Please see the note in response to comment 1-1, which explains the BSL SEIS scoping process and how the MPCA determined which issues were included in the final Scope and why it cannot be changed.

33. Comments by John and Mary Crampton. Email received July 29, 2021.

Comment 33-1: Commenter stated, "I strongly object to the Draft Supplemental Environmental Impact Statement, because it is proposing a project that will be an environmental catastrophe of monumental proportions."

Response: Comment noted.

Comment 33-2: Commenter stated, "BSL Height: The height of the proposed BSL "garbage mountain" will make it over 23 stories (250 ft.) higher than any residence in Bloomington. It will become the dominant, defining visual feature in the Minnesota River Valley.

It will pose serious hazards to aircraft on approach to MSP and Flying Cloud Airport. It will attract scavenger birds at these higher elevations that will crash into planes and foul up jet engines as they prepare to land, thus endangering the safety of both passengers and people on the ground. Constantly blinking aircraft lights will be required on BSL "garbage mountain", which will be a constant nuisance to people in our communities who want to go outside of their homes in the evening.

"Garbage mountain" will also be a terrible noise generator, positioned high above surface levels at the epicenter of the ear horn shaped delta and valley of Nine Mile Creek. I suggest you reference the noise levels that the proposed Freeway Landfill Amphitheater project would have generated in the early 2000s. The proposed BSL landfill will be an even worse generator of noise pollution with garbage trucks hauling their waste and font end loaders pushing it around at all hours of day and night. (If you don't think this is a problem, come out and measure the noise levels of big trucks coming up out of the valley going north on 35W…."Garbage mountain" will be a much steeper climb!)"

Response: Please see the following responses to comments:

- Bird/Aircraft Interactions – Response to comment 9-4
- Blinking Lights – Response to comment 9-4
- Noise and visual impacts – Response to comment 6-1

Comment 33-3: Commenter stated, "Storm water runoff: To construct the proposed "garbage mountain" will require steep slopes that will facilitate gigantic run-off rivers flowing down and carving out huge ravines underneath the so-called caps. They will carry roaring streams of polluted waters into the floodplain lakes, the Minnesota River, and the Mississippi River. With increasing climate change this

will happen quite often as 3”-4” rainfalls become the norm. Deluges of Biblical proportions will not be out of the realm of possibility, as we just witnessed in Zhengzhou, China….24” of rain in 24 hours!

If this proposed BSL project is built, it will require an exponentially bigger footprint so the height is much lower and runoff rates do not exceed the current runoff rates. As basic geometry indicates, this bigger footprint will cause terrific problems in terms of encroachment on wetlands, floodplain lakes and environmentally sensitive areas.”

Response: Please see response to comment 4-2.

Comment 33-4: Commenter stated, “Greenhouse Gas Emissions: It is estimated that the BSL will generate 5,863 standard cubic ft of landfill gases per minute. 25% (1,465 cubic ft./minute) of that will be permitted to escape into the air, which will make it one of the largest emitters of methane and C02 in this area. This is unacceptable in terms of its climate impact, particularly since 69% of the existing waste being re-landfilled is recoverable. You could probably burn the captured methane gases to power the reprocessing of the existing waste. (You could probably even mine the copper that’s in there.) This, reprocessing coupled with a standard of 75% recycling goal by 2030 could significantly reduce the amount of waste in and size of the proposed BSL landfill.”

Response: Section 6.5 of the DSEIS found that the Project’s annual maximum greenhouse gas (GHG) emissions are estimated to increase from 233,859 to 320,401 tons per year. There are no MAAQS or NAAQS for carbon dioxide (CO_2) or any other GHG. The assessment of GHG emissions and climate change is extremely complex. Currently, it is not possible to model the physical impacts of global or regional climate change, such as storm frequency/intensity or temperature increases caused by incremental GHG emissions. In other words, while solid waste landfills contribute to climate change generally, existing scientific tools do not allow the MPCA to quantify the specific impacts of a particular project on climate change. Some of the landfill gas associated with the Project will be captured and combusted and used to produce electricity. This has a positive impact on climate change because this landfill gas is used rather than being wasted by burning in a flare. BSL’s use of landfill gas also reduces the electricity demand from sources that burn coal or natural gas.

Comment 33-5: Commenter stated, “Ecologically sensitive areas: The proposed BSL landfill is located in ecologically sensitive area. Unlined segments of the existing landfill are close to groundwater levels. You are now proposing to add the new waste on top of the old waste sitting on unlined portions? This is short sighted and dangerous! This will be exacerbated by the imminent closure of Kramer Quarry that will stop the pumping of water out of the quarry, thus causing water levels to rise close to the lowest levels of the landfill. Once contaminated, the groundwater will flow everywhere and be a major threat to water supplies for Savage and Burnsville and other communities that use the aquifer.”

Response: The BSL SEIS Scope does not includes the term, “ecologically sensitive area” and therefore no specific analysis of such an area is required in the BSL SEIS. However, since the BSL SEIS does investigate the Scope-required environmental impacts of the Project, in the BSL area, the SEIS by default covers the ecologically sensitive area referenced by the commenter that would be affected by the BSL Project.

Please see the note in response to comment 1-1, which explains the BSL SEIS scoping process and how the MPCA determined which issues were included in the final Scope.

Please see response to comment 4-2 for the BSL DSEIS findings regarding potential groundwater impacts

of the Project, including those related to BSL adding new waste over its existing unlined waste, and potential impacts to aquifers and drinking water supplies.

Currently, solid waste permits are issued for a period of ten years, and the status of the regional groundwater management will be considered during each permit reissuance. The solid waste permit also requires regular groundwater monitoring (including groundwater elevations), and any future groundwater impacts identified above regulatory limits during the permit-required monitoring would trigger a response action to address the impacts. Additionally, groundwater data submitted by BSL is and will be evaluated on an annual basis.

As noted above the SEIS has documented these potential issues and noted they will need to be addressed during the permitting process. The purpose of the BSL SEIS is to provide information on the project to the public and decisions makers for future regulatory decisions. The SEIS has accomplished this task. It is not a decision document.

Comment 33-6: Commenter requested the following: "A robust analysis of climate change impacts on this proposed project that was "hatched" long before climate change became recognized as an existential threat. This analysis must include different greenhouse gas emission levels, global warming temperature increases, extreme weather events, groundwater and surface water pollution as our waters are continually stressed by increasing drought/flooding regimes."

Response: The BSL SEIS Scope does not require a specific analysis of climate change impacts of the BSL Project and therefore none is included in the BSL SEIS.

The BSL SEIS Scope and BSL SEIS, however, both take into account some aspects of climate change in the SEIS sections on surface water (6.2) and on the landfill's liner and leachate collection system (6.3). Specifically, these sections analyzed the potential impact of a 500-year storm event on surface water and the impacts of a 500-year flood on the liner and leachate collection system. These sections of the BSL SEIS also identified potential mitigation measures for those impacts, as required by the BSL SEIS Scope.

The BSL SEIS Scope requires that the BSL SEIS include the following, with respect to greenhouse gases, "The SEIS will include a qualitative summary of expected greenhouse gas production from the Project." Section 6.5.4.3 of the BSL SEIS contains all of the Scope-required greenhouse gas information and therefore the BSL FSEIS will not include the additional information requested by the commenter.

Please see the note in response to comment 1-1, which explains the BSL SEIS scoping process and how the MPCA determined which issues were included in the final Scope.

Comment 33-7: Commenter asked the following: "What would be required to implement dramatically increased recycling and pre-processing of waste?

Response: The overall solid waste management strategy for the Twin City Metro area is generally outside the Scope of the BSL SEIS, however, the MPCA is currently working on the development of the Metro Solid Waste Policy Plan. The primary focus of the plan is developing strategies to minimize our reliance on land disposal facilities. Public input to that process is vitally important so that the Agency can incorporate the concerns of residents in the Twin Cities Metropolitan Area. The next public comment

period will be sometime in early 2022, after the initial draft is created. This will be one of the next opportunities for the public to participate in shaping solid waste policy. In addition, the Minnesota Legislature periodically brings up solid waste legislation, and therefore the public can engage their legislators to inform them of their ideas and concerns regarding solid waste management.

Comment 33-8: Comment suggested the following: "Shredding the remaining waste from the existing landfills to allow for greater compaction"

Response: The overall solid waste management strategy for the Twin Cities Metro area is generally outside the Scope of the BSL SEIS. With respect to BSL specifically, Section 7.1.3 of the BSL SEIS includes an analysis of the feasibility of shredding waste at BSL to increase waste compaction.

Comment 33-9: Commenter suggested the following: "Limiting the amount of waste to be landfilled in the future."

Response: Please see response to comment 33-7.

Comment 33-10: Commenter suggested the following: "A complete economic analysis of the economic impact of this project in terms of property values, taxes and, potentially, tremendous clean up costs for Bloomington, Burnsville, and Savage along with state and federal governments?"

Response: Section 7.3 of the DSEIS contain findings regarding the economic impacts of the Project, as required by the BSL SEIS Scope. The request for a "A complete economic analysis of the economic impact of this project in terms of property values, taxes and, potentially, tremendous cleanup costs for Bloomington, Burnsville, and Savage along with state and federal governments?" is beyond the Scope of the BSL SEIS and will not be included in the BSL FSEIS.

Comment 33-11: Commenter requested the following: "An analysis of reprocessing and moving the waste to landfills areas that are less ecologically sensitive and less populated."

Response: The BSL SEIS Scope does not require that the BSL SEIS contain an analysis of reprocessing and moving waste to landfills areas that are "less ecologically sensitive and less populated" and therefore the BSL FSEIS will not include it.

Comment 33-12: Commenter requested the following: "Impacts on the Minnesota Valley National Wildlife Refuge and other natural areas in adjacent areas that provide education, recreation and habitat for generations of people, plants, trees, soils, water and animals."

Response: The BSL SEIS Scope does not requires that the BSL SEIS contain an analysis of "Impacts on the Minnesota Valley National Wildlife Refuge and other natural areas in adjacent areas that provide education, recreation and habitat for generations of people, plants, trees, soils, water and animals." and therefore the BSL FSEIS will not include it.

The BSL SEIS Scope does require, "Inventories will be completed of nearby existing and planned recreational resources. Potential impacts resulting from the expansion will be described and mitigation measures provided." Section 6.6 of the BSL SEIS includes all of this Scope-required information.

Comment 33-13: Commenter stated, "I suggest you open the review process up to reach the widest

populations of citizens on this issue…. Not just Burnsville but also Bloomington, Savage, Eden Prairie, Eagan, Richfield and all the other people who live, work, and recreate in the Minnesota Rive Valley. We are the ones who will be on the hook for trying to clean up this mess when the proposed "garbage mountain" project fails, so we should have a major say in if/when/how this project moves forward."

Response: Please see response to comment 9-11.

34. Comments by Lucinda MacDonald. Email received July 29, 2021.

Comment 34-1: Commenter stated, "As a long time resident of Bloomington, it has come to my attention that your department is evaluating the possibility of expanding the landfill area in Burnsville. As a realtor, I have concerns for property values in Burnsville and Bloomington, and consider this a rather dramatic change to the scenery of the two cities."

Response: Please see response to comment 17-1.

Comment 34-2: Commenter stated, **"**Most Minnesotans are proud of the waterways, lakes and natural beauty of our homeland. This atrocity would detract from that. Besides the visual implications, I am concerned that this would create potential problems in ground water and run off into the river. As a child, I remember the 1965 flood, which devastated the Minnesota River Valley. Standing on the Bloomington river bluffs, I could see the flooding stretched all the way to the railroad track and Hwy 13 in Savage. Obviously, this area is a part of this flood plain and would be impacted again if there was ever a large flood to rival '65. I am sure lesser floods would still impact this area and create the possibility of contamination."

Response: Please see the following responses to comments:

- Groundwater – Response to comment 4-2
- Surface Water – Response to comment 4-2
- Visual Impacts – Response to comment 6-1

Comment 34-3: Commenter stated, **"**Yes, the existing landfill was approved in the past. But, this does not mean that we must continue making the same mistakes going forward. Please consider this an opportunity to reverse some of the damage that has been done in the past by putting a halt to an expansion and even consider shutting down this facility in the future in order to preserve the river named after our state."

Response: Please see response to comment 4-6.

35. Comments by Dale Johnson. Email received July 30, 2021.

Comment 35-1: Commenter stated, "In addition to the problems with expanding this landfill I would add that in the summer months the wind is usually from the South, SouthWest and sometimes SouthEast. This would cause the dust that is created by the bulldozers pushing this material around to blow into Bloomington. I live not far from the bluff and I can see where people near the edge of the bluff overlooking the Minnesota river would get a good dusting of garbage dust and smell. I think this is a very bad idea."

Response: Please see the following responses to comments:

- Air Quality – Response to comment 4-3
- Odor – Response to comment 6-1

Comment 35-2: Commenter stated, "Why couldn't a garbage recycling/burning plant be constructed like the one in Minneapolis. The garbage could be burned and turned into energy to power electric generators. How about connecting it will Blackdog power plant."

Response: The overall solid waste management strategy for the Twin City Metro area is generally outside the Scope of the BSL SEIS, however, the MPCA is currently working on the development of the Metro Solid Waste Policy Plan. The primary focus of the plan is developing strategies to minimize our reliance on land disposal facilities. Public input to that process is vitally important so that the Agency can incorporate the concerns of residents in the Twin Cities Metropolitan Area. The next public comment period will be sometime in early 2022, after the initial draft is created. This will be one of the next opportunities for the public to participate in shaping solid waste policy. In addition, the Minnesota Legislature periodically brings up solid waste legislation, and therefore the public can engage their legislators to inform them of their ideas and concerns regarding solid waste management.

Comment 35-3: Commenter stated, "I didn't know about the blinking light for airplanes, I guess eventually this thing is going to be a huge mountain of garbage if approved. I'm not in favor of a mountain of garbage in that location."

Response: Please see response to comment 9-4.

36. Comments by Edward Crozier. Email received July 30, 2021.

Comment 36-1: Commenter stated, "We oppose the proposal to expand the Burnsville Sanitary Landfill and therefore object to the Draft Supplemental Environmental Impact Statement, because it is proposing a project which will have severe negative impact on the Minnesota River Valley, the adjacent communities, the Twin Cities Metropolitan Area and the Minnesota and Mississippi River Systems.

I am a founder of the 14,000-acre Minnesota Valley National Wildlife Refuge (MNVNWR), which is within a stone – throw of the Burnsville Sanitary Landfill and the first Manager of the MNVNWR. I was a member of the Burnsville Environmental Council that advised the Burnsville City Council not to renew the operational permit of the Freeway Landfill in the early 1970's. The City Council ignored this recommendation so it could continued receiving the landfill revenue and the Freeway Landfill continued to accept hazardous waste for years until it closed. Now there is a multimillion dollar need to clean up that mess and in the process of cleaning up after past bureaucratic mistakes, officials are proposing to create a new monster in the valley."

Response: The purpose of an EIS is to provide information for governmental units, the proposer of the project, and other persons (e.g., the public) to evaluate proposed projects that have the potential for significant environmental effects, to consider alternatives to the proposed projects, and to explore methods for reducing adverse environmental effects. The BSL SEIS identifies potential mitigation measures for adverse environmental effects. The EIS process does not approve or deny a project. All approvals and/or denials of the BSL Project occur during the permitting phase of a project, which cannot occur until the BSL SEIS process is complete

Comment 36-2: Commenter stated, "Devastating Visual Impact: The proposed height of the landfill expansion (Garbage Mountain) will dominate the south metro area, as it will be the highest landscape feature seen from Lakeville to Richfield and a highly visible feature in much of the Minnesota River Valley. Its visual impact should be described in the EIS. The expanded Burnsville Sanitary Landfill will be particularly in view of much of the adjacent Bloomington City Parklands in the valley and the federal Minnesota Valley National Wildlife Refuge, incidentally one of the few urban National Wildlife Refuges. Public visitation to these natural recreation areas will forever be blemished, reducing the visitor experience. It will be extremely shortsighted for the citizens of today to leave such a lasting negative landmark for generations to come. It will be a disastrous, highly visible symbol of our present-day civic leadership that favors financial greed and disastrous fixes of problems of their own past making. If today's State and Community decision makers wish to leave a lasting "LEGACY" of their own making, then this "Garbage Mountain will be it – not something I would wish to leave for my future descendants."

Response: Please see response to comment 6-1.

Comment 36-3: Commenter stated, "Potential for contaminating the Minnesota and Mississippi Rivers: The Burnsville Sanitary Landfill is located in the original Minnesota River Floodplain, but now presumed to be separated from the River by a dike or a separation barrier, but there are immediately adjacent to the landfill, wetlands that can become directly connected to the river proper in flood stages and thus convey contaminants to the river proper. There can be no assurance that Minnesota River floodwaters will not at some point in time directly inundate portions of the landfill material and thus pollute the Minnesota River and the Mississippi River all the way to the Gulf of Mexico. With climate change, flood levels throughout the world are increasing and there can be no assurance that the future flood levels will not connect with the landfill pollutants and contaminate our nation's greatest river systems. This aspect should be elaborated on in the EIS."

Response: Please see response to comment 4-2.

Comment 36-4: Commenter stated, "Groundwater Contamination Potential: Portions of the existing landfill are already close to groundwater levels and new waste is proposed to be piled on top. Once Kramer Quarry is closed and the quarry fills with water levels that will be close to the lowest levels of the landfill there is the possibility that there will be a direct connection between the contaminated landfill and the south of the river groundwater. Once contaminated, the groundwater will be a major threat to water supplies for Savage and Burnsville and other communities. This too should be described in the EIS."

Response: Please see response to comment 4-2.

Comment 36-5: Commenter stated, "Favoring potential increased city revenue over sensible environmental decisions: The dumping of hazardous waste for years into the Freeway Landfill was a result of Burnsville city leaders favoring a continued revenue stream into the city from the Freeway Landfill over closing a contamination making operation. Now, the city leaders are again taking that shortsighted decision path by proposing to extend/expand the life and size of the Burnsville Sanitary Landfill with its related increased revenue payments to the City. In addition, with the proposed relocation of the waste (including the hazardous material) from the now closed Freeway Landfill to the Proposed Burnsville Sanitary Landfill that will theoretically free up "Developable Land" around the

flooded Kramer Quarry that will probably be advertised by Burnsville as "High End" business sites and maybe even residential potential sites, presumably with water views of the new "Quarry Lake". If this happens then future state and local governments will continually be faced with providing more flood protection of those areas - areas with potential groundwater pollution too. The aspect of increasing flood plain developments and thus city revenue should be exposed in the EIS."

Response: This BSL SEIS Scope does not include a requirement to analyze the issues identified in this comment and therefore they are out of the Scope of the BSL SEIS and will not be included. Please see the note in response to comment 1-1, which explains the BSL SEIS scoping process and how the MPCA determined which issues were included in the final Scope.

Comment 36-6: Commenter stated, "Hidden Impacts – There isn't a thorough or complete analysis of the total environmental impact i.e. the increase in extreme weather conditions resulting in more extreme flooding and how items such as how storm water runoff and greenhouse gas emissions, will be handled or the economic impact on adjacent communities and the impact on the adjacent park and wildlife areas. And, there doesn't seem to be consideration for an increase in recycling. Again, the EIS should discuss these aspects."

Response: The BSL DSEIS includes findings for all of the potentially significant environmental impacts of the Project, as required by the BSL SEIS Scope.

Please see the following responses to comments for the specific environmental concerns expressed in the comment:

- Surface Water (including extreme weather impacts) – Response to comment 4-2
- Liner and Leachate Collection System (including extreme weather impacts) – Response to comment 4-2
- GHG – Response to comment 33-4
- Recreational Resources – Response to comment 18-3
- Recycling – Response to comment 4-1
- Economic – Response to comment 33-6

In addition, as required by its Scope, the BSL SEIS includes an evaluation of cumulative air impacts of the Project and a discussion of cumulative potential significant adverse and beneficial effects of a smaller landfill.

Please see the note in response to comment 1-1, which explains the BSL SEIS scoping process and how the MPCA determined which issues were included in the final Scope.

Comment 36-7: Commenter stated, "Psychological Impact – Within the EIS there should be a psychological evaluation made on the effects of having a garbage mountain being the dominant feature that daily looms over the residents that live in the south metro area. Living in pleasant surroundings is known to be beneficial to mental health whereas daily seeing a mountain of garbage would have the opposite effect."

Response: The BSL SEIS Scope does not require an analysis of the "Psychological Impact" of the Project and therefore none was included in the DSEIS. This comment is beyond the Scope of the BSL SEIS.

Please see the note in response to comment 1-1, which explains the BSL SEIS scoping process and how the MPCA determined which issues were included in the final Scope.

Comment 36-8: Commenter stated, "Creating an Inconsistent Land Feature (Legacy) – Creating a "Garbage Mountain" that will dominate the metropolitan landscape over approximately a 15 - mile space from Hwy I-494 in Bloomington south to Hwy 42 in Burnsville will be a preeminent land feature that can be compared in size to the Egyptian Pyramids, only in a negative manner. Making a governmental decision of that magnitude with such forbidding aspect would seemingly be an extremely negative tag that present day decision makers would not want to be their legacies. This needs to be told in the EIS."

Response: The BSL DSEIS includes findings for all of the potentially significant environmental impacts of the Project, as required by the BSL SEIS Scope. This comment is outside the Scope of the BSL SEIS.

Please see the note in response to comment 1-1, which explains the BSL SEIS scoping process and how the MPCA determined which issues were included in the final Scope.

37. <u>Comments by Greg and Kathleen Anderson. Email received July 30, 2021.</u>

Comment 37-1: Commenter stated opposition to the Project.

Response: Comment noted**.**

Comment 37-2: Commenter stated the following regarding "Groundwater Contamination, "The Savage Pacer July 24th edition explains the Burnsville and Savage water supply "artificially suppresses the area's water table" temporarily avoiding inevitable contamination. Lined or not, we must prioritize and protect our water supply over the convenience and profit of exploiting an existing landfill."

Response: Please see response to comment 4-2.

Comment 37-3: Commenter stated the following regarding "Recreational and Environmental Impact", "An expansion guarantees the landfill will become the ironic "centerpiece" of the Minnesota Valley National Wildlife Refuge and destroy recreational use of these popular destinations:

- Minnesota Valley State Trail, Bloomington
- Minnesota Riverfront Park, Burnsville
- Cliff Fen Park, Burnsville
- Blackdog Park, Burnsville

An expansion will also increase the flocks of seagulls currently attracted to this food source and consequently transport pollution to bodies of water beyond the Minnesota Valley. As noted at nih.gov in The biogeochemical implications of massive gull flocks at landfills: "We conclude that mega-flocks of landfill gulls are common and widespread, and that their capacity to transport nutrients may be contributing to the eutrophication of aquatic ecosystems and water supplies."

Response: Please see response to comment 18-3

The BSL SEIS Scope does not require an analysis of the Project's potential impact on bird populations and therefore none was included in the DSEIS. This comment is beyond the Scope of the BSL SEIS.

Please see the note in response to comment 1-1, which explains the BSL SEIS scoping process and how the MPCA determined which issues were included in the final Scope.

Comment 37-4: Commenter stated the following regarding "Community Life and Tourism", "Erecting a "hill" of waste eclipsing the Hyland Hills and Buck Hill ski areas will become the unwanted signature landmark of this area with its footprint, height, and inescapable nauseous smell.

Our thriving communities, health, aesthetics, and property values will sink as the landfill expands."

Response: Please see the following responses to comments:

- Visual impacts (aesthetics) – Response to comment 6-1
- Odor – Response to comment 6-1
- Property Value – Response to comment 17-1

Comment 37-5: Commenter stated, "We implore the MPCA to stop pursuing this inertial expansion, contain the growth and impact of the landfill, and identify other strategies for long-term waste management.

Response: The MPCA did not propose the BSL landfill expansion project. The BSL proposed the Project. The MPCA is required by state rules to conduct environmental review of the Project. Please see the note in response to comment 1-1, which explains the BSL SEIS scoping process and how the MPCA determined which issues were included in the final Scope.

The overall solid waste management strategy for the Twin City Metro area is generally outside the Scope of the BSL SEIS, however, the MPCA is currently working on the development of the Metro Solid Waste Policy Plan. The primary focus of the plan is developing strategies to minimize our reliance on land disposal facilities. Public input to that process is vitally important so that the Agency can incorporate the concerns of residents in the Twin Cities Metropolitan Area. The next public comment period will be sometime in early 2022, after the initial draft is created. This will be one of the next opportunities for the public to participate in shaping solid waste policy. In addition, the Minnesota Legislature periodically brings up solid waste legislation, and therefore the public can engage their legislators to inform them of their ideas and concerns regarding solid waste management.

38. Comments by Paul Erdmann. Email received July 30, 2021.

Comment 38-1: Commenter stated, "I am opposed to the expansion of the Burnsville Sanitary Landfill as currently proposed."

Response: Comment noted.

Comment 38-2: Commenter stated, "This landfill should not be allowed to expand next to the already highly impaired Minnesota River, that many people and many funds have worked to clean up and restore for the last 20 or so years."

Response: The purpose of an EIS is to provide information for governmental units, the proposer of the project, and other persons (e.g., the public) to evaluate proposed projects that have the potential for significant environmental effects, to consider alternatives to the proposed projects, and to explore methods for reducing adverse environmental effects. The SEIS identifies potential mitigation measures for adverse environmental effects. The EIS process does not approve or deny a project. All approvals and/or denials of the BSL Project occur during the permitting phase of a project, which cannot occur until the BSL SEIS process is complete.

Comment 38-3: Commenter stated, "This proposed expansion is a direct threat to environmental and human health."

Response: The purpose of an EIS is to provide information for governmental units, the proposer of the project, and other persons (e.g., the public) to evaluate proposed projects that have the potential for significant environmental effects, to consider alternatives to the proposed projects, and to explore methods for reducing adverse environmental effects. The BSL SEIS did evaluate the potential significant impacts of the proposed BSL Project on the environment.

The purpose of an EIS is not to conduct research on public health and therefore no such analysis will be included in the BSL FSEIS.

Comment 38-4: Commenter stated, "It would also severely impact recreation and the aesthetics of the region."

Response: Please see response to comment 18-3 regarding potential impacts of the Project on recreational resources.

The BSL SEIS Scope does not require that the BSL SEIS include an evaluation of aesthetics and therefore none will be included within the BSL FSEIS. Section 6.4 of the BSL SEIS does include information regarding the visual impacts of the Project.

Comment 38-5: Commenter stated, "There must be better places and better solutions for our garbage than this proposal."

Response: The overall solid waste management strategy for the Twin City Metro area is generally outside the Scope of the BSL SEIS, however, the MPCA is currently working on the development of the Metro Solid Waste Policy Plan. The primary focus of the plan is developing strategies to minimize our reliance on land disposal facilities. Public input to that process is vitally important so that the Agency can incorporate the concerns of residents in the Twin Cities Metropolitan Area. The next public comment period will be sometime in early 2022, after the initial draft is created. This will be one of the next opportunities for the public to participate in shaping solid waste policy. In addition, the Minnesota Legislature periodically brings up solid waste legislation, and therefore the public can engage their legislators to inform them of their ideas and concerns regarding solid waste management.

39. Comments by Melanie Mesko Lee, City Manager, City of Burnsville. Email received July 30, 2021 (updated August 3, 2021) and letter received August 2, 2021.

Comment 39-1: Commenter stated, "The City of Burnsville is supportive of the capacity expansion at the landfill per the attached Findings of Facts approved by the City Council on March 5, 2019.

Response: Comment noted.

Comment 39-2: Commenter stated, "The City is also supportive of the remediation of the nearby Freeway Landfill and Freeway Dump that results with remediation to occur off-site per the attached Resolution 19-6618 Supporting Closure of Freeway Landfill. It is our understanding that a Certificate of Need (CON) is not needed for the remediation of Freeway Landfill or Freeway Dump waste to move to the BSL.

Response: The question of whether BSL will receive waste from Freeway Landfill or Freeway Dump is unknown at this time, but Attachment I of the BSL DSEIS provides the following information:

The BSL SEIS does not include an evaluation of potential impacts of transferring Freeway Landfill waste (or waste from any other source) to BSL because it was not required by the BSL SEIS Scope. The waste source analysis was not part of the Scope because the purpose of the Project is not to take waste from any specific source, but instead to increase BSL's ultimate design capacity so they can continue operation into the future, whatever the waste source.

Please see the note in response to comment 1-1, which explains the BSL SEIS scoping process and how the MPCA determined which issues were included in the final Scope.

The remediation of the Freeway Landfill and/or Freeway Dump does not require CON.

Comment 39-3: Commenter stated, "A permit allowing for the expansion of the BSL will be needed from the Minnesota Pollution Control Agency (MPCA) and this DSEIS is the environmental process necessary to consider expansion of the existing permit. The current Freeway Landfill and Freeway Dump remediation scenarios include a possibility that they be remediated off-site to BSL due to efficiencies of proximity."

Response: The Project will require several approvals, after the BSL SEIS process is complete, as indicated in section 4.0 of the DSEIS.

The BSL Project is independent from any remediation that may be completed at the Freeway Landfill and/or Freeway Dump and therefore it is not part of the BSL SEIS.

As indicated BSL DSEIS, Attachment I, during the BSL SEIS preparation process, the MPCA identified potential additional Project impacts and/or information needs that must be addressed during the course of Project permitting and decision making. These information needs are beyond what is legally required to be included in the SEIS by its Scope. Attachment I identifies potential Project issues (including air quality impacts from the option of transferring waste from Freeway Landfill to BSL) and information needs and describe how they will be addressed and resolved by the MPCA during the Project's permitting process.

Comment 39-4: Commenter stated the following, "1. The City has an adopted Sustainability Plan which can be found at the following link: Sustainability Plan. One of our main goals is to reduce greenhouse gas emissions for our own operations and for operations in the City as a whole. The introduction section of our Plan describes our goals and measured reductions of City operations to date. The DSEIS indicates an increase in greenhouse gas emissions as described by showing an increase in Total Carbon Dioxide

Equivalent comparing a build/no build scenario. We would like to see measures taken to reduce emissions to the greatest extent possible to help us meet our greenhouse gas reductions within the City.

a. What is the plan for long term mitigation of excess methane gas from the expansion, particularly following closure of the landfill and also after the post closure period?

b. Who is responsible for methane gas mitigation following formal closure of the landfill?

c. What happens to the methane gas to recovery system if it cannot accommodate increased gas from the expanded landfill?

d. What are the impacts to emissions and odor if the methane recovery to electricity plant is limited or shut down in the future?

e. The emissions information addresses direct impacts from landfilling activity itself. It is not addressing the emissions impacts from the trucks hauling at increased rates or for longer periods of time (years that the landfill will be open). What are the emissions from the trash haulers at the landfill and on Highway 13, Interstate 35W, Cliff Road West, Washburn Avenue and future interchange at Chowen Avenue?

    i. We do understand that having a local area to place waste will intrinsically reduce emissions when considering how many emissions are given off if the waste is hauled long distances. Can this potentially be quantified?

Response: The MPCA applauds the City's efforts to reduce GHG emissions and shares its interest in reducing impacts to climate changes.

With respect to the BSL SEIS -

The BSL SEIS Scope requires that the BSL SEIS provide a qualitative summary of expected GHG production from the Project. Section 6.5 of the DSEIS includes the required qualitative summary and the following additional information regarding the Project and its GHG emissions:

- General discussion of GHG pollutants and their impact on the environment
- Discussion of any applicable GHG air emission standards and required mitigation
- Identification of the Project's GHG emission sources and quantification of their GHG emissions
- Description of measures that BSL is required to take to mitigate the impacts of its GHG emissions of its Project
- Discussion of climate change and the Project

With respect to the City's comments above -

a. What is the plan for long term mitigation of excess methane gas from the expansion, particularly following closure of the landfill and also after the post closure period?

Once the landfill is closed, the owner/operator of the landfill is responsible for a minimum 20-year post-closure care period. This post-closure care includes continued management of methane gas being generated by the landfill. As the landfill nears the end of the post-closure care period, the MPCA will

evaluate the data from the landfill during the post-closure care period – including landfill gas generation rates – and may extend the post-closure care period if the data suggest that the methane gas still requires active management to prevent off-site migration. The landfill would only be allowed to exit the post-closure care period if the landfill gas generation data indicates that gas volumes are low enough to no longer require active management of the gas to prevent offsite migration.

b. Who is responsible for methane gas mitigation following formal closure of the landfill?

See above response to item a). The owner/operator of the landfill would be responsible for methane gas mitigation until the data suggests that active management is not required for this mitigation.

c. What happens to the methane gas to recovery system if it cannot accommodate increased gas from the expanded landfill?

The air quality permit will require the facility to capture at least 75% of the landfill gas emissions and operate the gas capture and control system in accordance to NSPS XXX. If the facility does not comply with these requirements, the air compliance and enforcement unit would work with the facility to correct the issue.

d. What are the impacts to emissions and odor if the methane recovery to electricity plant is limited or shut down in the future?

There will be no changes to emission or odors if the electric generating units are limited or shut down. If the electric generating units are limited or shut down, the methane will be combusted at the flare.

e. The emissions information addresses direct impacts from landfilling activity itself. It is not addressing the emissions impacts from the trucks hauling at increased rates or for longer periods of time (years that the landfill will be open). What are the emissions from the trash haulers at the landfill and on Highway 13, Interstate 35W, Cliff Road West, Washburn Avenue and future interchange at Chowen Avenue?

The Project only addresses air quality impacts of increased truck traffic within the facilities ambient air boundary. However, having a local area to place waste will intrinsically reduce emissions when considering the increased emissions if the waste is hauled long distances.

Comment 39-5: Commenter stated the following, "2. Please refer to the attached Memorandum from Brad Woznak, S.E.H. dated July 26, 2021 for additional comments to be addressed in the DSEIS."

The following are the SEH comments from the memo referenced above:

"We have reviewed the Supplemental Environmental Impact Statement (SEIS) obtained from the MPCA website for the Waste Management – Burnsville Sanitary Landfill Inc. proposed landfill expansion project. The intent of the review was to verify compliance with Burnsville City Code (Title 10, Chapter 10) and general FEMA floodplain regulations.

REVIEW
A key item to note is that the original project fill footprint for the North Development Area (NDA), from the 2002 Conditional Letter of Map Revision (CLOMR) (Attachment 1), encroached into the Minnesota

River floodplain very near the regulatory Floodway and in one location the levee fill appeared truncated at the Floodway. The revised footprint shown in the SEIS (Attachment 2) depicts the proposed levee fill footprint set back from the regulatory Floodway by approximately 700 feet. Due to this, the SEIS footprint as shown should have less hydraulic effects on the Minnesota River than demonstrated with the 2002 CLOMR alignment.

While we concur with the results that demonstrate a vegetative cover on the face of the levee provides sufficient protection from erosive forces during that of the 500-year flood event on the Minnesota River, we recommend utilizing the hydraulic model and results associated with that of the effective FEMA Flood Insurance Study to verify the Minnesota River hydraulic characteristics versus the overly simplified methodologies utilized in the SEIS. A cursory review of the effective model depicts slightly higher average channel velocities than that of the SEIS, although they still appear to be within the realm in which vegetative cover is still an effective means of erosion protection.

RECOMMENDATIONS
We recommend revising all wording in the SEIS to remove the term "floodway fringe" and replace it with "flood fringe." This may help avoid misinterpretations of "floodway" regulations versus "flood fringe" regulations and will also correspond to more typical definitions found in local, state, and federal floodplain regulations.

We recommend updating the erosion protection analysis to, at a minimum, include a discussion of how the simplified methods utilized in the SEIS compare to that given in the effective FIS and associated hydraulic modeling.

Lastly, although not specific to the proposal in the SEIS, it is recommended that the Lower Minnesota River Watershed District (LMRWD) requirements, specifically the compensatory storage requirements, be addressed. The original project was approved prior to the Lower Minnesota River Watershed District (LMRWD) current rules, and it is not clear if this will be "grandfathered in" and exempt from any additional regulations. The layout in the SEIS appears to reduce the floodplain storage footprint. The LMRWD compensatory storage requirement would essentially prohibit a development such as, because providing an equivalent volume of compensatory floodplain storage would not be feasible due to the project size. Since the proposed project falls entirely within the flood fringe area (Attachment 3), any increase in the Base Flood Elevation (BFE) is allowable under FEMA, state, and City floodplain regulations."

Response: The following three responses correspond to the three recommendations in the above comment:

1. The term "floodway fringe" will be replaced by "flood fringe" in the final SEIS.

2. The design details for levee erosion protection will be addressed during permitting, at which time a comparison of methodologies for estimating channel velocities can made. The commenter notes that the channel velocities estimated in the SEIS are similar if slightly lower than channel velocities estimated by the river flow model that supports the FEMA Flood Insurance Study for the Minnesota River in the vicinity of the BSL. The commenter also concurs with the conclusion presented in the SEIS that vegetative cover on the face of the levee provides sufficient protection from erosive forces during that of the 500-year flood event on the Minnesota River. As such, alternate analytical methods are not expected to change the

conclusions of SEIS regarding potential environmental effects relating to levee erosion.

3. The application of new rules promulgated in February 2020 by the LMRWD regarding creation of compensatory storage is a permitting issue that will be addressed following completion of environmental review.

   The NDA levee was permitted in 2005. At the time, the NDA was shown to have negligible impact on the flood elevation, and subsequent hydraulic analyses in 2010 and 2014 did not change this conclusion. Partial construction of the NDA levee began in 2007; the City of Burnsville administered permitting for work in the floodplain at that time and there was no requirement for creation of compensatory storage.

Comment 39-6: Commenter stated the following: "3. Page 79 of the DSEIS is missing references to Minnesota Valley Wildlife Refuge and Black Dog Park."

Response: Black Dog Park is outside of the BSL vicinity shown on BSL DSEIS Figure 6-11. The park is over three miles away from BSL and it was not considered a "nearby" recreational resource for the purposes of the BSL SEIS.

Portions of the "Minnesota River Valley Park" noted on page 79 and shown on BSL DSEIS Figure 6-11 are part of the Minnesota Valley National Wildlife Refuge via easements with the City of Bloomington. The Minnesota River Valley Park is therefore functionally equivalent to the Minnesota Valley National Wildlife Refuge.

Comment 39-7: Commenter stated the following: "4. Final cover for the landfill slopes is required by the City to be a wildflower mix approved by the City's Natural Resources Department."

Response: Comment noted.

Comment 39-8: Commenter stated the following: "5. What changes and/or improvements are needed at BSL to take waste from Freeway Landfill and Freeway Dump (i.e. specialized liner, additional or different type of leachate system, special cells, different monitoring equipment etc., especially because of the hazardous materials)?"

Response: The BSL SEIS does not include an analysis or information regarding changes needed at BSL to accept waste from Freeway Landfill and/or Freeway Dump because it was not required by the BSL SEIS Scope. The Scope does not require this analysis because the purpose of the Project is not to take waste from any specific source, but instead to increase BSL's ultimate design capacity so it can continue operation into the future, whatever the waste source.

Please see the note in response to comment 1-1, which explains the BSL SEIS scoping process and how the MPCA determined which issues were included in the final Scope.

In addition, the final remedial action for Freeway Landfill and Freeway Dump has not been chosen. If the selected remedial action is to dig up the waste and relocate it to another landfill (i.e., the "dig and haul" option), the permit for the landfill receiving the waste may need to be modified to accept the waste.

The final remedial action plan for a "dig and haul" option would include waste characterization procedures to determine the waste type. The landfill receiving the waste may need to modify their design or operating procedures to meet applicable standards to accept the waste type(s) determined during the waste characterization.

Comment 39-9: Commenter stated the following: "6. What are the impacts of additional waste (including hazardous waste), on the longevity, durability and operation of the leachate collection system?"

Response: The landfill is not currently permitted to accept hazardous waste and will not be permitted to accept hazardous waste in future permits. The leachate collection system will be evaluated during the permitting process for ability to manage the anticipated leachate volumes under active landfilling operations and after the landfill is closed.

Comment 39-10: Commenter stated the following: "7. The City of Burnsville remains concerned over the potential impacts to groundwater and the lack of existing landfill liners. Please accept the attached Memorandum "Burnsville Area Water Study" from Black & Veatch dated July 19, 2021 for the City's concern in this area. The City is supportive of all of the measures listed in the DSEIS regarding the permitting for groundwater impacts and that the potential for higher groundwater elevations must be considered when evaluating the permitting."

The following are the Black & Veatch comments from the memo referenced above:

"Section 3.3, page 11 of 30, Second Paragraph; Section 4.1.1, Page 12 of 30, Bulleted List; and Figure 5.
Section 3.3 indicates the Prairie du Chien-Jordan Aquifer is the "hydrogeologic unit of concern" at the landfill. Section 4.1.1 describes the different well depths corresponding to the different geologic units beneath the landfill. Figure 5 indicates there are four well locations on the eastern perimeter of the landfill. While the Prairie du Chien unit is noted as the most likely to be impacted, the alluvial unit where present may also be impacted. Monitoring wells for these units should be present at all four monitoring locations. However, it does not appear that the alluvium is being monitored at locations 231 and 247, or the Prairie du Chien is being monitored at locations 125 and 139. It will be necessary to monitor both units along the length of landfill's eastern perimeter once the quarry lake is present and groundwater flow from the southeastern portion of the landfill is toward the lake.

Section 4.6.2, Conceptual Groundwater Monitoring Plan, Page 25 of 30, First Paragraph.
Black & Veatch concurs that PFAS and 1,4-dioxane should be added to the list of monitored parameters since both are emerging contaminants of concern.

Section 4.7, Summary of Groundwater Impacts, Page 26 of 30, First Paragraph.
This paragraph states that groundwater monitoring has not identified impacts to groundwater for the monitored parameters other than high background manganese levels and sporadic VOC detections. In order to further validate this conclusion, we have the following questions regarding the groundwater monitoring program:

- Are the "100" series downgradient monitoring wells screened at an elevation near the base of the unlined area, across the water table, or at a reasonable depth to not miss shallow impacts? Depending on the thickness of the alluvium and the well depths, it may be possible to miss contamination.

- How long after flooding events is groundwater data collected? If groundwater data was collected after significant time had passed, higher concentrations may have been missed.
- Do the sporadic VOC detections correlate with flood events? This would suggest there is a leaching issue even if the detections are low.
- Has groundwater directly underneath the unlined area been analyzed? It is important to understand if there is no contamination present, or if some contaminants are leaching but become diluted once they reach the monitoring wells. This would have implications regarding leachability if the water table is allowed to be in contact with the base of the liner.

Section 4.7, Summary of Groundwater Impacts, Page 26 of 30, Second Paragraph.
The paragraph suggests that based on multiple flood events exceeding the base of the unlined area and no observed change in water quality, landfill expansion would not result in increased potential for impacts related to future water table conditions. Black & Veatch agrees with the assertion that the landfill expansion will not negatively impact groundwater conditions. However, this is based on current regulations and construction requirements. Impacts to groundwater may still be possible from the unlined area rather than the new expansion. Multiple flood events only represent temporary saturation of the unlined area. The discontinued pumping of the quarry and resulting rise in groundwater levels would allow permanent saturation of the base or higher which has the potential to induce further leaching. While the potential concentrations are unknown, continued monitoring and potential remedial actions should be in place. It appears this will be addressed by the MPCA during the solid waste permit modification process.

Appendix D, Future Permitting Needs.
A list of ten future action items is provided. Once complete, these items will provide significant controls to mitigate future groundwater and quarry lake impacts from landfill related contamination. Confirmation is requested that all future permitting needs be conducted under scenarios with elevated groundwater (i.e. quarry full water levels)."

Response: The following responses correspond to the individual comments above:

Section 3.3, page 11 of 30, Second Paragraph; Section 4.1.1, Page 12 of 30, Bulleted List; and Figure 5.
Comment noted. The monitoring well network and monitoring parameters will be evaluated during the permitting process. MPCA rule requires that facilities are protective of ground and surface water impacts.

Section 4.6.2, Conceptual Groundwater Monitoring Plan, Page 25 of 30, First Paragraph.
Comment noted.

Section 4.7, Summary of Groundwater Impacts, Page 26 of 30, First Paragraph.
The following MPCA responses correspond to the bullet points associated with this comment:

- *Downgradient Monitoring Wells* - Comment Noted. The description of the monitoring wells, including design construction, is included with the solid waste permit application and supporting documents. Assessment of the effectiveness of the monitoring network occurs annually as part of the Annual Groundwater Report submittal, as well at the time of permitting.

- Grou*ndwater Data Collection Frequency* - Under the current permit, groundwater monitoring is required annually in the spring, summer, and fall.

- *VOC Detections* - Based on the available data, there does not appear to be a correlation between flooding events and detections of VOCs.

- *Groundwater Analysis (beneath unlined waste)* - Groundwater directly beneath the unlined waste area has not been sampled or analyzed. Current rule requires that the groundwater not exceed the parameter limits in the permit at the compliance boundary. This is where groundwater impacts from landfilling are assessed and evaluated to determine if contamination is migrating beyond the extent of the property.

Section 4.7, Summary of Groundwater Impacts, Page 26 of 30, Second Paragraph.
Comment noted.

Appendix D, Future Permitting Needs.
The MPCA will conduct the appropriate evaluation based on the current conditions of the Kraemer Quarry at the time of the assessment. If the conditions of the Kraemer Quarry change, the MPCA will reassess those effects on the landfill and any current groundwater or surface water receptor.

Comment 39-11: Commenter stated the following: "8. The City will be evaluating the project further at the time the Development Stage Planned Unit Development is submitted to ensure Burnsville's Water Resources Management Plan requirements are met."

Response: Comment noted.

Comment 39-12: Commenter stated the following: "9. The City will be evaluating the project further at the time of Development Stage Planned Unit Development to ensure the Burnsville Wetlands Management Plan and all wetlands related mitigation regulations are met."

Response: Comment noted.

Comment 39-13: Commenter stated the following: "10. The information concerning the Environmental Justice Areas should be reevaluated regarding visibility and odors as they will be more prominent closer to the landfill and thus within the identified area. How can those impacts be mitigated?"

Response: The DSEIS found that the Project is not expected to cause increased odors relative to current conditions (Section 6.5.8.3) and therefore there is no potential for significant impacts or disproportionate impacts on EJ Areas of Concern for this issue. BSL is currently required and will continue to be required by its solid waste permit to mitigate odor impacts, whether the Project is implemented or not. Section 6.5.8.2 of the DSEIS provides information on odor control protocols at BSL.

The DSEIS found that the increased height of the landfill would cause it to be visible from more locations than under the currently permitted design. The photo renderings (Attachment E of DSEIS) demonstrate that the taller landfill will be visible from areas both inside and outside the identified Environmental Justice Area of Concern. The renderings have not shown that the Project will be more prominent to the EJ Area of Concern. The visual impacts of the Project could be mitigated by measures such as landscaping (screening) as well as reducing the height of the proposed landfill expansion.

40. Comments by Deborah Loon, Executive Director, Minnesota Valley Trust. Email received July 30, 2021.

Comment 40-1: Commenter stated, "It's time to move away from the practice of landfilling waste in the Minnesota River Valley, an ecologically-significant area that is important to resident and migrating wildlife and the many generations of Minnesotans (both indigenous and immigrant) that live, work and recreate in the river valley. Rather than allow for an expansion of the Burnsville Landfill, the MPCA should motivate Waste Management, Inc. and the local units of government to invest more in alternatives higher on the state's waste management hierarchy, especially recycling and composting.

The Minnesota Valley Trust, a nonprofit partner of the Minnesota Valley National Wildlife Refuge, respectfully submits comments on two significant deficiencies in the draft Supplemental EIS for the expansion of the Burnsville Landfill."

Response: The overall solid waste management strategy for the Twin City Metro area is generally outside the Scope of the BSL SEIS, however, the MPCA is currently working on the development of the Metro Solid Waste Policy Plan. The primary focus of the plan is developing strategies to minimize our reliance on land disposal facilities. Public input to that process is vitally important so that the Agency can incorporate the concerns of residents in the Twin Cities Metropolitan Area. The next public comment period will be sometime in early 2022, after the initial draft is created. This will be one of the next opportunities for the public to participate in shaping solid waste policy. In addition, the Minnesota Legislature periodically brings up solid waste legislation, and therefore the public can engage their legislators to inform them of their ideas and concerns regarding solid waste management.

Comment 40-2: Commenter stated, "1. The section on "Visual Impacts" provides a cursory consideration of the actual impacts at best. The DSEIS does not really analyze the impact of constructing a mountain of trash over four decades in a river valley.

First, the DSEIS does not consider whether such an unnatural mountain should even exist in the river valley. It will be much taller than the river bluffs, thereby dominating and forever altering the natural landscape.

Second, the DSEIS does not consider the visual impact of the process of building the mountain. Large trucks and heavy equipment will operate for decades on the trash mountain as it grows. Open faces of trash will be visible from great distances. The renderings provided in the DSEIS suggest a serene grassy mound, rather than what it will be -- an active industrial operation with heavy equipment and trash visible to everyone from a long distance."

Response: The BSL SEIS Scope required that the SEIS illustrate potential visual impacts of the Project using renderings from specific key locations with images of BSL at complete buildout elevation, including some views with leaf cover and some without. Section 6.4.1 of the DSEIS provides an explanation of the photo renderings and Attachment E provides the actual renderings, as required by the Scope. All requirements of the Scope regarding the Project's impacts are included within the DSEIS. The question of whether or not the Project should be located within the Minnesota River Valley is outside the Scope of the BSL SEIS.

Please see the note in response to comment 1-1, which explains the BSL SEIS scoping process and how the MPCA determined which issues were included in the final Scope.

Comment 40-3: Commenter stated, "2. The "Alternatives" analysis (and eventual decision on permit) should assume at least the 75% recycling mandate and incorporate organics composting. The waste composition study of waste going into the landfill in December 2019 found that 69% could be recovered (49% composted and 20% recycled). Organics composting is not a new concept; it is being done in significant parts of the metro area, including the City of Minneapolis. The DSEIS ignores the fact that expansion of organics composting is a significant opportunity to recover waste and reduce the need for landfilling."

Response: With respect to recycling, the BSL SEIS Scope requires the following to be included in the BSL SEIS:

1. "The alternatives section will outline the economic and sociological impacts on the proposed landfill and community if the legislative goals to recycle 75% of the waste stream generated in the metropolitan area are achieved and if the landfill complies with the legislative restriction on the disposal of unprocessed MMSW generated in the metropolitan area."

2. "The SEIS will evaluate a smaller landfill with lower height and capacity. The SEIS will examine the results of preprocessing waste to remove material banned from MMSW and to recover recyclable materials. The SEIS will estimate the remaining waste to be landfilled and the resulting size and height of the landfill after 41 years of operation."

The BSL DSEIS provides all of the Scope-required recycling information in section 7.1.1.

The Scope does not require a specific analysis of organics composting in the alternatives analysis and therefore none will be included in the FSEIS.

Please see the note in response to comment 1-1, which explains the BSL SEIS scoping process and how the MPCA determined which issues were included in the final Scope.

The MPCA has considered the growth of organics programs in the Metro area. While much material can still be recovered from the waste stream, it is clear that the Metro Area will not meet the 75% goal in the near future, without significant investments and changes to the system. One limiting factor is that all compost facilities that currently serve the Metro Area are operating at full capacity and additional capacity will be needed in order to successfully divert more organic material from landfills.

Comment 40-4: Commenter stated, "The fact that we comment on these two sections of the DSEIS is not intended to imply that we find the balance of the document sufficient. We have significant concerns about surface water, groundwater and air quality impacts of the landfill, but have not retained the technical capacity to comment on those and other sections.

Once the Burnsville Landfill starts growing and becomes a mountain of trash, it will be a permanent scar on the Minnesota River Valley. A landfill is not like a building that can be demolished or moved at will. It is a lasting testament to a society that prefers to take the easiest path and push environmental challenges onto future generations."

Response: Comment noted.

41. Comments by Steven C. Mielke, Director, Physical Development Division, Dakota County. Email received July 30, 2021.

Comment 41-1: Commenter stated the following regarding "Groundwater-Related Uncertainties":

"The Burnsville Sanitary Landfill (BSL), Kraemer Quarry water supply, and future Quarry lake are within the Burnsville Drinking Water Protection Overlay District. They are subject to a number of groundwater-related uncertainties that are generally independent of the proposed BSL expansion, but which should be monitored closely in coming years. These uncertainties are specifically related to 1) how the future cessation of mining in the Kraemer Quarry may impact groundwater flow patterns and the contact between groundwater and waste, and 2) PFAS and 1,4 dioxane.

Groundwater Assessment 6.1.3.3, pp. 27-30 - The site was initially developed by Ed Kraemer & Sons and was operated as on open dump between 1962 and 1971. In 1971 development plans were prepared, and between 1971 and approximately 1992 the site accepted MMSW in unlined waste cells. The unlined waste cells include an area of approximately 98.4 acres. The base grade elevation (bottom of the waste) of the unlined landfill area has been estimated at 700 feet based on pre-development mapping, initial development plans, and site investigation reports. Water table measurements indicate that the water table periodically exceeds an elevation of 700 feet in the unlined area during flood events. Based on BSL groundwater monitoring data, there have not been notable impacts to groundwater quality observed following flood events. If the quarry dewatering sump were simply turned off, it is likely that the water level in the quarry would rise to an elevation of 700 feet, or more, depending on the future configuration of the existing flood protection dike and numerous other factors.

Periodic flood events intruding into the unlined wastes areas are not equal or similar to the eventual saturation of unknown wastes in the unlined portion of the landfill. This section of the landfill should be fully evaluated and the potential contaminants of concern be identified and quantified and a mitigation plan prepared before exceedances are identified in groundwater or surface water. The additional waste added from this expansion project over the top of the unlined portion will significantly complicate investigation and mitigation in the future."

Response: Please see response to comment 4-2.

Comment 41-2: Commenter stated the following regarding "Kraemer Quarry":

"The potential changes to groundwater flow patterns below BSL from changes in dewatering at Kraemer Quarry are identified in 1.1.2.1 Groundwater Impacts (p.3) and other places in the EIS. Dakota County recommends ongoing monitoring of groundwater levels and potential groundwater contaminants at that time, so any problems can be identified and addressed promptly."

Response: The BSL solid waste permitting process will consider risks from potential groundwater contamination to receptors, including drinking water. For example, in permitting, the MPCA will consider locations of waste, groundwater flow direction, and locations of receptors (such as drinking water).

As indicated in section 6.1.3.6 of the DSEIS, as part of the solid waste permitting process, the MPCA will require that BSL update its groundwater Sampling and Analysis Plan to include current standard parameters and monitoring limits based on Minnesota Department of Health (MDH) HRLs or similar

health standards, as appropriate, and evaluate additional contaminants of concern for potential inclusion into BSL's permit. The specific contaminants of concern that will be evaluated during the permitting process may include per- and polyfluoroalkyl substances (PFAS) and 1,4-dioxane. Additional permitting requirements include identifying contingency actions to be taken if groundwater impacts are detected, as well as establishment of financial assurance that will provide funding for contingency actions and/or mitigation activities.

Comment 41-3: Commenter stated the following regarding "PFAS and 1,4 dioxane":

Dakota County recommends that BSL's updated Sampling and Analysis Plan (Plan) include more frequent sampling (such as quarterly) of leachate and groundwater for PFAS and 1,4 dioxane. The Plan should be updated frequently in response to anticipated changes in laboratory analytical methods for PFAS that will allow detection of more compounds at lower detection levels and to anticipated changes and additions to MDH drinking water guidelines.
MPCA staff, during their June 3, 2021, on-line "PFAS Monitoring Plan Kick-off Event," reported their monitoring shows, in general, the presence and concentrations of "long-chain PFAS" (such as PFOS and PFOA) are decreasing but "short-chain PFAS" (PFAS compounds taking the place of PFOS and PFOA) are increasing. As a result, it should be assumed that PFAS compounds should be viewed as "forever chemicals," indeed.

Specific to BSL, PFAS are identified under 1.1.2.1 Groundwater Impacts (p.3) and 1.3 (p. 11), Issues To Be Resolved (p. 11). Under 6.1.3.1 Groundwater Quality and Areas of Impact in Vicinity of the Project (p. 26), the EIS reports that MPCA sampled monitoring wells at BSL in 2007 and 2008. PFAS were detected in all four of the monitoring wells sampled, which included three wells down-gradient and one well up-gradient from the landfill. The PFAS concentrations were below the ILs [intervention limits] used at the time the data were collected, but PFAS standards have become more stringent and the concentrations would be above current drinking water standards.

Attachment I, "Future Permitting Needs Document," (second page) says that BSL will be required to update its Sampling and Analysis Plan. Dakota County supports this in light of the considerations described above."

Response: Please see response to comment 4-2.

Comment 41-4: Commenter stated the following regarding "Other Issues": "Manganese -- 1.1.2.1 Groundwater Impacts (p.3). Dakota County concurs that the elevated manganese detected in BSL groundwater is likely naturally occurring."

Response: Comment noted.

Comment 41-5: Commenter stated the following regarding "Stormwater/Surface water":

"The project will expand an existing sedimentation pond and have an erosion control plan in place. According to the SEIS, runoff will only increase for a 500-year event due to the increased steepness of the slopes, but it appears that it will decrease or improve for all smaller events.

Surface water impacts – 6.2 Surface Water Impacts (pp. 33-39). Dakota County recommends the SEIS address the potential for more intense precipitation events in the future."

Response: During the BSL SEIS scoping process, the MPCA received public comments requesting that the SEIS include information on more intense precipitation events and their impacts on the Project. In response, the MPCA added to the BSL SEIS Scope, a requirement that the BSL SEIS include information regarding impacts of a 500-year storm event.

Comment 41-6: Commenter stated the following regarding "Air Quality":

"GHGs and Climate Change – 1.1.2.5, p. 7 - Currently, it is not possible to model the physical impacts of global or regional climate change, such as storm frequency/intensity or temperature increases caused by incremental GHG emissions. In other words, while solid waste landfills contribute to climate change generally, existing scientific tools do not allow the MPCA to quantify the specific impacts of a particular project on climate change.

Dakota County Environmental Resources staff recommends the SEIS address the potential for more evaluation or reassessment of the impacts of GHGs and climate change as the scientific tools advance and information changes in the future."

Response: The purpose of the BSL SEIS is to investigate the Project's potential for significant environmental effects, based on available information as required by the BSL SEIS Scope. The request to have the BSL SEIS address the potential for more evaluation or reassessment of the impacts of GHGs and climate change as the scientific tools advance and information changes in the future is beyond the Scope of the BSL SEIS. However, the MPCA will continue to revise its GHG and climate change analyses in the environmental review process as more information and tools become available to do so.

Please see the note in response to comment 1-1, which explains the BSL SEIS scoping process and how the MPCA determined which issues were included in the final Scope.

Comment 41-7: Commenter stated the following regarding "Future permitting needs":

"The MPCA noted future impacts or information needs that were beyond what was legally required in the SEIS scoping decision document, this includes the following:

Air quality impacts
BSL needs an air quality permit amendment for the Project because it will increase potential air emissions from the landfill. In addition to the expansion Project, the application also indicated that BSL is considering pursuing the option of transferring waste from the nearby Freeway Landfill to its landfill. BSL's application also indicated that this option would include construction of a new unpaved road between the two landfills in order for trucks to haul waste between the two facilities.
The BSL SEIS does not include an evaluation of potential impacts of transferring Freeway Landfill waste (or waste from any other source) to BSL because it was not required by the BSL SEIS Scope. The waste source analysis was not part of the Scope because the purpose of the Project is not to take waste from any specific source, but instead to increase BSL's ultimate design capacity so they can continue operation into the future, whatever the waste source. The MPCA will therefore require BSL to conduct an appropriate analysis of the air quality impacts (e.g., air dispersion modeling) of the unpaved road option. This analysis will be done as part of BSL's air quality permitting process (i.e., not part of the BSL SEIS process).

Water quality impacts
BSL needs a permit modification for the Project because it will increase the facility's solid waste disposal capacity.

The following items will be addressed by the MPCA during the solid waste permit modification process required for BSL's expansion Project:

1. Establishment of a compliance boundary based on drinking water standards where water (surface or ground) is used as drinking water, such as the Minnesota River;
2. The MPCA will require, during Project permitting, that BSL update its groundwater Sampling and Analysis Plan to include current standard parameters, monitoring limits based on Health Risk Limits or equivalent health standard, and additional contaminants of concern based on information obtained from groundwater monitoring in the Project area. The specific contaminants of concern that will be evaluated during the permitting process for potential inclusion into BSL's permit include PFAS and 1, 4 dioxane;
3. An updated Environmental Monitoring Plan that details the ground water monitoring network at the facility and any additional wells needed in order to identify potential contaminant release;
4. A Geotechnical stability analysis for in-place waste based on the increased mass and height of the proposed expansion including an analysis of any leachate held within the in-place waste;
5. An analysis of in-situ leachate in the unlined waste cell to identify potential contaminates that could be introduced to groundwater that could threaten human health and the environment;
6. A Contingency Action Plan that details actions the Project proposer must undertake in the event groundwater contamination or other potential environmental impacts are detected at the facility;
7. Detailed Technical Specifications that describe construction methods and materials that will be used to establish environmental controls;
8. A Financial Assurance Plan that will establish a mechanism to provide funding in the event of any necessary future contamination clean-up or operational changes at the facility;
9. A Closure Plan that specifies steps that will be taken to close out the facility in an environmentally protective way after the facility reaches its final capacity; and
10. A Post-Closure Care Plan that describes maintenance and environmental controls that will provide long-term environmental protection at the facility after it closes.

Dakota County Environmental Resources staff agrees with the identified future permitting needs and recommends consideration of our comments presented above relating to groundwater related uncertainties, Kraemer quarry, groundwater flow, groundwater levels and waste interface, emerging COC (PFAS and 1, 4-dioxane), and climate change."

Response: Comment noted.

Comment 41-8: Commenter stated the following regarding "Parks and Greenways", "The proposed build-out and end use of the landfill is 41 years. The EAW recognizes the future Minnesota River Greenway as part of a final end use plan for open space and recreation. Will there be an opportunity to develop the continuation of the Minnesota River Greenway through/around the landfill area prior to final buildout? Can trail be constructed on the levy and utilized as a trail in the next 10 years?"

Response: The future development plan for the Minnesota River Greenway is unknown at this time. The area is controlled by the city of Burnsville through a recorded easement. Any development within this

area would need to be coordinated between the city of Burnsville and BSL. The top of the levee will not be available for use as a trail because it will be needed for landfill access and operations.

42. Comments by Mary Jo Exley. Email received July 30, 2021.

Comment 42-1: Commenter stated, "I am against allowing Burnsville to increase the height of the current landfill. It will be an eyesore on the view out my windiw."

Response: Comment noted. Please see section 6.4 of the BSL SEIS for detailed information regarding the potential visual impacts of the Project.

Comment 42-2: Commenter stated, "I am concerned about the flame to burn off excess gas both because of pollution and the smell."

Response: Section 6.5 of the DSEIS contains findings regarding the Project's air quality impacts (including from landfill gas and flares), including potential mitigation measures. The BSL DSEIS found that BSL's Project is predicted to meet all applicable Minnesota Ambient Air Quality Standards (MAAQS) and National Ambient Air Quality Standards (NAAQS).

Please see the response to comment 6-1 regarding odors.

Comment 42-3: Commenter stated, "I also thunk its irresponsible to have a landfill on the edge of the Minnesota River Valley. It could contaminate ground water and will mist likely cause the death of lots a birds that migrate through the Valley as well as thise that live here."

Response: Please see response to comment 4-2 regarding the Project's potential impacts to groundwater.

The BSL SEIS Scope did not include a requirement for an evaluation of air emissions impacts on birds, but the BSL SEIS did find that the Project would meet all applicable ambient air quality standards that are set to be protective of human health.

Comment 42-4: Commenter stated, "I understand the need for a landfill, but if ElkRiver can close it's landfill why should the excess be dumped in the river Valley."

Response: The facility in Elk River that closed was not the Elk River Landfill; it was the Great River Energy Resource Recovery Facility. When that facility decided to stop operations, it resulted in the need for more waste to go to metro area landfills. The impacts of that closure are outside the Scope of the BSL SEIS.

The overall solid waste management strategy for the Twin City Metro area is generally outside the Scope of the BSL SEIS, however, the MPCA is currently working on the development of the Metro Solid Waste Policy Plan. The primary focus of the plan is developing strategies to minimize our reliance on land disposal facilities. Public input to that process is vitally important so that the Agency can incorporate the concerns of residents in the Twin Cities Metropolitan Area. The next public comment period will be sometime in early 2022, after the initial draft is created. This will be one of the next opportunities for the public to participate in shaping solid waste policy. In addition, the Minnesota Legislature periodically

brings up solid waste legislation, and therefore the public can engage their legislators to inform them of their ideas and concerns regarding solid waste management.

Comment 42-5: Commenter stated, "Lights that will be needed to slert planes will also contribute to light pollution. Turn off the lights, don't burn /flame the gass and don't make a mountain of trash the tallest thing on the horizon. STOP THIS NOW. FIND ANOTHER SOLUTION. SAVE THE ENVIRONMENT!!!!"

Response: The FAA has made no conclusions as to whether BSL could have an impact on navigable airspace or whether any mitigation, such as landfill lighting will be required. Please see response to comment 9-4.

43. Comments by Jim Cox. Email received July 30, 2021.

Comment 43-1: Commenter stated, "Im writing in hopes that the MPCA will not allow the expansion of the Burnsville Landfill."

Response: The purpose of an EIS is to provide information for governmental units, the proposer of the project, and other persons (e.g., the public) to evaluate proposed projects that have the potential for significant environmental effects, to consider alternatives to the proposed projects, and to explore methods for reducing adverse environmental effects. The SEIS identifies potential mitigation measures for adverse environmental effects. The EIS process does not approve or deny a project. All approvals and/or denials of the BSL Project occur during the permitting phase of a project, which cannot occur until the BSL SEIS process is complete.

Comment 43-2: Commenter stated, "The is already too large and already a possible threat to our drinking water."

Response: Please see response to comment 4-2 regarding drinking water.

Comment 43-3: Commenter stated, "The landfill threatens the Minnesota Vally National Wildlife Refuge, and two of the states major rivers."

Response: Please see response to comment 18-3 for information on BSL SEIS findings regarding impacts to nearby recreational resources.

Please see response to comment 4-2 for information on BSL SEIS findings regarding impacts to surface water.

Comment 43-4: Commenter stated, "This is not to mention, the odor, noise, and runaway trash that the landfill produces."

Response: Please see response to comment 6-1 regarding odor, noise, and litter.

Comment 43-5: Commenter stated, "Please do not allow this new expansion"

Response: Please see response to comment 43-1.

44. Comments by Michael Yung. Email received July 30, 2021.

Comment 44-1: Commenter stated the following regarding "Blowing debris":

"Between 1995 and 2006, I drove on Pena Boulevard by *Tower Landfill* (which is located 1 mile west of Denver International Airport) on average a couple of times every other week. What I noticed while driving by was the amount of wind-blown debris lofted above the landfill and gulls and other birds circling the area. This occurred even though the landfill uses large water tankers to constantly spray down the landfill.

An observation of mine (non-scientific) regarding the areas of the Burnsville Landfill and Tower Landfill: living in Minnesota and Colorado, I can tell you that on any given day, it is certainly windier in MN than in CO for these two areas. Doubt that statement? Then try bicycling in those two locations and total the curse words you throw at the prevailing headwinds.

As you build up in height for this proposed landfill, you will also encounter greater velocity of wind speed, further increasing wind-blown debris.

I would think that odors from the landfill will also be able to be smelled further downwind as more of this material will be exposed to the wind then when digging a pit. I sure as heck would not want to have a business or home downwind of this towering landfill.

If the proposed landfill does go through, I guess Burnsville might eventually have bragging rights…"Our towering landfill is taller than your "Tower Landfill"."

Response: Please see response to comment 6-1.

Comment 44-2: Commenter stated the following regarding "500-Year Flood":

"Our family has lived on Crystal Lake for 61 years, and we have seen how water being redirected from surrounding neighborhoods in the Crystal Lake watershed has led to excessive high water levels on Crystal Lake. Until this past June, water had been continually flowing out of Crystal Lake since 2009. Water from Crystal Lake is routed via piping into the Minnesota River. What I am driving at is, think of all the current and future development that is along the Minnesota River Valley where water is eventually routed into the river. When we have excessive rains or periods of high rainfall, my feeling is that a 500 year flood will be much easier to achieve.

- The data that you have for a 500-year flood may be true of the past, but is that what you are projecting for the future?
- And if so, are you taking into account all of the future development surface area where the water will be routed into the Minnesota River Valley instead of being retained in its own locale? You cannot just look at Burnsville and Bloomington, you need to look both upstream and downstream as these areas will also affect flood levels in this location."

Response: Yes, the BSL DSEIS used the current definition of a 500-year storm event and a 500-year flood event from the following sources to predict potential impacts of extreme weather on the Project. The current definitions of these events were used because, how they will change in the future is unknown.

- 500-year Rainfall – National Oceanic and Atmospheric Administration (NOAA) Atlas 14, Precipitation-Frequency Atlas of the United States. Volume 8, Version 2.0. NOA. 2013.
- 500-year Flood – Flood Insurance Study, Dakota County Minnesota and Incorporated Areas. Federal Emergency Management Agency. Revised: March 2016. Flood Insurance Study Number 27037CV001B.

The DSEIS did not take into account "all of the future development surface area where the water will be routed to the Minnesota River Valley" because that is not required in the BSL SEIS Scope and would be impossible to predict.

Please see the note in response to comment 1-1, which explains the BSL SEIS scoping process and how the MPCA determined which issues were included in the final Scope.

Comment 44-3: Commenter stated the following regarding "Economic":

"From an economic standpoint, I would find it hard to believe that the City of Burnsville would be in support of such a project, if they are still in favor of the *Minnesota River Quadrant* redevelopment plan. The link below illustrates a possible concept for this project. It looks like the "18-hole championship" golf course will be built on the proposed 372 foot high landfill. This will make the former Otto's Golf course behind Buck Hill look tamed by comparison!"

Response: This comment is outside the Scope of the BSL SEIS. Please see the note in response to comment 1-1, which explains the BSL SEIS scoping process and how the MPCA determined which issues were included in the final Scope.

Comment 44-4: Commenter stated the following regarding "Minnesota River Quadrant":

"I wonder why you do not see Edina proposing a 372-foot high landfill along the Southdale development corridor! Heck, St. Paul is not even proposing such an improvement at the *Highland Bridge | Ford Site Redevelopment* project. What is it that Burnsville sees this being a benefit to the community that other cities do not?

Does Burnsville really believe that they will be able to go forward with the *Minnesota River Quadrant* redevelopment plan when your immediate next door neighbor is a tower mountain of trash?"

Response: This comment is outside the Scope of the BSL SEIS. Please see the note in response to comment 1-1, which explains the BSL SEIS scoping process and how the MPCA determined which issues were included in the final Scope.

45. Comments by Sarah Blood, Executive Director, Minnesota Valley Refuge Friends. Email received July 30, 2021.

Comment 45-1: Commenter stated, "The Minnesota Valley Refuge Friends opposes expansion of the Burnsville Sanitary Landfill, located at 2650 West Cliff Road, Burnsville, MN 55337.

In 1975, then U.S. Sen. Walter Mondale introduced S. 2097, which would establish the Minnesota Valley National Wildlife Refuge. It was the wish of Mondale and many other Minnesotans to preserve the Minnesota River Valley from further development, "assuring that our children will be able to use and enjoy this valuable, but fragile resource."

Since then, Minnesota Valley National Wildlife Refuge has grown to encompass 70 miles of the Minnesota River Valley, from Bloomington to Henderson. More than 400,000 visitors seek refuge in the refuge every year (pre-pandemic figures – which have grown five-fold).

The refuge is a premier urban wildlife refuge, one of just a handful of such gems in our country. It is a place where our Twin Cities residents can connect with nature, watch wildlife and enjoy outdoor recreational activities like hiking, canoeing and fishing. The refuge, according to the Star Tribune, "offers one of the rare spots in the Twin Cities where hikers can make it deep into the stillness of a marsh, or walk through one of the last remaining pockets of oak savannas in the state."

If approved, expansion of the Burnsville Sanitary Landfill will forever ruin the landscape of the Minnesota River Valley that was carved by glaciers. An unnatural mountain of waste will grow and become the dominant feature in this landscape. And while it grows over decades, visitors to the refuge and surrounding area will have to watch and hear truck traffic and heavy equipment moving waste around the landfill.

This is not what the creators of the refuge had envisioned. As stewards of this vision, we must protect the Minnesota Valley from such unnecessary and unwanted development.

Please protect the public's enjoyment of the Minnesota Valley National Wildlife Refuge. Deny the application for expansion of the Burnsville Sanitary Landfill."

Response: Please see the response to comments 4-6 regarding why an EIS is required for the BSL Project and 18-3 for potential impacts to recreational resources.

46. Comments by Melissa Collins, Regional Environmental Assessment Ecologist, Minnesota Department of Natural Resources. Email received July 30, 2021.

Comment 46-1: Commenter stated, "Page 3, Summary; 6.1.3 Groundwater Assessment. The DNR appreciates that the Groundwater Sampling and Analysis Plan will be updated to meet current standard parameters and monitoring limits so that additional contaminants of concern are monitored, and so that the occurrence of PFAS detected at the facility can be better monitored and understood."

Response: Comment noted.

Comment 46-2: Commenter stated, "Page 4, Water Supply Wells; 6.1.3.4 Area Water Supplies. The future of the Burnsville municipal water supply is uncertain after Kraemer Quarry ceases mining activities. Whether through continued dewatering or new municipal wells, the potential impact to calcareous fens and trout streams in the area will need to be considered when evaluating future water appropriations."

Response: Comment noted.

Comment 46-3: Commenter stated, "Page 5, 1.1.2.3 Liner/Leachate Collection; 6.1.3.2 Groundwater Flow Conditions. It is unclear in the document text if the potential impacts of 100-year and 500-year storm events were evaluated based on more conservative predicted flooding elevations after the cessation of mining at Kraemer Quarry? Continued dewatering at current levels cannot be assumed."

Response: The most current published data for prediction of the 500-year storm event and the 500-year river flooding event were utilized for the evaluations presented in the BSL DSEIS. Evaluation of the 100-year storm event and 100-year river flooding event were not included in the Scope of the BSL SEIS. It should be noted that the 500-year storm event and 500-year river flooding event are separate conditions, neither of which are influenced by the status of quarry dewatering.

The 500-year storm event is evaluated in the BSL DSEIS as a localized event at the BSL site for purposes of determining potential impacts on the landfill; this event may occur with or without a coincident river flooding event. Likewise, the 500-year river flooding event is evaluated in the BSL DSEIS as a condition present in the floodplain along the BSL site for purposes of determining potential impacts on the landfill; this event may occur with or without a coincident 500-year storm event at the BSL site.

Comment 46-4: Commenter stated, "Page 39, 6.2.2 Drainage to Wetlands and Wetland Impact Comparison. It is possible that the proposed annexation development area in Figure 3-1 might overlap with Public Waters Wetland 19-111. *Minnesota Rules* 6115.0190 Subp. 3 prohibits placement of fill to create upland areas. Please coordinate with the DNR to determine if this project will impact Public Waters."

Response: The Project proposer has indicated that it has coordinated, and will continue to coordinate with the DNR regarding the Project's implications for public waters and any permits needed. The Project Proposer attended a meeting with the DNR and City of Burnsville staff on September 19, 2019 to discuss flood plain permitting for the Project.

Comment 46-5: Commenter stated, "The DNR recommends using the most up to date river flow data to assess the flood risk of this project proposed within the floodplain of the Minnesota River, especially considering the potential rise in the surficial water table after the cessation of mining at Kraemer Quarry."

Response: River flow data used in the SEIS (in the form of HEC-RAS modeling files) was obtained by the Project proposer's engineering consultant from the DNR in January of 2020. As noted in the response to Comment 46-4 above, the Project proposer held a meeting with DNR and City of Burnsville staff on September 19, 2019 to discuss flood plain permitting for the Project. Any additional hydraulic analysis required during the flood plain permitting process will utilize the most up to date river flow data available.

Comment 46-6: Commenter stated, "No discussion or evaluation of potential impacts to wildlife, habitat, or state-listed rare features was included within this document. Given the proposal to expand the landfill into a wetland area mapped as a Minnesota Biological Survey Site of High Biodiversity Significance, wildlife impacts should be considered. Please see the attached Natural Heritage letter dated April 26, 2019 that was completed for the project regarding potential impacts to rare features. Please note that Minnesota's Endangered Species Statute (*Minnesota Statutes*, section 84.0895) and associated Rules (*Minnesota Rules*, part 6212.1800 to 6212.2300 and 6134) prohibit the take of threatened or endangered species without a permit."

Response: The 2005 BSL EIS, which is the document that the current BSL SEIS is supplementing, did include an evaluation of potential impacts to wildlife, habitat, or state-listed rare features. That evaluation included a Natural Heritage Information System (NHIS) review within the scoping EAW for the 2005 EISs. Scoping EAWs include a requirement to include a NHIS review letter.

The BSL SEIS (current supplemental EIS) does not include a discussion or evaluation of potential impacts to wildlife, habitat, state-listed rare features, or include a NHIS review because the BSL SEIS Scope does not require it and because no scoping EAW is required for a supplemental EIS.

Please see the note in response to comment 1-1, which explains the BSL SEIS scoping process and how the MPCA determined which issues were included in the final Scope.

Although it is not required to be included in the BSL SEIS, the MPCA does believe that it is in the public's best interest to be aware of the NHIS letter submitted by the commenter and therefore the NHIS letter will be included as an attachment to the BSL FSEIS.

47. Comments by Katherine Mullen. Email received July 30, 2021.

Comment 47-1: Commenter stated, "How is it possible we're having a conversation about expanding a landfill to essentially the height of a 30-story building for all to see, hear, smell and feel for miles around — adjacent to the Minnesota River Valley?"

Response: Please see response to comment 4-6.

Comment 47-2: Commenter stated, "How did it happen that a landfill was sited so close to this beautiful natural resource in the first place?"

Response: What is now BSL began as an unlined open dump in 1962. The rationale of why this site was chosen back in 1962 is beyond the Scope of the BSL SEIS.

Please see the note in response to comment 1-1, which explains the BSL SEIS scoping process and how the MPCA determined which issues were included in the final Scope.

The establishment of the facility pre-dates federal Resource Conservation and Recovery Act (RCRA) laws and regulations which contain design criteria for Municipal Solid Waste Landfills under 40 CFR Part 258, Subpart D (Subpart D) of the Code of Federal Regulations. Similarly, the Minnesota Solid Waste Rules include location restrictions for the siting of landfills, but the rules were not in place at the time the location for this landfill was chosen. Please see response to comment 7-2.

Comment 47-3: Commenter stated, "Where has our Minnesota pride gone? This proposal makes our heart sink and wonder what happened to us as a community of people who used to really care? Everyone coming across the 35W Minnesota River Bridge (some multiple times daily) will experience this landfill. It won't make people feel good about this area that many of us love, protect and care for very much."

Response: Comment noted.

Comment 47-4: Commenter stated, "We understand the "footprint" of the landfill is not "growing" as if that should make us all happy and comfortable with this whole arrangement. But that's the wrong way to look at this problem. Is the sky and air we breathe "free" space for the taking to pollute for all humans and animals around to breathe? Is that what we're saying here?"

Response: Please see response to comment 4-3.

Comment 47-5: Commenter stated, "Let's be honest about what we're proposing to give up for storing trash. Increased noise levels (yes noise will increase and carry farther the higher this goes)? Landfill dust and trash, swept by winds, ending up in the Minnesota River and in our neighborhoods and in our lungs in the case of dust? As the landfill grows, all this will happen and to pretend otherwise is naive at best.

Response: Please see the following responses to comments:

- Air Quality – Response to comment 4-3
- Noise and Litter – Response to comment 6-1

Comment 47-6: Commenter stated, "The volume of waste to be managed on this site will just grow and so will the toxicity of things collected and decaying in it. Eventually it will leak because frankly that's what most landfills eventually do, right? We all know that."

Response: Please see response to comment 4-2 related to liner and leachate collection.

Comment 47-7: Commenter stated, "The surrounding area including communities in Bloomington directly across from the Minnesota River and this landfill site will experience the many impacts as this landfill grows into the beautiful sky we seem to think is okay to despoil. Who cares, it's just sky right?!? What about us people who live here? Who cares about us?"

Response: Please see response to comment 4-6.

Comment 47-8: Commenter stated, "Reviewing the EIS and listening to all public comments from the video in July, the research on potential health concerns and property values is very weak (essentially non-existent). This is a *LARGER* vertical landfill than is typical in MN and merits much greater review and priority for the health of all people living within 5 miles of this landfill. This landfill will impact the surrounding communities and those of us living here within *2 miles as the crow flies*. You need to consider Bloomington residents more closely as some of us are closer to this landfill than even Burnsville residents."

Response: Please see the following responses to comments:

- Public Health - Response to comment 18-4.
- Property Values – Response to comment 17-1

Comment 47-9: Commenter stated, "MPCA's use of *limited available data* for comparison as the basis for making any decisions to move forward with this project is insufficient and would be irresponsible. We must look more closely at impacts on the land, air and water and how it impacts people's health over time. The relation to the Quarry and surrounding land use development plans and

unknown plans needs to be a bigger consideration given proximity to the Minnesota River and people living *within 2 miles* to this proposed site."

Response: As noted in the BSL SEIS Scope, "While the SEIS will provide a variety of information useful for permitting and approval decisions, it is not intended to provide all data and information required for these actions. Required permit applications and information for the Project will be developed and submitted independent of the SEIS."

The BSL DSEIS includes findings for all of the potentially significant Project impacts required by the Scope.

Please see the following responses to comments for more information for the following potential impacts of the Project:

- Public Health - Response to comment 18-4.
- Air Quality – Response to comment 4-3
- Groundwater (including information regarding Kraemer Quarry) – Response to comment 4-2
- Surface Water – Response to comment 4-2

The Scope does not require an investigation of land use development plans and therefore the BSL FSEIS will not include this information.

Please see the note in response to comment 1-1, which explains the BSL SEIS scoping process and how the MPCA determined which issues were included in the final Scope.

Comment 47-10: Commenter stated, "What, for instance, is our community plan in the event of high winds and tornados that generally don't impact lower landfills, but could impact a landfill of this height, sending dangerous debris around our community? As a statewide community, we need to think more carefully of what the risks are of building landfills this high. We're not seeing anything compelling that addresses the impacts of the height of this proposed landfill expansion. With a little common sense alone, it's not hard to imagine potential problems here."

Response: The BSL SEIS Scope does require an investigation of the following potentially significant Project impacts. The BSL DSEIS has considered the Project's height as follows:

- Visual impacts (aesthetics and lighting)
- Aviation Safety (birds)
- Groundwater (increased weight of a higher landfill)
- Surface Water (runoff due to higher/steeper slope)
- Air Quality/Odor (dispersion of air pollutants from a higher elevation)

However, the Scope does not require an investigation of potential impacts from high winds/tornadoes and therefore that will not be part of the BSL FSEIS.

Please see the note in response to comment 1-1, which explains the BSL SEIS scoping process and how the MPCA determined which issues were included in the final Scope.

Comment 47-11: Commenter stated, "There have to be other, better options than what's being proposed. Government has a duty to care for the people in its community and the environment, and to show more regard to everyone living here than this process and proposal reflect."

Response: The overall solid waste management strategy for the Twin City Metro area is generally outside the Scope of the BSL SEIS, however, the MPCA is currently working on the development of the Metro Solid Waste Policy Plan. The plan will direct how waste is managed in the Twin City Metro area. The primary focus of the plan is developing strategies to minimize our reliance on land disposal facilities.

Comment 47-12: Commenter stated, "We have to get creative and as a community address the growing trash problems in ways that have greater dignity and show better regard for people and the environment our lives depend on.

Someone wisely said "just because you can do it, doesn't mean you should." This sentiment surely applies in this case, so please reconsider this proposed plan before a big mistake is made, one that we will all pay for, *for many years.*

We do wish you well and have faith you will roll up your sleeves, put your heads together and find better solutions than this current proposal."

Response: Comment noted.

48. Comments by Dave Guzzi, Vice President, Minnesota Valley Refuge Friends. Email received July 30, 2021.

Comment 48-1: Commenter stated, "The Minnesota Valley Refuge Friends opposes expansion of the Burnsville Sanitary Landfill, located at 2650 West Cliff Road, Burnsville, MN 55337."

Response: Comment noted.

Comment 48-2: Commenter stated, "In 1975, then U.S. Sen. Walter Mondale introduced S. 2097, which would establish the Minnesota Valley National Wildlife Refuge. It was the wish of Mondale and many other Minnesotans to preserve the Minnesota River Valley from further development, "assuring that our children will be able to use and enjoy this valuable, but fragile resource.""

Response: Comment noted.

Comment 48-3: Commenter stated, "Since then, Minnesota Valley National Wildlife Refuge has grown to encompass 70 miles of the Minnesota River Valley, from Bloomington to Henderson. More than 400,000 visitors seek refuge in the refuge every year (pre-pandemic figures – which have grown five-fold)."

Response: Comment noted.

Comment 48-4: Commenter stated, "The refuge is a premier urban wildlife refuge, one of just a handful of such gems in our country. It is a place where our Twin Cities residents can connect with nature, watch wildlife and enjoy outdoor recreational activities like hiking, canoeing and fishing. The refuge, according to the Star Tribune, "offers one of the rare spots in the Twin Cities where hikers can make it deep into

the stillness of a marsh, or walk through one of the last remaining pockets of oak savannas in the state.""

Response: Comment noted.

Comment 48-5: Commenter stated, "If approved, expansion of the Burnsville Sanitary Landfill will forever ruin the landscape of the Minnesota River Valley that was carved by glaciers. An unnatural mountain of waste will grow and become the dominant feature in this landscape. And while it grows over decades, visitors to the refuge and surrounding area will have to watch and hear truck traffic and heavy equipment moving waste around the landfill."

Response: Comment noted.

Comment 48-6: Commenter stated, "This is not what the creators of the refuge had envisioned. As stewards of this vision, we must protect the Minnesota Valley from such unnecessary and unwanted development.

On behalf of our members and board of directors, please protect the public's enjoyment of the Minnesota Valley National Wildlife Refuge. Deny the application for expansion of the Burnsville Sanitary Landfill."

Response: The purpose of an EIS is to provide information for governmental units, the proposer of the project, and other persons (e.g., the public) to evaluate proposed projects that have the potential for significant environmental effects, to consider alternatives to the proposed projects, and to explore methods for reducing adverse environmental effects. The SEIS is not a decision document.

49. Comments by John Hickman. Email received July 30, 2021.

Comment 49-1: Commenter stated, "Erecting this mountain of garbage would be a mistake of monumental proportions. The magnitude of the visual pollution is hard to imagine, although the City of Bloomington did attempt an illustration. Please do not allow this monstrosity to blight the Minnesota River Valley."

Response: Please see response to comment 6-1 and 4-6.

50. Comments by Kim Kahlhamer. Email received July 30, 2021.

Comment 50-1: Commenter stated, "I realize everyone wants to "pass the buck" on undesirable elements near there neighborhoods, but outside of the "not in my neighborhood" aspect of things, *I am very surprised this project is even under consideration given the probable negative impact on sensitive ecosystems and the river environment, in general.* As we are learning this year, even in the land of ten thousand lakes, clean and abundant water can become scarce. We do not have the right to contaminate water and waste its precious value to many communities - other communities downstream likely will be negatively impacted by contaminated water in and from the river.

I live in Bloomington, across the river, and certainly don't want the mountain of trash in my view, but that is less important than the environmental impact of expanding this site.

Please discontinue this endeavor and seek another site in a less delicate ecosystem."

Response: Please see the response to comment 4-2 and 4-6.

51. Comments by Daniel Christensen. Email received July 31, 2021.

Comment 51-1: Commenter stated, "I would like to express my desire to have this project stopped or substantially altered.

As currently planned, the project would create an unnatural monstrosity of a landfill that will dwarf all of the surrounding environments. Drivers from all over the country passing through our metro area will be unpleasantly presented with an image resulting from poor planning now."

Response: Please see response to comment 4-6.

Comment 51-2: Commenter stated, "Additionally and more importantly, as a frequent user of the Minnesota River Valley, I fear the the long-term effects of the pollution generated by a landfill of that magnitude are potentially catastrophic to the Minnesota River and all waters downstream from there.

Yes, there may be greater costs to other solutions that will affect the customers of the waste collection vendors, but such is the result of our own individual lack of insight regarding the way our actions impact the environment."

Response: Please see response to comment 4-2.

52. Comments by Richard Hennes. Email received July 31, 2021.

Comment 52-1: Commenter stated, "We urge the MPCA to prioritize and complete the SEIS, permitting and Certificate of Need (CON) processes for the Burnsville Sanitary Landfill. The continued operation of the Burnsville Sanitary Landfill is vital to our business and we are concerned that the dwindling capacity at Burnsville Sanitary Landfill will negatively impact our business, our customers and the environment.

Transportation costs are a major factor in the collection of waste. If the Burnsville Sanitary Landfill were to close, or reduce the amount of waste accepted to lengthen the timeframe for the landfill to stay open, our business would have to seek other, more distant transfer stations or landfills to Dispose of mixed municipal solid waste (MMSW), including potential disposal facilities located in Greater Minnesota and/or out of state. This scenario would ultimately result in businesses and residents within Minnesota paying more for the collection and disposal of waste.

Increased transportation distances adversely impact the environment. Longer distances results in Increased fuel use and increased emissions.

Burnsville Sanitary Landfill is rapidly running out of its remaining capacity, have a projected remaining Capacity of 14 to18 months. We urge the MPCA to expediently move the remainder of this process forward."

Response: Comment noted.

53. Comments by Caroll Aasen Jr. Email received July 31, 2021.

Comment 53-1: Commenter stated, "As I have followed and read much on the proposed Burnsville Landfill Expansion, I can only come to the conclusion this proposal is more about money and the loss of tax revenue to the City of Burnsville, Dakota County and the State of Minnesota than what is truly good for the environment and ignores the potential for long term effect likely from contamination of our groundwater by this proposed expansion."

Response: Please see response to comment 4-2 and 4-6.

Comment 53-2: Commenter stated, "To allow the expansion of this Landfill over an unlined portion of the facility will just move the cost and size of the contamination area further down the road. IMO, this will result in a similar situation as what we have today with the Freeway Landfill."

Response: Please see response to comment 4-2 regarding groundwater findings of the DSEIS.

Comment 53-3: Commenter stated, "With my vast civil engineering experience which includes the design and creation of Landfill Expansion plans and knowledge gained from that experience, this proposal makes no sense and should be outrightly rejected."

Response: Comment noted.

Comment 53-4: Commenter stated, "As per the proposals information, to add up to 262 feet of waste and fill on top of an unlined facility will set up the residents of Burnsville, Savage, Bloomington and the State of Minnesota with an even larger area of contaminated groundwater and thus an even larger cleanup cost years down the road."

Response: Please see response to comment 4-2 regarding groundwater and unlined waste.

Comment 53-5: Commenter stated, "Even on the lined portion of the landfill, there is a potential for leakage and contamination from stress and breakage of the liner under that portion due to the weight and compression from adding 23 million cubic yards of waste piled up to 262 feet on top of the existing landfill."

Response: Please see response to comment 4-2 for response regarding the Project's liner and leachate collection system.

Section 6.1.3.5 of the BSL DSEIS contains findings related to the potential groundwater impacts from the weight of the vertical expansion of the landfill. The additional weight of the expanded landfill is not expected to significantly impact groundwater quality at the BSL. The waste in the unlined area has already undergone over 30 years of settlement.

Comment 53-6: Commenter stated, "Surely we have other options and sure they may cost more money, the MPCA and all parties involved need to look at the cost potential of removing all this waste due to the groundwater contamination possibilities."

Response: The purpose of an EIS is to provide information for governmental units, the proposer of the project, and other persons (e.g., the public) to evaluate proposed projects that have the potential for

significant environmental effects, to consider alternatives to the proposed projects, and to explore methods for reducing adverse environmental effects. Removing waste from the landfill is not part of the Project and therefore this comment is out of the Scope of the BSL SEIS.

Please see the note in response to comment 1-1, which explains the BSL SEIS scoping process and how the MPCA determined which issues were included in the final Scope.

Comment 53-7: Commenter stated, "To propose to allow this along the Minnesota River and tributary of the Mississippi River and sending potential contaminants downstream will likely result in much higher future costs from cleanup and remediation of highly likely contamination as well as costs added to filter and cleanup numerous municipal water supplies for all that use the Mississippi River as a source for Municipal Water Supplies."

Response: Please see response to comment 4-2 for the BSL DSEIS findings regarding the Project's potential impacts to surface water and drinking water supplies.

Comment 53-8: Commenter stated, "Please reject this proposal and look at alternatives. IMO, this proposal is a short term thoughtless idea that benefits the owners and government entities that receive the tax revenue in the short-term. Will Waste Management sign a waiver taking all liability for future cleanup and remediation costs, so that the Cities, County and the State will have no cost in a cleanup?"

Response: Section 7.0 of the BSL DSEIS includes findings for Project alternatives, including the "No Build" option and achievability of a smaller landfill expansion.

Financial Assurance Plans are outside the Scope of the BSL SEIS. The Project will require a solid waste permit from the MPCA. The permit will contain a financial assurance plan for landfill closure, post-closure, and a contingency action plan.

Please see the note in response to comment 1-1, which explains the BSL SEIS scoping process and how the MPCA determined which issues were included in the final Scope.

Comment 53-9: Commenter stated, "This proposal just due to the groundwater water contamination possibility should be rejected, to say nothing of the Visual Impact of creating Mount Burnsville Dump that will be visible for mile and mile across the Metropolitan Region."

Response: Please see the following responses to comments:

- Groundwater – Response to comment 4-2
- Visual Impacts – Response to comment 6-1

54. <u>Comments by Karen Shragg. Email received August 1, 2021.</u>

Comment 54-1: Commenter stated, "New laws supporting waste reduction, taxes on packaging and population stabilization are the only things to solve the ever growing garbage in our society. Expanding landfills not only has a detrimental environmental impact, it acts as a release valve for a wasteful world that needs taming from all angles. Build it and it will fill up and the what are you saddling future generations with????

The saying goes, just throw it away, but there is no away. It causes pollution which damages our health and the health of wildlife."

Response: The overall solid waste management strategy for the Twin City Metro area is generally outside the Scope of the BSL SEIS, however, the MPCA is currently working on the development of the Metro Solid Waste Policy Plan. The primary focus of the plan is developing strategies to minimize our reliance on land disposal facilities. Public input to that process is vitally important so that the Agency can incorporate the concerns of residents in the Twin Cities Metropolitan Area. The next public comment period will be sometime in early 2022, after the initial draft is created. This will be one of the next opportunities for the public to participate in shaping solid waste policy. In addition, the Minnesota Legislature periodically brings up solid waste legislation, and therefore the public can engage their legislators to inform them of their ideas and concerns regarding solid waste management.

55. Comments by Pdon and Glenda Pinkham. Email received August 1, 2021.

Comment 55-1: Commenter stated the following, "We believe having a landfill in an environmentally sensitive area was a mistake for the start.

- We understand there weren't rules at the time so a landfill was put in the floodplain of the river the state is named after.
- There are 3 solutions we currently see:
    1. The landfill be removed as proposed by MPCA for the Freeway landfill thru the Federal Superfund because of its unlined areas.
    2. The landfill be allowed to raise to it current permitted capacity and not used again.
    3. A permit be given so the landfill can have more waste.
- It appears to us it is not in the best interest of Minnesota and America to have the landfill expanded because of human and environmental damage/cost during BLF flooding all the way to the Guff of Mexico forever.
- We believe the BLF should be moved, as proposed for the Freeway landfill, because its environmentally sensitive area will continue to be this way for eternity.
    - Both the freeway landfill and part of the BLF garbage was set on the existing floodplain and therefore are not designed for flooding we will experience in the future.
    - The current SIES appears to be mainly considering the effect of floods during the time the BLF addition is being filled and covers' are not installed instead of considering the total time a landfill will be in the Minnesota river floodplain exposed to flooding."

Response: The BSL DSEIS includes an analysis of all of the potential significant environmental impacts required by the BSL SEIS Scope. The Scope does not require an analysis of removing the BSL, but section 7.0 of the BSL DSEIS does include an alternatives analysis as required by the Scope.

Please see the note in response to comment 1-1, which explains the BSL SEIS scoping process and how the MPCA determined which issues were included in the final Scope.

Please see response to comment 4-2 for a response to concerns regarding surface water and potential flooding.

Please see response to comment 44-2 for a response regarding the data used for the flood analysis.

Comment 55-2: Commenter stated the following, "We believe the SIES should be reopened to Scoping again so a 2021 SIES can truly ascertain the physical, environmental, and social impact of the addition to the BLF for the following reasons:

1. We now have a new United States President and Administration who believe that climate change is a serious problem and willingness to act on it.
2. Flood rules are currently outdated because it is hard to keep up with presidential and legislative changes.
3. More Minnesota and United States citizens believe that climate change is happening and is a serious problem.
4. New research has been done regarding the devastating effects of climate change on future Minnesota's natural resources (air, water, soils, wetlands, and wildlife).
5. George Floyd's murder has greatly increased demands for environmental justice.
5. Increasing numbers and severity of extreme weather events in Minnesota and worldwide.

If new scoping cannot currently be done, please use the comments we make within scoping in the SIES and consider putting the ones which fall outside in appendix L with the other items."

Response: Please see the note in response to comment 1-1, which explains the BSL SEIS scoping process and how the MPCA determined which issues were included in the final Scope. and why the Scope cannot be changed.

Comment 55-3: Commenter stated the following: "

1. The SIES indicates under areas of the proposed addition to the BLF there are places where there is no liner and the waste was put on top of the existing floodplain. Therefore, groundwater contamination will occur with landfill waste when the water level gets to 700 ft. The quarry pumping has kept the water well below this so there would be no expectation of contaminated leachate observed in the wells. - as has been found.
    1. If the quarry pumping was turned off what would be expected leachate concentrations found in the wells around the quarry.
    2. How would the proposed figures differer from those found around the freeway landfill causing it to be a Superfund site.
    3. The amount of water/day which has to be pumped out of the quarry per day, the amount of GHG released by this pumping, the effect of the environment of pumping, and a way for us to visualize how much water this is - ie number of Olympic swimming pools."

Response: Predictive modeling indicates the potential for the water table to be in contact with the base of the unlined area at BSL if dewatering at the neighboring Kraemer Mining and Materials quarry ceases in the future. Potential groundwater quality impacts associated with this condition are unknown at least in part due to plans for the future quarry lake being unknown. However, water level monitoring at BSL has shown the water table periodically exceeds the base elevation of the unlined area during periods of flooding on the Minnesota River, and no significant changes in groundwater quality are evident for the monitored parameters following flood events. The proposed Project does not change the depth or span of the unlined area relative to currently permitted conditions, so the Project would not result in Increased potential for impacts from the unlined area related to future water table conditions.

The BSL SEIS Scope does not require the information requested in the comment and therefore it will not be included in the BSL FSEIS. The MPCA will be requiring additional groundwater monitoring at BSL at permit reissuance, so there will be additional groundwater information available to the public in the future.

Comment 55-4: Commenter stated the following: "

2. The current SIES doesn't include any mention of the BLF being removed in the future meaning the landfill will exist for thousands of years with possible flooding damage to BLF surrounding area, Mississippi, and the Gulf of Mexico.
    - If the chances of having a 1,000-year flood is 100% certainty in 1000 years, an analysis of the effects of 1,000 year floods on structure, environment, and people down to the Gulf of Mexico be included for the proposed addition.
    - how the structure can be repaired after a 1,000-year magnitude flood.
    - Social justice considerations should be included for entire Mississippi valley and Gulf of Mexico.
    - The effect of the released leachate on the health of people, for the additional landfill content and the unlined base liner part of BLF on people and wildlife.

Response: The BSL SEIS Scope does not require the information requested in the comment and therefore it will not be included in the BSL FSEIS.

The BSL SEIS does contains the Scope-required information on potential flooding and its impacts on groundwater, surface water, and BSL's liner and leachate collection system (DSEIS sections 6.1, 6.2, and 6.3). Please also see response to comment 4-2 for more details.

Comment 55-5: Commenter stated the following: "

3. Quantification of waste height below addition
    1. We would like a better explanation of how the height value of 700 feet was determined.
    2. The possible runoff problems with water getting to lower than 700 feet.
    3. Since we are not having runoff now because of quarry pumping more bore holes should be in the study for a more complete picture of what garbage is below 700 feet."

Response: The base grade elevation (bottom of the waste) of the unlined landfill area at BSL has been estimated at 700 feet based on pre-development mapping, initial development plans, and site investigation reports.

The BSL SEIS contained all of the required surface water runoff and unlined waste information required by the BSL Scope. Please see the note in response to comment 1-1, which explains the BSL SEIS scoping process and how the MPCA determined which issues were included in the final Scope. and why the Scope cannot be changed.

Comment 55-6: Commenter stated the following: "

4. The geomembrane part of the composite liner has a half life of 400 years so please include in the SIES:
    1. What a membrane half-life means and the testing done to determine this in the main body of the SIES instead of appendix D with help from a white paper.

2. How do the membrane and the clay barrier work to keep the landfill contents from leaching and how do they function as a team in a 500 and 1,000-year flood?
3. Provide more details about how the BLF barrier will hold up to 500 and 1,000-year floods before and after the 400-year membrane life is over.
4. How can the membrane be fixed when it leaks during thousands of years?"

5. How the caps work during continued 500 and 1,000-year flood events and how they would be repaired for thousands of years?

Response: Section 6.3.3.2 of the BSL SEIS already identifies that the geomembrane component of the proposed BSL Project's liner is estimated to have a half-life of approximately 400 years and that the clay or geosynthetic barrier layer is not expected to lose effectiveness, barring a significant shift in the landfill foundation soils. Half-life means that the geomembrane is expected to lose half of its effectiveness of containing leachate every 400 years. Attachment G of the BSL DSEIS provides detailed information on the evaluation of liner degradation as well as how they function.

The BSL SEIS includes all of the Scope-required information regarding the Project's liner and leachate collection system. The BSL FSEIS will not be revised to include the additional requested information, because it is out of the Scope of the SEIS.

Comment 55-7: Commenter stated the following: "

6. The SIES doesn't include the impacts of 100, 500, and 1,000-year floods at the BLF site from heaven rain fall downstream causing BLF flooding because there is no place for the water to go."

Response: The BSL SEIS contains all of the Scope-required information relating to floods. Please see response to comment 55-4.

Comment 55-8: Commenter stated the following: "

7. Future climate change impacts need to be figured into the SIES:
    1. We recognize the problems associated with trying to predict the effects of climate change on natural disasters and therefore why it wasn't included in the scoping requests of 2019. We suggest MPCA try using new simulation tools which have recently been created. A good example of this is the En-ROADS simulator, developed by MIT, and used throughout the world by planners to make decisions concerning the future impacts of global warming.
    - The website is https://www.climateinteractive.org/tools/en-roads/
    - There is a trained En-ROADS facilitator in the area (Bill Middlecamp - billmiddlecamp@gmail.com) if MPCA would desire his help.
        1. Use this data with "Weather Attribution" https://www.worldweatherattribution.org
        2. Weather attribution is a technique to answer the question of whether and to what extent the likelihood and intensity of an observed event changed due to the anthropogenic modification of the Earth's climate using a method called "extreme event attribution".
        3. With En-ROADS or similar simulation and attribution tools, the MPCA will be able to obtain the likelihood of a 100, 500, and 1000-year floods occurring more often because of climate change.

- Here's how this might work:
    1. Currently the global temperature has increased 1 degree Celsius in the last 250 years.
    2. With the simulator set to our current global warming mitigation strategies, it projects an increase of 2 degree Celsius temperature would be reached in 2050, 3 degree Celsius temperature in 2080, and 3.6 degree Celsius temperature in 2100.
    3. The internet site, "world weather attribution" information about Hurricane Harvey can be extrapolated to estimates of frequency of flooding at the BLF site - to summarize: It was found the hurricane was 3 times more likely and had a 15% higher volume of water because of global warming of 1 degree Celsius.
    4. Therefore with 1 degree Celsius global warming in 2017 the chances of a Hurricane Harvey increased by 3 times over its 1% chance per 9,000 years.
    5. Therefore, the dice came up "heads" in 2017, Harvey occurred, and there will be a 1% chance of occurrence again within 3,000 years with current 1 degree Celsius warming.
- If we use this technique on a 500-year flood with the Minnesota River.
    1. A 500-year flood chance in 2022 would have a 0.2% chance per year because the temperature is 1 degree Celsius higher in 2022 than it has been for the past 500 years.
    2. The En-ROADS simulator forecasts a 2 degree temperature rise by 2050 so there would be a 0.6% chance per year (3 times 0.2%), by 2080 a 1.8% chance per year (3 times 0.6%), and by 2100 a 5.6% chance per year (3 times 1.8%).
- With this data MPCA can confidently include in their SIES, by using best current methods, that a 500-year flood is inevitable in the next 100 years because of the increase in probability created by the simulated global warming. We won't have to wait 500 years to experience a 500-year magnitude flood at the proposed expanded BLF.
-
- This means when a person born today is 78 they will have a 5.6% chance that year and greater chance every subsequent year, of a magnitude 500 flood.
-
- This does not stop with this persons lifetime, it continues for this persons grandchildren and their grandchildren for thousands of years.
-
- Theses continuing floods for thousands of years will contact the berm, caps, unlined base liner, and garbage put on floodplain to leak today's garbage down the Minnesota and Mississippi Rivers all the way to the Gulf of Mexico - not a pleasant future to leave for our grandchildren.
- Another reason for the MPCA believing the 500-year flood will happen more frequently is the SEIS indicates a 100 year magnitude flood has occurred 2 times in the last 70 years.
    1. This would appear to mean the likelihood of a 100 year magnitude flood should now be 35 years.
    2. MPCA should then compute the probability of when a 1,000 year flood should have occurred because of climate warming."

Response: Please see response to comment 33-6.

Comment 55-9: Commenter suggested that the following economic information be included in the BSL SEIS: "

1. In section L of the SIES:
    1. Information about how the money for continued maintenance, damage caused by BLF during flooding, the continued costs of pumping water out of the land quarry, and costs for leachate disposal, for thousands of years is not discussed.
    2. During the addition of landfill waste, now till 2062, we don't see mention of where money will come from for damage during 100, 500, and 1000-year floods."
2. Please estimate the economic costs to people over the next 1,000 years caused by raising the height of landfill 262 feet, continued operation until 2062, and the "forever chance" of leakage on:
    - Home values
    - Tourism
    - Existing businesses values
    - Number and kind of businesses moving into and out of the adjacent areas
    - Winter and summer recreation by Minnesotans.
    - Ongoing efforts to clean up the Minnesota and Mississippi Rivers.
2. What will be the costs to disadvantaged communities along the Mississippi River and Gulf of Mexico for 1,000 years of run-off?
3. Cost and plan to repair the leakage to the surrounding area, Mississippi, and Gulf of Mexico when a 1,000-year magnitude flood occurs.
    1. Please include costs to wildlife, vegetation, drinking water, and farmland irrigation for the Minnesota and Mississippi Rivers down to and including the Gulf of Mexico.
    2. The costs associated with fixing the BLF after a 1,000-year flood.
4. Costs and details on how the suggested recycling and compacting of trash, before it is landfilled in the addition will be accomplished and how the funds for this will be obtained.
5. No build alternative:
    1. Cost of Waste Management building a new 23.6 million ton landfill in a less environmentally sensitive and less populated area.
    2. The difference in costs, of maintaining the BLF over 1,000 years for the proposed addition in the flood plain of the Minnesota river and the new location.
    3. In the future if society feels the landfill should not be in the floodplain of the Minnesota River what would be the cost to remove the additional landfill waste, in today's dollars?
6. Costs associated with a flood going above the berm as the landfill is being filled with climate change impacts of the frequency of 500 and 1,000-year floods.
7. Waste managements plan to pay for upkeep, cleanup, and repair damage associated with BLF's problems, including 1,000-year floods, over the next 1000's of years to assure that the future public is financially protected against the risks of "failures" (our opinion is current citizens dumping large amounts of waste should pay).
    1. Possible examples would be insurance and/or performance bonds to be set aside by Waste Management and their amount.
8. There is no mention of having the landfill removed in the future. - therefore there will be a time in the future when the landfill addition has to withstand a 5,000 and 10,000 year magnitude floods.
    - In todays dollars what would be clean up and repair costs for the Burnsville landfill addition for 5,000 and 10,000 year floods after the landfill is capped?
15. One of the ideas which has been thrown around is to have the Freeway Landfill and Dump wastes moved to the BLF as it is cleaned out using the Superfund dollars.
    - This seems totally weird because taxpayers will pay for this now, because the landfill garbage was dumped without a liner and in future when a 1,000, 5,000, 10,000-year magnitude flood occurs without a liner at parts of BLF.

- Why not take the freeway landfill contents out of the Minnesota floodplain now rather than having it dumped in the addition's floodplain?

16. How will the addition affect the possible cost of the unlined parts of the landfill clean up efforts for the next 1,000 years? Is it really a good idea to pile the new waste on top of the old, non-protected waste?"

Response: The DSEIS contains all BSL SEIS Scope-required findings regarding the Project's economic impacts in section 7.3. The following bullets list what the Scope requires of the BSL SEIS with respect to economic impacts:

- The SEIS will assess impacts on cost to the users of the BSL including general public from waste going to other locations.
- The SEIS will also assess effects on regional and county solid waste system costs.
- Finally, the SEIS will assess the economic effects to the city of Burnsville and Dakota County and other public and private entities forecast to use the BSL resulting from the "No Build" Alternative and compare it with construction of the Project.
- The SEIS will review existing studies, reports and other information of MSW landfills within the five state area as it relates to their impact on property values within a 2-mile radius of the landfill. The review will also include information on the change in property values resulting from an expansion of an existing MSW landfill.

The Scope does not include a requirement to assess the additional economic impacts requested in this comment and therefore they will not be included in the BSL FSEIS.

Please see the note in response to comment 1-1, which explains the BSL SEIS scoping process and how the MPCA determined which issues were included in the final Scope.

Comment 55-10: Commenter suggested that the following information be included in the BSL SEIS: "

1. Greenhouse gas emissions
    1. How would a 1,000-year magnitude flood impact the amount and kind of emissions from the BLF addition during the rest of the filling of the addition and after the addition is capped.
    2. Please include the following sequestering by trees for the addition:
        1. The estimated total number of cu ft of CH4 and CO2, that will be emitted each year including the end of life value.
        2. Convert this to greenhouse gas equivalents each year until 2062 and the year 2063.
        3. Calculation of the number of acres of trees need to be planted each year to sequester these GHG emissions from 2022 till 2062 and the year 2063.
        4. During drought what will be done to insure the forests are not subject to wildfires?
        5. The costs associated with buying the land and planting the trees up until 2062.
        6. Yearly cost of maintaining these trees and adding more land and trees as the landfill continues to emit GHG for a 1,000 years?"

Response: Please see response to comment 33-6.

Comment 55-11: Commenter suggested that the following information be included in the BSL SEIS: "

2. Other gas emissions
   - How the additions burden of "other gas emissions" can be cleaned up during emission so surrounding communities would not be harmed by them.
     1. What will be the cost?
   - If not cleaned up the additions 262 height increase will allow the emissions to travel farther with the wind affecting more communities and people.
     1. Cost for the health problems to people and the environment associated with these emissions for thousands of years?
     2. Describe the "other gas emissions" which will escape in a 1,000-year magnitude flood initially and each year after for 1,000 years and the health problems and costs associated with these escaped emissions.
   - There is a plan circulating that the Freeway Landfill's dump's contents will be moved to the BLF addition.
     1. Provide information on how this will change the number and amount of other gas emissions from the addition.
     2. Should we have "the continued escape for the next 1,000 years in a populated environmentally-sensitive area or move the waste to a less populated area(s)?

Response: The BSL SEIS Scope requires that the BSL SEIS include an analysis of the potential air quality impacts of the Project. All of the Scope-required air quality impacts information can be found within section 6.5 of the SEIS.

In addition, as indicated in Attachment I of the BSL SEIS (Future Permitting Needs Document), the BSL SEIS does not include an evaluation of potential impacts of transferring Freeway Landfill waste (or waste from any other source) to BSL because it was not required by the BSL SEIS Scope. The waste source analysis was not part of the Scope because the purpose of the Project is not to take waste from any specific source, but instead to increase BSL's ultimate design capacity so they can continue operation into the future, whatever the waste source.

BSL's air quality major permit amendment application indicates that the proposed unpaved road would increase particulate matter (dust) emissions over and above the amount of emissions currently expected from the Project. The MPCA will therefore require BSL to conduct an appropriate analysis of the air quality impacts (e.g., air dispersion modeling) of the unpaved road option. This analysis will be done as part of BSL's air quality permitting process (i.e., not part of the BSL SEIS process), if and when the facility proposes to construct the unpaved road. BSL will not be permitted to pursue the unpaved road option without proper air dispersion modeling and any needed changes to its air quality permit to ensure protection of ambient air quality.

The BSL SEIS Scope does not require the SEIS to include the additional information being requested by the commenter, and therefore it will not be included within the BSL FSEIS.

Please see the note in response to comment 1-1, which explains the BSL SEIS scoping process and how the MPCA determined which issues were included in the final Scope and why it cannot be changed.

Comment 55-12: Commenter suggested that the following information be included in the BSL SEIS: "

3. Amount of particulate air pollution
    - Particulate matter from garbage and its movement by the wind blowing across the addition should be included with a daily and yearly total as the landfill height rises.
        1. The total amount of particulate matter increase released because of the 262 feet hight increase.
        2. The distances and directions of this increased wind blown material so the total effect to communities can be found.
        3. We feel this information is so important it should be in the main body of the report.
        4. Also, the particulate matter released by garbage on days the landfill is not filled should be included.
    - Based of the number of trucks and heavy equipment, what is the anticipated total amount of exhaust particulate emissions that will be emitted each year and the total till 2062?
        5. The wind speed and direction changes need to be calculated for the 262 feet high increase in the additions hight and what effects this will have on communities.
            1. It would be nice to see this information on a daily and yearly bases up to 2062 with a total accumulation.
    - Given the effects of particulate matter, what will be the health-wise impacts on the ability of people in surrounding communities to work and enjoy life and the costs associated?
4. Please provide discussion about how recycling and compaction will decrease/increase different air emissions."

Response: The BSL SEIS Scope requires that the BSL SEIS include an analysis of the potential air quality impacts of the Project. All of the Scope-required air quality impacts information can be found within section 6.5 of the SEIS (including an analysis of particulate matter emissions). The BSL SEIS determined that the Project would comply with all applicable federal and state national ambient air quality standards, including those for particulate matter emissions.

The BSL SEIS Scope does not require that the BSL SEIS include the additional information requested by the commenter and therefore it will not be included in the BSL FSEIS.

Please see the note in response to comment 1-1, which explains the BSL SEIS scoping process and how the MPCA determined which issues were included in the final Scope and why it cannot be changed.

Comment 55-13: Commenter suggested that the following information be included in the BSL SEIS: "

5. What is the BLF additions' burden in terms of waste material being blown out of the landfill at high elevations on a regular basis? - During high winds and tornados.? Costs associated with cleanup?"

Response: BSL is subject to the litter control requirements of its solid waste permit which includes measures such as spreading and compacting solid waste immediately after unloading to reduce blowing litter, application of a daily cover over the waste, utilizing litter control fences to catch blowing litter.

The BSL SEIS Scope does not require inclusion of the information requested by the commenter and therefore it will not be included in the BSL FSEIS.

Please see the note in response to comment 1-1, which explains the BSL SEIS scoping process and how the MPCA determined which issues were included in the final Scope and why it cannot be changed.

Comment 55-14: Commenter suggested that the following information be included in the BSL SEIS: "

6. Effect of lightning on maintenance of landfill during and after filling and associated costs."

Response: Section 6.4.2 of the BSL SEIS provides findings regarding the potential significant lighting impacts of the proposed Project as required by the BSL SEIS Scope.

The BSL SEIS Scope does not require inclusion of the information requested by the commenter and therefore it will not be included in the BSL FSEIS.

Please see the note in response to comment 1-1, which explains the BSL SEIS scoping process and how the MPCA determined which issues were included in the final Scope and why it cannot be changed.

Comment 55-15: Commenter suggested that the following information be included in the BSL SEIS: "

7. The additions Light pollution from the operation of BLF and blinking aircraft lights will be a problem because it will be at a much higher elevation than the surrounding land including Bloomington and other communities."

Response: Please see response to comment 9-4.

Comment 55-16: Commenter suggested that the following information be included in the BSL SEIS: "

8. What is the current cumulative noise pollution in the area, and how will that be impacted from the addition by trucks going up steep inclines and front-end graders operating at all hours from high atop the expanded BLF?"

Response: BSL is subject to the state of Minnesota's noise pollution control rule, Minn. R. Chapter 7030. The MPCA's Noise Pollution webpage provides information on how noise pollution is regulated in Minnesota.

The BSL SEIS Scope does not require inclusion of the noise pollution information requested by the commenter and therefore it will not be included in the BSL FSEIS.

Please see the note in response to comment 1-1, which explains the BSL SEIS scoping process and how the MPCA determined which issues were included in the final Scope and why it cannot be changed.

Comment 55-17: Commenter suggested that the following information be included in the BSL SEIS: "

9. Landfills are know for noxious smelling gases and the higher in elevation the gases are released the higher the wind speed. What is Waste Managements plan and the associated costs to keep the wind from blowing them off the addition for miles into surrounding communities including Bloomington."

Response: The BSL SEIS Scope requires that the BSL SEIS include the following information regarding odors, "The SEIS will review existing odor issues at the landfill and compare expected changes resulting

from the Project. The SEIS will review current odor control protocols used at the BSL and review odor control methods used at other MSW landfills in the five-state area (Minnesota, North Dakota, South Dakota, Iowa, and Wisconsin."

Section 6.5 of the BSL SEIS includes all of the Scope-required information regarding odors and the Project.

The BSL SEIS Scope does not include a requirement to assess the additional impacts requested in this comment and therefore they will not be included in the BSL FSEIS.

Please see the note in response to comment 1-1, which explains the BSL SEIS scoping process and how the MPCA determined which issues were included in the final Scope and why it cannot be changed.