CLEAN WATER LAND & LEGACY AMENDMENT

LEGACY FUND RESTORATION EVALUATION REPORT

Technical Panel Findings and Recommendations—Fiscal Year 2015



Report to the Legislature

Senate Finance Committee, Subcommittee on Legacy

House Environment, Natural Resources Policy and Finance Committee

House Legacy Funding Finance Committee

Lessard-Sams Outdoor Heritage Council

Clean Water Council

October 2016

Submitted by the Department of Natural Resources and the Board of Water and Soil Resources

MNDNR

Minnesota Board of Water & Soil Resources

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Legislative Charge

Parks and Trails Fund: M.S. 85.53, Subd. 5.
Outdoor Heritage Fund: M.S. 97A.056, Subd. 10.
Clean Water Fund: M.S. 114D.50, Subd. 6.

Estimated cost of preparing this report

(as required by Minn. Stat. 3.197)

MN DNR/BWSR

Total value of staff time:	$6,900
Production/duplication	$300
Total	$7,200

EWR_239_16

Printed on recycled paper containing 10 percent post-consumer waste and vegetable-based ink.
Minnesota-manufactured paper.

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Glendalough State Park—
combining prairie seed.

Mulcher at work—

Geneva Wildlife Management Area.

EXECUTIVE SUMMARY

When Minnesotans passed the Clean Water, Land and Legacy Amendment in 2008, they did so with high expectations. As work has moved forward throughout the state, so too have efforts to ensure that work is being performed in a way that meets both funding and restoration goals.

This *Restoration Evaluation Report* summarizes annual work to evaluate restorations, and is intended to support project managers as they work to maximize outcomes. The Department of Natural Resources (DNR), Board of Water and Soil Resources (BWSR) (agencies), and the evaluation panel (panel), have worked together with a goal of improving future project planning and supporting restorations of the highest quality.

This report summarizes 12 restoration evaluations, consisting of 32 individual project sites, and the panel recommendations based on these and 55 previous site evaluations conducted to date.

The new recommendation in the 2015 report is:

- **Improved Project Teams—**improve ecological outcomes through the use of more comprehensive interdisciplinary project teams.

Continued recommendations from previous reports (2012-2015) are:

- **Improved Documentation**
- **Improved Restoration Training**
- **Evaluation Process Improvement**
- **Improved Design Criteria for Lakeshore Projects**

Evaluation Summary

All 32 projects evaluated in this report were determined to be on track to meet their planned goals with prescribed maintenance, and have been implemented in compliance with the laws and reporting requirements for their respective Funds.

Almost all of the projects used current science-based practices. The panel considered specific instances of nonnative seed use and aspects of some stream channel designs inconsistent with current restoration science. DNR, BWSR and the implementing project managers discussed these specific practices and identified opportunities for improving future project planning to avoid inconsistencies.

EVALUATIONS SUMMARY

All 32 projects evaluated in this report were determined to be on track to meet their planned goals with prescribed maintenance, and have been implemented in compliance with the laws and reporting requirements for their respective Funds (see *Appendix B. Fund Evaluations*).

As directed in statute, projects are evaluated relative to: the law, current science and stated goals. Statute also directs the panel to determine: any problems with the implementation. A high-level summary of these criteria for Fiscal Year 2015 is shown below in Table 1. Panel comments and detailed project evaluations are provided in *Appendix D. Project Evaluations.*

Table 1. Evaluation summary for 2015 projects

	Clean Water	**Outdoor Heritage**	**Parks and Trails**
Complied With Applicable Laws	All projects	All projects	All projects
Utilized Current Science	Predominantly*	Predominantly*	All projects
Fulfilled/On Track to Meet Planned Goals	All projects	All projects	All projects
Problems with Implementation	Some Instances**	Some Instances**	None

*Current Science	Many projects utilized state of the art restoration practices in a thorough and strategic manner including site specific treatments and practices based on best restoration science. The panel identified one instance of nonnative seed use and two instances of stream channel design as being inconsistent with current restoration science. All other projects implemented practices within the range of current science based restoration practices for the given project type.
**Problems with Implementation	The majority of projects had no significant problems with implementation. Project managers predominately employed accepted controls to monitor and manage projects towards desired outcomes, in acknowledgment of typical challenges faced by restoration projects. Site assessors and the panel noted problems with the implementation of stream channel projects that may limit their effectiveness and long term durability. The panel also identified situations where overall project goals and scope would have benefited from a more diverse set of ecological expertise on the project team. Instances of nonnative seed use could also have been avoided with a broader set of ecological expertise (see recommendation *Improved Project Teams)*. Specific technical aspects of implementation are discussed in *Appendix D. Project Evaluations.*

PROJECT LOCATIONS

Projects are selected for evaluation to provide a representative sample of project habitat types and geographic areas of the state.

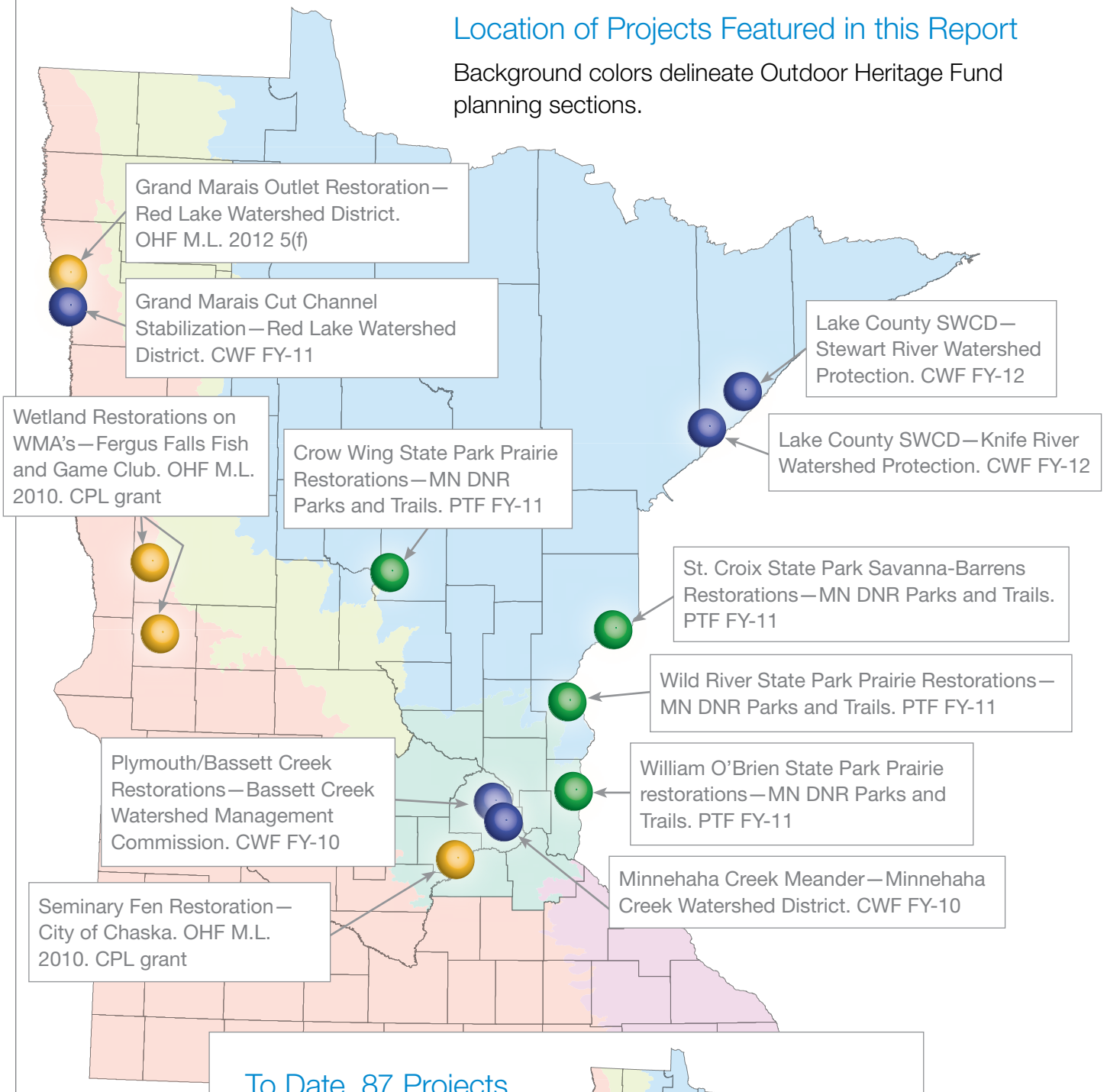
Table 2. Total projects evaluated to date (2012–2015) and total projects in evaluation pool

	Clean Water	Outdoor Heritage	Parks and Trails	All Funds
Projects sites evaluated; this report	7	19	6	32
Projects sites evaluated; reported to date	34	42	11	87
Restoration Projects in evaluation program pool. Funded M.L. 2009 to M.L. 2015.	160	128 restorations 960 enhancements	45	1293

Scott County—
Clean Water Fund grassland restoration.

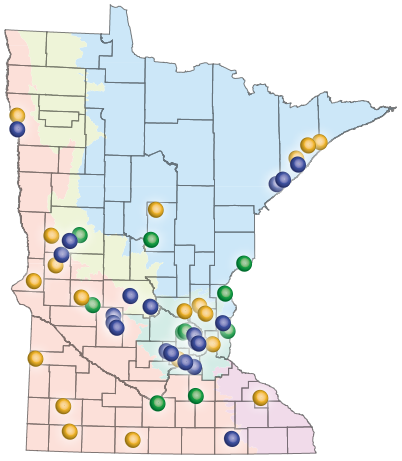
Location of Projects Featured in this Report

Background colors delineate Outdoor Heritage Fund planning sections.



To Date, 87 Projects Have Been Evaluated

Dots may represent more than one project site.



RECOMMENDATIONS

One of the most important components of restoration evaluations, and the primary purpose of this report, is to identify issues in implementation and provide guidance to project managers for how to improve restoration work in the future.

Statute for restoration evaluations directs the panel to determine:

> *…any problems with the implementation of restorations, and if necessary, recommendations on improving restorations.*

The emphasis of reporting is also directed in statute:

> *The report shall be focused on improving future restorations.*

The panel provided one new recommendation based on evaluations in this report. Updates are provided for four continuing areas for improvement identified in prior reports.

Improved Project Teams

New Recommendation

This year, the panel recommends the use of more comprehensive project teams to improve ecological outcomes and better meet funding goals. This recommendation is primarily directed towards projects of a scale, scope and complexity that warrant a multidisciplinary team. Projects such as stream restorations where multiple habitats and vegetation communities are being managed would benefit from more robust teams. Using a more multidisciplinary planning process, and bringing more sets of expertise to the table, will ideally minimize instances of nonnative seed use, improve stream channel design, expand limited project goals, and other issues that may arise. Funding agencies should support this effort by improving their screening of project teams during the Request for Proposal (RFP) process.

During review of this year's projects, and past projects, the panel noted instances where the stated project goals were too narrow, limiting potential opportunities for restoring ecological functions. Some projects did not adequately address critical ecological components in the design and/or installation. Ensuring that project teams include ecologists or agency technical experts, for example, should address some of these concerns.

The panel believes that this recommendation will support higher quality restorations resulting in increased multiple benefits by engaging project partners and accelerating "learning in practice," ultimately supporting project managers in planning and implementing projects with broader ecological goals, specifications and outcomes.

To support this recommendation, the panel will collaborate with agencies to recommend language that establishes guidance for desired project team credentials and experience for inclusion in relevant grant RFP materials.

Roles

Project Managers	• Plan and design restorations of a significant scale and/or complexity that engages multiple habitats with a multidisciplinary project team. • Engage state agency, local government units (LGU) and other technical experts early in the project planning phase.
Funding Agencies	• Identify in RFPs as appropriate: › Project team credentials and project type experience. › Ecologist/planting design consultant, stream ecologist, aquatic ecologist. › Opportunities/needs for collaborative technical review with agency technical experts (e.g. BWSR/DNR clean water specialist, DNR stream habitat specialists). • Make appropriate technical staff available to consult with project managers at key project phases: planning, design and/or installation (agency technical staff currently regularly consult with project managers).

Tracking progress:

RFPs will be monitored for inclusion of suggested language regarding project teams. The use of ecological expertise will also be tracked in the surveys of project managers directed by recommendation *Evaluation Process Improvement, Track Evaluation Recommendations.* The number of projects that effectively use this multidisciplinary project team approach will be the measure of success. As that number increases, so too should the ecological outcomes. As information is collected on how project teams are being improved, those results will be shared with the panel and updates provided in future reports.

Improved Documentation

Continued Recommendation

First addressed in Fiscal Year 2012 report

The panel believes proper documentation is critical for understanding, tracking and achieving successful restorations. To achieve a consistent base level of documentation the panel recommends that the agencies work to improve documentation through targeted trainings and grant guidance for project managers. Project managers should consistently document restoration project data in a simple, accessible format and designate one project partner to permanently store project data.

Roles

Project Managers	• Consistently document restoration project data in a simple accessible format. • Designate one project partner to permanently store project data.
Funding Agencies	• Develop checklist of key project data to be used by project manager as part of evaluation process.

Tracking progress:

As a preliminary step, a basic template and example of project data was developed for project managers in the Fiscal Year 2014 evaluation report and is available online at **Legislative Library**. Best practices in project documentation are highly recommended by the panel and will be promoted by the agencies where applicable through restoration training and technical assistance. Progress in promotion and adoption of documentation best practices will be tracked as indicated in recommendation *Evaluation Process Improvement, Track Evaluation Recommendations.* As information is collected on how project documentation is being improved, those results will be shared with the panel and updates provided in future reports.

Improved Restoration Training

Continued Recommendation

First addressed in Fiscal Year 2012 report

The panel believes continued development and implementation of training is essential to promote best practices and improve restoration practice and project outcomes. To support implementation of the recommended improvements identified in this report the agencies and panel will identify specific opportunities to develop and disseminate trainings. It is recommended that the agencies track and report progress in integrating evaluation recommendations and lessons learned into new and existing trainings.

Roles

Agencies/Panel	• 1) Compare needs identified from evaluations with existing training content. 2) Identify gaps and opportunities for targeted trainings. • Evaluation program prepares restoration practice case studies designed to support restoration technical trainings. • Integrate evaluation program findings and recommendations into existing trainings. Potential opportunities: › BWSR Academy: BWSR is committed to ensure panel recommendations are conveyed to LGUs and technical trainings supporting recommendations are included. › Restoring Minnesota: Online restoration training sponsored by the University of Minnesota. This program is designed to support foundational restoration skills and knowledge for a wide array of practitioners including professional staff, technicians and community members by sharing the best available knowledge from research and practice. › Other technical trainings sponsored by: Minnesota Erosion Control Association, Farm Bill Assistance Program, NRCS, University of MN Extension, and Wetland Delineator Certification Program.

Tracking progress:

The agencies will track how and when evaluation program guidance is used in trainings. Improvement will be tracked using project manager surveys as indicated in recommendation *Evaluation Process Improvement, Track Evaluation Recommendations.* As information is collected on how restoration training is being improved, those results will be shared with the panel and updates provided in future reports.

Evaluation Process Improvement

Continued Recommendation

First addressed in Fiscal Year 2012 report

The panel has made interrelated recommendations in previous reports to improve the evaluation process:

- Conduct follow-up (multi-year) site evaluations on a subset of the projects: further inform the accuracy of initial site assessments, use to recalibrate field assessment methods.
- Conduct project case studies: examine the process, decision making and outcomes of selected projects to best learn from challenges and successes in implementation.
- Track factors for success: monitor key components and indicators of successful projects to guide future policy and practice.
- Track evaluation recommendations: survey project managers to gauge application of recommended actions.

The panel believes the Legacy Restoration Evaluation Program should implement these strategic process improvements to better document long-term restoration outcomes and be successful in achieving its stated goal of improving future restorations. Progress made in these three areas will be tracked and presented in future reports.

Roles

Agencies/Panel	• Follow-up site evaluations: Track critical aspects of project effectiveness by selecting a subset of previously evaluated projects for follow-up evaluations. It is anticipated that two or more sites will be revisited per fund each year. Case studies: Include as appendices in future restoration evaluation reports. They may also be used to support technical assistance guidance and restoration trainings. It is anticipated that at least two in-depth case studies of projects and/or practices will be produced annually. • Track factors of success: environmental, social and operational factors that influence restoration success, including: › Landownership; public, private › Environmental extremes › Type of implementing organization › High-level plan guidance › Plan documentation › Field monitoring protocols › Project manager turn over › Shifts in state of the art restoration techniques Findings should be compiled and disseminated to help guide future restoration planning and management. • Track evaluation recommendations: Project managers and project data will be surveyed to gauge the adoption and/or use of practices recommended by the evaluation panel (improved documentation, training, lakeshore design criteria and multidisciplinary project teams).

Tracking progress:

Follow-up site evaluations: The number of revisits and key findings learned from revisits will be tracked. Two to five projects will be revisited for each fund annually.

Case studies: Document the number of cases studies produced each year. At least two case studies should be completed each year beginning in 2016.

Track factors of success: Conduct follow up surveys of evaluated projects completed. Survey results, trends and patterns will be presented in annual evaluation reports. Findings of an initial survey of factors influencing Legacy restoration projects is anticipated to be presented in 2017, based on findings from the first five years of the evaluation program. Within ten years, trends and indicators of project success and areas for improvement should emerge as the sample of evaluated projects becomes larger.

Track evaluation recommendations: Survey project managers and associated project data of evaluated projects to gauge the adoption and/or use of recommended practices to see if recommendations have been implemented and to what additional actions may be needed. As information is collected on how project documentation is being improved, those results will be shared with the panel and updates provided in future reports.

Improved Design Criteria for Lakeshore Projects

Continued Recommendation
First appearing in Fiscal Year 2014 report

The panel recommends that project managers establish consistent minimum design criteria as guidance for lakeshore projects if not already established. These improved criteria will allow project managers to more effectively screen projects to ensure they provide a base level of environmental benefit that aligns with funding goals.

This recommendation applies to all Legacy Funds where lakeshore projects are involved. Deficiencies observed in projects reviewed in previous reports that support this recommendation include:

- Insufficient scale: shoreline buffer narrower then recommended landward width based on current science; the panel felt this did not provide adequate scale to fully benefit project goals.
- Inadequate site preparation and maintenance: desirable vegetation removal, insufficient treatment of invasive vegetation.
- Less than optimum siting: lack of connection to or interception of upland runoff due to topographic constraints; concurrent placement of impervious surface in the shoreline zone.

This recommendation addresses the need for a consistent beneficial level of performance for publicly funded projects. While these lakeshore projects are primarily minor in size and scope, voluntary best practice implementations, and represent a small portion of the total restoration work, this is a specific area for improvement where viable solutions are available.

Shoreland projects that have achieved greater benefits shared the following attributes:

- Designed at a scale to provide significant water quality and habitat benefits based on current science.
- Sited based on a clear need (gully erosion, bank erosion) and/or strategically positioned in the landscape (to intercept an appreciable area of upland runoff with a disturbed land cover type, several times larger than the property or project site).

The panel identified existing local government and state programs that have effectively used minimum design criteria and achieved successful outcomes and abundant participation (examples on following page). Implementation of minimum criteria, such as a native vegetation buffer of at least 75 percent of the shoreline length and at least 25 feet landward of the ordinary high water level, provide a more appropriate example for promoting social adoption of natural shoreline practices and a greater level of support for achieving larger restoration goals. Bioengineering practices that rely primarily on vegetation and natural materials for shoreline stabilization should also be considered first priority techniques whenever practicable.

Design criteria should be established by project managers to accommodate local, regional and site conditions and specific project types, such as upland runoff buffer or shoreline habitat restorations. Adaptability to specific conditions and constraints is vital to ensuring effective guidance.

Role specific recommendations

Project Managers	• Establish minimum design criteria based on programmatic goals and local conditions; integrate with existing direction for shoreline restoration from total maximum daily load (TMDL) or local water plan. Use guidance from state agencies and area technical assistance staff to identify appropriate criteria. • Specify minimum design criteria in lakeshore best management practices (BMP) agreements (between LGU project managers and landowners). • Promote the value/technical need for established criteria. • Use improved criteria when recruiting and screening potential projects.

Tracking progress:

The use of design criteria will be tracked through surveys of project managers directed by recommendation *Evaluation Process Improvement, Track Evaluation Recommendations.* As further evaluations are conducted, the number of projects using consistent criteria should increase. As information is collected on how lakeshore design criteria is being improved, those results will be shared with the panel and updates provided in future reports.

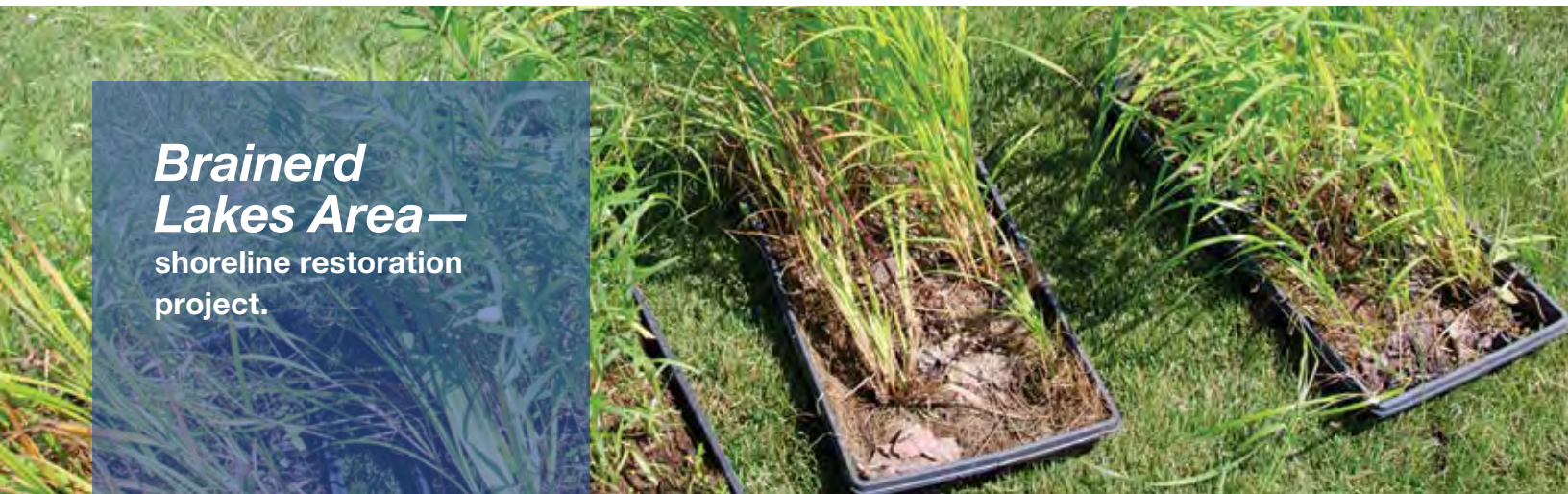
The following are examples of design criteria integrated into organizational policy that have proved viable and successful for ensuring best practice implementation.

Stearns County Soil and Water Conservation Districts (SWCD) Board—Policy for Shoreland Projects

All shoreland restoration projects are required to have a native buffer in existence or planted as part of an approved Stearns County SWCD plan. The native buffer on the property shall require at least 75% of the shoreline length, with a maximum traffic area of no more than 25 feet along the shoreline. Properties in public and commercial ownership can be given exception to this policy, but will have to adhere to having a 75% buffer of native vegetation on the length of shoreline owned. Public and commercial properties will have to provide a needs and suitability request for a larger traffic area to the SWCD Board. Traffic area is defined as any area not containing a majority of native vegetation, ie: mowed grass, areas with retaining walls, steps, paths, buildings, other topographic alterations or man made structures. The existing and new buffer areas shall extend at least 25 feet landward of the ordinary high water level of the lake/river or to the top of the nearest slope (12% steepness or more) whichever is greater. This shall be applied to the watercourse of all properties where projects are proposed and implemented.

Minnesota DNR, Fish and Wildlife Division, Aquatic Habitat Program—Shoreland Grant Application Information

Projects on private properties will have at least 75% of the frontage restored with an adjacent buffer zone that is at least 25 feet deep/wide. The focus of these projects must be on reestablishing habitat for fish and wildlife using locally native riparian and aquatic vegetation, wood and natural structures to provide in lake habitat, and/or fluvial geomorphology based restoration in streams. Projects that include the use of rock riprap instead of bioengineering for stabilization or permanent wave breaks will not be funded. Funds can be used for materials needed to reestablish aquatic habitat including: native trees, shrubs, plants and seeds, temporary biodegradable toe protection and erosion control fabric, mulch, herbicide to treat invasive species on site, labor to design, install and maintain project, labor to implement appropriately designed stream and river restorations, temporary biodegradable wave breaks and temporary fencing for keeping out foot traffic or herbivores (geese/muskrats) from the site. Grant may be terminated if projects are implemented different from the approved plan, without prior approval by the DNR Authorized Representative.



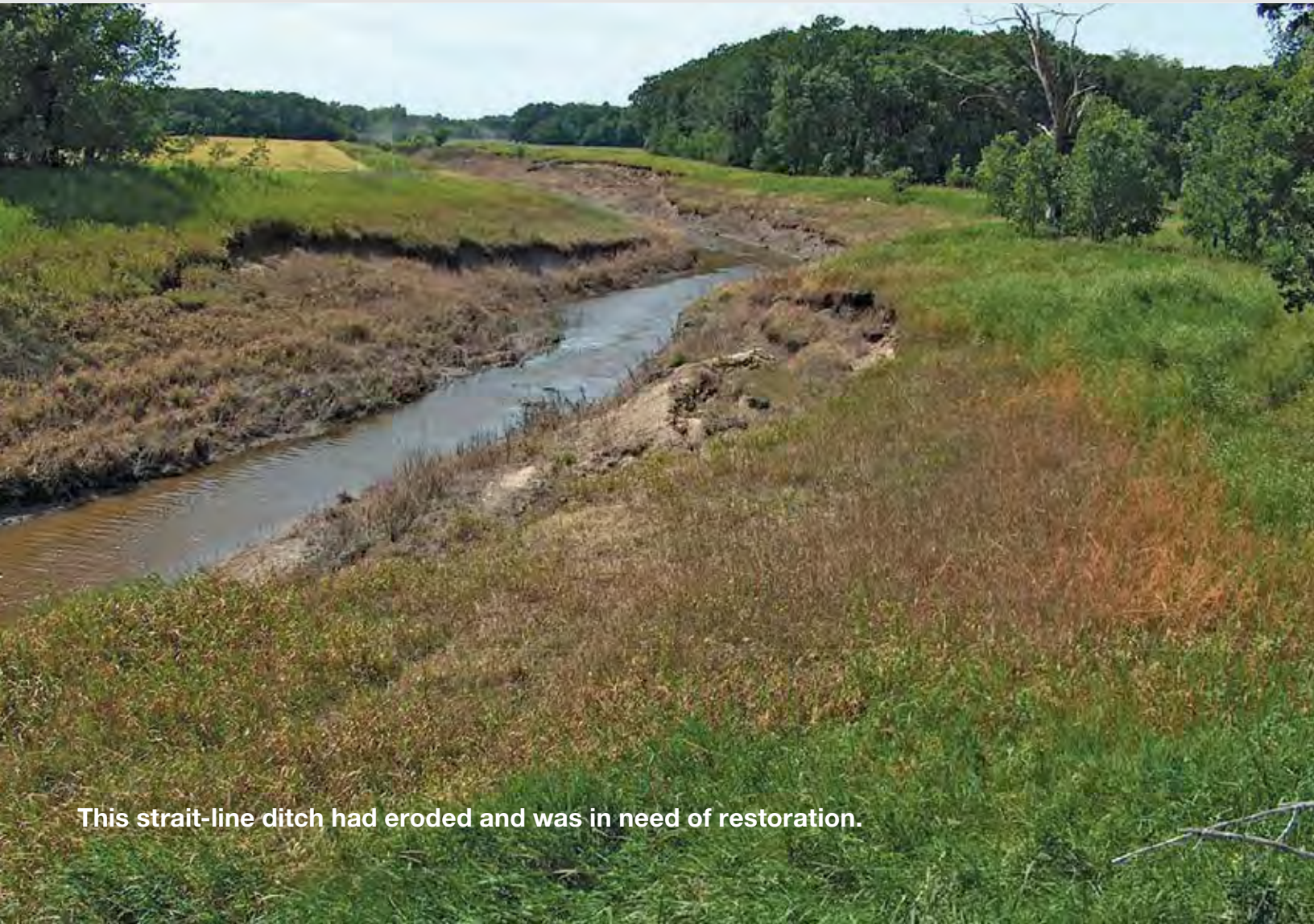
Brainerd Lakes Area—
shoreline restoration project.

PROJECT PROFILE

Outdoor Heritage Fund
and Clean Water Fund

Grand Marais Outlet and Cut Channel Restoration—Restoring Habitat and Water Quality in Grand Marais Creek

In the early 1900s a 1¼-mile ditch channel was created to improve drainage from Grand Marais Creek to the Red River. This alteration cut off flow to the lower 6 miles of the natural channel. Over the 20th century the straight-line ditch progressively eroded to a steep channel with unstable banks which deposited up to 700 tons of sediment into the Red River annually. The steep ditch channel also created a barrier for fish moving from the Red River to spawn.

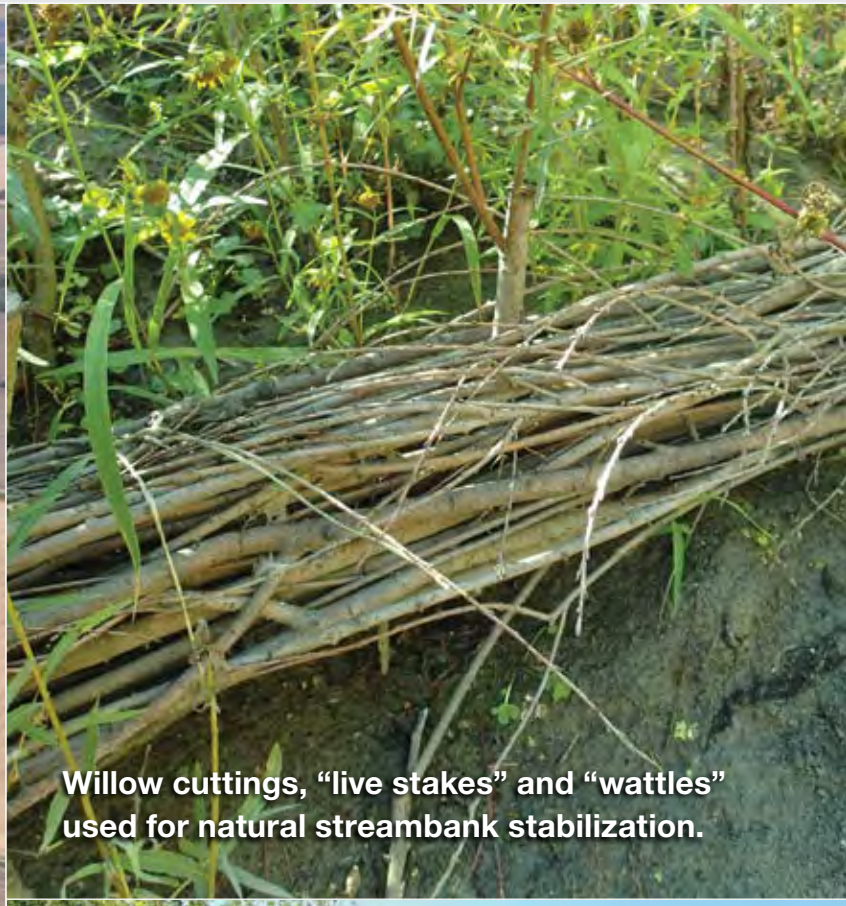


This strait-line ditch had eroded and was in need of restoration.

After more than a decade of coordination with state, federal and local partners and adjacent landowners, the Red Lake Watershed District spearheaded the effort to restore the lower Grand Marais Creek. To complete this project the watershed district leveraged local and federal funds and received funding from two Legacy Amendment Funds:

- Clean Water Fund to stabilize and restore vegetation in the cutoff ditch.
- Outdoor Heritage Fund to restore flow and habitat to the historic lower 6 miles of the creek.

During the project planning phase Red Lake Watershed District and consulting engineers coordinated with DNR stream habitat experts on design specifications for reconstructing the historic stream channel. This pre-project coordination enabled the best outcomes for a challenging and unique stream channel restoration.



Willow cuttings, “live stakes” and “wattles” used for natural streambank stabilization.

Restored stream channel.

PROJECT PROFILE

Parks and Trails Fund

St. Croix State Park—Restoration After the Storm

In 2011 wind storms impacted more than 13,000 acres of St. Croix State Park. Large areas of blowdown within the park created the opportunity to restore natural barrens–savanna plant communities. Barrens–savannas are fire dependent systems and have largely become overgrown with trees and shrubs due to fire suppression in the 20th century. Rare species such as Blanding's turtle, Hill's thistle and several moths and butterflies use these open habitats within St. Croix State Park.

Unprecedented blowdown at St. Croix State Park.

Parks and trails managers leveraged the damage created by the blowdown to accelerate restoration of these fire-dependent habitats. Through a combination of salvage logging, brush mowing, prescribed fire, and invasive plant control, managers are restoring the habitat structure and plant communities.

Restoring barrens–savannas using fire requires a hot, slow burning fire that can kill unwanted trees and woody shrubs. To achieve this, managers shredded woody debris into a more readily burnable form using mechanical wood mulching equipment. This shredded wood facilitated a successful burn that has opened up the ground to recolonization by barrens–savanna plants. Management plans including fire, brush mowing, and invasive plant control ensure continued recovery of these rare habitats.

Shredded wood facilitates a successful burn.

Site Assessor Paul Bockenstedt (Stantec Inc.) and Cathy Handrick, DNR Parks Resource Specialist investigate plant recovery after the burn.

APPENDIX A: LEGISLATIVE CHARGE

The statutory requirements for this report

Parks and Trails Fund: ***M.S. 85.53, Subd. 5.***
Restoration evaluations. The commissioner of natural resources may convene a technical evaluation panel comprised of five members, including one technical representative from the Board of Water and Soil Resources, one technical representative from the Department of Natural Resources, one technical expert from the University of Minnesota or the Minnesota State Colleges and Universities, and two other representatives with expertise related to the project being evaluated. The commissioner may add a technical representative from a unit of federal or local government. The members of the technical evaluation panel may not be associated with the restoration, may vary depending upon the projects being reviewed, and shall avoid any potential conflicts of interest. Each year, the commissioner may assign a coordinator to identify a sample of up to ten habitat restoration projects completed with parks and trails funding. The coordinator shall secure the restoration plans for the projects specified and direct the technical evaluation panel to evaluate the restorations relative to the law, current science, and the stated goals and standards in the restoration plan and, when applicable, to the Board of Water and Soil Resources' native vegetation establishment and enhancement guidelines. ***The coordinator shall summarize the findings of the panel and provide a report to the chairs of the respective house of representatives and senate policy and finance committees with jurisdiction over natural resources and spending from the parks and trails fund.*** *The report shall determine if the restorations are meeting planned goals, any problems with the implementation of restorations, and, if necessary, recommendations on improving restorations. The report shall be focused on improving future restorations. Up to one-tenth of one percent of forecasted receipts from the parks and trails fund may be used for restoration evaluations under this section.*

Outdoor Heritage Fund: ***M.S. 97A.056, Subd. 10.***
Restoration evaluations. The commissioner of natural resources and the Board of Water and Soil Resources may convene a technical evaluation panel comprised of five members, including one technical representative from the Board of Water and Soil Resources, one technical representative from the Department of Natural Resources, one technical expert from the University of Minnesota or the Minnesota State Colleges and Universities, and two representatives with expertise in the project being evaluated. The board and the commissioner may add a technical representative from a unit of federal or local government. The members of the technical evaluation panel may not be associated with the restoration, may vary depending upon the projects being reviewed, and shall avoid any potential conflicts of interest. Each year, the board and the commissioner may assign a coordinator to identify a sample of up to ten habitat restoration projects completed with outdoor heritage funding. The coordinator shall secure the restoration plans for the projects specified and direct the technical evaluation panel to evaluate the restorations relative to the law, current science, and the stated goals and standards in the restoration plan and, when applicable, to the Board of Water and Soil Resources' native vegetation establishment and enhancement guidelines. ***The coordinator***

shall summarize the findings of the panel and provide a report to the chair of the Lessard-Sams Outdoor Heritage Council and the chairs of the respective house of representatives and senate policy and finance committees with jurisdiction over natural resources and spending from the outdoor heritage fund. The report shall determine if the restorations are meeting planned goals, any problems with the implementation of restorations, and, if necessary, recommendations on improving restorations. The report shall be focused on improving future restorations. At least one-tenth of one percent of forecasted receipts from the outdoor heritage fund must be used for restoration evaluations under this section.

***Clean Water Fund:** M.S. 114D.50, Subd. 6. Restoration evaluations. The Board of Water and Soil Resources may convene a technical evaluation panel comprised of five members, including one technical representative from the Board of Water and Soil Resources, one technical representative from the Department of Natural Resources, one technical expert from the University of Minnesota or the Minnesota State Colleges and Universities, and two representatives with expertise related to the project being evaluated. The board may add a technical representative from a unit of federal or local government. The members of the technical evaluation panel may not be associated with the restoration, may vary depending upon the projects being reviewed, and shall avoid any potential conflicts of interest. Each year, the board may assign a coordinator to identify a sample of up to ten habitat restoration projects completed with clean water funding. The coordinator shall secure the restoration plans for the projects specified and direct the technical evaluation panel to evaluate the restorations relative to the law, current science, and the stated goals and standards in the restoration plan and, when applicable, to the Board of Water and Soil Resources' native vegetation establishment and enhancement guidelines. The coordinator shall summarize the findings of the panel and provide a report to the chairs of the respective house of representatives and senate policy and finance committees with jurisdiction over natural resources and spending from the clean water fund. The report shall determine if the restorations are meeting planned goals, any problems with the implementation of restorations, and, if necessary, recommendations on improving restorations. The report shall be focused on improving future restorations. Up to one-tenth of one percent of forecasted receipts from the clean water fund may be used for restoration evaluations under this section.*

APPENDIX B: PROCESS

This report was produced in response to state law directing the Department of Natural Resources and Board of Water and Soil Resources to convene an expert panel to evaluate restoration projects completed with Clean Water, Land and Legacy Funds. DNR and BWSR's goal is to improve conservation outcomes across the state through the evaluation process. The evaluation program's method of independent expert review and direct engagement with project managers is unique and provides a "value added" benefit to the restoration work of the Legacy Funds. Working collaboratively with project managers to identify gaps and capture lessons learned from restoration implementation, the agencies plan to use this valuable information to enhance future work through restoration training and technical assistance.

Program Logic Model

Inputs	Activities	Outcomes	
		Short term	Long term
Approximately 1/10 of 1% of annual funds: • Clean Water Fund • Outdoor Heritage Fund • Parks and Trails Fund Technical Evaluation Panel (unpaid experts) Program Coordinator (DNR) Site Assessment Experts (DNR, BWSR, Contractors)	Communicate with project managers regarding implementation of their restoration practices. Site assessment experts conduct field assessment of restoration projects (up to 10 projects per fund annually). Evaluation panel reviews assessed projects relative to: the law, current science, stated goals and standards; and makes recommendations for improving future recommendations. Panel's recommendations for improvement reviewed by agencies; procedures and protocols developed and promoted to address identified areas for improvement. Annual Report to Legislature focused on improving future restorations.	Feedback loop: Restoration education and technical assistance training for project managers supported by lessons learned from field assessments. Project managers adopt improved documentation and implementation practices. Funding agencies improve granting and review procedures for restoration projects.	Greater transparency and accountability in the use of Legacy Funds. Improved restoration outcomes.

Roles and Responsibilities

Evaluation Panel

Statute directs the evaluation panel to:

- Evaluate restorations relative to the law, current science, and the stated goals and standards in the restoration plan.
- Provide findings on the evaluations, determining whether restorations are meeting planned goals, identify problems with implementation of restorations and, provide recommendations on improving restorations.

Members of the Restoration Evaluation Panel are unpaid technical experts. The panel was chosen to fulfill the statutory requirements for agency representation and to provide a balance of needed expertise. To the extent practicable, panel members have specific expertise in prairie/grassland, forest, wetland, or aquatic ecosystems and habitat restoration techniques, so that at least one panel member will have proficiency related to any project being evaluated. The panel may seek advice and assistance from others including site assessors with additional expertise to help the panel in its work.

Program Coordinator

The program coordinator is responsible for coordinating site assessments, program administration and managing the work of the panel and affiliated staff for the three funds. The coordinator is directed in Statute to:

- Identify a sample of restoration projects completed with funding from the Parks and Trails, Outdoor Heritage, and Clean Water Funds.
- Secure restoration plans for selected projects.
- Summarize the findings of the panel.
- Provide reports to the legislature.

The Coordinator also leads efforts to facilitate and document continuous improvement in restoration practice. To facilitate these efforts, the Coordinator delivers panel recommendations to the agencies, project managers and partner organizations, then works with the panel and agencies to identify actions and provide guidance for implementing improved methods. The coordinator tracks, evaluates and reports on the progress and effectiveness of improvement actions. The

Panel Composition

Statutory Direction	Member	Affiliation
a. One technical representative from BWSR.	a. Dan Shaw	MN BWSR
b. One technical representative from DNR.	b. Chris Weir-Koetter	MN DNR Parks
c. One technical expert from the U of M or MNSCU.	c. Sue Galatowitsch	U of MN
d. Two representatives with expertise related to the project being evaluated.	d. Greg Berg d. Brian Nerbonne	Stearns County SWCD MN DNR Fish & Wildlife
e. May add a technical representative from a unit of federal or local government.	e. Mark Oja	USDA NRCS MN

agencies have assigned a single coordinator to ensure consistency in program implementation. A proportionate amount of the three Legacy Funds is used to support the coordinator position and a memorandum of understanding (MOU) between the agencies guides cooperative support for this position. The coordinator position is currently housed in DNR's Ecological and Water Resources Division.

Site Assessors

The site assessors are responsible for conducting the site evaluations and providing the results of the assessments, in collaboration with the Program Coordinator, to the panel for evaluation. Site assessors are selected based on knowledge of restoration applications in the given project habitat type and project location. Site assessors work closely with the coordinator in assessing project plan materials, conducting site evaluations, and participate in discussion with the panel to ensure queries are adequately addressed. Site assessors may be state agency staff, LGU or federal agency staff or a private contractor. Services provided by the site assessors are negotiated through the use of contracts, State Interagency Agreements, or work assignments.

Project Managers

Project managers responsible for implementation are expected to actively participate in the restoration evaluation process. Project managers work with the program coordinator to provide the necessary project background information. Project managers are also expected to attend the site evaluations when possible to not only identify project work sites for the site assessors, but to provide important project context, and answer any questions that may arise.

Project manager affiliations vary between funds and projects. It is necessary to acknowledge the diversity of managing organizations and the scope and focus of their practice when evaluating project implementation. Project managers for the three Legacy Fund restoration projects may include, but are not limited to the affiliations below:

Clean Water Fund	Outdoor Heritage Fund	Parks and Trails Fund
Soil and Water Conservation District (SWCD) manager or technician	State agency staff (DNR, BWSR)	MN DNR, Parks and Trails Division, resource management staff
Watershed District (WD) staff	Federal agency staff (USFWS)	Metro Regional Parks managers, including county park systems and Three Rivers Park District
Watershed Management Organization (WMO) staff	County conservation and land management staff	Greater Minnesota park managers
County Water Resource or Environmental Services staff	Watershed District staff	
City Water Resource staff	Nongovernmental wildlife organizations	

Evaluation Methods

Project Selection

The program coordinator has chosen projects over the first four years of the evaluation program as a representative sample of habitat types and geographic distribution. Project habitat types of sites featured in this report include:

- 8 streams and 13 additional streambank easement riparian/upland project sites
- 5 wetlands
- 5 grasslands
- 1 savanna/barrens

Projects with one or more of the following criteria were considered eligible for selection:

- Manipulation of a degraded or substantially intact site with the goal of returning the site's natural/historic ecological structure and/or function.
- Statement of "restoration," "reconstruction," "re-establishment" or "re-creation" in the project description.

The number of projects selected was in relative proportion to each fund's appropriation to restoration evaluations. All 12 grants and appropriations featured in this report funded restoration activities at multiple dispersed project sites. A smaller subsample of project sites was typically evaluated. Projects described in this report include:

- 5 Clean Water Fund grants with 7 project sites.
- 3 Outdoor Heritage Fund Programs/ Appropriations, including 3 Conservation Partner grants, with 20 project sites (Outdoor Heritage Fund projects include several individual parcels).
- 4 Parks and Trails Fund projects with 6 project sites.

Site Assessments

DNR, BWSR and the panel developed a process that provides for meaningful evaluation of project effectiveness while keeping the process as simple and consistent as possible. The project evaluation process engages project managers to the extent possible in conducting site visits and communicating lessons learned from project implementation. The agencies and the panel believe that facilitating an inclusive evaluation process with project managers will increase the transfer of knowledge between field practitioners and the agencies and ultimately improve restoration outcomes.

A standardized Site Evaluation Form was developed by the agencies and the panel to provide essential project information and answer the key evaluation requirements as directed by law. This form describes site assessors' observations regarding project effectiveness, estimated outcomes based on current conditions and application of current science. The effectiveness of this form will be assessed and improved in future years based on feedback from the panel, site assessors and project managers.

Projects were evaluated by site assessors who are not affiliated with the respective projects. Sites were assessed by visual inspection of the project's structural components and plant materials. All projects evaluated are in relatively early establishment due to the recentness of the Legacy Funds. Restored plant communities may take several years or even decades to mature. Evaluations are based on observations of the present and projected conditions of specific project site relative to the project goals. Assessments of these discrete project sites do not represent an overall evaluation of the larger program or fund.

Restoration science is continually evolving. Current state of the art practice is an area of ongoing discussion between practitioners, researchers, government agencies and stakeholders. Site assessors and the panel evaluate projects for implementation of methods commonly considered to be within the range of current science based restoration practices. Observations by field assessors are discussed in *Appendix D. Project Evaluation.*

Legacy Fund Attributes and Requirements

Each of the three Legacy Funds has a distinct focus on restoration projects directed by the fund's purpose. Each fund also has specific requirements pertaining to restoration projects.

Legacy Fund Attributes and Appropriation Laws Applicable to Restoration Projects

	Clean Water	Outdoor Heritage	Parks and Trails
Fund Purpose	*protect, enhance, and restore water quality in lakes, rivers, and streams and protect groundwater from degradation*	*restore, protect, and enhance wetlands, prairies, forests, and habitat for fish, game, and wildlife*	*support parks and trails of regional or statewide significance*
Primary Restoration Goal	Restore water quality.	Restore specific wildlife habitat types.	Ecological restoration of specific habitat types.
Guidance for project types and locations	Local water management plan, TMDL Implementation plans, or Watershed Restoration and Protection Strategies.	Statewide or national wildlife habitat plans.	State or regional park natural area management plans.
Funding source for restoration projects	Competitive grants administered by BWSR.	Direct appropriation to project manager; recommended by Outdoor Heritage Council. Conservation Partners grants administered by MN DNR.	• MN DNR appropriation: resource management. • Met Council appropriation: County Regional Park System, Three Rivers Park District.

Table Continued…

	Clean Water	Outdoor Heritage	Parks and Trails
Requirements for restoration projects	M.S. 114D.50 Subd. 4. (a) *include measurable outcomes, as defined in section 3.303, subdivision 10, and a plan for measuring and evaluating the results. A project must be consistent with current science and incorporate state-of-the-art technology*	Different appropriation years are subject to different requirements. M.L. 2009 & 2010 projects in this report; Conservation Partners Grants *Wetland Restorations on WMAs and Seminary Fen;* are subject to M.L. 2009, Chap. 172, Article 1, Section 2. Subd. 5a & Subd. 10. and M.L. 2010, Chap. 361, Article 1, Sec. 2. Subd. 9. This includes: • Plant vegetation and sow seed of ecotypes native to Minnesota. • Ecological restoration and management plan (M.S. 97A.056. Subd. 13. (c)(d). M.L. 2012 project in this report; Grand Marais Outlet; is subject to M.L. 2012, Chap. 264, Article 1, Sec. 4. Subd. 13. Project requirements. This includes Subd. 13 (c)(d) restoration plan directing: • *"establishment of diverse plant species"*	M.S. 85.53 Subd. 2 *include measurable outcomes, as defined in section 3.303, subdivision 10, and a plan for measuring and evaluating the results. A project or program must be consistent with current science*

APPENDIX C: FUND EVALUATIONS

As directed in statute, projects are evaluated relative to: the law, current science and stated goals. Statute also directs the panel to determine: any problems with the implementation. A high-level assessment of these criteria and a summary of panel comments is presented in this section. Detailed project evaluations are provided in *Appendix D. Project Evaluations.*

All Funds

Statutory Direction for Restoration Evaluation	Compliance Evaluation
The Law	Program coordinator verified that all projects evaluated in this report complied sufficiently with appropriation laws directly applicable to restorations. An overview for each fund is provided in this section.
Current Science	Practices implemented were predominantly within the range of current science based restoration practices for the given project type. Many projects utilized state of the art restoration practices in a thorough and strategic manner including site specific treatments and practices based on best restoration science. The panel considered specific instances of nonnative seed use and inappropriate stream channel design inconsistent with current restoration science. Restoration science is continually evolving and current state of the art practice is an area of ongoing refinement and discussion between practitioners, researchers, government agencies and stakeholders. The panel intends for the evaluation outcomes to inform ongoing improvements in the application of current science.

Table Continued…

All Funds continued…

Statutory Direction for Restoration Evaluation	Compliance Evaluation
Stated Goals	All projects reviewed were determined to have the potential to meet stated project goals if prescribed management is implemented as planned. It will take several years of monitoring by project managers to determine if longer term outcomes will be achieved. The panel noted deficiencies in the clarity and detail of specific goals for some projects in this and past reports. Guidance for improving the clarity of goals is provided in the recommendation for improved documentation. (See Fiscal Year 2014 Report at **Legislative Library**.) The panel also considered some project goals such as bank stabilization to be too limiting to the potential for addressing a larger ecological context, such as the surrounding floodplain. The panel considered this a planning phase issue that would benefit from a more diverse set of ecological expertise on the project team (see recommendation *Improved Project Teams)*.
Problems with Implementation	The majority of projects had no significant problems with implementation. Project managers predominately employed accepted controls to monitor and manage projects towards desired outcomes, in acknowledgment of typical challenges faced by restoration projects. Site assessors and the panel noted problems with the implementation of some projects that may limit their effectiveness and long term durability. The following Fund tables provide specific instances relating to technical aspects of implementation. The panel considered these technical issues as well as instances of limited consideration of project goals/scope to be planning phase issues that would benefit form a more diverse set of ecological expertise on the project team (see recommendation *Improved Project Teams)*.

Each of the three Legacy Funds has specific requirements pertaining to restoration projects *(Appendix B, Fund Attributes and Requirements).* The requirements most directly related to restorations are addressed for each fund in the tables below.

Clean Water Fund

Statutory Direction for Project Managers	Compliance Method	Compliance of Evaluated Projects
1. Measurable outcomes 2. Plan for measuring and evaluating results	1. Typically modeled pollutant load reduction included in standard reporting in BWSR E-link system. 2. Routine, uniform inspections conducted by local project management staff at regular intervals (typically annual) to confirm installation and maintenance per plan. Inspection forms are kept on file by project managers.	All 5 projects (7 project sites) reported: 1. Measurable water quality outcomes for the specific project. 2. Plans to monitor on a routine schedule and evaluate results.
Consistent with current science and incorporate state-of-the-art technology	Planning and design are completed by professional engineers, area technical assistance and/or local water resource specialists. Practices are reviewed by BWSR Conservationists, Clean Water Specialists and/or area technical assistance staff for adherence with state of the art methods.	All projects evaluated utilized state of the art methods. However, site assessors and the panel considered specific technical details of some stream channel designs to be deficient. These include: • Location of riffle structures above bends may exacerbate bank erosion. • Installation (or settling) of cross-vane boulders at similar elevation across the stream rather than gradually dropping in elevation toward the center may lead to bank erosion/modified stream course in undesirable direction. • Stream channel design size significantly lower than common flood flows for the stream; may create instability in stream reach and influence floodplain to shallow marsh (hybrid cattail vs floodplain forest).

Parks and Trails Fund

Statutory Direction for Project Managers	Compliance Method	Compliance of Evaluated Projects
1. Measurable outcomes	1. MN DNR Parks and Trails projects evaluated in this report document acres of habitat type restored for each project.	1. All 4 projects (6 project sites) reported measurable outcomes in acres of specific upland habitat types restored.
2. Plan for measuring and evaluating results	2. Evaluation of project results is fulfilled through the project manager's documentation of ongoing monitoring and adaptive management activities.	2. Regional Parks resource managers maintain ongoing monitoring protocols of key measures (i.e. monitoring stations, plant community Relevés, transects or percent species cover) to assess results and inform future management.
Consistent with current science	MN DNR Parks resource management staff record and continue to systematically refine restoration methods with current science.	All practices evaluated were consistent with current restoration science.

Outdoor Heritage Fund

Statutory Direction for Project Managers	Compliance Method	Compliance of Evaluated Projects
M.L. 2019-2010 projects Seminary Fen Restoration and Wetland Restorations on WMAs are subject to: M.L. 2009, Chap. 172, Article 1, Section 2. Subd. 5a & Subd. 10. and M.L. 2010, *Chap. 361*, Article 1, Sec. 2. Subd. 9. Project Requirements. These include: *"plant vegetation and sow seed of ecotypes native to Minnesota to the extent possible"* *"restoration and management plan… consistent with the highest quality conservation and ecological goals for the restoration site"*	Project managers record seed source/vendor, origin "yellow tags," seeding methods and timing in project documentation. Project managers document project planning and implementation showing consideration of the required components.	These projects utilized native ecotype seed and have documentation on file. Projects documented and have on file applicable considerations and content required in the restoration and management plan.
M.L. 2012 project: Grand Marais Outlet is subject to M.L. 2012, Chap. 264, Article 1, Sec. 4. Subd. 13. Project Requirements This includes Subd. 13 (c) (d) directing: *"restoration and management plan… consistent with current conservation science and ecological goals for the restoration site"* *"establishment of diverse plant species"*	Project managers document project planning and implementation showing consideration of the required components.	Project managers substantially documented project planning and implementation in accordance with project requirements. The panel considered instances of nonnative seed use on project easements to not be consistent with "current conservation science" and may detract from potential habitat in these areas. Most seeded areas in the project utilized native seed mixes.

APPENDIX D: PROJECT EVALUATIONS

http://www.leg.state.mn.us/edocs/edocs.aspx?oclcnumber=823766285

Minnesota Department of Natural Resources
500 Lafayette Road
St. Paul, MN 55155-4040
888-646-6367 or 651-296-6157
mndnr.gov

This information can be made available in alternative formats such as large print, braille or audio tape by emailing info.dnr@state.mn.us or by calling 651-259-5016.

APPENDIX D. PROJECT EVALUATIONS

Table of Contents

RESTORATION EVALUATION PROGRAM for LEGACY PROJECTS
Minnesota Board of Water and Soil Resources
Minnesota Department of Natural Resources

Project Evaluation Form

Project Background

Project Name: Knife River Bank Stabilization Project **Fiscal Year 2012**

Project Location: Lake County

Township/Range Section: T52N R10W Sec 19

Project Manager/Affiliated Organization, Contact: Lake County Soil and Water Conservation District

Fund: CWF Fiscal Year Funds: 2012 Project Start Date: 2015

Predominant Habitat type: Forest, Aquatic

Project Status: Establishment Phase

Project Goals and Planning

(Site Assessment Preparation from Plan Sets and Documents)

1. **What are the specific project components?**
   - Bluff stabilization via channel alignment alteration and the introduction of toe wood and instream structures

2. **What plans/record of project decisions/prescription worksheets are available? Provide location data?**

Environmental Assessment Worksheet (2/2015); Construction Plan Set (4/2015); Cultural Resource Reconnaissance Survey (6/2015); As-Built Plan & Profile (9/21/2015) and Project Overview (dated 9/2015).

3. **What are the stated goals of the project?**
   Excerpt from Original CWF Abstract:

This project will restore two severely eroding streambank sites on the Knife River, a river that is listed as impaired for excess turbidity by the MPCA. Combined, the two sites are 1,000 feet in length with 50 to 70-foot high clay banks. Annually, the sites generate 697 pounds of phosphorus and contribute 606 tons of sediment to the TMDL turbidity impairment. With an average annual sediment delivery amount of 3,630 tons for the Knife River, stabilizing these sites will reduce the sediment load by approximately 17%.

Hydrology: Maintain current hydrology (duration, magnitude, and timing of flows); improve baseflow conditions for trout

Geomorphology: Restore the appropriate channel form (dimension, pattern, and profile) to create a stable channel (neither aggrading nor degrading, while maintaining its form); provide a diversity of habitat and cover

Connectivity: Restore appropriate connectivity to the floodplain and improve vertical connectivity of stream to groundwater; Re-establish the riparian zone where needed

Water Quality: Reduce sediment input by minimizing stream bank erosion (a reduction of 574 tons per year); improve water temperatures through shading, improved baseflow and narrowing of the channel width.

Biology: Increase the amount and quality of habitat and cover for all life stages of trout and other aquatic organisms; improve temperature and water quality for trout.

4. **Were measures of restoration success identified in plans? Yes**
   If yes, list specific measurements.

From a stand point of evaluating the project & stream health the Owner intends to execute a monitoring plan. The following is an excerpt of the provided plan:

The completed stabilization reach will be inspected for structural and vegetative components at the end of the first year and every three years thereafter throughout the duration of the effective life. The goal is to create a project that does not need maintenance and will work with river dynamics and sediment transport in a way that the solutions are long term and sustainable. Lake SWCD will establish permanent cross-sections that will be monumented and re-surveyed in the future to ensure the stream channel remains stable and to estimate erosion rates. Bank Erosion Hazard Index (BEHI) and Near Bank Shear Stress (NBSS) assessments have been performed and will continue to be assessed after restoration is complete to determine erosion rates and amounts of sediment entering the river.

The comprehensive inspection schedule and protocol is intended to more thoroughly evaluate the long-term effectiveness of the channel modifications for North Shore streams. The overall success of the project will be formally assessed by the TSA 3 conservation engineer.

5. **Are plan Sets available? Yes Have new GIS maps been created? No**

   If yes, provide in Appendix A and list Maps provided:

Figure 1 - Project Overview from construction plan set (sheet 2 of 15)

Figure 2 - Representative Bank Stabilization Profile (Sheet 5 of 12)

Figure 3 - As-Built Plan

Figure 4 - As-Built Profile

Figure 5 - Representative image of stabilization (bankfull bench). As illustrated in the photograph the created bankfull bench was appropriately being accessed (over-topped) by a near bankfull flow event.

Figure 6 - Representative image of stabilization (bluff). As visible in photograph the attempt to establish vegetated cover on the clay bluff in question (right side of image) via hydroseeding is showing early signs of failure. It is acknowledged though that the primary project means for reducing sediment from the bluff is the realignment of the stream away from the bluff and the creation of a stable bluff toe and associated bankfull bench.

6. **Provide list of best management practices, standards, guidelines identified in plan set? Are these based on best current science? If not, what parameters diverge from these practices? Do these divergences affect outcomes?**

    1. Natural Channel Design (NCD) methodology was reportedly implemented to inform analysis & design. NCD is a standard industry methodology for stream restoration, most associated with Wildland Hydrology Consultants and Dave Rosgen.
    2. The practices employed, such as Toe-wood, are common practices used in stream restoration/ stabilization in Minnesota and suitable to “North Shore” streams.

Project Implementation

(Questions for Site Manager and Cooperating Professionals)

7. **Were alterations made to the original plan during construction? Discuss changes to the following:** No

8. **In what ways did alterations to the plan or implementation change the proposed project outcome? Did this change derive from a desire to change outcomes?**
   N/A

Site Assessment

Field Review: September 24, 2016

9. **Surrounding Landscape Characteristics:**

Current land use is privately owned, undeveloped forest land. Private homes are present on each of the three parcels of land. The dwellings are outside of the construction limits. Future land use will be preservation and recreation.

Land type of the project area is Laurentian Mixed Forest. Vegetation at the project site consists of hardwood trees and conifers. Riparian vegetation is made up of grasses, sedges, willow and alder. The Knife River is a designated trout stream. Brook trout and steelhead yearling are present in this reach as well as creek chub, blacknose dace, and redbelly dace. Beaver, deer, reptiles and amphibians are common in the stream corridor.

The Natural Heritage Review determined that the entire project site is within an area the Minnesota Biological Survey (MBS) has identified as a Site of Moderate Biodiversity Significance. This means that the site contains occurrences of rare species and/or moderately disturbed native plan communities, and/or landscapes that have a strong potential for recovery.

10. Site Characteristics:

10a. Soils: The unstable clay bank in question is primarily a Miskoaki-Cuttre complex 5-45 percent slope, 25 percent area; 60% Firm clay till, well drained, HSG =D, less than 5% organic matter 30% Firm clay till, very poorly drained HSG =D, less than 5% organic matter 10% Firm clay till, moderately well drained HSG =D, less than 5% organic matter Increasing clay with depth, 15% sand.

10b. Topography: High gradient stream

10c. Hydrology: Stream flow is flashy due to prevalence of tight soils, shallow depth to bedrock and steep topography.

10d. Vegetation A: The following vegetation establishment measures were completed prior to the evaluation: Native seeding (three custom native mixes with cover crop), via hydroseeding and live staking of Black Willow and Willow spp. cuttings. Additional specified plantings are scheduled for 2016. Overall, it is too soon after installation and late in the year to estimate survivorship and vegetation establishment. Project managers should monitor plant establishment throughout 2016 & 2017, paying particular attention to project & site challenges, such as: harvest and transplanting of material outside of dormancy and the general difficulty of establishing cover on the bankfull bench (rocky, low-organic soils) as well as the bluff (red clay slopes exceeding 1H:1V, with compounding failure mechanisms).

10e. Vegetation B:

11. Is the plan based on current science? Yes
If no, explain in detail.

12. List indicators of project outcomes at this stage of project:

Summary: It is too early to confidently predict outcomes at this time (see #17 below). Furthermore the stream was at or near bankfull discharge during the evaluation—a coincidence that both limited the evaluation (physically & visually obstructed) and provided a testing opportunity for the project. Therefore, these limited indicators were available at the time of the evaluation:

- Connectivity: near bankfull event had accessed a portion of the floodplain;
- Water Quality: relocation of stream away from bluff should decrease sediment contribution;
- Biology: the addition of wood, large rock and pool forming/holding structures should increase the amount and quality of habitat and cover for trout and other aquatic organisms.

13. Does the project plan/implementation of the project plan reasonable allow for achieving proposed project outcome?

The design and executed project can reasonably address the core hydrology, geomorphology, connectivity, water quality and biology criteria. The intended long-term monitoring should be sufficient and documenting success and any shortcomings.

14. Are corrections or modifications needed to meet proposed outcomes?

No warranted corrections/modifications apparent this early in the establishment phase.

15. Do proposed or planned future steps, including long term management appear practical and reasonable? What are the potential challenges, limitations?

No foreseeable issues with the core project.

16. Do any of the project activities, planned or implemented, likely detract from existing or potential habitat? Explain.

No long-term detraction apparent

17. Are follow-up assessments needed? Explain.

Yes—there would be significant value in reevaluating this project in 3-5 years. This evaluation was completed within 3± weeks of substantial completion, when vegetation inputs were not fully completed and temporary and permanent vegetation had yet to establish. A follow up evaluation after vegetation has established and the project has experienced ≥ 2 channel forming discharges will be more telling of probable outcome, especially if the monitoring plan is executed as planned (see #4 above).

18. Additional comments on the restoration project.

Establishing permanent and desirable vegetative cover on “North Shore” red clay bluffs via seeding and/or planting has posed to be challenging. The more successful and cost-effective attempts in providing stability have resulted from investment in providing a stable bluff toe (as this project addresses) along with vegetative inputs or allowing the bluff to naturally colonize (albeit a slow process).

Project Evaluation

19. The project will:

a. Likely not meet proposed outcomes ☐
b. Minimally meet proposed outcomes ☒
c. Meet proposed outcomes ☐
d. Likely exceed proposed outcomes ☐
e. Greatly exceed proposed outcomes ☐

Confidence of outcome determination

a. Low ☐
b. Medium ☒
c. High ☐

20. Provide explanation of reason(s) for determination.

Given that the project is in the very early stages of establishment, reviewer evaluation is conservative. The designed and executed project has indicators of success, but it is premature to determine whether goals have been met.

21. Site Assessor(s) Conducting Review:

Kevin Biehn, Consultant, Emmons & Olivier Resources, Inc.; Wade Johnson, MN DNR 9/24/2015.

Site Maps:

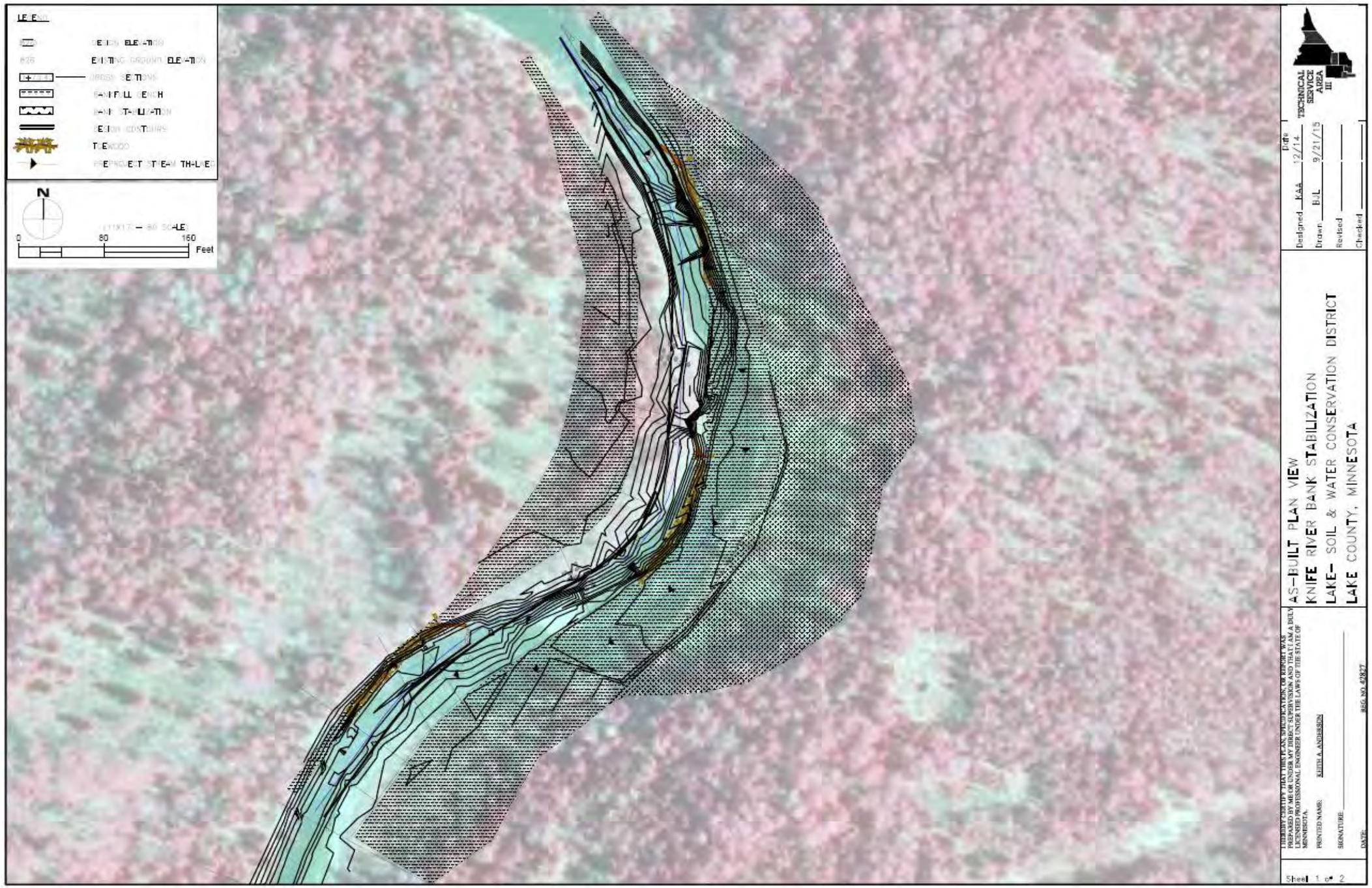


Figure 1 - Project Overview from construction plan set (sheet 2 of 15)

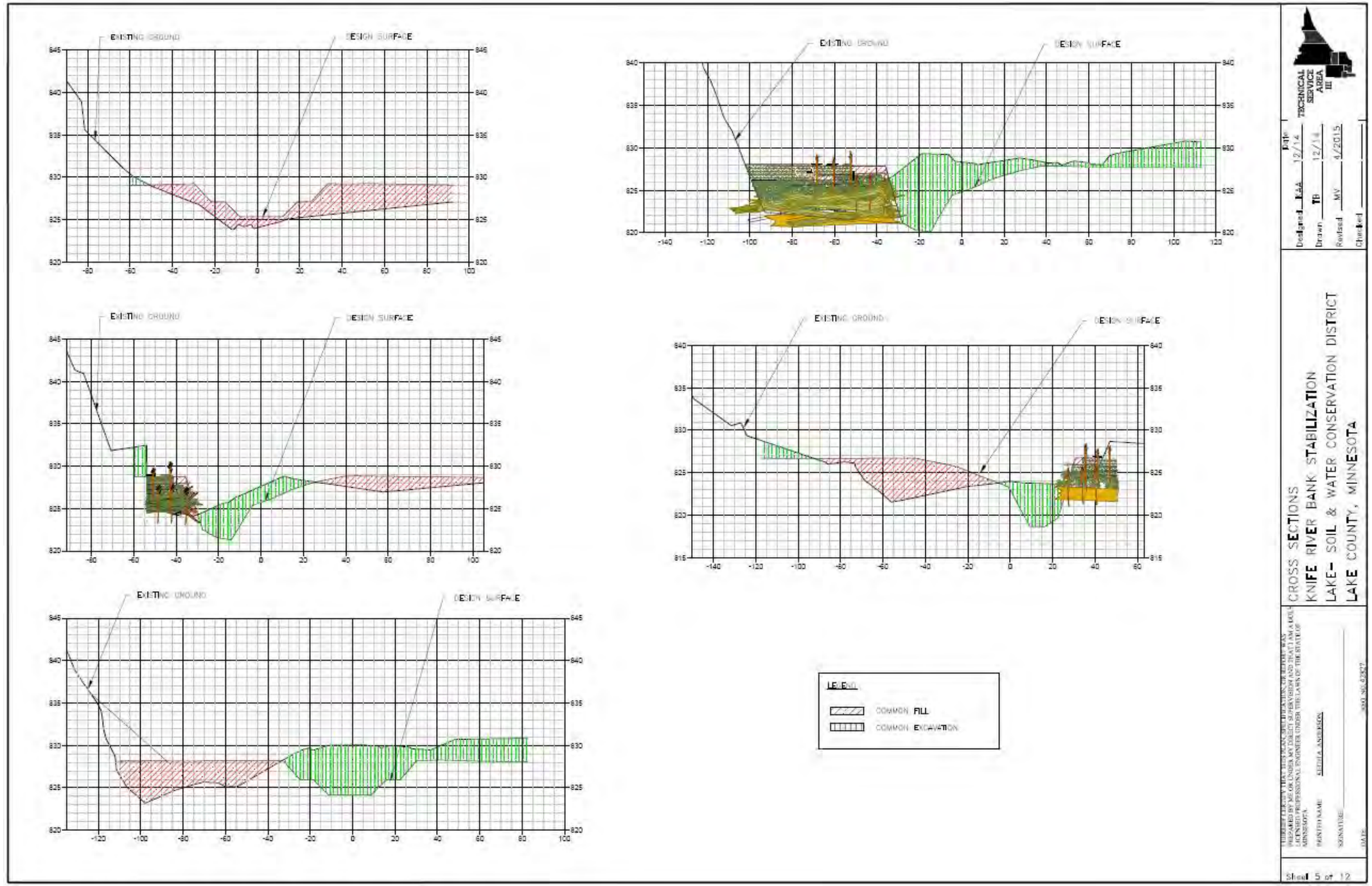


Figure 2 - Representative Bank Stabilization Profile (Sheet 5 of 12)

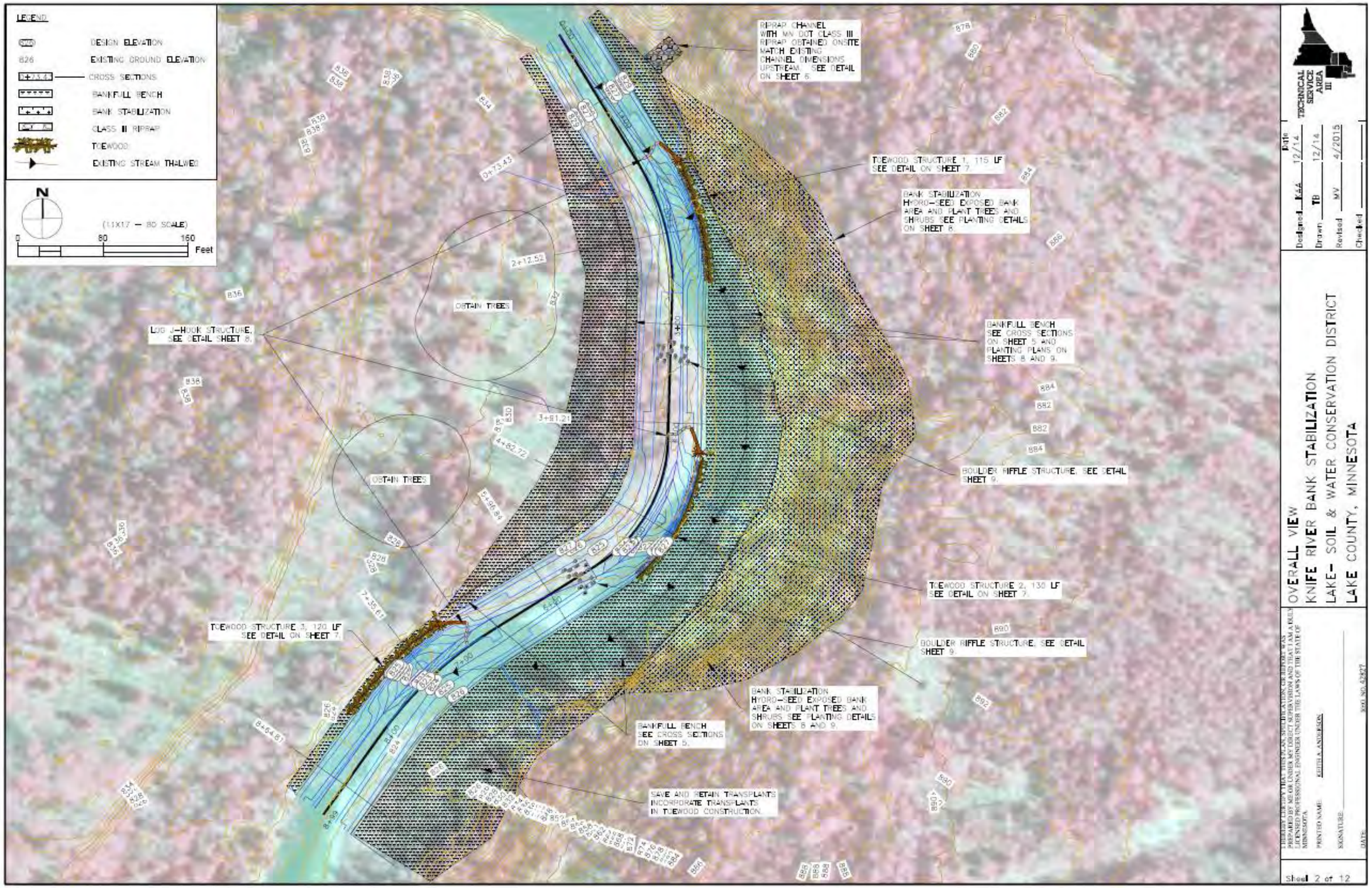


Figure 3 - As-Built Plan

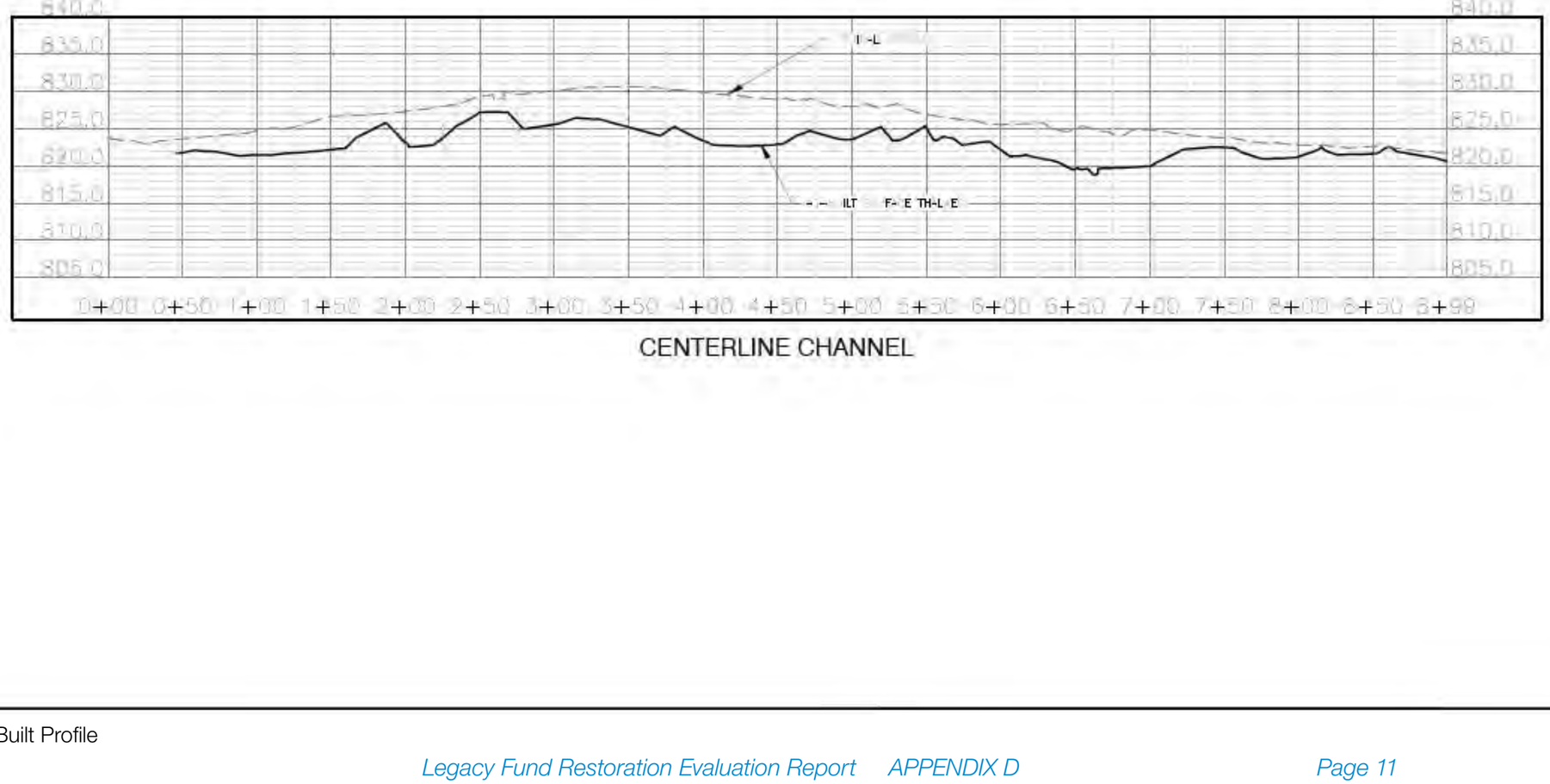


Figure 4 - As-Built Profile

Site Photographs

Figure 5 - Representative image of stabilization (bankfull bench). As illustrated in the photograph the created bankfull bench was appropriately being accessed (over-topped) by a near bankfull flow event.

Figure 6 - Representative image of stabilization (bluff). As visible in photograph the attempt to establish vegetated cover on the clay bluff in question (right side of image) via hydroseeding is showing early signs of failure. It is acknowledged though that the primary project means for reducing sediment from the bluff is the realignment of the stream away from the bluff and the creation of a stable bluff toe and associated bankfull bench.

Project Evaluation Form

Project Background

Project Name: Stewart River – Big Rock Road **Fiscal Year 2012**

Project Location: Lake County

Township/Range Section: T53N R10W SECTION 13

Project Manager/Affiliated Organization, Contact: Lake County Soil and Water Conservation District

Fund: CWF **Fiscal Year Funds:** 2012 **Project Start Date:** 2015

Predominant Habitat type: Aquatic Habitat, Forest

Project Status: Establishment Phase

Project Goals and Planning

(Site Assessment Preparation from Plan Sets and Documents)

1. **What are the specific project components?**
   - Alteration of stream dimension, pattern & profile
   - Associated habitat and stabilization inputs
   - Site restoration/vegetation establishment inputs

2. **What plans/record of project decisions/prescription worksheets are available? Provide location data?**

WSFR Section 7 Evaluation Documents (1/26/2015) Environmental Assessment Worksheet (2/2015); Construction Plan Set (4/10/2015); Quality Assurance Project Plan (4/15/2015); Cultural Resource Reconnaissance Survey (6/2015); and Project Overview (dated 9/2015).

3. **What are the stated goals of the project?**

Excerpts from Original CWF Abstract:

> This project will restore five severely eroding streambank sites [it's understood that the Big Rock Road Project comprises 4 of the 5 sites] along a 1.5 mile reach of the Stewart River. The cumulative streambank length is 976 feet and the streambank heights vary from 6 to 30 feet. The sites generate over 446 tons of sediment and 480 pounds of phosphorus annually.

Overall, these five projects will restore and stabilize the natural channel morphology and will contribute to stable stream channel conditions. The benefits from a stable channel in this location will include reduced sediment downstream, less sediment pollution into Lake Superior, and protection of native riparian plant communities. Toe wood combined with rock stream vanes, will decrease bluff erosion and create beneficial fisheries habitat through the introduction of much needed woody debris.

Hydrology: Maintain current hydrology (duration, magnitude, and timing of flows); improve baseflow conditions for trout;

Geomorphology: Restore the appropriate channel form (dimension, pattern, and profile) to create a stable channel (neither aggrading nor degrading, while maintaining its form); provide a diversity of habitat and cover;

Connectivity: Restore appropriate connectivity to the floodplain and improve vertical connectivity of stream to groundwater; Re-establish the riparian zone where needed;

Water Quality: Reduce sediment input by minimizing stream bank erosion (a reduction of 551 tons per year on 3,000 linear feet of stream); Improve water temperatures through shading, improved baseflow and narrowing of the channel width;

Biology: Increase the amount and quality of habitat and cover for all life stages of trout and other aquatic organisms; improve temperature and water quality for trout.

4. **Were measures of restoration success identified in plans? Yes**
   If yes, list specific measurements.

From a stand point of evaluating the project & stream health the Owner intends to execute a monitoring plan. The following is an excerpt of the provided plan:

The completed stabilization reach will be inspected for structural and vegetative components at the end of the first year and every three years thereafter throughout the duration of the effective life. Lake SWCD and DNR staff will establish permanent cross-sections that will be monumented and re-surveyed in the future to ensure the channel remains stable and to estimate erosion rates. Bank Erosion Hazard Index (BEHI) and Near Bank Shear Stress (NBSS) assessments have been performed and will continue to be assessed after restoration is complete to determine erosion rates and amounts of sediment entering the river. The DNR will assess fish populations and stream temperatures prior to restoration and post-restoration in varied locations throughout the watershed. These numbers will be compared to baseline data collected prior to the June 2012 flood. Sediment loads will be monitored by the DNR in partnership with the USGS. Sediment samples will be taken during high flow events to measure both suspended sediment and bedload. Sediment loads will be monitored pre and post construction at the downstream edge of the restoration reach. Sediment load data will be paired with flow data to allow DNR and SWCD staff to determine how much sediment is being moved during specific flow events. Flow data will be collected by the SWCD and the DNR. Flow data will be collected at low, medium, and high flows with the goal of creating a flow duration curve.

5. **Are plan Sets available? Yes Have new GIS maps been created? No**
   If yes, provide in Appendix A and list Maps provided:

Figure 1 - Project Overview from construction plan set (sheet 2 of 15)

Figure 2 - Plan & Profile from Construction Plan Set (Sheet 3 of 15)

Figure 3 - Representative image of restoration. Stream was near bankfull discharge during site evaluation

Figure 4 - Representative image of one of the created ponds (left)

Figure 5 - Representative image of project elements: Toe Wood (right) with willow harvested mats above and Log J Hook with Rootwad downstream (left)

6. **Provide list of best management practices, standards, guidelines identified in plan set? Are these based on best current science? If not, what parameters diverge from these practices? Do these divergences affect outcomes?**
   1. Natural Channel Design (NCD) methodology was reportedly implemented to inform analysis & design. NCD is a standard industry methodology for stream restoration, most associated with Wildland Hydrology Consultants and Dave Rosgen.
   2. The practices employed, such as Toe-wood, are common practices used in stream restoration/ stabilization in Minnesota and suitable to “North Shore” streams.

Project Implementation

(Questions for Site Manager and Cooperating Professionals)

7. **Were alterations made to the original plan during construction? Discuss changes to the following:**
   - No

8. **In what ways did alterations to the plan or implementation change the proposed project outcome? Did this change derive from a desire to change outcomes?**
   N/A

Field Review: September 24, 2016

9. Surrounding Landscape Characteristics:

Land type of the project area is Laurentian Mixed Forest. Vegetation at the project site consists of hardwood trees and conifers. Riparian vegetation is made up of grasses, sedges, willow and alder. The Stewart River is a designated trout stream. Brook trout and steelhead are present in this reach.

Current land use is privately owned, undeveloped forest land. Private homes are present on each of the three parcels of land. The homes are outside of the project area. State angling easements are present along the riparian corridor on parcel 25-5311-15910 on the northeast side of the river and on parcel 25-5311-15740 on both the east and west sides of the Stewart River.

10. Site Characteristics:

10a. Soils: The two primary soils types within the restored reach are Forbay-Fluvaquents, frequently flooded complex, 0 to 45 percent slope, 24 percent area; 60% Coarse-loamy drift over friable fine-loamy till over dense coarse-loamy lodgment till, well drained, HSG = B 35% stratified loamy and clayey alluvium, very poorly drained, HSG = B/D Miskoaki-Fluvaquents, frequently flooded complex, 0 to 45 percent slope, 31 percent area; 60% Stratified loamy and clayey alluvium with soils that are fine and well drained alfisols HSG = D35% Fluvaquents that are very poorly drained stratified loamy and clayey alluvium HSG = B/D.

10b. Topography: High gradient stream

10c. Hydrology: Stream flow is flashy due to prevalence of tight soils, shallow depth to bedrock and steep topography

10d. Vegetation A: The following vegetation establishment measures were completed prior to the evaluation: Native seeding (hydro-mulch), live staking of cuttings and onsite harvest & transplant of single woody species and a conglomeration of “living root balls.” Additional specified plantings are scheduled for 2016. At the time of the site visit the live cuttings and transplanted material appeared viable and an emerging nurse/cover crop was apparent with 20%± coverage of disturbed ground. Overall, it is too soon after installation and late in the year to estimate survivorship and vegetation establishment. Project managers should monitor plant establishment throughout 2016 & 2017, paying particular attention to project & site challenges, such as: harvest and transplanting of material outside of dormancy and the general difficulty of establishing cover on rocky, low-organic soils.

10e. Vegetation B:

11. Is the plan based on current science? Yes

If no, explain in detail.

12. List indicators of project outcomes at this stage of project:

Summary: It is too early to confidently predict outcomes at this time (see #17 below). Furthermore the stream was at or near bankfull discharge during the evaluation—a coincidence that both limited the evaluation (physically & visually obstructed) and provided a testing opportunity for the project. Therefore, these limited indicators were available at the time of the evaluation:

- Connectivity: near bankfull event had accessed a portion of the floodplain;
- Water Quality: relocation of stream away from high, unstable banks should decrease sediment contribution;
- Biology: the addition of wood, large rock and pool forming/holding structures should increase the amount and quality of habitat and cover for trout and other aquatic organisms.

13. Does the project plan/implementation of the project plan reasonable allow for achieving proposed project outcome?

The design and executed project can reasonably address the core hydrology, geomorphology, connectivity, water quality and biology criteria. The intended long-term monitoring should be sufficient and documenting success and any shortcomings.

14. Are corrections or modifications needed to meet proposed outcomes?

No warranted corrections/modifications apparent this early in the establishment phase.

15. Do proposed or planned future steps, including long term management appear practical and reasonable? What are the potential challenges, limitations?

No foreseeable issues with the core project, there may be challenges with maintaining the created ponds (see #18).

16. Do any of the project activities, planned or implemented, likely detract from existing or potential habitat? Explain.

No long-term detraction apparent.

17. Are follow-up assessments needed? Explain.

Yes—there would be significant value in reevaluating this project in 3-5 years. This evaluation was completed within 3± weeks of substantial completion, when vegetation inputs were not fully completed and temporary and permanent vegetation had yet to establish. A follow up evaluation after vegetation has established and the project has experienced ≥ 2 channel forming discharges will be more telling of probable outcome, especially if the monitoring plan is executed as planned (see #4 above).

18. Additional comments on the restoration project.

The created ponds (should also be closely monitored as the project evolves. A beneficial product of onsite borrow/harvesting gravel and/or rock for the project, resources were also invested in providing and controlling flow to and through these features. Created, flow-through ponds/wetlands in the floodplain are difficult to control and/or maintain, as flood flows and associated detritus commonly fill, erode and otherwise alter these feature. Constructed ponds/wetland in this context should be resilient, permitted to evolve and/or constructed for a short lifespan.

It's worth noting that additional value was gained from this project via the utilization as a hands-on learning opportunity for 30± local and state water resource professionals.

Project Evaluation

19. The project will:

a. Likely not meet proposed outcomes ☐
b. Minimally meet proposed outcomes ☐
c. Meet proposed outcomes ☐
d. Likely exceed proposed outcomes ☒
e. Greatly exceed proposed outcomes ☐

Confidence of outcome determination

a. Low ☐
b. Medium ☒
c. High ☐

20. Provide explanation of reason(s) for determination.

Given that the project is in the very early stages of establishment, reviewer evaluation is conservative. The designed and executed project has indicators of success, but it is premature to determine whether goals have been met.

21. Site Assessor(s) Conducting Review:

Kevin Biehn, Consultant, Emmons & Olivier Resources, Inc.; Wade Johnson, Restoration Evaluations Coordinator, MN DNR.

Site Maps:

Figure 1 - Project Overview from construction plan set (sheet 2 of 15)

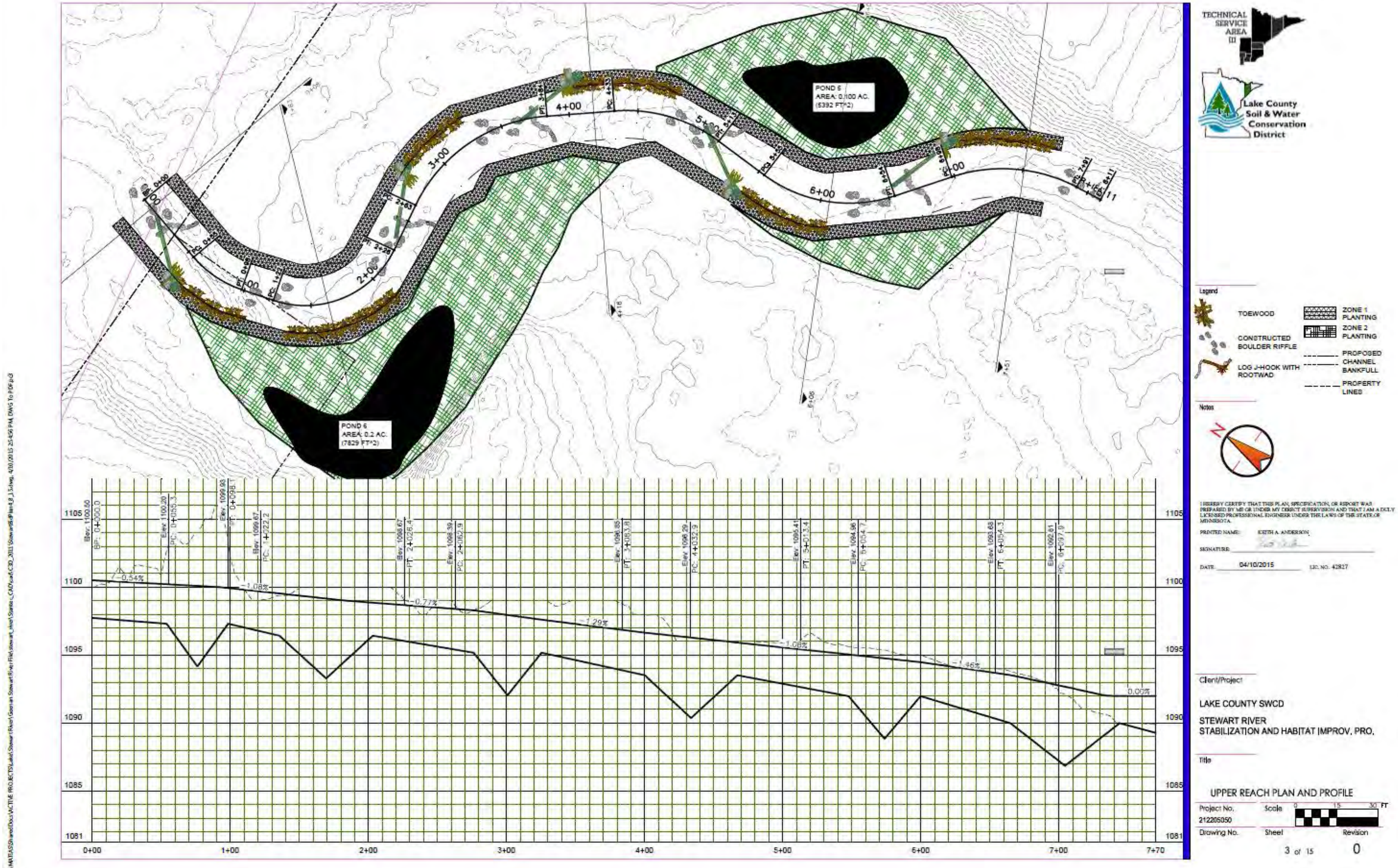


Figure 2 - Plan & Profile from Construction Plan Set (Sheet 3 of 15)

Site Photographs

Figure 3 - Representative image of restoration. Stream was near bankfull discharge during site evaluation.

Figure 4 - Representative image of one of the created ponds (left).

Figure 5 - Representative image of project elements: Toe Wood (right) with willow harvested mats above and Log J Hook with Rootwad downstream (left).

RESTORATION EVALUATIONI PROGRAM for LEGACY PROJECTS
Minnesota Board of Water and Soil Resources
Minnesota Department of Natural Resources

Project Evaluation Form

Project Background

Project Name: Stewart River Stabilization and Habitat Improvement – Liukkonen Project **FY 2012**

Project Location: Lake County

Township/Range Section: Section 13 T53N, R10W

Project Manager/Affiliated Organization, Contact: Lake County Soil and Water Conservation District

Fund: CWF **Fiscal Year Funds:** 2012 **Project Start Date:** 2015

Predominant Habitat type: Aquatic Habitat, Forest

Project Status: Establishment Phase

Project Goals and Planning

(Site Assessment Preparation from Plan Sets and Documents)

1. **What are the specific project components?**
   - Bank stabilization via channel alteration (pattern, profile and dimension) and the introduction of Toe Wood and instream structures

2. **What plans/record of project decisions/prescription worksheets are available? Provide location data?**

Construction Plan Set (3/2015); SHPO Review and Compliance Memorandum (5/27/2015); Stewart River Clean Water Fund Evaluation (9/2015).

3. **What are the stated goals of the project?**

   Excerpts from Original CWF Abstract:

   This project will restore five severely eroding streambank sites [it is understood that the Liukkonen Project is 1 of 5 sites] along a 1.5 mile reach of the Stewart River. The cumulative streambank length is 976 feet and the streambank heights vary from 6 to 30 feet. The sites generate over 446 tons of sediment and 480 pounds of phosphorus annually.

Overall, these five projects will restore and stabilize the natural channel morphology and will contribute to stable stream channel conditions. The benefits from a stable channel in this location will include reduced sediment downstream, less sediment pollution into Lake Superior, and protection of native riparian plant communities. Toe wood combined with rock stream vanes, will decrease bluff erosion and create beneficial fisheries habitat through the introduction of much needed woody debris.

Hydrology: Maintain current hydrology (duration, magnitude, and timing of flows); improve baseflow conditions for trout

Geomorphology: Restore the appropriate channel form (dimension, pattern, and profile) to create a stable channel (neither aggrading nor degrading, while maintaining its form); provide a diversity of habitat and cover

Connectivity: Restore appropriate connectivity to the floodplain and improve vertical connectivity of stream to groundwater; Re-establish the riparian zone where needed

Water Quality: Reduce sediment input by minimizing stream bank erosion (a reduction of 551 tons per year on 3,000 linear feet of stream); Improve water temperatures through shading, improved baseflow and narrowing of the channel width.

Biology: Increase the amount and quality of habitat and cover for all life stages of trout and other aquatic organisms; improve temperature and water quality for trout.

4. **Were measures of restoration success identified in plans? Yes**
   If yes, list specific measurements.

From a stand point of evaluating the project & stream health the Owner intends to execute a monitoring plan. The following is an excerpt of the provided plan:

The completed stabilization reach will be inspected for structural and vegetative components at the end of the first year and every three years thereafter throughout the duration of the effective life. Lake SWCD and DNR staff will establish permanent cross-sections that will be monumented and re-surveyed in the future to ensure the channel remains stable and to estimate erosion rates. Bank Erosion Hazard Index (BEHI) and Near Bank Shear Stress (NBSS) assessments have been performed and will continue to be assessed after restoration is complete to determine erosion rates and amounts of sediment entering the river. The DNR will assess fish populations and stream temperatures prior to restoration and post-restoration in varied locations throughout the watershed. These numbers will be compared to baseline data collected prior to the June 2012 flood. Sediment loads will be monitored by the DNR in partnership with the USGS. Sediment samples will be taken during high flow events to measure both suspended sediment and bedload. Sediment loads will be monitored pre and post construction at the downstream edge of the restoration reach. Sediment load data will be paired with flow data to allow DNR and SWCD staff to determine how much sediment is being moved during specific flow events. Flow data will be collected by the SWCD and the DNR. Flow data will be collected at low, medium, and high flows with the goal of creating a flow duration curve.

5. **Are plan Sets available? Yes Have new GIS maps been created?** No

If yes, provide in Appendix A and list Maps provided:

6. **Provide list of best management practices, standards, guidelines identified in plan set? Are these based on best current science? If not, what parameters diverge from these practices? Do these divergences affect outcomes?**

    1. Natural Channel Design (NCD) methodology was reportedly implemented to inform analysis & design. NCD is a standard industry methodology for stream restoration, most associated with Wildland Hydrology Consultants and Dave Rosgen.
    2. The practices employed, such as Toe-wood, are common practices used in stream restoration/ stabilization in Minnesota and on North Shore streams.

Project Implementation

(Questions for Site Manager and Cooperating Professionals)

7. **Were alterations made to the original plan during construction? Discuss changes to the following:**
   Yes

    - One or more grade control structures (e.g. Cross Vane or Vortex Weir) were added to the project.

8. **In what ways did alterations to the plan or implementation change the proposed project outcome? Did this change derive from a desire to change outcomes?**

    The reasoning is unknown, but the introduction of one or more such structures will likely control the horizontal and vertical position of the stream and will also likely generate and maintain downstream pool depth

Site Assessment

Field Review: September 24, 2016

9. **Surrounding Landscape Characteristics:**

Land type of the project area is Laurentian Mixed Forest. Vegetation at the project site consists of hardwood trees and conifers. Riparian vegetation is made up of grasses, sedges, willow and alder. The Stewart River is a designated trout stream. Brook trout and steelhead are present in this reach.

Current land use is privately owned, undeveloped forest land with rural residential homes.

10. Site Characteristics:

10a. Soils: The primary soil type within the area of work is Miskoaki-Fluvaquents, frequently flooded, complex 0 to 45 percent slopes; NRCS Map Unit Symbol – E2-33E.

10b. Topography: High gradient stream.

10c. Hydrology: Stream flow is flashy due to prevalence of tight soils, shallow depth to bedrock and steep topography.

10d. Vegetation A: The following vegetation establishment measures were completed prior to the evaluation: Native seeding, live staking of cuttings, tree planting, (with browse protection), shrub planting and onsite harvest & transplant of single woody species and a conglomeration of "living root balls. At the time of the site visit the live cuttings and planted material appeared viable and an emerging nurse/cover crop was apparent with 10%± coverage of disturbed ground. Overall, it is too soon after installation and late in the year to estimate survivorship and vegetation establishment. Project managers should monitor plant establishment throughout 2016 & 2017.

10e. Vegetation B:

11. Is the plan based on current science? Yes (Explain)

12. List indicators of project outcomes at this stage of project:

Summary: It is too early to confidently predict outcomes at this time (see #17 below). Furthermore the stream was at or near bankfull discharge during the evaluation—a coincidence that both limited the evaluation (physically & visually obstructed) and provided a testing opportunity for the project. Therefore, these limited indicators were available at the time of the evaluation:

- Connectivity: near bankfull event had accessed a portion of the floodplain;
- Water Quality: relocation of stream away from high, unstable banks should decrease sediment contribution;
- Biology: the addition of wood, large rock and pool forming/holding structures should increase the amount and quality of habitat and cover for trout and other aquatic organisms.

13. Does the project plan/implementation of the project plan reasonable allow for achieving proposed project outcome?

The design and executed project can reasonably address the core hydrology, geomorphology, connectivity, water quality and biology criteria. The intended long-term monitoring should be sufficient and documenting success and any shortcomings.

14. Are corrections or modifications needed to meet proposed outcomes?

No warranted corrections/modifications apparent this early in the establishment phase.

15. **Do proposed or planned future steps, including long term management appear practical and reasonable? What are the potential challenges, limitations?**

    No foreseeable issues with the core project.

16. **Do any of the project activities, planned or implemented, likely detract from existing or potential habitat? Explain.**

    No long-term detraction apparent.

17. **Are follow-up assessments needed? Explain.**

    Yes—there would be significant value in reevaluating this project in 3-5 years. This evaluation was completed within 3± weeks of substantial completion, when vegetation inputs were not fully completed and temporary and permanent vegetation had yet to establish. A follow up evaluation after vegetation has established and the project has experienced ≥ 2 channel forming discharges will be more telling of probable outcome, especially if the monitoring plan is executed as planned (see #4 above).

18. **Additional comments on the restoration project.**

Project Evaluation

19. **The project will:**

    a. Likely not meet proposed outcomes ☐
    b. Minimally meet proposed outcomes ☒
    c. Meet proposed outcomes ☐
    d. Likely exceed proposed outcomes ☐
    e. Greatly exceed proposed outcomes ☐

Confidence of outcome determination

    a. Low ☐
    b. Medium ☒
    c. High ☐

20. Provide explanation of reason(s) for determination.

Given that the project is in the very early stages of establishment, reviewer evaluation is conservative. The designed and executed project has indicators of success, but it is premature to determine whether goals have been met.

21. Site Assessor(s) Conducting Review:

Kevin Biehn, Consultant, Emmons & Olivier Resources, Inc.; Wade Johnson, Restoration Evaluations Coordinator, MN DNR.

Site Maps:

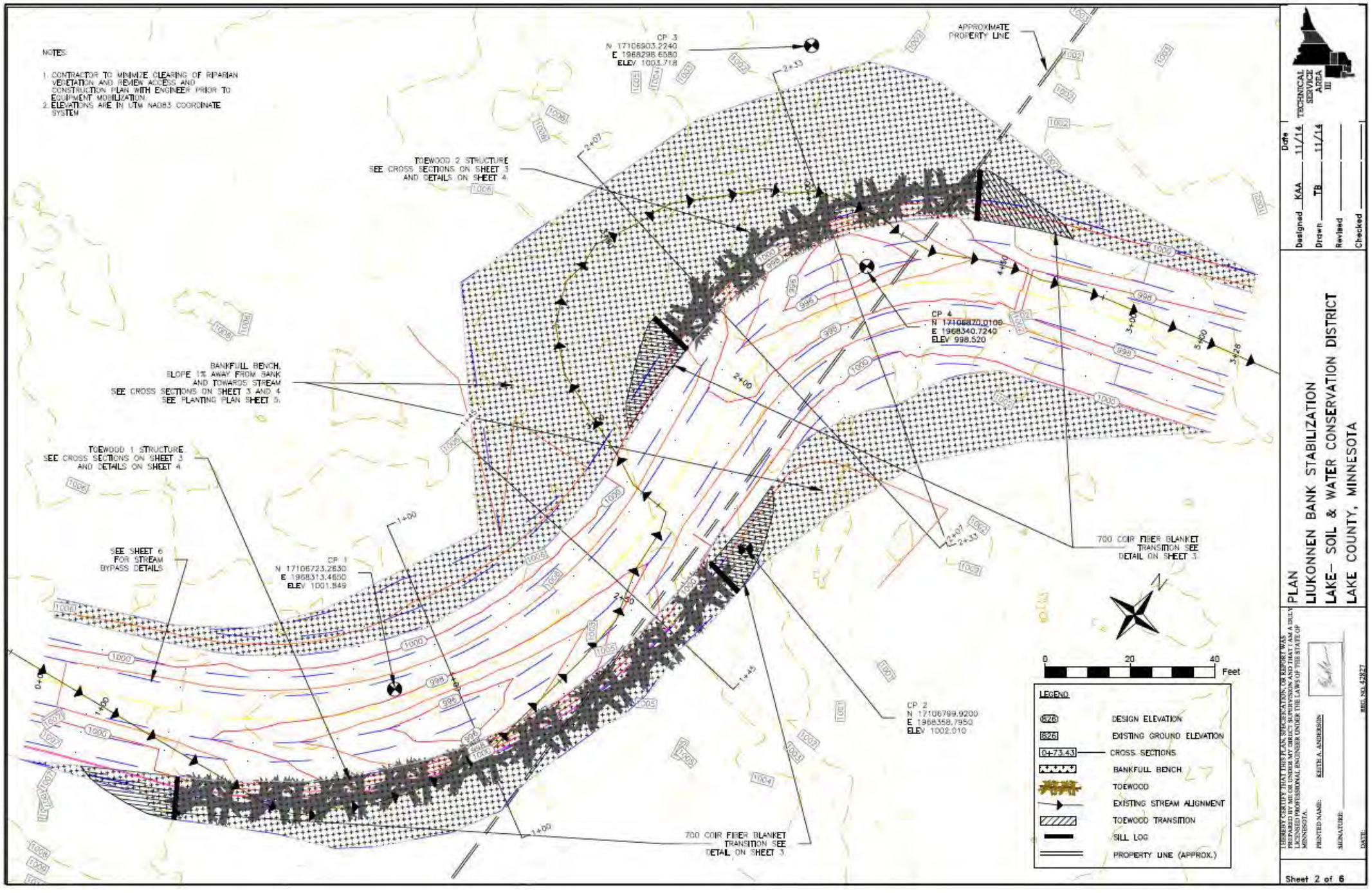


Figure 1 - Project Overview from construction plan set (Sheet 2 of 6)

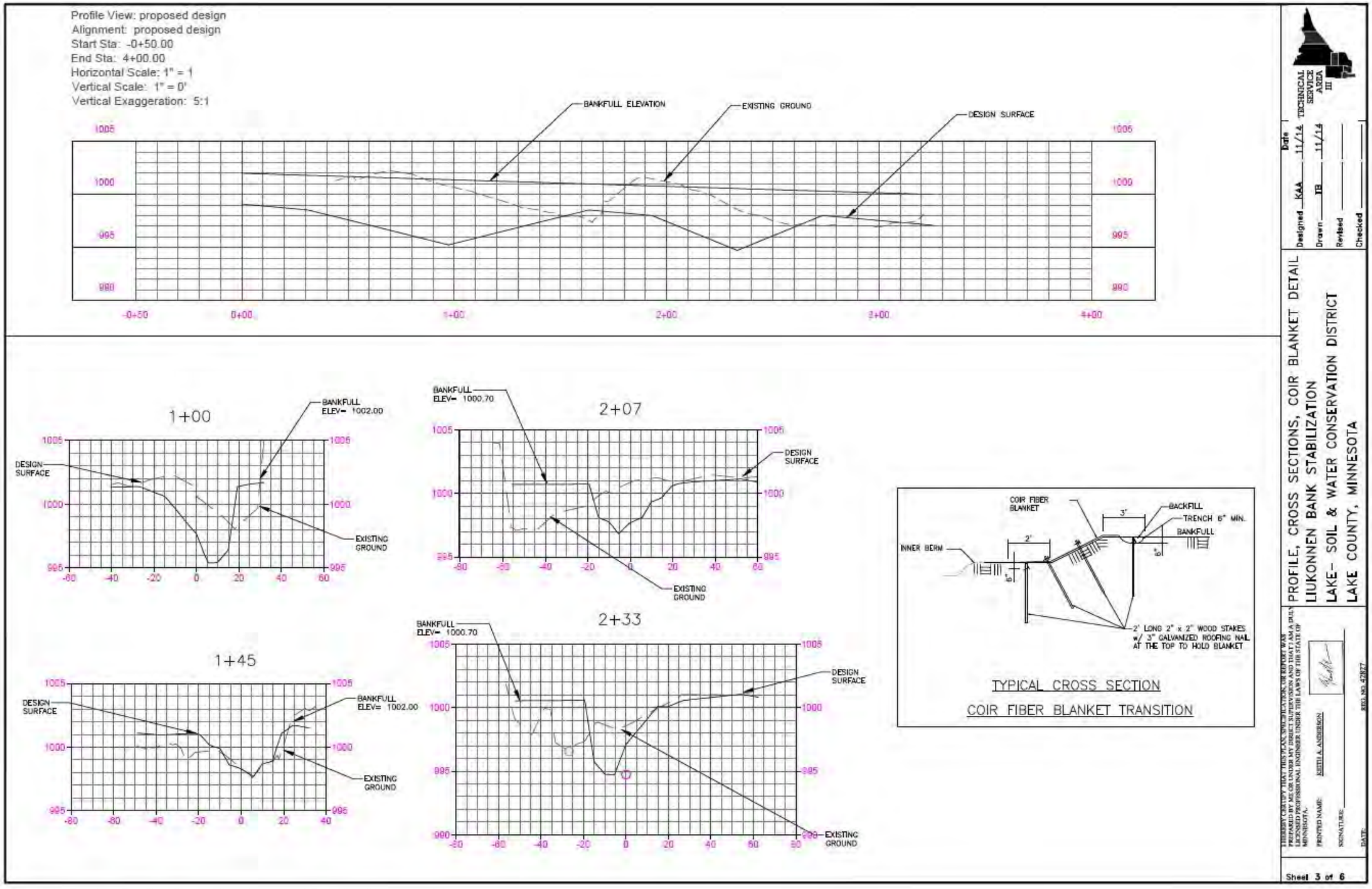


Figure 2 -Design Profile, Cross-Sections and Details (Sheet 3 of 6)

Site Photographs

Figure 3 - Representative image of stabilization. Note the grade control structure (center images) was a project add-on (understood to have been requested and/or funded separately by Minnesota Trout Unlimited).

Figure 4 - Representative image of toe wood (near bank) and onsite transplants (near bank) along with the tree and shrub plantings with browse protection.

Figure 5 - A constructed offline “wildlife pond” (left side of image), a minor project change, was a product of balancing cut & fill.

RESTORATION EVALUATIONI PROGRAM for LEGACY PROJECTS
Minnesota Board of Water and Soil Resources
Minnesota Department of Natural Resources

Project Evaluation Form

Field Review: September 16, 2015

Project Background

Project Name: Grand Marais Creek Cutoff Channel

Project Location: Polk County, Minnesota

Township/Range Section: T153N, R50W Sections 22, 23 and 26

Project Manager/Affiliated Organization, Contact: Red Lake Watershed District

Fund: CWF **Fiscal Year Funds:** 2011 **Project Start Date:** 2011

Predominant Habitat type: Prairie/Savanna/Grassland Wetland Aquatic

Project Status: Establishment Phase

Project Goals and Planning

(Site Assessment Preparation from Plan Sets and Documents)

1.What are the specific project components?

- In the early 1900s, a state and County drainage project was constructed to provide for a shortened pathway for waters from Grand Marais Creek to the Red River. The 1¼ mile channel cut off 6 miles of the meandering natural channel. By 2011, head cutting, steep gradients, unstable banks and slough led to an estimated 700 tons of annual sediment loss into the Red River. Agricultural land was being lost along the banks of the Grand Marais cut-off channel due to erosion and bank failure.
- Bank stabilization is provided through the armoring of critical locations, resloping of the channel banks, establishment of an appropriate stream cross section and bank revegetation.
- Two vertical drop structures and spillways were constructed to flatten the channel profile to non-erosive velocities in order to eliminate head cutting, bank sloughing and sediment transport into the Red River.
- Provide a stable outlet of Grand Marais Creek to accommodate potential future agricultural drainage projects.
- Install buffer strips on approximately 18.5 acres along Cut Channel to prevent erosion, improve water quality and enhance habitat for wildlife and aquatic life. Buffer strips are a minimum of 20 feet between the top of bank and the permanent ROW.
- Land rights were acquired to through perpetual easement.

- This project is explicitly tied to the Grand Marais Creek Restoration Project, providing an outlet to the creek during high flows, thus protecting both channels. An additional Diversion Structure between the two projects was constructed as well.
- Side water inlets were installed using NRCS standards. Inlets were constructed with a combination Class 3 Rip Rap and Steel culverts with flap gates.

2. **What plans/record of project decisions/prescription worksheets are available? Provide location data?**

http://www.redlakewatershed.org/cutchannel.html

2011 – Grant Detail Report – Runoff Reduction Red Lake Watershed District.

2011 – Grant Detail Report – Shoreland Improvement – Red Lake Watershed District.

Construction Plans for Grand Marais Creek Cut Channel Stabilization Project (As-Built Plan), April 2012: Red Lake Watershed District Project No. 60FF, Ester Township, Polk County.

Project Specifications: Grand Marais Creek Channel Restoration Project (Phase 2-Diversion Structure). Red Lake Watershed District Project No. 60F.

Grand Marais Creek Outlet Restoration and Cutoff Ditch Stabilization: Cutoff Ditch Slides, Powerpoint Presentation). Red Lake Watershed District Project 60F and 60FF. Project Team Update.

3. **What are the stated goals of the project?**
    - Provide Stabilization of cut channel for 25 years.
    - Reduce turbidity impairment in the Red River.
    - Provide protection for adjacent agricultural lands adjacent to the Cut Channel.

4. **Were measures of restoration success identified in plans? No**

If yes, list specific measurements.

5.Are plan Sets available? Yes Have new GIS maps been created? Yes

If yes, provide in Appendix A and list Maps provided:

Map A: Soils Texture

Map B: Site Topography

Map C: Site Visit Notes

6. **Provide list of best management practices, standards, guidelines identified in plan set? Are these based on best current science? If not, what parameters diverge from these practices? Do these divergences affect outcomes?**

    1. NPDES Stormwater Pollution Prevention Plan was incorporated into the plan set for the project and incorporates a range of Best Management Practices for erosion control and timing of project activities. General guidance included:
        a. Surface roughening to capture seed, reduce runoff and capture rainfall
        b. Silt Fence with inspections and cleanout required
        c. Erosion Control Blanket on slopes (Did not notice in field. Appeared to be straw mulched and seeded only)
        d. Trenched Filter Logs
        e. Rocked Construction entrances
        f. Floating Silt Curtain at open waters
    2. Given the nature of the project as providing protection within the confines of the existing cut channel location, the project is designed more as conveyance channel than stream, using armoring and sheet pile drop structures to achieve project goals.
    3. A native upland seed mix (listed as MnDOT 350) appropriate to the region was used. No Wetland or Streambank seed mix was specified in the plan set and none was identified in the "As-built" as seeded.
    4. The plan set for the Diversion Structure (funded separately with Outdoor Heritage Fund) uses MnDOT Seed Mix 280 "Agricultural Roadside" for use on project. This mix includes species such as Smooth Brome (DNR invasive grass) which will likely be a seed sources for downstream restored areas.

Project Implementation

(Questions for Site Manager and Cooperating Professionals)

7. **Were alterations made to the original plan during construction? Discuss changes to the following:**

    - **Grading alterations:** Yes
        - Construction began in June 2012. During construction, water seepage through the slope upstream of the CR 64 Bridge was found. Seepage was visible on the surface causing cracks in the bank soon after construction. It became apparent that subsurface drainage would be needed to fix this problem. The project initially stabilized a stretch of the south bank, upstream of the CR64 Bridge. Along 800 feet of the bank stabilization of the south bank upstream of the bridge, drain tile (6" perforated PVC pressure pipe) was installed parallel to the channel near the top of the slope at a depth approximately equal to the channel bottom. Two drain tile outlets were installed perpendicular to the channel to alleviate the seepage in the 800 feet of drain tile. As the project moved forward multiple bank stabilization methods were used. A clay

plug method was used for an additional 1,700 feet on the south bank, 700 feet upstream of the bridge continued from the drain tile installation and 1,000 feet downstream of the bridge. This method included excavating a trench near the top of the slope to a depth similar to the channel bottom and backfilling with clay material. One drain tile outlet and five coarse filter aggregate drains were installed perpendicular to the channel, through the clay plug to alleviate the seepage behind the clay plug. A 1,400 feet clay plug installation was used on the north channel slope upstream of the bridge near the top of the slope with five coarse filter aggregate drains. The purpose of the plug and the drains is to help prevent slope sloughing due to groundwater seepage.

- Banks were also stabilized on the upstream sides of the grade stabilization structures. Drain tile was installed to prevent bank seepage and sloughing near the structures. Consulting engineer recommended the installation of 6" PVC poly pipe drain tile with a gated outlet with pea rock at an estimated cost of $30,000 to help stabilize the banks by the grade stabilization structures. To help stabilize the channel slopes, 4:1 slopes were used. Where there was channel seepage problems, 5.5:1 slopes were used.

- **Changes to Elevation of structures or other components:** Yes
  - *Cut Channel:* Changes to elevations in cut channel are described above
  - *Diversion Structure:* Post construction survey indicates sheet pilings at slightly different elevations that plan. These are within tolerances for the project. Slight changes in channel profile were made to accommodate for spoil material. In a few areas where seepage was a problem downstream of the diversion structure, sideslopes were increased from 4:1 to 5.5:1 to ensure stability.
- **Changes to vegetation plan:** No Assume seeded to MnDOT Seed Mix 350 (Current MNDOT Mix 35-241, Mesic Prairie General). Most grass species identified in seed mix are present.
- **Fill Material:** No As-bulit is consistent with plansets.
- **Others:** Yes The structure nearest to the Red River was moved upstream by 170 feet due to encountering burnt bison bones, a site of cultural importance. This change was precipitated by USACE requirements to protect potentially significant cultural settings and/or artifacts. This change may have the potentially adverse effect of increasing sedimentation and scour due to greater backwater effects from the Red River.

8. **In what ways did alterations to the plan or implementation change the proposed project outcome? Did this change derive from a desire to change outcomes?**

   The alterations to the stream channel slopes should reduce the likelihood of slope failure along the stabilized channel. This was a field-fix based on on-site conditions and should not change the stated goals or outcomes of the project.

Site Assessment

Field Review: September 16, 2015

9. Surrounding Landscape Characteristics:

The surrounding landscape is a mix of forested floodplain along the upper elevations of the channel, CRP grasslands and tilled agriculture.

10. Site Characteristics:

10a. Soils: Soils along the channel are entirely finely textured soils with predominately fine silts within the channel itself. K Factors of the soils within the entire channel are considered moderately erodible (K Factors from 0.24 to 0.28), though on the low side of the range. Generally along the cut channel, vegetation is present along the slopes to the bottom of channel. Small rills are present just above the bottom of channel, but these tend to be very small, perpendicular to the channel and very widespread. No large rills were noted along the channel in the project area.

10b. Topography: Topography in the project area is very flat, with steep slopes found only within stream channels. Former river channels are generally shallow wetlands at present in the area of the Cut Channel. These areas have been restored and are generally enrolled in conservation programs and are fully vegetated north of the cut channel. South of the channel, agricultural land appears to be cropped to annuals and likely consists of bare soils outside of the Channel Buffer. Buffer should provide protection from agricultural runoff.

10c. Hydrology: During site visit, water in the channel was very low and low flow. Water in the restored Grand Marais Creek is substantially lower than the diversion structure and thus, no water was flowing in the Cut Channel at the upstream end of the project. Shallow pooled water was present at the base of the Diversion Structure. It is likely this water is from groundwater sources.

10d. Vegetation A: Vegetation along the Cut Channel Restoration area is a mix of seeded native species and nonnative invasive species (Smooth Brome); seeding with MnDOT 280 Ag Roadside seed mix on the up-channel diversion structure (funded separately from this project) may exacerbate weed seed. This Clean Water Fund Grant for channel stabilization seeding (MnDOT 130 Soil Building Cover & MnDOT 350 Mesic Prairie) reasonably meets the BWSR Clean Water Fund Grant guidance, as stated: *"To the extent possible, applicable projects must have vegetation planted or seed sown only of ecotypes native to Minnesota, and preferably of the local ecotype, using a high diversity of species originating from as close to the project site as possible, and protect existing native prairies from genetic contamination."* Ideally, plant species adapted to wet conditions would have been specified and seeded/planted in areas where soil and surface saturation were to be expected.

10e. Vegetation B: Plant species common within project areas are listed below. Species lists were generated during meander review of project area and do not include all species within the project area. Generalized locations are shown in Figures 1, 2 & 3.

CC1

Common Name	Scientific Name	Abundance	Native/ Nonnative	Plan Seed Mix (Y/N)
Yellow Foxtail	*Setaria glauca*	C	Nonnative	N
Indian Grass	*Sorghastrum nutans*	C	Native	Y
Tall Sunflower	*Helianthus giganteaus*	U	Native	Y
Cocklebur	*Xanthium sp.*	C	Nonnative	N
Barnyard Grass	*Echinochloa crus-galli*	C	Nonnative	N
Big Bluestem	*Andropogon gerardii*	C	Native	Y
Perennial Ryegrass	*Lolium perenne*	A	Nonnative	Y
Slender Wheatgrass	*Elymus trachycaulus*	A	Nonnative	Y
Giant Ragweed	*Ambrosia trifida*	U	Nonnative	N
Prairie Cordgrass	*Spartina pectinata*	U	Native	N
Canada Thistle	*Circium arvense*	U	Nonnative	N
Switchgrass	*Panicum virginianum*	C	Native	Y
Rye (cover)	*Secale cereal*	C	Nonnative	N
Reed Canary Grass	*Phalaris arundinacea*	C	Nonnative	N
Sandbar Willow	*Salix interior*	C	Native	N
White Clover	*Trifolium repens*	C	Nonnative	N
In Channel				
Hybrid Cattail	*Typha x glauca*	C	Nonnative	N
Barnyard Grass	*Echinochloa crus-galli*	C	Nonnative	N
A Sedge Species	*Carex sp.*	U	Native (likely)	N
Water Smartweed	*Polygonum aquatic*	C	Native	N
River Bulrush	*Scirpus fluviatalis*	C	Native	N
Beggar's Ticks	*Bidens cernua*	C	Native	N
Soft-stem Bulrush	*Scirpus viridis*	C	Native	N
Site Setting/Description: Cracked fine soils mudflat at confluence of Cut Channel with Red River. Appears as though lower portion of channel was not seeded.				

*Abundance: D=dominant (>26%), C=Common (5-25%), U=Uncommon (0-5%)

** Native/Nonnative: Desirable Native (DN), Invasive (In), Nonnative Invasive (NN)

CC2 (Up)

Common Name	Scientific Name	Abundance	Native/ Nonnative	Plan Seed Mix (Y/N)
Canada Wild Rye	*Elymus canadensis*	C	Native	Y
Virginia Wild Rye	*Elymus virginiana*	C	Native	Y
Indian Grass	*Sorgastrum natans*	C	Native	Y
Western Wheatgrass	*Elymus trachycaulus*	C	Native	Y
Big Bluestem	*Andropogon gerardii*	C	Native	Y
Side-oats grama	*Bouteloua curtipendula*	C	Native	Y
Foxtail	*Setaria glauca*	C	Nonnative	N
New England Aster	*Aster noae-angliae*	U	Native	Y
Switchgrass	*Panicum virgatum*	C	Native	Y
Canada Thistle	*Circium arvense*	U	Nonnative	N
False Sunflower	*Heliopsis helianthoides*	U	Native	Y
Bergamot	*Monarda fistulosa*	U	Native	Y
Gray-headed Coneflower	*Ratibida columnifera*	U	Native	Y
Blue Vervain	*Verbena hastate*	U	Native	Y
Black Eyed Susan	*Rudbeckia hirta*	U	Native	Y
Prairie Sunflower	*Helianthus pauciflorus*	U	Native	Y
Site Setting/Description: CRP land along the northern edge of the channel at the lower drop structure.				

*Abundance: D=dominant (>26%), C=Common (5-25%), U=Uncommon (0-5%)

CC3

Common Name	Scientific Name	Abundance	Native/ Nonnative	Plan Seed Mix (Y/N)
Begger's Ticks	*Bidens cernua*	C	Native	N
Yellow Nutsedge	*Cyperus esculentus*	C	Native	N
Cottonwood	*Populus deltoides*	U	Native	N
River Bulrush	*Scirpus fluviatalis*	C	Native	N
Hybrid Cattails	*Typha x glauca*	C	Nonnative	N
Duckweed	*Lemna sp.*	C	Native	N
Reed Canary Grass	*Phalaris arundinacea*	C	Nonnative	N
Pigweed	*Amaranthus sp.*	C	Nonnative	N
Barnyard Grass	*Echinochloa crus-galli*	C	Nonnative	N
Giant Ragweed	*Ambrosia trifida*	U	Native	N
Western Wheatgrass	*Elymus trachycaulus*	U	Native	N
Cocklebur	*Xanthium strumarium*	U	Native	N
Sedge Species	*Carex sp.*	U	Native (likely)	N
Site Setting/Description: Cracked fine soils mudflat at confluence of Cut Channel with Red River. Upstream of the immediate confluence, a mix of annual and perennial weedy species predominate on the shelf within the river floodplain. River Bulrush, Hybrid Cattails and Duckweeds are present, though not yet dominant in the channel. Sod forming carex species are present in clumps along the steeply sloping banks.				

*Abundance: D=dominant (>26%), C=Common (5-25%), U=Uncommon (0-5%)

11. Is the plan based on current science? Portions If no, explain in detail.

- *Channel Stabilization:* This project is a channel stabilization designed to function as a conduit for water, maintaining the configuration of the drainage system created in the early 1900s. The plan appears to be engineered and armored appropriately to achieve this goal. This does not fit into best current scientific thinking with regard to stream restoration which would incorporate natural stream geometry and meanders. The project is not intended to do so this and thus meets current science for channel stabilization. Additionally, stabilization of this channel supports the Grand Marais Creek Restoration Project by capturing flows above the two year flood stage. *2. Vegetation Planning:* The project did not take into account the planning for vegetation at the saturated soil, wetland and high water zones. Given that the project lies in a floodprone area, seed mixes and plantings should have taken these factors into account when designing the revegetation of the channel. In the short term, this may leave soils along the banks vulnerable to erosion. In the long term, more deeply rooted flood tolerant species are more likely to provide long term stability.

12. List indicators of project outcomes at this stage of project:

- *Slope Stability:* Side slopes along the channel appear to be stable with minimal soil loss and rill development. Fixes to the project that included the addition of the clay plug and tile systems to protect the slopes where groundwater seeps were identified during construction appear to provide the stability intended. A small number of seepage areas were noted in the field during the visit (notably along the south side of the channel at the upper grade control structure). Project Engineers and owners should continue to monitor these locations for future stability.
- *Vegetation:* In general, channel slopes are fully vegetated above normal water elevations and meet project intent. Where standing water is present, wetland vegetation, dominated by Hybrid Cattail, Softstem Bulrush and River Bulrush is taking hold and becoming the dominant type. Mudflats are present at the confluence of the Cut Channel and Red River. Sedimentation from the Red River will likely maintain this condition. The zone immediately above the existing water level and below the well stabilized dry slopes has limited vegetation and is somewhat prone to the erosive forces of waters during flood stages.
- *Soils and Sedimentation:* Exposed soils in the form of mud flats are common at the lowest end of the cut channel. This sedimented area is likely to remain over the coming years as the Red River deposits sediment during spring flooding. It is likely that the Cut Channel will clear itself of this sediment on a regular and annual basis as floodwaters recede and flows in the cut channel move the sediments back into the Red River.
- As long as slope stability and vegetation on the banks remain in-tact, and grade control structures within the channel function as planned, the project appears to be on track to reduce sedimentation from the Grand Marais Creek and provide slope stability for the channel itself, protecting surrounding agricultural lands.

13. **Does the project plan/implementation of the project plan reasonable allow for achieving proposed project outcome?**

    Project appears to be on track to meet the goals of project outcomes.

14. **Are corrections or modifications needed to meet proposed outcomes?**

    Since the project is in it's early phases, at a minimum, an annual review of the project after spring snowmelt is recommended to assess the success of the existing vegetation at holding the slopes in place. If vegetation, particularly in the floodprone zone is not providing sufficient protection of the slope, the project should consider additional seeding/planting of appropriate materials that can withstand periodic inundation and siltation. Additionally, backwaters behind control structures should be periodically assess for siltation and cleaned if sediments are reducing the effectiveness of the structures at controlling velocities and reducing sediment loads into the Red River.

15. **Do proposed or planned future steps, including long term management appear practical and reasonable? What are the potential challenges, limitations?**

    Yes. The Cut Channel project appears to require only periodic monitoring at this stage for erosion along the channel banks, vegetation success at holding these banks, and assessments of groundwater seepage with the potential to undercut shaped slopes.

16. **Do any of the project activities, planned or implemented, likely detract from existing or potential habitat? Explain.**

    Neglecting to include wetland plantings/seedings has the potential to cause short or long term stability issues. Monitoring the site to ensure that vegetation growing on the lower banks can provide the stability needed should be incorporated into watershed district annual scheduling.

17. **Are follow-up assessments needed? Explain.**

    - **Yes. Local Review:** Followup assessments of the site should occur on the local level by the watershed district to ensure that the cut channel slopes remain stable. At the same time, these assessments should identify whether any headcutting is occurring that could compromise project goals. Assessment of vegetation should occur annually to assess the success of the species in the planting mix (MnDOT 350).
    - **State/Partners Technical Review:** A Restoration Evaluation review of the site should occur in 2017 to assess the long term stability of the project in achieving stated project goals of sediment reduction and slope stability. Additionally, the review should assess the confluence of the channel with the Red River to review whether the channel continues to move sediments downstream, or whether the lower end of the cut channel is becoming more permanently sediment laden.

Project Determinations

18. The project will:

a. Likely not meet proposed outcomes ☐
b. Minimally meet proposed outcomes ☐
c. Meet proposed outcomes ☒
d. Likely exceed proposed outcomes ☐
e. Greatly exceed proposed outcomes ☐

Confidence of outcome determination

a. Low ☐
b. Medium ☒
c. High ☐

19. Provide explanation of reason(s) for determination.

The Cut Channel project is designed to provide stability to the channel. As such, engineered drop structures and stabilized 4:1 to 5.5:1 vegetated side slopes with minimal base flow should provide for the long term needs of the project as an outlet channel for flows exceeding the two year water levels.

20. Site Assessor(s) Conducting Review: Anthony Randazzo, HDR Engineering.

Site Maps: Figure 1 (pre-project aerial)

Site Maps: Figure 2 (pre-project aerial)

Site Maps: Figure 3 (pre-project aerial)

Site Photographs (Reference Maps Above)

CC Photo 1: Stabilized slopes immediately south of Diversion Structure.

CC Photo 2: Stabilized slopes along upper channel. Note erosion at lower elevations near water level.

CC Photo 3: vegetation growing in the bottom of the cut channel.

CC Photo 4: Upper grade control structure.

CC Photo 5: Immediately downstream of upper grade control structure.

CC Photo 6: Slope in CRP planted upland above Upper Grade Control Structure.

CC Photo 7: Wetland vegetation developing along channel above lower grade control structure.

CC Photo 8: Lower grade control structure with upland grassland.

CC Photo 9: Mudflat near the confluence of Cut Channel and Red River.

RESTORATION EVALUATION PROGRAM for LEGACY PROJECTS
Minnesota Board of Water and Soil Resources
Minnesota Department of Natural Resources

Project Evaluation Form

Project Background

Project Name: Minnehaha Creek Stream Meander Date of Review: 09/16/2014

Site Assessment Attendees – Reviewers: Brian Nerbonne MN DNR; Wade Johnson MN DNR

Project manager(s): Sean Walther, City: St. Louis Park; Renae Clark, Mike Hayman, Minnehaha Creek WD; Steve Christopher, Brad Wozney, BWSR – **Property owners:** City of St. Louis Park

Project Location: County Hennepin Township/Range/Section S 21W T 117 N R 21 W

Project Manager/Affiliated organization, Contact: Sean Walther, Senior Planner, City of St. Louis Park

Fund: OHF ☐ CWF ☒ PTF ☐ Fiscal Year Funds - FY 2010 Project Start Date 2012

Predominant Habitat Type: Prairie/Savanna/Grassland ☐ Wetland ☐ Forest ☐ Aquatic ☒

1. Goal(s) of the restoration

Improving fish and wildlife habitat, creating a more naturally functioning stream and riparian zone, improving stormwater detention, storage and infiltration within this segment of Minnehaha Creek floodplain, and strengthening regional connectivity and recreational opportunities along the stream corridor.

Quantifiable objectives of the restoration

- Restores the creek channel to its natural course adding 1,600 ft. of stream.
- Add 4,000 cu. yd. of flood storage by connecting to historic floodplain.
- Treat stormwater from 80 acres removing 45 lbs./yr. total phosphorus.
- Restore 7 acres of wet meadow, floodplain forest, shallow marsh and deep marsh communities.
- Improve public access to the creek and 30 acres of restored natural area.

What plans/record of project decisions/prescription worksheets are available? Where are they located?

Minnehaha Creek provided a number of plans, summaries, and maps describing the project. In addition, they provided a Design Report for the stream restoration that was prepared by the projects design consultant. The document describes some of the methodology for the channel design, as well as assumptions that were used.

2. **What is the status of the project?**

Treatment/establishment phase [X] Post-establishment phase [ ]

3. **Has the plan or project implementation been modified from the original plan? If yes, why and how?**

Adjustments are being made in the planting plan, based on unexpected differences in the hydric condition of soils. Due to the highest flows ever measured on Minnehaha Creek that occurred during the spring/summer of 2014, areas that were originally planned for terrestrial vegetation have sprouted in wetland plants instead, mainly hybrid cattail. A minimal amount of cattail control is underway, but much of the floodplain surrounding the project appears to be destined to be a monoculture.

Have alterations in plan or implementation changed the proposed outcomes? Outcomes do not specify the relative amounts of various floodplain vegetation types, so the total of 7 acres will still be met. Cattails may reduce public access to the creek by creating a tall and dense screen of vegetation between boardwalks and the river.

Project Assessment

4. **Site description (by reviewer):**

This reach of Minnehaha Creek has been heavily impacted by urbanization. The stream had been straightened, with ditch spoils piled along the bank forming a levy that prevented the stream from accessing the floodplain during high water. Dense commercial, industrial, and residential land uses have crowded the stream, minimizing any buffer area. In addition, stormwater treatment from local impervious surfaces was minimal to non-existent. As a result, Minnehaha Creek exhibits flashy flows and received excessive pollutants from stormwater runoff.

Soils: Primarily hydric soils typical of marsh conditions, along with alluvium in the stream channel and ditch spoil banks. Isolated upland areas are more well-drained loams. The stream channel has a bed of predominantly sand and silt, with coarser substrates rare.

Topography: The valley slope throught the project reach is gradual, resulting in stream slopes of 0.1% or less. Floodplains include flat areas of wetland in much of the project reach, with some areas of higher ground that rises above the semi-saturated conditions of the floodplain. The ditch spoil bank also rise up above what would naturally be the floodplain elevation.

Hydrology: Hydrology of this reach as been significantly altered by urban development. The predominance of impervious surfaces in the local watershed is high, and much of that runoff has no rate or volume control; it is simply routed to the stream via storm sewers. This creates a flashy hydrograph that is prone to large bounces following storm events. In contrast, the upper watershed of the Minnehaha Creek includes numerous wetlands and lakes, the largest being Lake Minnetonka, that provide significant storage of water that can help to sustain low flows during dry periods, or prolong high flows during wet periods. Lake Minnetonka serves as the headwaters of Minnehaha Creek, with a dam at the outlet controlling flow. The dam's operating plan includes minimum baseflows during summer months, but also limits stream discharge to prevent downstream flooding during wetter periods that

results in reduced flood peaks, but extended-duration flood events. The dam spillway is closed in winter, when the stream often loses flow completely.

Vegetation (structure, dominant species % cover, invasive species (MN DNR) % cover, other): The floodplain in areas of lower elevation are predominantly hybrid cattails. Some floodplain forest of box elder, silver maple, cottonwood, and buckthorn are also well represented.

Surrounding conditions (adjacent land use/veg.): Land use outside of the project boundaries is predominantly dense residential, commercial, or industrial sites. Turf grass and ornamental trees are the primary vegetation.

5. **Survey methods used (include deliverable format, number of pages):**

Site visit and visual reconnaissance, as well as review of recent and historic air photos.

6. **Is the plan based on current science (best management practices, standards, and guidelines)?**

The design memo provided by the stream design consultant was helpful in understanding the methodology and assumptions used, but left out some explanation of how some aspects were designed. The designers used multiple methods to determine estimates of stream discharge for the project, both from modeling as well as available measured flow data. Typically these various estimates are used to find a design discharge, where the stream channel dimensions and slope are balanced so that the channel handles flow up to a certain level, at which point flows spill onto the floodplain (aka bankfull flow). Research has shown that bankfull flow has a recurrence interval between 1.1 and 1.8 years, with an average of 1.5 years. This channel-forming flow has sufficient energy to move sediment, but recurs with enough frequency to effectively shape the stream channel. The modeled estimate of a 1.5 year flow was 133 cubic feet per second (cfs), while measured data from the Lake Minnetonka outlet had a discharge of 181 cfs. It should be noted that there is a significant amount of impervious area that drains to Minnehaha Creek between Lake Minnetonka and the project site, meaning that discharges at the project location would be greater than 181 cfs. It is unclear why the modeled discharge was not calibrated to measured discharges in the stream, but this calls into question the accuracy of the model data, at least for discharges in this range.

Often stream designers will estimate a design discharge based on a reference reach, where channel dimensions, slope, and roughness are measured or estimated in order to estimate bankfull discharge. The design report mentions a reference reach in the middle of the project area, but does not provide data on dimensions or estimated bankfull discharge in that reach. Only qualitative descriptions are made that the reach was an appropriate template, and that dimensions were similar. The designers also used relic channel meanders that remain from prior to stream ditching to estimate channel width.

The stream designers chose a design discharge for the channel of 80 cfs, which is considerably smaller than either the modeled (133 cfs) or measured (181 cfs) 1.5 year recurrence flow. Based on available data, it appears that the stream would exceed 80cfs every year, except in extremely dry years. The design report justifies the 80 cfs design discharge because in reflects unspecified analog reaches within the system, and that it would result in a stream with a frequently inundated wetland floodplain. Looking

at a longitudinal profile of the stream as designed, one can see multiple locations where the stream would spill out of its banks onto the floodplain at 80 cfs or less.

For anyone who has ever done a stream restoration, it should come as no surprise that the year following construction of the project had the highest flows ever recorded for Minnehaha Creek. 2014 had record flows that lasted for the better part of three months, inundating much of the floodplain for that entire period. A downstream gage recorded a discharge of 900 cfs, and had flow of over 400 cfs for 6 weeks. These high flows inundated floodplain areas along the project reach and smothered any seeding or planted vegetation such as willow life stakes. As water receded, hybrid cattail germinated throughout the floodplain where there was open sun, and quickly has covered the site. Planting plans have been changed as the hydrologic nature of the site has become apparent. Although the high water undoubtedly exacerbated the situation, one must also wonder about the decision to create a stream channel that was designed to spill from its banks so frequently. If the goal was to establish a type-3 wetland throughout then it makes sense. Designing to a type-2 sedge meadow would have been more conducive to the goal of public access, however. A larger stream channel could have reduced the out-of-bank flows and reduced the amount of time with saturated soil conditions. One of the expected outcomes is to enhance floodplain storage, but that outcome could likely have been met without such a frequency of inudation. A two-stage channel design could also have maintained a baseflow channel with improved fish habitat, while allowing some spillage of discharge onto a smaller floodplain at high flows, with the larger floodplain only access during bigger flows that could have allowed better survival of type 2 wetland or floodplain forest vegetation. It is unclear if this design alternative was considered.

There is no mention in the design memo about sediment transport. In additional to being able to convey the water that is flowing from upstream, the stream channel must be able to transport the sediment that is moving into the reach from above. If the channel has less power to move sediment or capacity to transport it, the channel and floodplain become depositional environments where the stream drops excess sediment. This process, called agradation, can result in channel instability as the stream fills in with sediment and can not longer carry the water that flows downstream. A stream's power to move sediment increases with depth and velocity. By allowing flow to spill onto the floodplain at a relatively low discharge, the channel as designed may not be able to convey all of the sediment that is transported from the upstream reach. However, because no sediment transport information is conveyed in the design report it is difficult to tell if that will be an issue.

The new stream channel includes the addition of coarse substrate to serve as spawning riffle, as well as abundant woody debris on the outside of bends. Both practices will not only help to stabilize the new stream channel, but they provide habitat diversity that will benefit the fish community. Plans for woody habitat include extensive cabling of logs together. In a low gradient setting such as this, the use of cables seems excessive. No calculations are included to indicate the necessity of this practice. The risk of cabling logs is that should the structure fail catastrophically, a jumble of logs could wash downstream and block the stream at the next obstruction such as a bridge crossing.

The project includes multiple locations where previously untreated stormwater runoff is detained in ponds or infiltration areas that will benefit water quality in the stream. However, at least one of these basins was backwatered by the stream for much of the summer, which negates the benefit of the practice and potentially compromises its long term success by clogging the basin with deposited sediment. It is unclear if this impact is due to the extremely high flow seen in 2014, or if this will be a recurring problem that would indicate that the practice should have been built at a higher elevation.

7. **List indicators of project outcomes at this project stage:**

1,600 feet of new stream channel has been added as planned. An excess of 4,000 cubic yards of flood storage is available within the project. Stormwater facilities were built as specified, but it is unknown whether they are functioning as specified. Monitoring data would be required to answer that question. The goal of creating 7 acres of wet meadow, floodplain forest, and marsh communities has been met, as previously mentioned this is almost entirely marsh at this point. Access within the site has been improved by the construction of the boardwalk, although the abundance of cattails limits the public's access to and view of the stream.

8. **Does the project plan/implementation of the project plan reasonably allow for achieving proposed project outcome(s)?**

The project plan has a reasonable chance of success, but the issues that result from what appears to be an under-sized stream channel have the potential to compromise the long-term stability of the stream channel if sediment transport is an issue. This is unclear based on the information provided by the designer. The prevalence of marsh habitat is another likely consequence of the design, which may be intentional and accepted by the project proposers. However, there appears to be wetter conditions than anticipated, even given the high flows of 2014.

9. **Are corrections or modifications needed to meet proposed outcomes? Explain.**

At this point only a complete redesign and construction could address the issue of the stream channel's flow capacity. Monitoring of sediment agradation should be done to assess whether the stream is in fact storing sediment. The additional floodplain area created by the project does create room for the stream to adjust over time, so that even major channel changes may not have risks to any structures and therefore allow flexibility to allow those processes to play out without the need for intervention. It will also require time to assess whether the high flows of 2014 are primarily to blame for the explosion of hyrid cattails, or if the frequent inundations that may result for the smaller channel will enable the cattails to thrive.

10. **Has anything been done or planned that would detract from existing or potential habitat? Explain.**

The trade-off between access of high flows to the floodplain and potential channel instability and the hydrologic conditions on the floodplain have been spelled out in previous questions.

11. **Are proposed future steps, including long-term management, practical and reasonable? Explain.**

The city seems to have a reasonable approach to adapting to a different hydrology than they were expecting in the floodplain, adjusting planting plans accordingly. They are attempting to chemically control cattail in one viewing area, but the long-term prospects of a one-time application seem futile. Planting of moisture tolerant tree and shrub species (willow, cottonwood, silver maple) to shade out cattails seems like a reasonable long-term approach.

12. Are follow-up assessments needed? Explain.

Because the entire seeding and planting was washed out by high water, follow-up is needed to assess that phase of the project. The project proposers should consider monitoring the stream channel to assess if aggradation is occurring that may destabilize the stream.

13. Additional comments on the restoration project.

I appreciate the intentions of the project to restore a ditched stream to a meandering channel. There are concerns that I've outlined in this document, but they are based in some cases on missing information that may in fact have been available to designers that informed there decision. I would be open to hearing from the designer about these issues to hear their rationale on decisions that were made, especially if they counter some of the concerns that I have raised.

Project Evaluation

The project will:

a. Likely not meet proposed outcomes ☐
b. Minimally meet proposed outcomes ☒
c. Meet proposed outcomes ☐
d. Likely exceed proposed outcomes ☐
e. Greatly exceed proposed outcomes ☐

Confidence of outcome determination

1. Low ☐
2. Medium ☒
3. High ☐

Provide an explanation of the reason(s) for the determination. Outcomes of restored length of stream and floodplain acreage are easily quantified as having been met. Project was built as designed, including stormwater infrastructure. However, our assessment was not designed to evaluate the effectiveness of stormwater practices. The potential under-sizing of the channel is also an issue that may affect the stability of the channel and the type of riparian vegetation present. However, the creation of a broad floodplain minimizes the risk of the project to any channel instability. The channel has room to adjust to the flows and sediment that it receives without high risk to infrastructure.

Site Assessment Lead(s) Conducting Site Review: Brian Nerbonne, MN DNR

Signature:_____

MINNESOTA DEPARTMENT OF NATURAL RESOURCES
OFFICE MEMORANDUM

DATE: 2-18-2015

TO: Wade Johnson, Restoration Evaluations Program Coordinator

FROM: Brian Nerbonne, Stream Habitat Consultant

SUBJECT: Minnehaha Creek Restoration project review

This memo serves as an addendum to my original review of the Minnehaha Creek Watershed District's (MCWD) restoration project. Subsequent to writing that review, there has been additional information provided by MCWD and their consultant. This includes a written response to the review, providing stream geomorphology survey data for other locations on Minnehaha Creek, and a conference call between DNR and project designers to discuss project design assumptions and constraints. The additional information has allowed us a better understanding of project design, as well as provided an opportunity to discuss the DNR's concerns directly with the designers.

The major issues identified by DNR in the original review centered around the design discharge of the stream channel. There are multiple lines of evidence that indicate that the stream will exceed that discharge annually, and for extended periods of time that are longer than what is seen on other streams. Both the designer and the DNR agreed on this point during the conference call. Our difference of opinion is on whether this is a serious issue at this site. It is the opinion of the designers that the extended flooding of the riparian area is consistent with the wetland conditions at the site, and was necessary in part due to funding constraints that did not allow solutions that would have contained flow in the channel in manner more typical of other streams.

It remains the DNR's opinion that the extended duration of flooding may have negative consequences to stream stability through a reduction in the stream's ability to transport sediment. The stream will likely deposit sediment in this reach, either in the floodplain or the channel. The designers acknowledge this is possible, but feel that the small grain size of instream sediment (sand) and relatively small supply in an urban and impounded watershed mean that process will be very slow if it does occur, with time for the stream to adjust. The DNR indicated in its original review that the project left an adequate floodplain that will allow the stream to adjust, so it appears there is some agreement on this aspect.

The main concern of both the project designers and MCWD is the summary evaluation that the project will "minimally meet proposed outcomes." It is their opinion that such

a judgment is not justified, and should instead indicate that the project bears future monitoring to see if these concerns are valid. We feel that the issues raised with the project warrant the rating given, as the Restoration Evaluation Program requests a summarizing statement about projected outcomes based on statutory direction to determine if restorations are meeting planned goals. As stated in the original review, the project is an improvement over the previous site conditions, and the department is pleased that MCWD is undertaking this type of project. However, we feel that the project deviates from standard practices of how to incorporate hydrology into the design that may create issues with the project in the future.

The DNR has learned from this project review that our current review process is inadequate for us to adequately evaluate stream restoration projects. Permit applicants are required to provide construction plans, but not stream geomorphology and hydrology data that would help characterize the site and project design. As a result of our review of this project, there are discussions in the department about updating our permit application requirements to include submission of specific geomorphic and hydrologic information that is likely already collected or prepared as part of a stream restoration design. Having these summary data will allow for better understanding and evaluation of the project, so that issues can be raised, experiences shared and alternatives discussed at that point. Ideally, conversations and information exchange could also happen earlier in the design process to identify issues at the conceptual phase. These changes in the permit process may take time to implement, but should improve the process for future projects.

RESTORATION EVALUATION PROGRAM for LEGACY PROJECTS
Minnesota Board of Water and Soil Resources
Minnesota Department of Natural Resources

Project Evaluation Form

Project Background

Project Name: Plymouth Creek Stabilization Projects (Plymouth Creek)
Date of Review: 05/6/2015

Site Assessment Attendees – Reviewers: Brian Nerbonne MN DNR; Wade Johnson MN DNR

Project manager: Laura Jester, Administrator Bassett Creek Watershed Commission; Derek Asche, City of Plymouth – Property owners:

Project Location: County Hennepin Township/Range/Section S26 T118N R22W

Project Manager/Affiliated organization, Contact: Laura Jester, Administrator Bassett Creek Watershed Commission

Fund: OHF ☐ CWF ☒ PTF ☐ Fiscal Year Funds - FY 2011 Project Start Date 2011

Predominant Habitat Type: Prairie/Savanna/Grassland ☐ Wetland ☐ Forest ☐ Aquatic ☒

1. **Goal(s) of the restoration**

Reduce nutrient loading to Medicine Lake (per TMDL plan) by repairing eroded banks, realign Plymouth Creek upstream of Medicine Lake to eliminate creek encroachment on adjacent private properties.

Quantifiable objectives of the restoration “annually keep 160-200 lbs of phosphorus and 170-200 tons of Total Suspended Solids from flowing into Medicine Lake”

What plans/record of project decisions/prescription worksheets are available? Where are they located?

Feasibility Report for Plymouth Creek Restoration Project – Barr Eng. July 2009; Construction Plans for Plymouth Creek Rehabilitation – Wenck Eng, Nov 2010, Plymouth City Project No. 8128

2. **What is the status of the project?**

Treatment/establishment phase ☒ Post-establishment phase ☐

3. **Has the plan or project implementation been modified from the original plan?**

If yes, why and how? No

Have alterations in plan or implementation changed the proposed outcomes?

Project Assessment

4. **Site description (by reviewer): Brian Nerbonne**

Soils: Sandy loam alluvium in upstream portion of project, wetland muck in downstream reach.

Topography: Narrow valley with relatively steep slope in upstream reach, flat topography downstream

Hydrology: Plymouth Creek watershed is predominantly urban, resulting in a flashy hydrograph with high peak flow and low baseflow. Some wetlands in the upper part of the watershed likely sustain baseflow during dry periods.

Vegetation (structure, dominant species % cover, invasive species (MN DNR) % cover, other): Upstream reach has been planted primarily with live cuttings of willow and dogwood. Buckthorn is present in several locations. Downstream reach flows through a reed canary grass meadow.

Surrounding conditions (adjacent land use/veg.): Some yards with turf grass outside of a narrow buffer; other areas are a mix of nonnative grasses and early-successional trees (box elder, cottonwood, ash) with some oaks away from the stream.

5. **Survey methods used (include deliverable format, number of pages):**

Reivew of project documentation, historic air photos, and visual observation of project.

6. **Is the plan based on current science (best management practices, standards, and guidelines)?**

The upstream portion of the project is appropriately designed for the most part, with the stream channel providing access to a flood plain during high water, bank stabilization at vulnerable locations, grade control structures, and densely rooted riparian vegetation. However, there are issues with the design and installation of some of the practices. The designed verticle drop of the cross vanes is just under two feet; this is a large drop that generates significant scour on the downstream bed and banks. More frequent cross vanes or riffles with smaller drops would have addressed this issue. In addition, some cross vanes and riffles are not built according to specifications, with relatively flat elevation across the structure rather than a gradual rise from the center of the stream toward the bankfull elevation at the ends. As constructed, they do not adequately concentrate flow in the center of the stream. In addition, some of the riffles or vanes are not adequately tied into the streambank as indicated on plans, and the stream is starting to flank around the structure. There are also issues with the designed placement of cross vanes or riffles at some locations. In at least two places the structures are placed just upstream of a bend. The high amount of scour created by these structures is already showing evidence of contributing to bank instability on the downstream bend. Rootwads were used in at least one channel bend, but it does not appear that the significant amount of wood harvested in conjunction with the project was utilized to stabilize the stream channel. Toe wood structures could have been employed at several locations as alternatives to hard-armor practices that were chosen. This would have decreased material and disposal costs, enhanced habitat, and still met other project goals. One additional concern in the upstream reach is an area between project stations 41+00 and 43+00 where the channel width increases significantly to over twice areas upstream and downstream. This change reduces the sediment transport capability of

the stream and is causing aggrdadation of the stream that may cause channel instability. The width on the plans is supposed to be similar to other areas of the stream.

The plan for the downstream portion of the project appears to have misinterpreted both the current and historic site conditions and issues in designing the new stream channel. The feasibility study notes evidence from historic air photos of a channel further to the south within the wetland than existing (2009) conditions or those from historic airphotos going back to 1937. Based on these evidence, and to achieve a stated goal of reducing flooding of some properties on the north side of the wetland, a new meandering channel was excavated through the wetland. There are tradeoffs with this design that affect the long-term stability of the stream channel, as well as maintenance consequences at the water quality ponds located downstream.

The setting of this project has two distinct reaches, and they function in very different ways. The upstream reach has a high potential for sediment transport due to it's steeper slope and relatively narrow floodplain. In contrast, the wetland area downstream has very low sediment transport potential because of a gradual slope and broad floodplain. The construction plans are deceptive in that they indicate a similar slope (0.2%) in upstream and downstream reaches. However the upstream slope ignores the drop in elevation over cross vanes and riffles. During baseflow the slope is equal to what is shown on the plans, but during higher flows when most bedload transport occurs the effective slope will increase as those features are drown out by high water.

As a result of the steep slope in the upstream reach, the much of sediment transported downstream through the upper portion of the project can not be moved throught the wetland. Instead, that sediment is dropped out in the bed and banks of the stream. In effect, the wetland is functioning as a delta between the upsteam reach and Medicine Lake. Deltas typically have multiple stream channels that change course over time as they fill with material. Looking at the historic airphotos, there is evidence that is exactly how this stream reach behaves. The 1937 photo shows only a single straight ditch through the wetland. Only in the 1947 photo during a time of higher water are there a few meander scrolls in the upstream portion of the wetland that are visible. The ditch was no doubt cut prior to the 1937 photo to facilitate drainage. However, looking at succeeding airphotos over time the ditch fills in with sediment and the channel begins to migrate north. By 2006 a single defined channel has disappeared, replaced by many smaller channels (see attached) typical of a delta setting.

The decision to cut the new stream channel through the wetland alters this situation, creating a more defined flow path with higher sediment transport capability. As a result, sediment that would have been deposited in the wetland previously is now routed through the wetland and into the water quality ponds downstream. This has resulted in annual dredging for the ponds since the stream restoration was completed. This increases ongoing maintenance costs to the city. Discussions with the city and with project designers indicates that this is an acceptable tradeoff in order to accomplish the goal of reducing flooding on properties to the north of the wetland.

The stream appears to already be adjusting to return to more of a delta situation, with deposition of gravel bars in the transition area between the upstream project and the wetland channel. Attempts to address instability in that locaiton following completion of the project have been unsuccessful. Project designers acknowledge that the stream channel will be active in this area, but the design was for that to occur on the south side of the wetland away from houses to the north.

A potential alternative design in the south part of the wetland away from houses could have used a braided channel design that mimics the stable form for this setting. This would have reduced sediment transport to the downstream pond, and taken better advantage of the wetland's potential to filter sediment and phosphorous. Another alternative could have been to buy out properties or purchase flooding easements on the affected properties to the north. It is unknown whether the city conisidered buyouts as an alternative, but they may have found them cost prohibitive or the landowners may not have been willing sellers.

7. List indicators of project outcomes at this project stage:

Riparain plant establishement, streambank and channel stability, and TSS concentration enerting the water quality ponds. Measuring TSS leaving the ponds is measuring the two projects together. Grab samples of the flow prior to the ponds is a better measure of the success of the stream restoration to achieve stated goals, but data from below the ponds does indicate a preliminary trend toward reductions in TSS and phosphorous.

8. Does the project plan/implementation of the project plan reasonably allow for achieving proposed project outcome(s)?

The issues with design and installation of structures listed in question 6 may require maintance in order to for the project to reach its potential in the upstream reach. The channel design within the wetland does not take advantage of the natural filtering potential of the wetland, but the water quality ponds are likely able to handle in inflow of sediment so long as regular maintenance is done to remove deposited sediment.

9. Are corrections or modifications needed to meet proposed outcomes? Explain.

Maintenance of cross vanes and riffles that do not slope down at the center would address their potential to cause bank erosion or structure failure. There are localized areas where live stakes failed uniformly, and bank erosion is already occurring. These areas should be replanted.

Regarding the wetland reach, I recommend that if the stream channel shows signs of aggradation or if ongoing pond dredging costs are too high, that the project partners consider allowing the stream to again function more as a delta by flowing throught the wetland in multiple channels. If this causes recurring issues with flooding of property owners, consider localized mitigation at those properties.

10. Has anything been done or planned that would detract from existing or potential habitat? Explain.

The stream design issues are less about stream habitat than they are issues with ongoing maintenance, as well as additional sediment removal that the wetland could have provided. Stream stability may be an ongoing issue due to the concerns listed above, but they are not likely to have detrimental effects on habitat. Installation issues with some of the structures in the upper reach of the project are causing some issues with bank erosion.

11. Are proposed future steps, including long-term management, practical and reasonable? Explain.

Ongoing vegetation maintenance is not treating buckthorn appropriately. Rather than treated with a foliar spray, buckthorn should either be cut and stump-treated, or uprooted.

Dredging of the water quality pond due to sedimentation is a long-term issue that the project partners will have to address.

12. Are follow-up assessments needed? Explain.

To evaluate this project independently, monitoring of TSS and phosphorous flowing into the pond rather than between the two ponds would better assess water quality goals. However, treating the projects together is understandable because their goals are both to protect water quality in Medicine Lake.

13. Additional comments on the restoration project.

Project Evaluation

The project will:

a. Likely not meet proposed outcomes	☐
b. Minimally meet proposed outcomes	☐
c. Meet proposed outcomes	☒
d. Likely exceed proposed outcomes	☐
e. Greatly exceed proposed outcomes	☐

Confidence of outcome determination

1. Low	☐
2. Medium	☒
3. High	☐

Provide an explanation of the reason(s) for the determination. The stream restoration will reduce the TSS load from this watershed by stabilizing eroding stream banks. I have sediment transport and stream stability concerns associated with the channel design in the wetland as well as localized erosion issues associated with portions of the project, but the downstream water quality ponds appear to be effetively capturing sediment and phosphorous and will handle the impacts from these issues so long as the city continues to maintain them.

Site Assessor(s) Conducting Site Review: Brian Nerbonne _____

RESTORATION EVALUATION PROGRAM for LEGACY PROJECTS
Minnesota Board of Water and Soil Resources
Minnesota Department of Natural Resources

Project Evaluation Form

Project Background

Project Name: Bassett Creek and Plymouth Creek Stabilization Projects (Bassett Creek) **Date of Review: 10/16/2013**

Site Assessment Attendees – Reviewers: Brian Nerbonne MN DNR; Wade Johnson MN DNR –

Project manager: Laura Jester, Administrator Bassett Creek Watershed Commission; Eric Eckman, City of Golden Valley – Property owners:

Project Location: County Hennepin Township/Range/Section S- T- R-

Project Manager/Affiliated organization, Contact: Laura Jester, Administrator Bassett Creek Watershed Commission

Fund: OHF ☐ CWF ☒ PTF ☐ Fiscal Year Funds - FY 2011 Project Start Date 2011

Predominant Habitat Type: Prairie/Savanna/Grassland ☐ Wetland ☐ Forest ☐ Aquatic ☒

1. Goal(s) of the restoration

These changes will reduce phosphorus and sediment loads to the lower creek.

Quantifiable objectives of the restoration “annually keep 96 pounds of phosphorus and 200,000 pounds of Total Suspended Solids from washing downstream”

What plans/record of project decisions/prescription worksheets are available? Where are they located?

Feasibility Report for Bassett Creek Restoration Project – Barr Eng. Aug 2009; Bassett Creek Restoration Project Reach II – WSB Eng, Oct 2010, Plymouth City Project No. 8128

2. What is the status of the project?

Treatment/establishment phase ☒ Post-establishment phase ☐

3. Has the plan or project implementation been modified from the original plan?

If yes, why and how? No

Have alterations in plan or implementation changed the proposed outcomes?

Project Assessment

4. Site description (by reviewer):

Bassett Creek flows through a portion of city-owned open space. A trail roughly follows the stream through the project reach. Review of historic air photos of the project area show that prior to 1937 the stream through this reach had been straightened and channelized. Reaches upstream and downstream of the project area are highly sinuous, indicating what the natural condition for this stream would have been. By the early 2000's when the project was being planned, the stream had begun to remeander itself by eroding the formerly straightened channel. Channelization also created an entrenched stream channel that can not access its floodplain except during very large events. This exacerbates instream erosion during floods. Through the erosional and depositional processes at work since the channelization, the stream has built a narrow floodplain at a lower elevation than the surrounding topography.

Soils: Sandy loam alluvium

Topography: Relatively flat floodplain bordering a low-gradient stream. A trail that roughly follows the stream is elevated above the surrounding topography in places, suggesting either imported fill or that it is located along the top of the ditch spoils that were excavated when the stream was straightened.

Hydrology: Because of the predominantly urban land use in the watershed, the hydrology of the stream is flashy. Peak flows are high relative to watershed size and are relatively short in duration. Low flows are very low, although the presence of Medicine Lake and other smaller waterbodies likely helps to sustain some baseflow throughout the year.

Vegetation (structure, dominant species % cover, invasive species (MN DNR) % cover, other): Vegetation is typical of a disturbed urban stream corridor. Riparian tree species such as cottonwood, box elder, and silver maple predominate the overstory, with annual invasive species and reed canary grass making up most of the ground layer. Buckthorn and honeysuckle are abundant in areas away for the stream project.

Surrounding conditions (adjacent land use/veg.): Outside of the stream corridor and buffer the land use is residential. Adjacent to the stream there are two stormwater ponds that treat runoff from nearby impervious surfaces.

5. Survey methods used (include deliverable format, number of pages):

Review of project documentation, plans, and specifications. Site visit with visual observation of the project.

6. Is the plan based on current science (best management practices, standards, and guidelines)?

During project planning, the channel erosion at the site was determined to be detrimental to downstream water quality. Standard practices that combine hard armor and bioengineering approaches were selected to halt channel erosion within the project reach to reduce TSS and phosphorous loading. Although the design appears to be achieving the stated objectives, I feel that the project's goals could have been more broad in considering stream processes and habitat that a different approach could have achieved.

The decision to armor the stream channel to halt bank erosion focused almost solely on that symptom rather than on the ultimate cause, which was the historic channelization of the stream. The erosional process that the project was intended to address is a natural one that streams undergo as it reforms itself into a more stable morphology that adequately dissipates energy and balances sediment transport. Given enough time, the stream could have returned to a more natural meander pattern and adequate floodplain so that the stream channel would have been stable. However, there are consequences to downstream water quality from the transport of eroded sediment that may be unacceptable. An alternative could have been to construct a new stream channel with an appropriate geomorphology for the stream's hydrologic regime. There appears to be room in the open space to accommodate this type of project, instream habitat could have been improved, hard armor would not have been necessary except at bridges and storm sewer outfalls, and the stream could have been stable and self-sustaining over time. Utilizing ample on-site trees for materials could have significantly reduced materials costs and allowed for a more complete restoration for a similar or perhaps even cheaper cost. Designers and the city had concerns about site constraints such as the trail, water quality ponds, and wetlands that would have made a remeander project difficult and potentially much more expensive.

7. **List indicators of project outcomes at this project stage:**

Native plant establishment, bank and channel stability, TSS loading.

8. **Does the project plan/implementation of the project plan reasonably allow for achieving proposed project outcome(s)?**

As stated in question 6, the project plan appears to be meeting the narrow outcomes planned for the project. However, potential broader goals for instream habitat and channel self-maintenance are not fully realized using this approach, and hard armoring of the channel has habitat and stability consequences as well. Of note is a large depositional bar at the downstream end of the project that is likely related to the hard armoring of the channel. Riprap throughout the reach and a relatively narrower channel cross section increases the stream's velocity and sediment transport capability. Once the stream reaches the project's end, sediment transport decreases and material is deposited. This deposition will likely cause instability at that location and accelerate bank erosion.

There are minor issues with the implementation of the plan that could have been improved. Planting success of live stakes was poor, potentially due in part to the use of long poles that only had a small percentage of their length buried in the ground. Live stakes are more successful when the majority of the stake is buried, with only a few inches exposed to leaf out. This minimizes desiccation that is generally responsible for planting failure. The vegetated reinforces soil stabilization was constructed higher than the surrounding topography, confining flood flows in the channel to a higher elevation. This increases shear stress in the channel and contributes to channel and bank instability.

9. **Are corrections or modifications needed to meet proposed outcomes? Explain.**

Most of the changes I would suggest for this project would have happened in the planning stages, so they should instead be considered thoughts for future projects in similar situations. The watershed plans

to involve DNR at earlier stages in these types of projects so that alternatives can be considered prior to significant investment in design. The project could have better taken advantage of the 65 trees harvested for the project by incorporating more wood into the design, such as toe wood bank stabilization. This would have saved on materials costs, increased habitat, and reduced the downstream destabilization issues. One actionable item going forward would be that any follow-up plantings with live stakes should modify their planting method as described above.

10. Has anything been done or planned that would detract from existing or potential habitat? Explain.

Concerns regarding the potential for a more full restoration that addresses broader goals is described in the above questions.

11. Are proposed future steps, including long-term management, practical and reasonable? Explain.

Vegetation maintenance may keep out some of the invasive species, but reed canary is likely to dominate the site unless live staking is successful at establishing shrubs. Perhaps with time some of the planted trees will shade out the reed canary, although other invasives such as garlic mustard will likely become established in its place. Ongoing maintenance and perhaps follow-up plantings will be needed to sustain a primarily native community.

12. Are follow-up assessments needed? Explain.

The project partners should continue to monitor vegetation establishment and manage invasives. They should also watch what happens in the depositional area at the downstream end of the project for channel instability. This may require a follow-up project to help the stream to a more stable geomorphology.

13. Additional comments on the restoration project.

Project proposers and grant funders should think more broadly than simply water quality measures when planning stream projects, and consider alternatives that work with natural stream processes rather than against them. Design should at historic disturbance and stream channel succession as both an explanation for symptoms of instability, and for potential solutions.

Project Evaluation

The project will:		Confidence of outcome determination	
a. Likely not meet proposed outcomes	☐	1. Low	☐
b. Minimally meet proposed outcomes	☐	2. Medium	☒
c. Meet proposed outcomes	☒	3. High	☐
d. Likely exceed proposed outcomes	☐		
e. Greatly exceed proposed outcomes	☐		

Provide an explanation of the reason(s) for the determination. The project appears to be meeting goals for reducing bank erosion and TSS loading. However, the limitations on instream and riparian habitat caused by the hard-armor approach do not allow for broader potential goals to be realized.

Site Assessment Lead(s) Conducting Site Review: Brian Nerbonne _____

RESTORATION EVALUATION PROGRAM for LEGACY PROJECTS
Minnesota Board of Water and Soil Resources
Minnesota Department of Natural Resources

Project Evaluation Form

Field Review: September 16, 2015

Project Background

Project Name: Grand Marais Creek Stream Channel Restoration

Project Location: Polk County, Minnesota

Township/Range Section: T153N, R50W Sections 15, 16, 22, 23 and 26

Project Manager/Affiliated Organization, Contact: Red Lake Watershed District

Fund: OHF Fiscal Year Funds: 2013 Project Start Date: 2013

Predominant Habitat type: Prairie/Savanna/Grassland Wetland Aquatic

Project Status: Post-Establishment Phase

Project Goals and Planning

(Site Assessment Preparation from Plan Sets and Documents)

1. **What are the specific project components?**
   - *Diversion Structure/Weir:* Diversion structure directs all flows up to a 2-year event into the original Grand Marais Creek channel. The weir is 100 ft. in length, constructed of compacted clay, sheet piling, rip rap, structurally armored spillway, vegetated slopes and controlled drawdown culvert.
   - *Channel Restoration:* 6.0 miles of channel is restored/created to approximate pre-1900 cross section, sinuosity and profile grade. Specifically, components include:
     - › Restored gradient of 0.5 to 1 foot per mile slope.
     - › 400,000 cubic yards of material was expected to be removed from the channel and placed in adjacent uplands. It was expected that removal of fill from the lowest 1.5 miles of the channel would be minimal.
     - › Alignment roughly follows channel alignment recorded at the time of U.S. expansion and settlement into the area with an exception for the preservation of an existing building/crossing. Channel is a relict of former Red Lake River and has had low flows for this alignment since prior to farming expansion.
     - › Channel realignment primarily occurred in uplands. Pre-project alignment has been retained and will persist as oxbow type wetlands.
     - › All excavated material was spread into adjacent fields and blended into the landscape allowing high water to rise and retreat back into the channel naturally.

- *Grade Stabilization Structures:* Two grade control structures are added to reduce potential for headcutting and bank failures. These structures are placed near the confluence with the Red River. Fish Passage is incorporated into design in consultation with DNR staff.
- *Road and Trail Crossings:* Two public road bridges were constructed in consultation with county and township authorities. Private agricultural and recreational crossings used flat railcars to span creek at grade and spanning the low flow channel. These crossings are intended to allow for frequent overtopping.
- *Plantings:* The Channel Restoration project utilized used three seed mixes
  - Mixture Special (PLS) native seed mix on adjacent RIM easements (see spec book 5.2-21)
  - CP23A native seed mix on adjacent CRP land
  - MnDOT 250 (currently MnDOT Mix 25-141) nonnative grassland mix along the set back levies north of 130th St.

  MnDOT 110 (currently MnDOT 21-111) Oats cover crop was used on all disturbed areas in combination with the MnDOT mixes.

The Diversion Structure Plantings utilized MnDOT 130 (currently MnDOT 21-113) Soil Building Cover (Oats & Field Pea) and MNDOT Mix 280 (currently MnDOT Mix 24-142) Agricultural Roadside Mix to provide erosion control and vegetative stabilization.

Mixes MnDOT 250 & 280 include Smooth Brome Grass, a species listed by the MN DNR as invasive. Live stake willow and wattling was used adjacent to the private agricultural road crossings.

- *Consultation with Agencies:* Project proposers and engineers worked closely with DNR stream restoration specialists to develop stream profile design and specifications.

2. What plans/record of project decisions/prescription worksheets are available?

Final Engineer's Plan Report: Red Lake Watershed District Project 60F: Grand Marais Outlet Restoration. July 2012

Construction Plans for Grand Marais Creek Channel Restoration Project (As-Built Plan): Red Lake Watershed District Project No. 60F, Esther Township, Polk County.

Project Manual: Grand Marais Creek Channel Restoration Project: RLWD Project No. 60F

Project Specifications: Grand Marais Creek Channel Restoration Project (Phase 2-Diversion Structure). Red Lake Watershed District Project No. 60F

Red Lake WD letter to MN DNR Re: *Grand Marais Outlet Restoration seeding.* March 22, 2016

3. What are the stated goals of the project?

- Reconstruct six miles of natural channel based on sound scientific principles of natural channel design, hydrology and fluvial geomorphology.

- Restore and sustain aquatic habitat conditions in the channel and on up to 400 acres of riparian corridor habitats, which were abandoned and mostly farmed for the past 50+ years.
- Divert flows from the existing outlet channel or Cutoff Ditch, and restore hydrology to the original Grand Marais Creek channel. The downstream end of the project is located at the original outlet of the Grand Marais Creek into the Red River.
- Maintain or slightly reduce existing flood stages immediately upstream of the project limits by increasing conveyance abilities during flood events on the Grand Marais Creek.
- Minimize/control flood impacts throughout the channel restoration segment through establishment of flowage easements and isolated setback levees.
- Restore permanent and seasonal fish spawning and juvenile habitat as well as habitat for a variety of other aquatic and terrestrial species.
- Original Grand Marais channel reconstruction is designed for the following Natural Resources Enhancement purposes: riparian corridor, aquatic habitat, fish passage.
- Connected to the Outlet Improvement Project, the channel is designed to accommodate diverted flows in the creek without increasing upstream flood stage water levels with their potential to impact personal property or farmland.
- Diversion structure is designed to accommodate all flows from the cutoff ditch up to a two year event.
- Stream outlet and grade stabilization structures at the Red River are designed to provide for fish passage up Grand Marais Creek.
- All stream crossings are designed to meet hydraulic requirements as well as fish passage and other aquatic habitat needs.
- RIM program was used to acquire sufficient habitat for riparian and aquatic restoration needs.
- Setback levees are incorporated to contain diverted flows and create a buffer between channel and agricultural lands.
- The restored channel corridor will also provide a more functional, reliable connection between the Red River and more than 20 miles of upstream riverine and wetland habitats in Grand Marais Creek.

4. **Were measures of restoration success identified in plans? Yes**

If yes, list specific measurements. Are these measures adequate to assess future success?

Measures of Restoration Success were listed in the *Grand Marais Accomplishment Plan.* Timeline goals relating to public meetings, environmental assessments, permitting and project construction have all been completed.

Measurable Project Goals include:

Measurement 1: Linear feet of river channel is reestablished with flow measurements along restored channel, acres of riparian area reestablished from agricultural use. (Area and linear calculations)

Measurement 2: Linear feet of river channel established. Increased gamefish populations in Red River and Grand Marais Creek. Target species include Northern Pike and Channel Catfish. Given that most of the project is new channel restoration, this parameter should be met at time of construction completion.

Measurement 3: Project Progress Reports sent to County Board, Township Board and Watershed District Board, Local agricultural communities. Assess long and short term reception to the project from surrounding stakeholders. (Progress reports and stakeholder feedback)

Measurements not defined:

- No measures of success were specified for vegetative restoration including the restoration of floodplain habitats.
- No measurements for channel stability were defined, only that creation would occur.
- Measures for success of fish habitat were not specified, only that habitats would be created.
- It is not clear that reference sites were identified or consulted for the development of plans.

5. Are plan Sets available? Yes Have new GIS maps been created? Yes

If yes, provide in Appendix A and list Maps provided:

Map 1: Soils Texture

Map 2: Site Topography

Map 3-6: Site Visit Notes

6. Provide list of best management practices, standards, guidelines identified in plan set? Are these based on best current science? If not, what parameters diverge from these practices? Do these divergences affect outcomes?

Best Management Practices:

1. NPDES Stormwater Pollution Prevention Plan was incorporated into the plan set for the project and incorporates a range of Best Management Practices for erosion control and timing of project activities.
2. Project engineers worked closely MN DNR stream experts in developing plan and profiles for stream configurations. U channel cross section design and careful placement of riffle and control structure along with bank stabilization techniques are in-line with best management practices.
3. Stream reconstruction occurred “off-line” of active stream flows, minimizing the likelihood of channel blowouts and increased sedimentation into the Red River.

Practices that diverge from best current science:

1. Slope stabilization within channel areas specified primarily using "hydraulic soil stabilizer." This method is considered a questionable method for slope stabilization. The practice was not used and no alternative for slope stabilization or slope seeding was specified (See Red Lake WD letter to MN DNR March 22, 2016 for a discussion of decision making).
2. Plans did not identify wetland plant species for either seeding or shrub live staking. This allowed for replacement by nonnative seed mixes and instances of unknown/unspecified plantings.

Project Implementation

(Questions for Site Manager and Cooperating Professionals)

7. **Were alterations made to the original plan during construction? Discuss changes to the following:**

- *Grading alterations:* Yes A small "field fix" change to the stream configuration was made between station 233 and 248. The change appears to have been made to accommodate field road crossing. This does not appear to have significant effect on the project. Many of the bank stabilization techniques were considered field fix approaches, including the uses and locations for Toe Wood, live staking and willow fascines.
- *Elevation of structures or other components:* No None Noted.
- *Changes to vegetation plan:* Yes Two seed mixes were specified in project specifications. "Seed Mixture Special" is a native seed mix designed for use in upland areas above the channel, primarily RIM easements. MnDOT 110 Oats cover crop was specified on all disturbed areas. No wetland or wet soils seed mix was specified. CRP mix CP-23A was substituted for "Seed Mixture Special" on 15.4 acres on Miles Gulbranson property. CP-23A is a native seed mix that meet specifications for programs under the Conservation Reserve Program, it is not clear what specific species were contained in this mix. The as-builts show the use of MnDOT seed mix 250 on upland areas adjacent to the top bank. This mix is a predominantly nonnative mix comprised of Smooth Brome (DNR Invasive), Timothy, Canada Bluegrass, Kentucky Bluegrass, White Clover, Redtop, Perennial Rye, Alfalfa, Switchgrass and Slender Wheatgrass (See Red Lake WD letter to MN DNR March 22, 2016 for a discussion of decision making). Specifications for Willow staking do not specify species to be used. Sandbar willow appears to have been exclusively installed.
- *Fill Material:* No Spoil areas were identified in plan and assume were used as specified.
- *Others:* Yes Side Inlet Channels were designed with Corrugated Metal Pipe (Culverts). These were not used but were replaced instead with Rock Chutes. The plan set allowed for either of these options to be used.

8. **In what ways did alterations to the plan or implementation change the proposed project outcome? Did this change derive from a desire to change outcomes?**

- *Seed Mixes:* Use of MnDOT mix 250 was clearly intended to provide rapid stabilization of bare soils with perennial seed along setback levees. CP-23A was not specified and it is not clear what species were planted though the timothy dominates these areas. Seed for use in the "Hydraulic Soil Stabilizer" was not specified. No "wetland" or "saturated soils" seed mix was specified. As a project that is expected to function predominantly as a flow through wetland with minimal in-tact remnant soils at the surface, vegetative cover is essential for holding the ground surface in place. However, the use of MnDOT mixture 250 will prevent the establishment of diverse riparian habitats comprised with native plant species, thus limiting the effectiveness of one project goal. This change did not derive from a desire to change project outcomes, but rather occurred due to planning oversight that did not clearly specify seed and plant stock species in project specifications (See Red Lake WD letter to MN DNR March 22, 2016 for a discussion of decision making).
- *Decision to not use Hydraulic Soil Stabilizer with Seed:* The Watershed District engineers determined that Hydraulic Soil Stabilizer with Seed was not to be used based on past poor performance in the projects in the area. Rather than replace the practice and seed/provide slope protection, no alternative was implemented. Lower slopes and banks were not seeded and in most cases, no stabilization practices were used. The Watershed District and engineers and considered the risk of destabilizing established volunteer vegetation in the channel to be a greater threat to channel profile stability then the potential benefits of establishing new vegetation (See Red Lake WD letter to MN DNR March 22, 2016 for a discussion of decision making).
- *Bioengineering:* Shift in location of specific bioengineering components (Toe Wood, fascines, live staking) does not appear to have changed project outcomes as these were field fit components.

Site Assessment

Field Review: September 16, 2015

9. **Surrounding Landscape Characteristics:**

The surrounding landscape is a mix of forested floodplain, CRP grasslands and tilled agriculture.

10. **Site Characteristics:**

10a. Soils: Soils in the project area are entirely finely textured soils with predominately fine silts within the restored channel area. K Factors of the soils within the entire channel are considered moderately erodible (K Factors from 0.24 to 0.28), though on the low side of the range. In general, early successional and annual native and nonnative species are present, but in many portions of the lower slopes, bare soils are common. Up to 50% of the entire project area in the zone immediately above the bankfull elevation is bare soil. Small rills are present throughout, but these tend to be very small, perpendicular to the

channel and very widespread. No large rills were noted along the channel where the project had been constructed. A gully was noted at roughly station 197. The gully appears to precede the project activities and is not likely project related (see Photo SR 28).

10b. Topography: Topography in the project area is very flat, with steep slopes found only within stream channels. Oxbows and former river channels are present throughout the surrounding landscape, but are typically gently sloping topography with minimal remnant stream bank. Low areas have been restored to wetland, and upland CRP to mostly native grasslands and are generally enrolled in conservation programs. Within the restored stream, since seeding was not used, nor were slope stabilization practices widely conducted, the success of establishment of the project will rely on the channel design, cross sections, bio-engineering practices and structural components. Limited vegetated cover poses a risk during spring flooding and elevated flows as river levels drop and channel flow is at its greatest. At this time, defining the "cutbank" elevation is difficult since nearly the entire channel has been recently created. Natural channel cross-sections should form in the coming years when annual flows are introduced.

10c. Hydrology: During site visit, water is present in the channel in low flow conditions. Based on conversations with the project team, site hydrology during the visit is as expected for late summer with perennial base flow from the Grand Marais Creek watershed. The overflow into the Cut Channel outlet is designed to occur when flood stages exceed the two year mark, providing protection for the restored channel and upstream farmland.

10d. Vegetation A:

- Within the wetted channel, rooted, native and nonnative emergent vegetation is established or establishing where velocities are minimal.
- Along the lower banks, early successional and annual native and nonnative species are present along most of the slopes, but bare soils are common.
- Above excavated channel elevations, nonnative dominated grasslands are most typical. In the upper reaches of the project early establishment of the Special Mixture Seed mix comprised of predominantly native species appears to be establishing with some success. In these areas, cover crops predominate, but the species contained within the mix are present.
- In the lower reaches of the project, (approximately STA 172 to 270) MnDOT Mix 250 "Mesic General Roadside" is establishing rapidly and will likely become the dominant cover within a short time. Between approximately STA 270 and 310, reed canary grass is more common along the upper banks of the stream and fewer native species are obvious.

10e. Vegetation B: No vegetation monitoring protocols have been established for the project. During the site evaluation, plant species common within various project areas were noted on the maps, and lists of these species are provided below. Species lists were generated during meander review of project area and are not all inclusive. Generalized locations are shown in Maps 3-6.

SR1

Common Name	Scientific Name	Abundance	Native/ Nonnative	Plan Seed Mix (Y/N)
Yellow Foxtail	*Setaria glauca*	D	Nonnative	N
Horsetail	*Conyza Canadensis*	C	Native	N
Tall Sunflower	*Helianthus giganteaus*	U	Native	Y
Cocklebur	*Xanthium sp.*	C	Native	N
Barnyard Grass	*Echinochloa crus-galli*	C	Nonnative	N
Big Bluestem	*Andropogon gerardii*	U	Native	Y
Plains Coreopsis	*Coreopsis tinctoria*	C	Native	Y
Slender Wheatgrass	*Elymus trachycaulus*	D	Nonnative	Y
Giant Ragweed	*Ambrosia trifida*	U	Native	N
Bull Thistle	*Cirsium vulgare*	C	Nonnative	N
Canada Thistle	*Circium arvense*	U	Nonnative	N
Switchgrass	*Panicum virginianum*	C	Native	Y
Reed Canary Grass	*Phalaris arundinacea*	D	Nonnative	N
Sandbar Willow	*Salix interior*	C	Native	N
White Clover	*Trifolium repens*	C	Nonnative	N
Side-oats Grama	*Bouteloua curtipendula*	U	Native	Y
Smooth Brome	*Bromus inermis*	C	Nonnative	N
Site Setting/Description: Area between forest and stream, graded in 2013/4 and seeded in spring, 2015. Very densely vegetated with scattered native grasses. Some native grasses from the seed mix are present, but in very low numbers.				

*Abundance: D=dominant (>26%), C=Common (5-25%), U=Uncommon (0-5%)

SR2

Common Name	Scientific Name	Abundance	Native/ Nonnative	Plan Seed Mix (Y/N)
Barnyard Grass	*Echinochloa crusgalli*	D	Nonnative	N
Canada Lettuce	*Lactuca Canadensis*	C	Native	N
Plains Coreopsis	*Coreopsis tinctoria*	C	Native	N
Beggar's Ticks	*Bidens cernua*	C	Native	N
Common Plantain	*Plantago major*	C	Nonnative	N
River Bulrush	*Bolboschoenus fluviatilis*	C	Native	N
Curly Dock	*Rumex crispus*	C	Nonnative	N
Reed Canary Grass	*Phalaris arundinacea*	C	Nonnative	N
Prairie Sunflower	*Helenium paucifolia*	C	Native	Y
Cocklebur	*Xanthium sp.*	C	Native	N
A Sedge Species	*Carex sp.*	C	Native (likely)	N

SR2 continued

Common Name	Scientific Name	Abundance	Native/ Nonnative	Plan Seed Mix (Y/N)
Site Setting/Description: East Bank of channel constructed in 2013. Vegetation is very dense. Along embankment, spoil is dominated by Reed Canary Grass with minimal other species. Away from the channel, Barnyard Grass dominates. Site appears wetter than most species in the Special Seed Mix would be adapted to. Prairie Sunflower, a species of the seed mix is present as is Plains Coreopsis, which is common to most of the other areas planted to the Special Seed Mix.				

*Abundance: D=dominant (>26%), C=Common (5-25%), U=Uncommon (0-5%)

SR3

Common Name	Scientific Name	Abundance	Native/ Nonnative	Plan Seed Mix (Y/N)
Yellow Foxtail	*Setaria glauca*	D	Nonnative	N
Smooth Brome	*Bromus inermis*	D	Nonnative	N
Big Bluestem	*Andropogon gerardii*	C	Native	Y
Scattered Bunch Grasses	-	C	Native (likely)	Y (likely)
Field Thistle	*Sonchus arvensis*	U	Native	N
Side Oats Grama	*Bouteloua curtipendula*	U	Native	Y
Common Milkweed	*Asclepias syriaca*	C	Native	N
Barnyard Grass	*Echinochloa crusgalli*	C	Nonnative	N
Field Thistle	*Sonchus arvensis*	U	Nonnative	N
Cocklebur	*Xanthium sp.*	U	Native	N
Plains Coreopsis	*Coreopsis tinctoria*	U	Native	N
Curly Dock	*Rumex crispus*	U	Nonnative	N
Prairie Sunflower	*Helenium paucifolia*	U	Native	Y
Canada Thistle	*Circium arvensis*	U	Nonnative	N
Site Setting/Description: Upland seeded with Mixture Special. Yellow Foxtail is dominant and appears that it may have been used as a “cover crop.” Bunch grasses are present under foxtail. Big Bluestem and Sideoats Grama are present with seed heads.				

*Abundance: D=dominant (>26%), C=Common (5-25%), U=Uncommon (0-5%)

SR4

Common Name	Scientific Name	Abundance	Native/ Nonnative	Plan Seed Mix (Y/N)
Yellow Foxtail	*Setaria glauca*	D	Nonnative	N
Barnyard Grass	*Echinochloa crusgalli*	C	Nonnative	N
Field Thistle	*Sonchus arvensis*	U	Nonnative	N
Plains Coreopsis	*Coreopsis tinctoria*	U	Native	N
Water Plantain	*Polygonum aquatic*	U	Native	N
River Bulrush	*Bolboschoenus fluviatilis*	U	Native	N
Curly Dock	*Rumex crispus*	U	Nonnative	N
Reed Canary Grass	*Phalaris arundinacea*	U	Nonnative	
Prairie Sunflower	*Helenium paucifolia*	U	Native	Y
Site Setting/Description: Upland seeded with Mixture Special. Yellow Foxtail is absolutely dominant and appears that it may have been used as a “cover crop.”				

*Abundance: D=dominant (>26%), C=Common (5-25%), U=Uncommon (0-5%)

SR5

Common Name	Scientific Name	Abundance	Native/ Nonnative	Plan Seed Mix (Y/N)
Hybrid Cattail	*Typha x glauca*	D (channel)	Nonnative	N
A Sedge Species	*Carex sp.*	C (channel)	Native (likely)	N
Curly Dock	*Rumex crispus*	C	Native	N
Horeweed	*Conyza Canadensis*	D	Native	N
Beggar’s Ticks	*Bidens cernua*	C	Native	N
Alfalfa	*Medicago sp.*	D	Nonnative	N
Squirrel Tail	*Hordeum jubatum*	C	Native	N
Reed Canary Grass	*Phalaris arundinacea*	U	Nonnative	N
Smooth Brome	*Bromus inermis*	D	Nonnative	N
Giant Ragweed	*Ambrosia trifida*	U	Native	N
Slender Wheatgrass	*Elymus trachycaulus*	D	Nonnative	Y
Site Setting/Description: Streambank and stream channel vegetation. Bare soil is common along lower sloping banks. Small rills have formed and are common all along bank.				

*Abundance: D=dominant (>26%), C=Common (5-25%), U=Uncommon (0-5%)

SR6

Common Name	Scientific Name	Abundance	Native/ Nonnative	Plan Seed Mix (Y/N)
Smooth Brome	*Bromus inermis*	D	Nonnative	N
Canada Wild Rye	*Elymus Canadensis*	D	Native	Y
Alfalfa	*Medicago sp.*	C	Nonnative	N
Slender Wheatgrass	*Elymus trachycaulus*	D	Native	Y
Yellow Foxtail	*Setaria glauca*	C	Nonnative	N
Foxtail Barley	*Hordeum jubatum*	C	Native	N
Sandbar Willow	*Salix interior*	C	Native	N
Prairie Sunflower	*Helianthus pauciflora*	U	Native	Y
Site Setting/Description: Established CRP plot. Dominated by Canada Wild Rye. Very dense vegetation above recent channel construction.				

*Abundance: D=dominant (>26%), C=Common (5-25%), U=Uncommon (0-5%)

SR7

Common Name	Scientific Name	Abundance	Native/ Nonnative	Plan Seed Mix (Y/N)
Smooth Brome	*Bromus inermis*	C	Nonnative	N
Plains Coreopsis	*Coreopsis tentorius*	U	Native	N
Alfalfa	*Medicago sp.*	C	Nonnative	N
White Clover	*Trifolium repens*	C	Native	Y
Yellow Foxtail	*Setaria glauca*	D	Nonnative	N
Foxtail Barley	*Hordeum jubatum*	C	Native	N
Site Setting/Description: Area seeded in early summer 2015. Strongly dominated by Yellow Foxtail. Assume this species was in the seed mix, though not specified.				

*Abundance: D=dominant (>26%), C=Common (5-25%), U=Uncommon (0-5%)

SR8

Common Name	Scientific Name	Abundance	Native/ Nonnative	Plan Seed Mix (Y/N)
Channel				
Hybrid Cattail	*Typha x glauca*	D (patchy)	Nonnative	N
Softstem Bulrush	*Schoenoplectus tabernaemontani*	D (patchy)	Native	N
River Bulrush	*Bolboschoenus fluviatilis*	D (patchy)	Native	N
Open Water in channel	-	D (60%)	-	-
Bank				
Reed Canary Grass	*Phalaris arundinacea*	C	Nonnative	N
Horseweed	*Conyza Canadensis*	C	Native	N
Giant Ragweed	*Ambrosia trifida*	U	Native	N
Pigweed	*Xanthium sp.*	C	Native	N
Beggar's Ticks	*Bidens cernua*	D	Native	N
Calico Aster	*Symphyotrichum lateriflorum*	C	Native	N
Cottonwood	*Populus deltoides*	C	Native	N
Site Setting/Description: Streambank below bankfull elevation. South bank at outside bend treated with Tow Wood. Inside bank forming shelf. Cross section shows no shelf in construction plans. May be forming during first season of water flows. Generally, monotypic stands of Softstem Bulrush, Hybrid Cattail and River Bulrush are forming.				

*Abundance: D=dominant (>26%), C=Common (5-25%), U=Uncommon (0-5%)

SR9

Common Name	Scientific Name	Abundance	Native/ Nonnative	Plan Seed Mix (Y/N)
Yellow Foxtail	*Setaria glauca*	D	Nonnative	N
Barnyard Grass	*Echinochloa crusgalli*	C	Nonnative	N
Field Thistle	*Sonchus arvensis*	U	Nonnative	N
Plains Coreopsis	*Coreopsis tinctoria*	U	Native	N
Water Plantain	*Polygonum aquatic*	U	Native	N
River Bulrush	*Bolboschoenus fluviatilis*	U	Native	N
Curly Dock	*Rumex crispus*	U	Nonnative	N
Reed Canary Grass	*Phalaris arundinacea*	U	Nonnative	N
Prairie Sunflower	*Helenium paucifolia*	U	Native	Y
Site Setting/Description: Upland seeded with Mixture Special. Yellow Foxtail is dominant.				

*Abundance: D=dominant (>26%), C=Common (5-25%), U=Uncommon (0-5%)

SR10

Common Name	Scientific Name	Abundance	Native/ Nonnative	Plan Seed Mix (Y/N)
River Bulrush	*Bolboschoenus fluviatilis*	D	Native	N
Rye (cover)	*Secale cereal*	U	Nonnative	N
Plains Coreopsis	*Coreopsis tentorium*	C	Native	N
Witchgrass	*Panicum capillare*	C	Native	N
Curly Dock	*Rumx crispis*	C	Native	N
Reed Canary Grass (on spoil)	*Phalaris arundinacea*	C	Nonnative	N
Prairie Sunflower	*Helianthus paucifolia*	U	Native	Y
Site Setting/Description: Area above bankful elevation as excavated. This area is dominated by river bulrush. Presumably this area was low prior to channel excavation and is a remnant wetland.				

*Abundance: D=dominant (>26%), C=Common (5-25%), U=Uncommon (0-5%)

SR11

Common Name	Scientific Name	Abundance	Native/ Nonnative	Plan Seed Mix (Y/N)
Channel				
Hybrid Cattail	*Typha x glauca*	D	Nonnative	N
Softstem Bulrush	*Schoenoplectus tabernaemontani*	C	Native	Y
River Bulrush	*Bolboschoenus fluviatilis*	C	Native	Y
Bank				
American sloughgrass	*Beckmannia syzigachne*	C	Native	N
Pigweed	*Amaranthus sp.*	C	Nonnative	N
Giant Ragweed	*Ambrosia trifida*	C	Native	N
River Bulrush	*Bolboschoenus fluviatilis*	C	Native	
Redtop	*Agrostis gigantea*	C	Nonnative	N
Alfalfa	*Medicago sp.*	U	Nonnative	N
White Clover	*Trifolium repens*	U	Nonnative	N
Common Plantain	*Plantago major*	U	Nonnative	N
Reed Canary Grass	*Phalaris arundinacea*	C (upper slope)	Nonnative	N
Curly Dock	*Rumex crispus*	C	Native	N
Calico Aster	*Symphyotrichum lateriflorum*	U	Native	N
Field Sow-thistle	*Sonchus arvensis*	U	Nonnative	N
Cottonwood	*Populus deltoides*	U	Native	N
Bare Ground (50%)	-	-	-	-

SR11 continued

Common Name	Scientific Name	Abundance	Native/ Nonnative	Plan Seed Mix (Y/N)
Site Setting/Description: Mostly vegetated slopes above bankful. Species dominated by native and nonnative species. Mostly early pioneer annual grass species dominate. Channel has abundant rooted River Bulrush and Softstem Bulrush. Exposed bank is limited to area immediately above water surface, whereas slopes above are well vegetated.				

*Abundance: D=dominant (>26%), C=Common (5-25%), U=Uncommon (0-5%)

SR12

Common Name	Scientific Name	Abundance	Native/ Nonnative	Plan Seed Mix (Y/N)
Smooth Brome	*Bromus inermis*	D	Nonnative	Y
Reed Canary Grass	*Phalaris arundinacea*	D	Nonnative	N
Curly Dock	*Rumex crispus*	C	Native	N
Snowberry	*Symphorocarpus alba*	C	Native	N
Calico Aster	*Symphyotrichum lateriflorum*	U	Native	N
Site Setting/Description: Upland along restored stream channel. Seeded to MnDOT Mesic Roadside Mix in 2014. Reed Canary Grass is dominant along the upper slopes of channel restoration and into the field. Presume this was dominant prior to channel restoration.				

*Abundance: D=dominant (>26%), C=Common (5-25%), U=Uncommon (0-5%)

SR13

Common Name	Scientific Name	Abundance	Native/ Nonnative	Plan Seed Mix (Y/N)
River Bulrush	*Bolboschoenus fluviatilis*	C	Native	N
Softstem Bulrush	*Schoenoplectus tabernaemontani*	U	Native	N
Reed Canary Grass	*Phalaris arundinacea*	D	Nonnative	N
Giant Ragweed	*Ambrosia trifida*	C	Native	N
Pigweed	*Amaranthus sp.*	C	Nonnative	N
Redtop	*Agrostis gigantea*	C	Nonnative	N
Barnyard Grass	*Echinochloa crus galli*	C	Nonnative	N
Bare Ground (50%)	-	-	-	-
Site Setting/Description: Most of the areas along the banks are comprised of bare soils with annualy weedy species. In some locations, Reed Canary is growing to the water's edge and presumably holding the banks. River Bulrush and Softstem Bulrush are scattered within the channel.				

*Abundance: D=dominant (>26%), C=Common (5-25%), U=Uncommon (0-5%)

SR14

Common Name	Scientific Name	Abundance	Native/ Nonnative	Plan Seed Mix (Y/N)
Horseweed	*Conyza canadensis*	D	Native	N
Pigweed	*Amaranthus sp.*	C	Nonnative	N
River Bulrush	*Bolboschoenus fluviatilis*	C	Native	N
Barnyard Grass	*Echinochloa crusgalli*	U	Nonnative	N
Redtop	*Agrostis gigantea*	C	Nonnative	N
Great Ragweed	*Ambrosia trifida*	U	Native	N
Alfalfa	*Medicago sp.*	U	Nonnative	N
Calico Aster	*Symphyotrichum lateriflorum*	U	Native	N
Reed Canary Grass	*Phalaris arundinacea*	C	Nonnative	N
Site Setting/Description: Restored stream within wooded area. Riffle Boulder Vane is located immediately downstream of railcar bridge. Area was not seeded. There is no evidence that erosion control blanket was used. Dominated by annual weedy species. River Bulrush is common in the channel, though not dominant.				

*Abundance: D=dominant (>26%), C=Common (5-25%), U=Uncommon (0-5%)

SR15

Common Name	Scientific Name	Abundance	Native/ Nonnative	Plan Seed Mix (Y/N)
Beggar's Ticks	*Bidens cernua*	D	Native	N
Horseweed	*Conyza canadensis*	D	Native	N
Reed Canary Grass	*Phalaris arundinacea*	C	Nonnative	N
Barnyard Grass	*Echinochloa crusgalli*	C	Nonnative	N
Curly Dock	*Rumex crispus*	C	Nonnative	N
Water smartweed	*Plygonum aquatilis*	C	Native	N
Burdock	*Arctium sp.*	C	Nonnative	N
River Bulrush	*Bolboschoenus fluviatilis*	U	Native	N
Sandbar Willow	*Salix interior*	C	Native	Y
Site Setting/Description: Very weedy and densely vegetated bank dominated by Beggar's Ticks and Horseweed. This section of the creek required tree clearing up to the point where design slopes were achieved. Will staking and willow fascines were installed. These appear to have been exclusively comprised of Sandbar Willow. These are greening up with some success (30%). Where Reed Canary Grass is present, it forms thick montypic stands. In a few locations, River Bulrush is present and forms dense stands, but limited in size.				

*Abundance: D=dominant (>26%), C=Common (5-25%), U=Uncommon (0-5%)

SR16

Common Name	Scientific Name	Abundance	Native/ Nonnative	Plan Seed Mix (Y/N)
Smooth Brome	*Bromus inermis*	D	Nonnative	Y
Yellow Foxtail	*Setaria glauca*	D	Nonnative	N
Water Smartweed	*Polygonum aquatilis*	C	Native	N
Giant Ragweed	*Ambrosia trifida*	C	Native	N
Reed Canary Grass	*Phalaris arundinace*	C	Nonnative	N
Curly Dock	*Rumex crispus*	C	Native	N
Hybrid Cattail (channel)	*Typha x glauca*	C	Nonnative	N
Broadleaf Arrowhead	*Sagittaria latifolia*	U	Native	N
Alfalfa	*Medicago sp.*	C (patchy)	Nonnative	N
Site Setting/Description: This area is located between the wooded forests upstream, and just above the point at which the rocked channel begins. The site is located in an opening with agricultural fields on either side of the creek.				

*Abundance: D=dominant (>26%), C=Common (5-25%), U=Uncommon (0-5%)

SR17

Common Name	Scientific Name	Abundance	Native/ Nonnative	Plan Seed Mix (Y/N)
Beggar's Ticks	*Bidens cernua*	C	Native	N
Pigweed	*Amaranthus sp.*	C	Nonnative	N
Yellow Nutsedge	*Cyperus esculentus*	C	Native	N
Cottonwood	*Populus deltoides*	C	Native	N
Water Smartweed	*Polygonum aquatilis*	C	Native	N
Horseweed	*Conyza Canadensis*	C	Native	N
Alfalfa	*Medicago sp.*	C	Nonnative	N
Slender Wheatgrass	*Elymus trachycaulus*	C	Native	Y
A Sedge Species	*Carex sp.*	C	Native (likely)	N
Canada Thistle	*Circium arvensis*	C	Nonnative	N
White Clover	*Trifolium repens*	C	Nonnative	N
Smooth Brome	*Bromus inermis*	C	Nonnative	N
Reed Canary Grass	*Phalaris arundinacea*	C	Nonnative	N
Calico Aster	*Symphyotrichum lateriflorum*	U	Native	N
Cocklebur	*Xanthium sp.*	C	Native	N
Common Plantain	*Plantago major*	U	Nonnative	N
Site Setting/Description: Heavily vegetated slopes above the rock lined channel.				

*Abundance: D=dominant (>26%), C=Common (5-25%), U=Uncommon (0-5%)

11. Is the plan based on current science? Portions Explain.

Yes:

- *Channel Design:* Channel design was developed by a team of river restoration professionals familiar with the characteristics of regional stream geomorphology. It appears as though the channel was designed using current science practices. These include channel sizing and cross section design that closely mimicked natural stream channel morphology from the region and engineered structural components based on design floods and regional conditions.
- In conversation with Luther Aadland (DNR Stream Restoration Specialist), the channel is likely to function most often like a tidal wetland with backwaters from the flooded Red River filling the valley during the spring, followed by a steady flushing of the system through the summer months.
- *Floodplain Habitat Restoration:* The project, as implemented, is likely to provide for the creation of functioning hydrological floodplain where none had been present for more than a century.
- *Fish Passage, Habitat:* Given the expected flood regime of the Grand Marais Valley in relation to the Red River Valley, fish passage into the newly created/restored channel will likely occur during high waters in spring and early summer before water levels recede below the high stream gradient of the rocked channel at the confluence with the Red River. Channel catfish habitat is expected to be abundant along muddy bottoms within the channel. Following regeneration of emergent

plant species within the channel, Northern Pike habitat should be available. Restoration of Grand Marais Creek with buffers will provide protection of habitat for Northern Pike, often under threat of drainage or dredging and removal of aquatic vegetation.

No:

- *Vegetation Species Selection:* Project planners neglected to specify seeding in large portions of the project area allowing for inappropriate seed mixes to be used. As a result, the project will likely not meet the goal of a fully functioning ecologically restored floodplain habitat. Fully functional ecological restoration of the floodplain would provide for structural diversity in the plant communities that will likely be lacking given the current planting trajectory. Greater structural diversity offers more niches, refugia, nectar sources and community stability for animal and plant species, over sites lacking diversity of native vegetation. Additionally, import of nonnative invasive species degrades surrounding landscapes by maintaining and increasing undesirable seed sources. Structural diversity in the plant communities would presumably provide greater resilience of the slopes and soils as a wider range of species would be more adapted to a the wide range of hydrological characteristics present in the floodplain setting with extended periods of high water, extended drawdowns and annual sediment loads. Ideally, plant species adapted to wet conditions would have been specified and seeded/planted in areas where soil and surface saturation are to be expected.

12. List indicators of project outcomes at this stage of project:

- *Fish Passage:* Given the expected flood regime of the Grand Marais Valley in relation to the Red River Valley, fish passage into the newly created/restored channel will provide the roughly six miles of intended habitat for species adapted to low gradient, sediment laden streams.
- *Stream Channel Restoration:* Side slopes along the channel appear to be stable with minimal soil loss but widespread development of small rills perpendicular to the flow of water. Bioengineering practices including Toe Wood, Willow Fascines and Live Staking were applied in select locations. These practices appear to be on track though springtime flows have not yet inundated the channel. Monitoring by the Watershed District and engineer in 2016 is essential and Technical Panel review in 2017 should occur to assess in stream stability.
- *Floodplain Habitat Restoration:*
  - Most of the project area is vegetated at this time with the exception of an area immediately above open water but within the excavated channel. This unvegetated area typically extends between 2 and 6 feet up the slope from the water's edge. Above this elevation, vegetation is typically thicker. In some areas the unvegetated area extends to the upper limits of excavation. With the low gradient of the stream in all but the final ½ mile above the Red River Confluence and well considered channel geometry and cross sectional design, it is likely that the channel may shift some until vegetation establishes.
  - Upland areas within the Floodplain Habitat Restoration areas in the upper reaches of the channel are dominated by annual and pioneering weed species typical of first year restorations. In most of these areas upstream (south) of the crossing at 130th Street NW,

native bunch grasses and native forbs are emerging in the seeded mix. Downstream of this crossing, upland areas were seeded to MnDOT 250 and are densely vegetated with species of this mix. Areas seeded to the species in this mix provide little improvement or change to conditions prior to project initiation.

  - Within the open water channel, a mix of native (Bulrushes) and nonnative (Hybrid Cattail) and emergent plant species is taking hold. These species will provide habitat within the channel for fish and other aquatic/terrestrial species of stream and wetland settings.

- *Community Support for the Project:* The project team reports continued support for the channel restoration by local landowners.
- *Summary:* As long as slope stability and vegetation on the banks remain somewhat stable, and grade control structures within the channel function as planned, the project appears to be on track to provide for the six miles of stream channel restoration intended with no effect to flood stage levels, agricultural or personal property. Habitat restoration along the upper reaches of the channel is on track to meet project goals. Downstream of 130th St. NW, habitat restoration is hindered by the use of nonnatives seed in mixes.

13. Does the project plan/implementation of the project plan reasonable allow for achieving proposed project outcome?

- The project is likely to achieve the proposed outcomes of stream channel reconstruction, hydrological floodplain restoration and landowner approvals; however, lack of vegetation on lower slopes presents a potential hazard for the project outcomes and the project has not yet been "on-line" through spring runoff. Given that the stream is very low gradient, with the exception of the 500 linear feet above the Red River, it is likely that the channel will retain it's intended geometry and sediment loads.
- The site should be inspected for bank failure issues two to three times during the first three years of establishment to ensure stability and make corrections.
- Floodplain habitat restoration for a wide range of ecological functions is minimized by the planting of low diversity seed mixes that include aggressive, nonnative, invasive species.
- The current contract specifies only one additional site treatment (mowing) within the seeded areas. While it appears that areas seeded to the Mixture Special Seed Mix are on a trajectory toward the successful establishment of the desired native species, this is not a certainty. The Watershed District should consider additional monitoring and followup vegetation management options.

14. Are corrections or modifications needed to meet proposed outcomes?

- The site should be revisited in 2016 to assess bank stability and develop corrective actions if needed.
- Project managers should convene further technical review with State Agency partners and others

to assess appropriateness of additional or redoing portions of vegetation restoration on the project. Two areas where this may be appropriate is in areas below the channel grading where species adapted to wet conditions may be appropriate, and in areas where MnDOT mix 250 was planted.

15. Do proposed or planned future steps, including long term management appear practical and reasonable? What are the potential challenges, limitations?

Yes. Should slope failure occur, a reassessment of options should take place, using techniques that stabilize slopes in the short term and provide long term, appropriate plantings to provide long term stability.

16. Do any of the project activities, planned or implemented, likely detract from existing or potential habitat? Explain.

Yes.

- Lack of wetland plantings/seedings in specifications or as implemented has the potential to cause short term stability issues prior to vegetation establishment, though given the low gradient nature of the stream it is likely that the channel will remain stable.
- Long term issues may persist if deep rooted perennial vegetation does not establish. Bank failure and associated erosion may continue to occur until slopes are permanently stabilized.
- Failure to develop and use native plant seed mixes appropriate to the project area detract from the potential to create high quality floodplain habitat with multiple ecosystem functions.

17. Are follow-up assessments needed? Explain.

Yes.

Local Review:

- Followup assessments of the site should occur on the local level by the watershed district to ensure that slopes remain stable.
- Site review of areas seeded to native species to assess potential management strategies that favor native seed plantings.

State/Partners Technical Review:

A Restoration Evaluation review of the site should occur in 2017 to assess the following project parameters:

- *Streambank and Channel stabilization:* the project should be reassessed in 2017 to determine the effectiveness of channel design and implementation, particularly slope stability.
- *Vegetation:* An assessment of the project should occur in 2017 to assess the status of seeded areas.

- *Development of long term measurable project goals:* The goals outlined for the project were achieved at the time of construction, i.e. channel construction, seeding of surrounding floodplain and resident/watershed board communications. These goals do not provide a measure of the long term success of the project. In order to assess the long term success of the project, the project managers, State Agencies and other partners should consider a set of measurable parameters for future site visits.

Project Determinations

18. The project will:

a. Likely not meet proposed outcomes ☐

b. Minimally meet proposed outcomes ☐

c. Meet proposed outcomes ☒

d. Likely exceed proposed outcomes ☐

e. Greatly exceed proposed outcomes ☐

Confidence of outcome determination

f. Low ☐

g. Medium ☒

h. High ☐

19. Provide explanation of reason(s) for determination.

The stated goals of the Project that have been met, or are likely to be met in the short term are: the creation of six miles of stream channel, creation of new fish habitat specifically for Northern Pike and Channel Catfish and strong communications with surrounding communities and residents, the project is on track to meet proposed outcomes. At present, given abundant exposed banks, a reassessment of the site is needed to ensure project meets these outcomes.

The creation of ecologically functional floodplain habitats will be limited in locations where MnDOT 250 seed mix was used and potentially in unseeded areas. In those areas seeded to the “Mixture Special Mix” (primarily upstream of 130th St. NW), it appears as though the project will likely meet proposed outcomes. The local team should consider short term monitoring and management (timed mowing, targeted herbicide applications or burning) to favor the native species in the mix. In those areas within the constructed channel not seeded, the likelihood of undesirable species, particularly Reed Canary Grass becoming dominant is high.

Site Assessor(s) Conducting Review: Anthony Randazzo, HDR Engineering.

Figure 1: Site Topography

Figure 2: Soil Textures

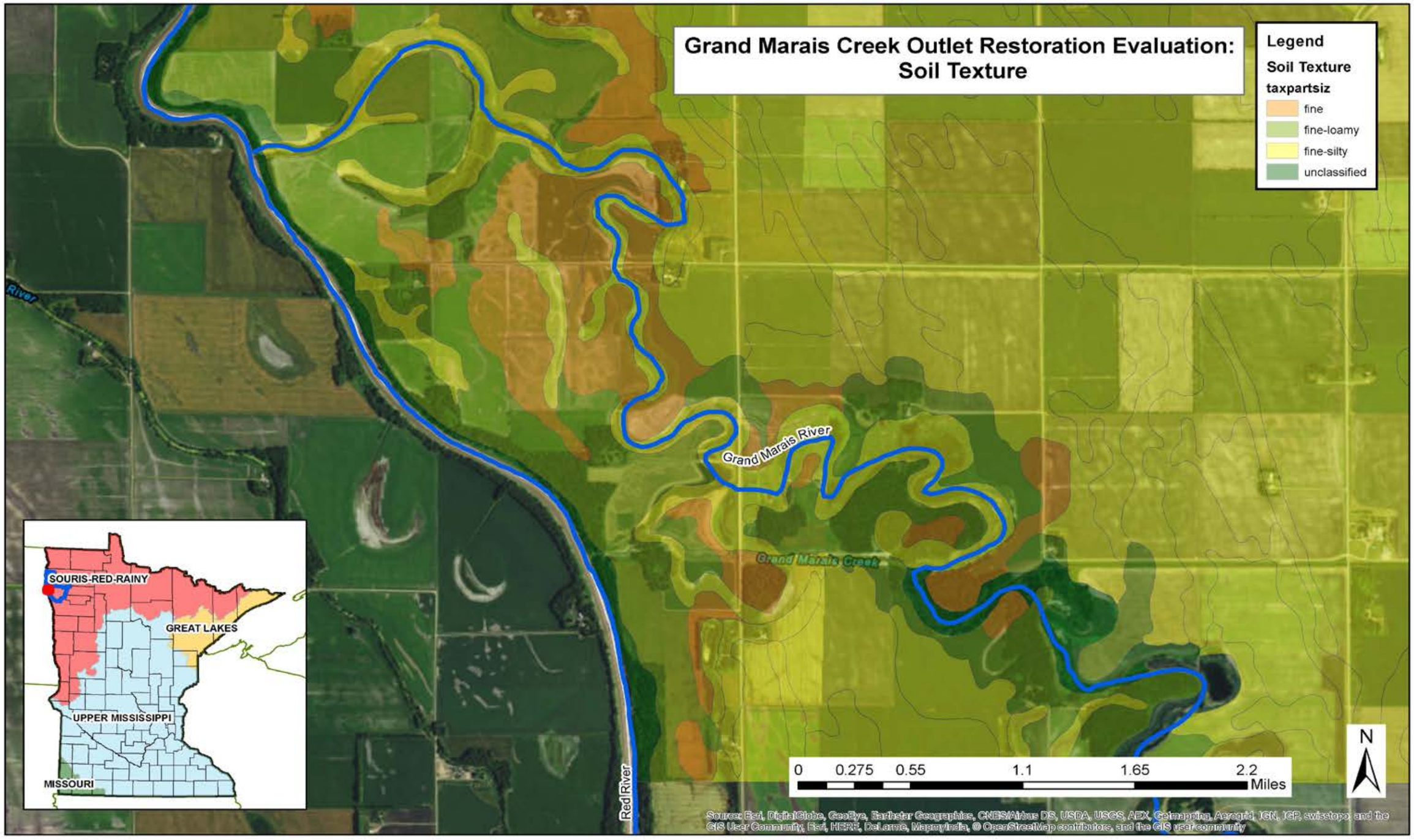


Figure 3: Site Visit Maps

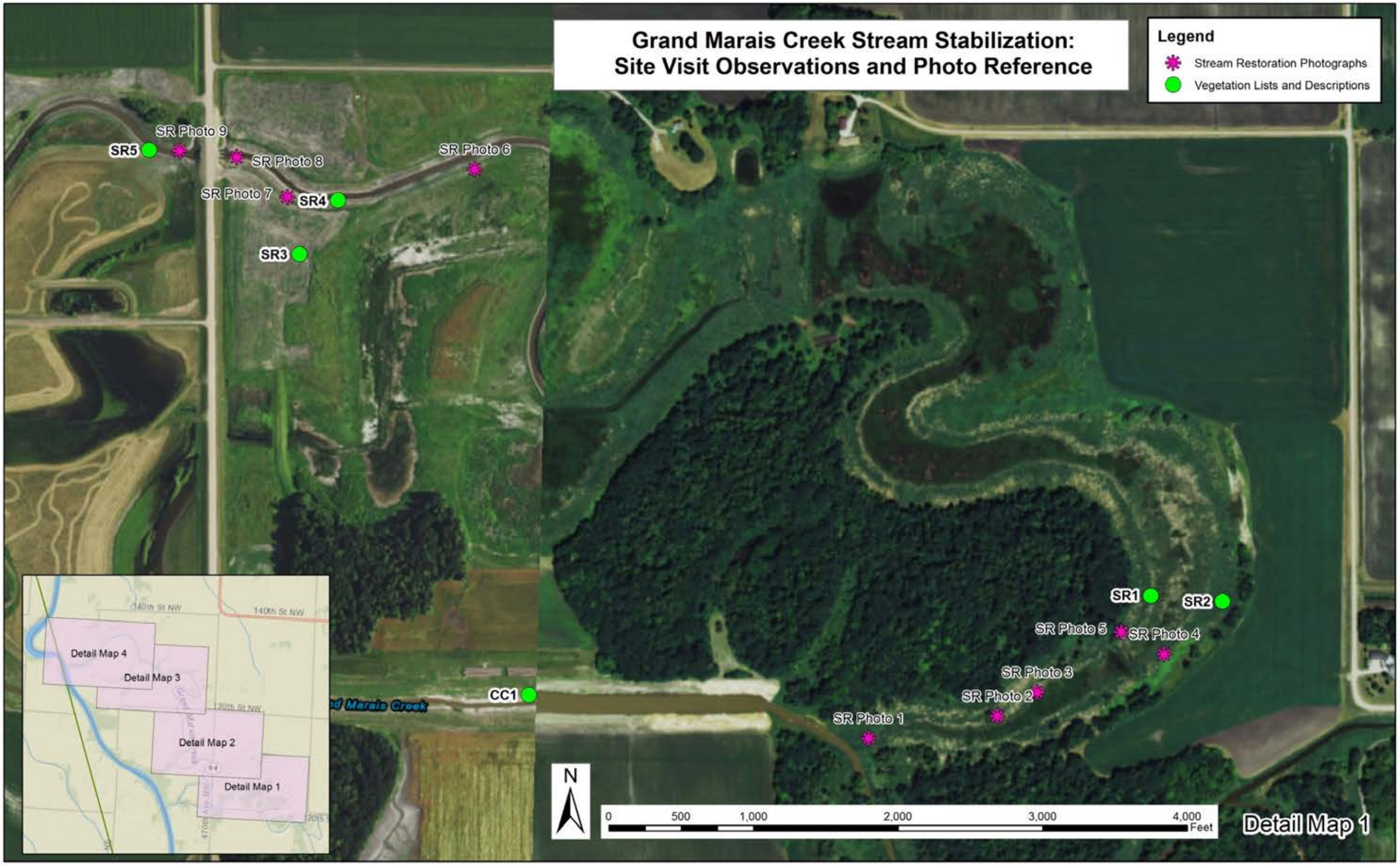


Figure 4: Site Visit Maps

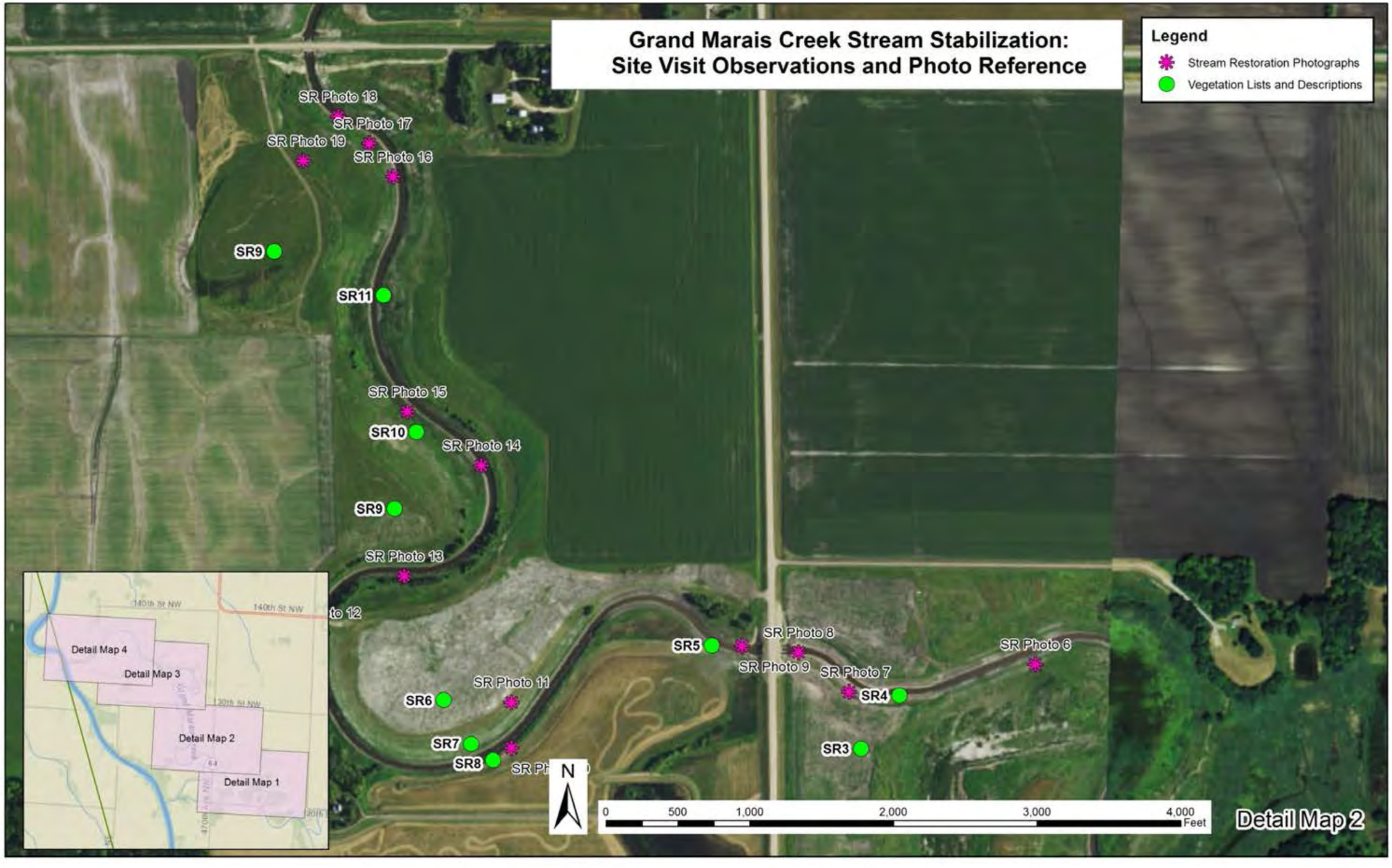


Figure 5: Site Visit Maps

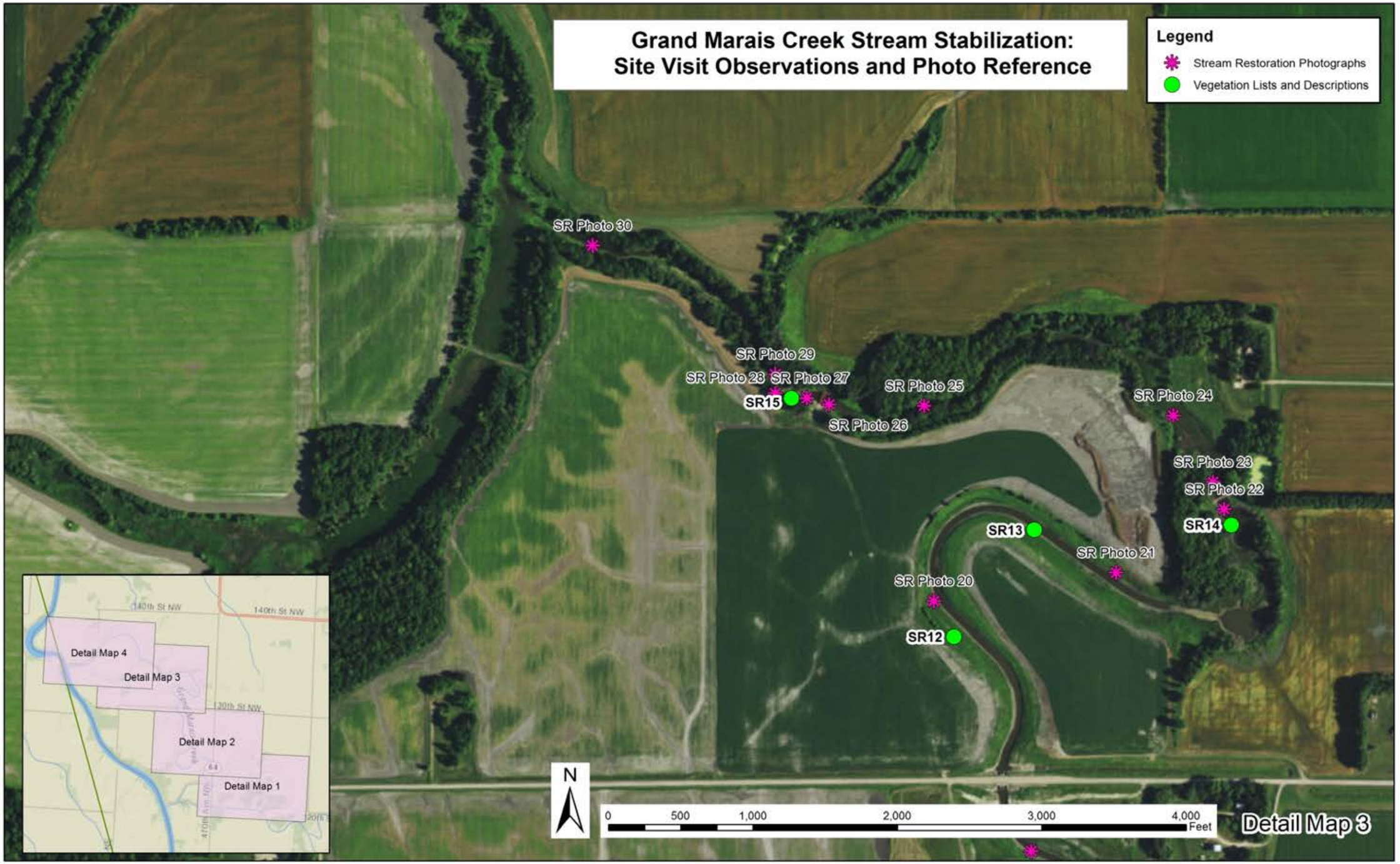
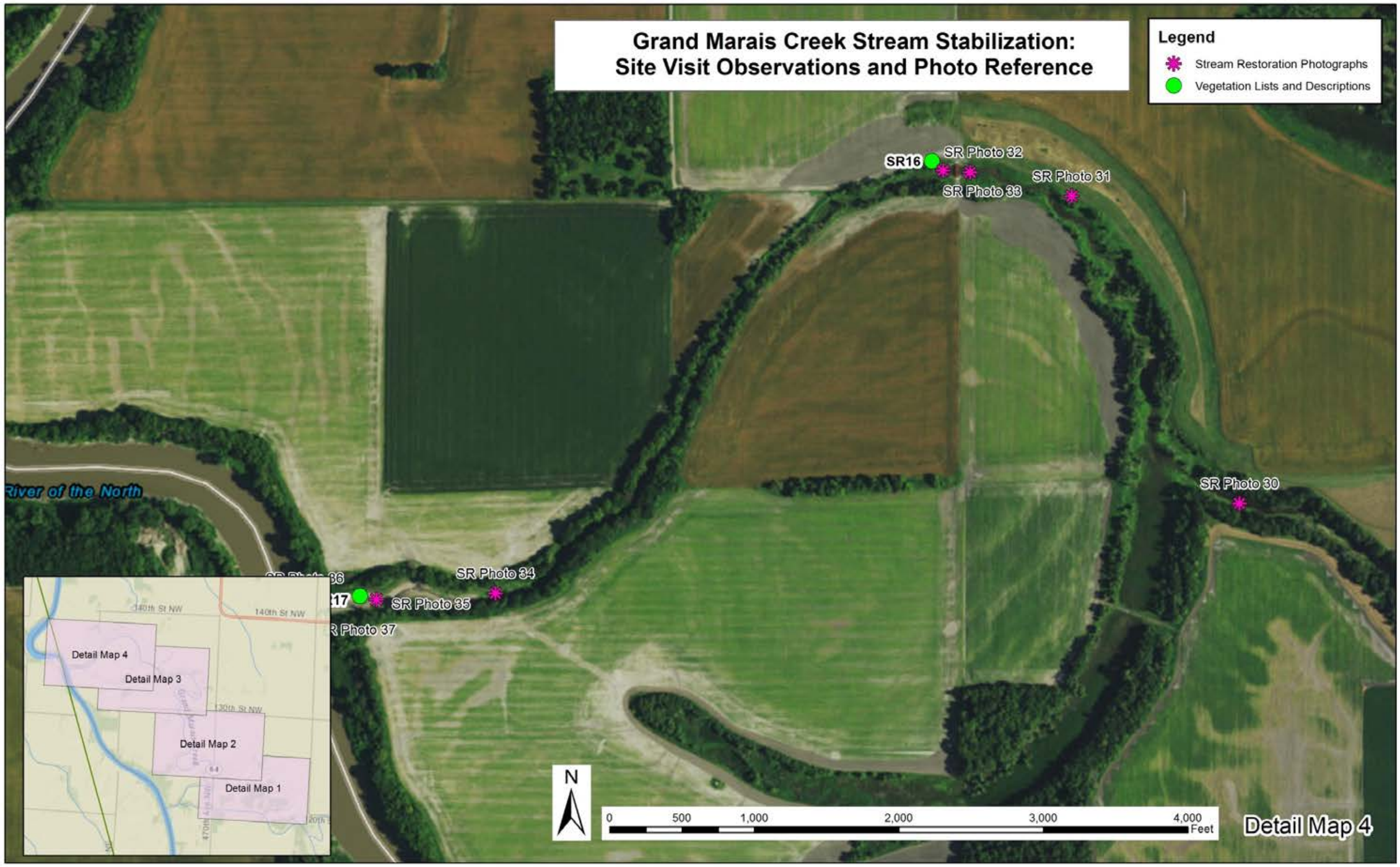


Figure 6: Site Visit Maps



Site Photographs

SR Photo 1: Grand Marais Creek at location of Diversion Structure.

SR Photo 2: Vegetated slopes in upper project area immediately downstream of Diversion Structure.

SR Photo 3: Area beneath vegetated bank dominated by reed canary grass.

SR Photo 4: East bank immediately downstream of Diversion Structure.

SR Photo 5: West bank immediately downstream of Diversion Structure.

SR Photo 6: Constructed Channel. Upper areas seeded to “Special Seed Mix.” Lower slopes not seeded, channel dominated by Hybrid Cattail.

SR Photo 7: Constructed channel. ~~Above~~

SR Photo 8: Constructed Channel looking east from 470th Avenue NW. Seeded upland, unseeded channel.

SR Photo 9: Constructed channel looking west from 470th Avenue NW. Channel dominated by Softstem Bulrush.

SR Photo 10: Constructed Channel. Toe wood treatment on opposite bank.

SR Photo 11: Seeding areas above the channel restoration. Note three zones of seeding. Appears to have been seeded at different times with very different species composition.

SR Photo 12: Ellipse Channel Riffle at 171+25. Vegetation is volunteer.

SR Photo 13: Unseeded slope at excavated channel.

SR Photo 14: Unseeded slopes revegetating with predominantly annual weedy species.

SR Photo 15: Bare slopes where unseeded.

SR Photo 16: American Sloughgrass Bechmannia syzigachne dominates the lower unseeded slope in this location.

SR Photo 17: Softstem Bulrush in channel and saturated zone. Mostly annual weedy species inhabit the zone above.

SR Photo 18: Stream channel upstream of the road crossing at 130th St. NW.

SR Photo 19: Upland area south of 130th St. NW. Appears to be seeded to CP-23A, similar to adjacent areas seeded to this mix, and not areas seeded to “Mixture Special Mix.” Setaria glauca dominates.

SR Photo 20: Restored Channel north of 130th Street NW. Above the channel, Seed Mix MnDOT 250 was used. Uplands largely dominated by Smooth Brome with Reed Canary grass common near/in channel.

SR Photo 21: Dense Smooth Brome above channel with bare soils below.

SR Photo 22: Excavated channel in cleared woodlands. Immediately above water, annual weedy species dominate. River bulrush is common in channel.

SR Photo 23: Riffle Boulder Vane below railroad car bridge.

SR Photo 24: Vegetating slopes dominated by annual forbs.

SR Photo 25: Exposed banks where channel was excavated in forested areas.

SR Photo 26: Graded channel in cleared woods. Annual pioneer species dominate.

SR Photo 27: Railroad car bridge with Boulder Vane in channel below.

SR Photo 28: Gully above construction area in wooded area. Likely predates project as it is above existing exposed roots.

SR Photo 29: Channel graded in cleared woods.

SR Photo 30: C

SR Photo 31: Heavily vegetated banks in the openings below cleared woods. Annuals dominate.

SR Photo 32: Exposed banks along slopes downstream of cleared woods.

SR Photo 33: Rocked channel border above Boulder Vane.

SR Photo 34: Entering the V Channel Riffle at downstream portion of project.

SR Photo 35: V Channel Riffle.

SR Photo 36: V Channel immediately upstream of confluence with the Red River. Note scour at base of cottonwood tree at top of slope.

SR Photo 37: V Channel at outlet to Red River.

SR Photo 38: Outlet to Red River. Sediment above constructed rock outlet assumed to be material deposited by Red River Floods in spring and scoured by Grand Marais Creek after coming on-line. Note change in water clarity between Grand Marais Creek and Red River at confluence.

RESTORATION EVALUATION PROGRAM for LEGACY PROJECTS
Minnesota Board of Water and Soil Resources
Minnesota Department of Natural Resources

Project Evaluation Form

Site Visit: October 9, 2016

Project Background

Project Name: Seminary Fen Restoration **Fiscal Year 2011**

Project Location: Carver County

Township/Range Section: T116N R23W Sec 34

Project Manager/Affiliated Organization, Contact: City of Chaska

Fund: OHF Fiscal Year Funds: 2011 Project Start Date: 2011

Predominant Habitat type: Wetland

Project Status: Post-Establishment Phase

Project Goals and Planning

(Site Assessment Preparation from Plan Sets and Documents)

1. **What are the specific project components?**
   - Wetland/Fen Restoration
   - Ditch Fill
   - Vegetation Reestablishment

2. **What plans/record of project decisions/prescription worksheets are available? Provide location data?**

Chaska Seminary Fen Wetland Restoration – Natural Resource Management Plan (2011), Construction Plans (2012), Final Accomplishment Form (2012), Seminary Fen Investigation Report for the Area within Chaska (2015).

3. **What are the stated goals of the project?**
   - Restore site to native vegetation
   - Improve conditions for brook trout in Assumption Creek by improving baseflow conditions
   - Improve habitat for SGCN species

4. **Were measures of restoration success identified in plans? Yes**

If yes, list specific measurements.

- Removal of nonnative vegetation species and establish native species
- Hydrologic restoration of the fen/wetland complex

5. **Are plan Sets available? Yes Have new GIS maps been created? Yes**

If yes, provide in Appendix A and list Maps provided:

Appendix A - Construction Plan Set

Appendix B - GPS Points

Appendix C - Site Photos (10/9/15)

6. **Provide list of best management practices, standards, guidelines identified in plan set? Are these based on best current science?**

1. Local genotype native seeds were used in the restoration. The species list was extensive including 42 native grass and forb species.
2. Reed canary grass control included herbicide followed by scraping that removed rhizomes and seed bank.
3. Onsite buckthorn control included cutting and herbicide treatment
4. Drain tiles were broken and sealed with concrete.
5. Drainage ditches were completely filled with soil scraped from the site.

Project Implementation

(Questions for Site Manager and Cooperating Professionals)

7. **Were alterations made to the original plan during construction?**

Yes

- The original plan was to treat the reed canary grass with herbicide. Scraping of reed canary grass was conducted in addition to herbicide.
- The original plan was to install ditch blocks. The design was changed to fill the ditches completely with the material scraped from the site.

8. **In what ways did alterations to the plan or implementation change the proposed project outcome? Did this change derive from a desire to change outcomes?**

Scraping of the reed canary grass dominated site provided a relatively weed-free medium for seeding native species. Using the scraped material to fill the ditches helped with hydrologic restoration and removed the evidence of ditches.

Site Assessment

Field Review: October 9, 2016

9. Surrounding Landscape Characteristics:

The upgradient watershed is developed urban residential. The site is on the far westerly edge of a large wetland complex that includes the Seminary Fen.

10. Site Characteristics:

10a. Soils: Two soil units are mapped within the site, Minneiska-Kalmarville is on the westerly portion and Blue Earth Mucky Silt loam comprises the easterly portion. The easterly portion of the site was had a springy feel which indicated saturated soils under the vegetation.

10b. Topography: Steep slopes exist to the north of the site however the site is generally level sloping slightly southeasterly.

10c. Hydrology: The site's hydrology is primarily from groundwater as evidenced by the seeps found along the north side of the site. See note above under soils.

10d. Vegetation A: The site is primarily a wet meadow/fen complex. Hydrophytic species included softstem bulrush, lake sedge, Boneset, Blue lobelia. Reed canary grass was found in several plots with some plots having very high coverage. Stinging nettle was also found on the site but in very low abundance and density.

10d. Vegetation B: Some tree species are found along the sites west, north and east boundaries. These species included boxelder, elm, cottonwood and black willow. A small stand of cottonwood and black willow are in the southcentral portion of the site. Buckthorn shrubs are found scattered around the site perimeter.

See Vegetation Tables in Attachment 1.

11. Is the plan based on current science? Yes

1. Local genotype native seeds were used in the restoration. Local sourcing of seed material has proven to provide more successful restoration projects. The wide diversity of plant species (42 native grass and forb species) selected for the restoration increases the chances of successful vegetation establishment.
2. Reed canary grass is a difficult invasive species to control. The process of herbicide then scraping to remove remaining viable rhizomes and seed bank has been demonstrated to be a reliable approach to reed canary grass control and management.

3. The most reliable control of mature buckthorn is cutting the stem and then treating the fresh stump with Garlon. This approach was used on the site. Due to the increased wetness on the site following restoration, common buckthorn is not expected to be a persistent problem.
4. A reliable method for restoring hydrology to areas with drain tiles is to physically break the tiles and seal the lines with concrete. This approach used here effectively disables the tile and rehydrates the soil column.
5. Open ditches also function to drain wetted soil. In this case the drainage ditches encircling the site were completely filled with soil scraped from the site. This approach is effective at restoring hydrology to previously drained hydric soil.

12. List indicators of project outcomes at this stage of project:

The current conditions of the site are characteristic of a wetland/fen community.

- Vegetation: Many vegetation plot data points were taken on October 9, 2015. The results of these data (see Attachment 1) indicate the site is dominated by hydrophytes with FACW and OBL species comprising 93% of the herbaceous coverage. Approximately 58% of the total coverage of all plots are native species. Reed canary grass and stinging nettle are the dominant nonnative species. Trees such as boxelder have perished on the site due to increased hydrology. Black willow and cottonwood appear to be unaffected by the hydrologic change. Approximately 27% of the herbaceous coverage found in the vegetation plots was represented by species in the project seed mix. Most prevalent species represented on the site that were not in the project seed mix included reed canary grass, softstem bulrush, stinging nettle and beggarticks. The diverse structure of forb and grass species on the site support a robust species of song birds, in particular migratory native sparrows.
- Soils and Sedimentation: As evidenced by the dominant hydrophyte community and visual seeps, the soil appears to be sufficiently hydrated. No evidence of sedimentation or erosion was found on the site.
- Summary: The combination of scraping, ditch blocks, tile plugs and reseeding has sufficiently achieved the restoration outcome.

13. Does the project plan/implementation of the project plan reasonable allow for achieving proposed project outcome?

Yes, data collected on October 9th 2015 indicate the site has achieved desired outcomes.

14. Are corrections or modifications needed to meet proposed outcomes?

Ongoing control of reed canary grass and stinging nettle would improve the wetland plant community.

15. Do proposed or planned future steps, including long term management appear practical and reasonable? What are the potential challenges, limitations?

Reed canary grass will continue to threaten the vegetative integrity of the site. Ongoing maintenance within the site and around its perimeter will be needed to better protect the site against reed canary grass. A high density stand of reed canary grass exists on the parcel immediately south of the project site. Control of reed canary grass on this neighboring parcel will improve likelihood of effective control on the project site.

16. Do any of the project activities, planned or implemented, likely detract from existing or potential habitat? Explain.

No.

17. Are follow-up assessments needed? Explain.

Yes, continued monitoring and control of reed canary grass is recommended.

18. Additional comments on the restoration project:

The site provide considerable habitat benefits over the reed canary grass monotype found prior to restoration activities.

Project Evaluation

19. The project will:

a. Likely not meet proposed outcomes	☐
b. Minimally meet proposed outcomes	☐
c. Meet proposed outcomes	☒
d. Likely exceed proposed outcomes	☐
e. Greatly exceed proposed outcomes	☐

Confidence of outcome determination

a. Low	☐
b. Medium	☒
c. High	☐

20. Provide explanation of reason(s) for determination.

The project has improved vegetative diversity and hydrologic function. The prevalence of reed canary grass may continue to degrade the site if not managed.

Site Assessor(s) Conducting Review: Jason Naber, Consultant, Emmons & Olivier Resources, Inc.; Wade Johnson & Mark Cleveland DNR EWR; 10/9/2015.

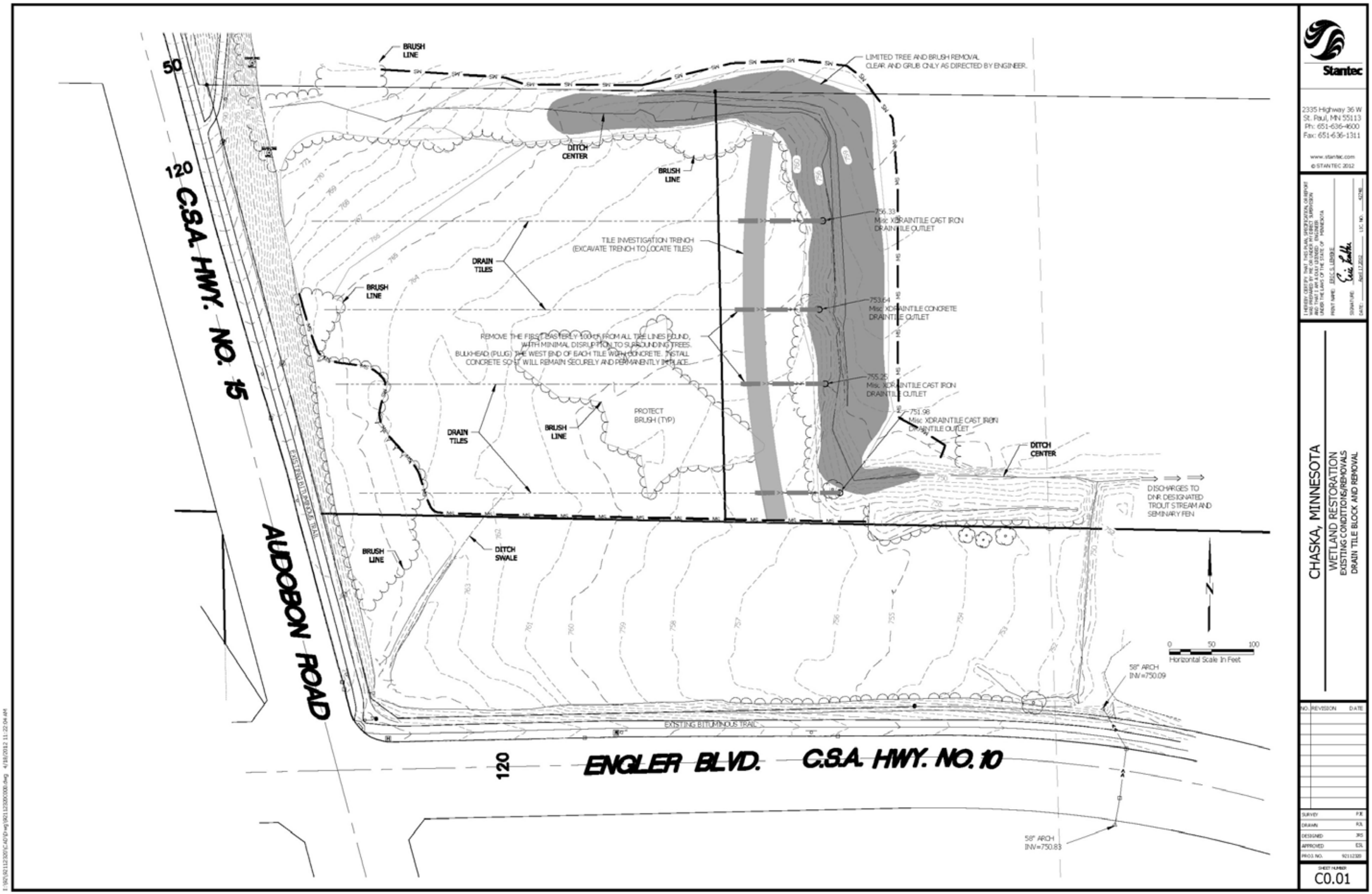


Figure 1 - Draintile Block Plan

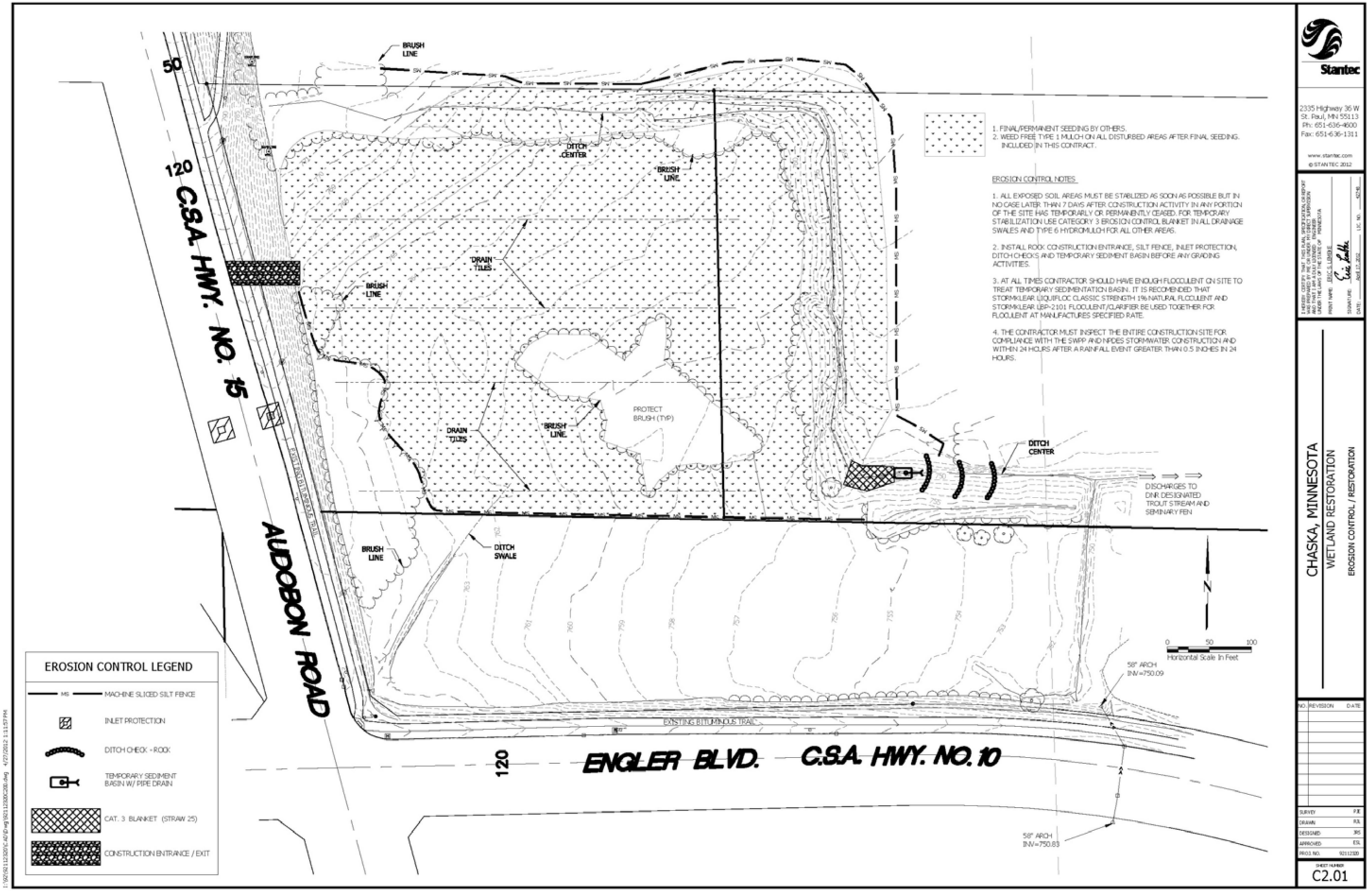


Figure 2 - Erosion Control and Restoration Plan

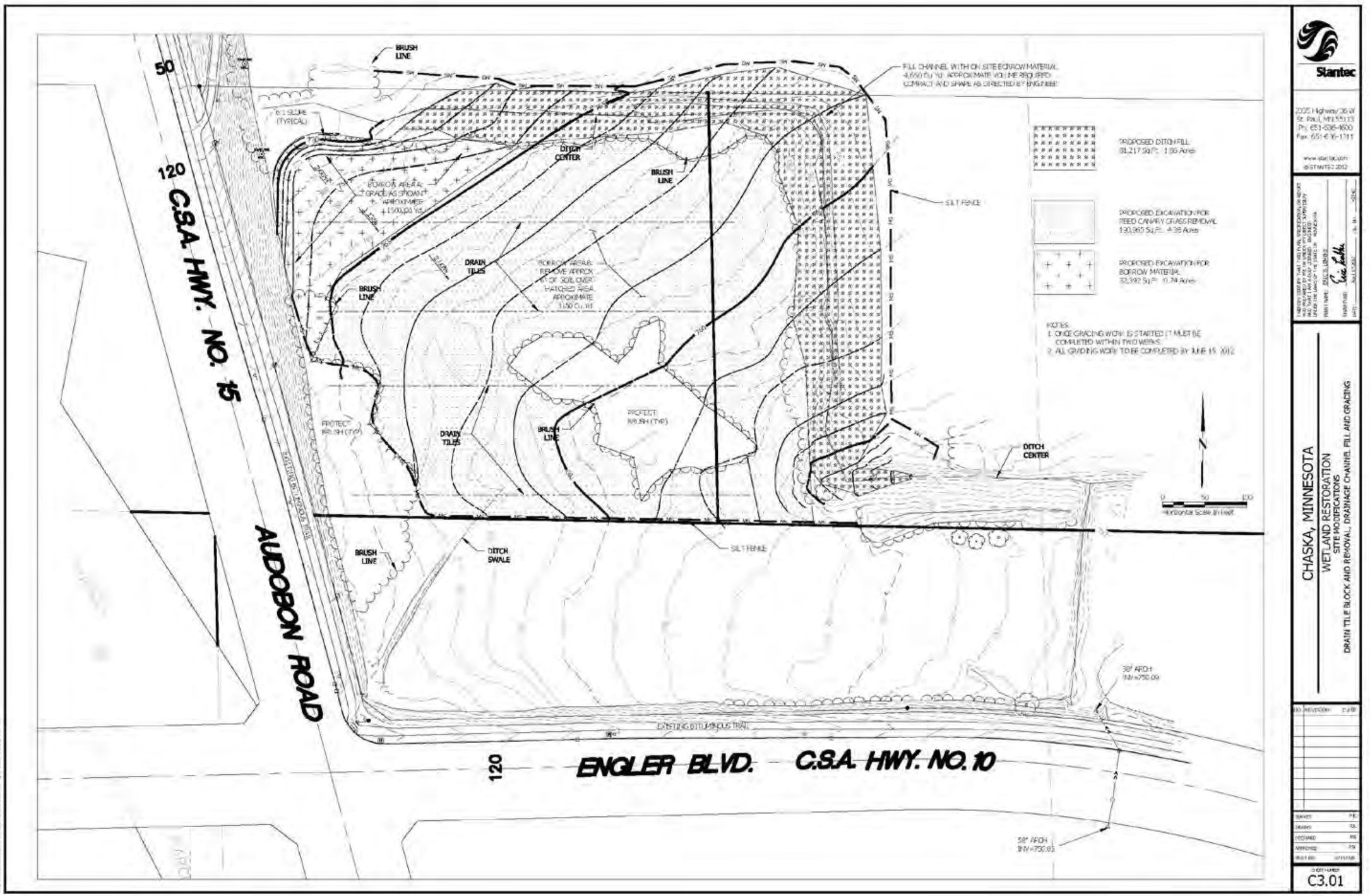
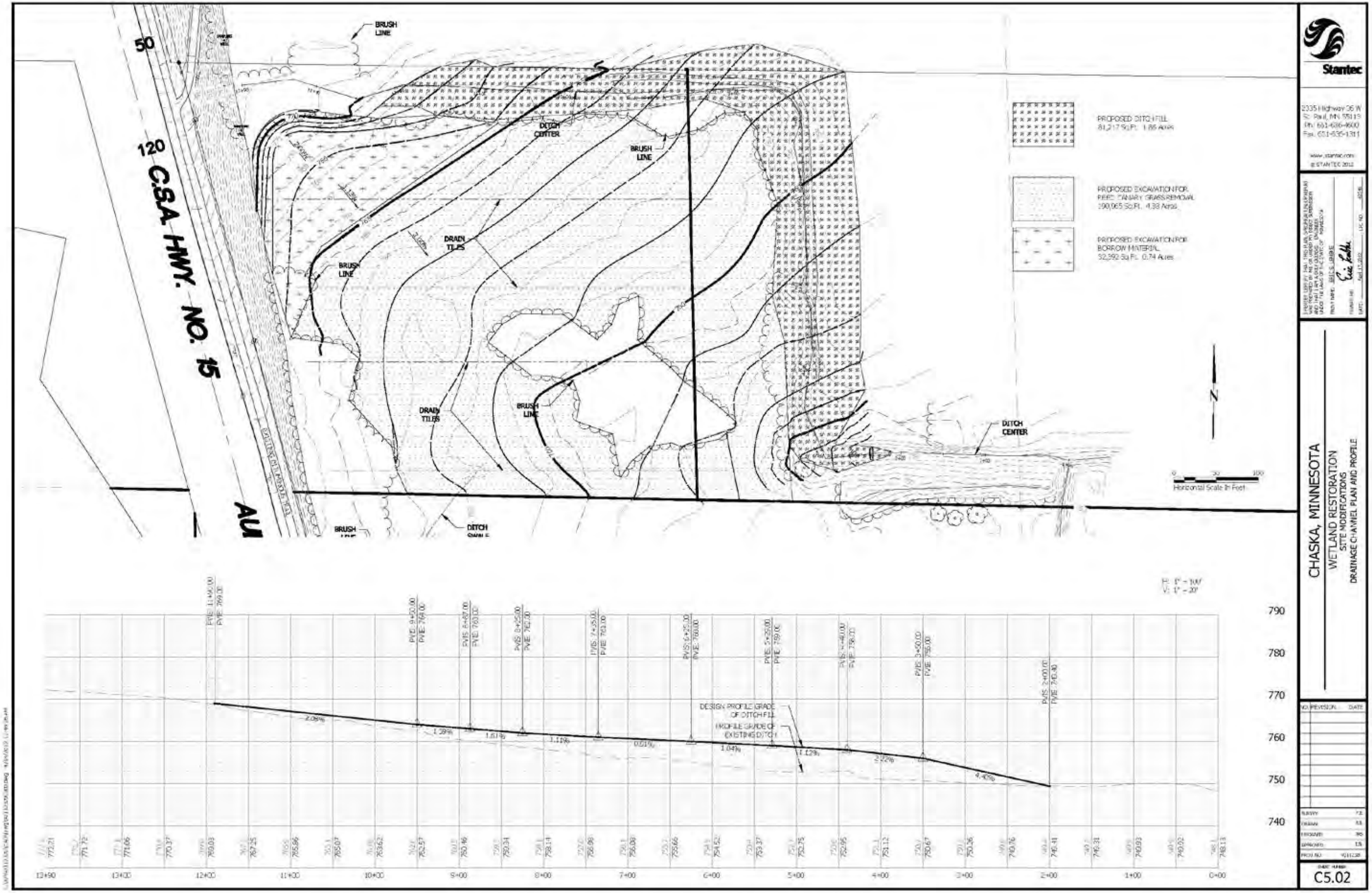


Figure 3 - Drainage channel fill plan



Stantec

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Fax: 651-636-1311

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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

PRINT NAME: ERIC S. LIEBSE

SIGNATURE: Eric Liebse LIC. NO. ____

DATE: ____ April 17, 2012

CHASKA, MINNESOTA
WETLAND RESTORATION
SITE MODIFICATIONS
DRAINAGE CHANNEL PLAN AND PROFILE

NO.	REVISION	DATE

SURVEY: TE
DESIGN: EL
DRAWN: EL
CHECKED: ESL
PROJ. NO. 401128

SHEET NUMBER
C5.02

Figure 4 - Drainage channel plan and profile

Appendix B: 10/9/15 Site Survey GPS Points

Figure 5 - GPS Survey points and locations of vegetation plot data

Appendix C: Site Photographs

Figure 6 - Site photo looking east from GPS point 450

Figure 7 - Site photo looking west from GPS point 455

Figure 8 - Site photo looking northwest from GPS point 459

Figure 9 - Calcareous seepage at GPS point 476

RESTORATION EVALUATION PROGRAM for LEGACY PROJECTS
Minnesota Board of Water and Soil Resources
Minnesota Department of Natural Resources

Project Evaluation Form

Project Background

Project Name: Wetland Restorations on WPA's – Ridgeway Site

Project Location: Otter Tail

Township/Range Section: T132N R44W Sec 9

Project Manager/Affiliated Organization, Contact: Fergus Falls Fish and Game Club

Fund: OHF Fiscal Year Funds: 2012 Project Start Date: 2011

Predominant Habitat type: Wetland Additional Habitat types: Prairie/Savana/Grassland/Aquatic

Project Status: Post-Establishment Phase

Project Goals and Planning

(Site Assessment Preparation from Plan Sets and Documents)

1. **What are the specific project components?**
   - Wetland Restoration/Creation
   - Ditch Plugs with Vegetated Spillways
   - Vegetation Reestablishment and Management

2. **What plans/record of project decisions/prescription worksheets are available? Provide location data?**

Conservation Partners Legacy Grant Application (2011), Conservation Partners Legacy Grant Program Accomplishment Report (2014). Ridgeway WPA Wetland Restoration Structure Plan set, USFWS Fergus Falls Wetland Management District.

3. **What are the stated goals of the project?**
   - Establish temporary and seasonal wetland basins in areas within key habitat areas of the Minnesota River Prairie and the Red River Prairie according to the State Wildlife Action Plan.
   - Provide additional habitat for wetland birds, waterfowl, mammals, amphibians and insects.
   - Improve habitat for SGCN species.

4. **Were measures of restoration success identified in plans? Yes**

If yes, list specific measurements.

- Establishment of temporary and seasonal wetland basins within the WPA.

5. **Are plan Sets available? Yes Have new GIS maps been created? Yes**

If yes, provide in Appendix A and list Maps provided:

Appendix A - Construction Drawings

Appendix B - GPS Points

Appendix C - Site Photos (10/26/15)

6. **Provide list of best management practices, standards, guidelines identified in plan set?**
    1. Native seeds were used in the restoration.
    2. Quick establishing native vegetation species were selected to minimize potential for erosion.
    3. Wire mesh was installed in flow over ditch plugs where the potential for damage by burrowing muskrats exists.
    4. A stabilized overflow spillway was constructed for ditch plugs to minimize risk of ditch plug failure.
    5. Mowing of annual weeds and woody species has been conducted since project initiation.
    6. Sediment accumulated in Basin 3 was removed.

Project Implementation

(Questions for Site Manager and Cooperating Professionals)

7. **Were alterations made to the original plan during construction? Discuss changes to the following:**

Yes

- Additional vegetation management including mowing of annual weeds and woody species was conducted by USFWS.

8. **In what ways did alterations to the plan or implementation change the proposed project outcome? Did this change derive from a desire to change outcomes?**

Proactive vegetation management such as the mowing that has already occurred improves site conditions and is important for long term sustainability of the created wetland features.

Site Assessment

(Field Review)

Date: 10/26/2015

Site Visit Participants: Jason Naber, Consultant, Emmons & Olivier Resources, Inc.; Wade Johnson, Restoration Evaluations Coordinator, MN DNR; Chad Raitz, USFWS; Tony Rondeau, Fergus Falls Fish and Game Club.

9. Surrounding Landscape Characteristics:

The adjacent watershed is managed as a Waterfowl Production Area (WPA) and is fully established to a native grassland ground cover. Outside of the WPA boundaries the land cover is dominated by row crop agriculture. Primary crops include corn, soybeans and to a lesser extent sugar beets.

10. Site Characteristics:

10a.Soils: The predominant soil units within the Ridgeway WPA are Aasdahl clay loam, Formdale-Buse complex, Swenoda fine sandy loam and Parnel silt loam. The wetland restoration sites within the Ridgeway WPA are located within the Parnel silt loam and the less common Hamerly clay loam.

10b. Topography: This site has gently rolling topography that includes gentle rises, swales and depressions. Slopes are generally from 1 to 6%.

10c. Hydrology: The site's hydrology is primarily from surface runoff. Permanent open water features within the WPA and adjacent to the WPA indicate the surficial water elevation is lower that the restored wetland features.

10d. Vegetation A: Vegetation represented in the restored wetland basins include (in order of prevalence) narrow leaf cattail, river bulrush, softstem bulrush, green bulrush, beggarticks, reed canary grass and mud plantain.

10e. Vegetation B: The vegetation comprising the upland area adjacent to the restored wetlands is primarily native prairie grasses and forbs. Representative species include Indian grass, big bluestem, little bluestem and switch grass. Native forb species do not comprise a significant coverage within the planted prairie areas. Invasive herbaceous species found adjacent to the restored wetland areas included reed canary grass and thistle. Willow shrubs and cottonwood saplings were recently mowed along the area buffering the restored wetland.

Is the plan based on current science? Yes

Restoring wetland hydrology to these basins with ditch plugs is a recognized method for establishing the desired wetland habitat.

If no, explain in detail. NA

11. List indicators of project outcomes at this stage of project:

- The current conditions of the site are characteristic of a seasonal wetland habitat.
- Vegetation: Vegetation data points were taken on October 26, 2015 for each of the four basins found on the Ridgeway site. In all cases the restored wetlands supported a robust stand of hydrophytic vegetation. Narrow leaf cattail was prevalent throughout and created dense vegetative monotypes. Some willow species were scattered within the wetland areas. The structure of these sturdy species provides cover for wildlife as evidenced by the sign (beds, tracks, trails) found within the basins.
- Soils and Sedimentation: As evidenced by the dominant hydrophyte community, the soil appears to be sufficiently hydrated. No evidence of sedimentation or erosion was found on the site.
- Summary: The combination of ditch blocks, tile plugs and reseeding has sufficiently achieved the restoration outcome outcomes of providing additional habitat for wetland birds, waterfowl, mammals, amphibians and insects.

12. Does the project plan/implementation of the project plan reasonable allow for achieving proposed project outcome?

Yes, data on the restored wetland and upland buffer habitat conditions collected on October 26th 2015 indicate the site has achieved desired outcomes.

13. Are corrections or modifications needed to meet proposed outcomes?

Ongoing control of narrow leaf cattail, reed canary grass and woody species are important to maintaining the targeted seasonal wetland habitat.

14. Do proposed or planned future steps, including long term management appear practical and reasonable? What are the potential challenges, limitations?

Woody species such as willow and cottonwood will continue to threaten the functional integrity of the site. Ongoing maintenance within the site and around its perimeter will be needed to sustain the desired habitat. This maintenance can be accomplished through a variety of activities such as burning and mowing. As evidenced by recent management activities, the USFWS is committed to the success of these wetland restorations.

15. Do any of the project activities, planned or implemented, likely detract from existing or potential habitat? Explain.

No.

16. Are follow-up assessments needed? Explain.

Yes, continued monitoring and control of narrow leaf cattail and wood species is recommended.

17. Additional comments on the restoration project:

The site provides considerable habitat benefits over the previous row crop land cover. The created wetland areas also provide important cover for wildlife and important seasonal wetlands for migratory birds.

Project Evaluation

18. The project will:

a. Likely not meet proposed outcomes ☐

b. Minimally meet proposed outcomes ☐

c. Meet proposed outcomes ☒

d. Likely exceed proposed outcomes ☐

e. Greatly exceed proposed outcomes ☐

Confidence of outcome determination

a. Low ☐

b. Medium ☐

c. High ☒

19. Provide explanation of reason(s) for determination.

The project has improved wildlife habitat and provided important wetland features within a Waterfowl Production Area located in an area of Minnesota where a very minimal percentage of native habitat persists. The USFWS along with other project partners are committed to management of the site to maintain desired habitat benefits.

20. Site Assessor(s) Conducting Review:

Jason Naber, Consultant, Emmons & Olivier Resources, Inc; Wade Johnson, Restoration Evaluations Coordinator, MN DNR.

Appendix A: Construction Drawings:

U.S. DEPARTMENT OF AGRICULTURE
NRCS

RIDGEWAY

A2-ENG-126
(2/10/2006)

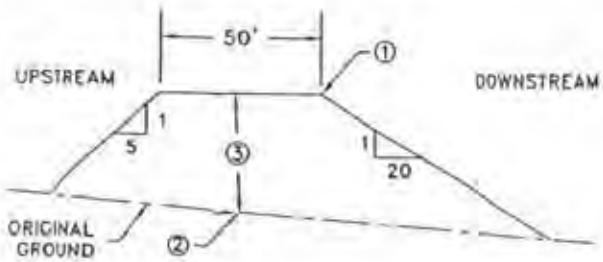
WETLAND RESTORATION STRUCTURE

FLOW OVER DITCH PLUG

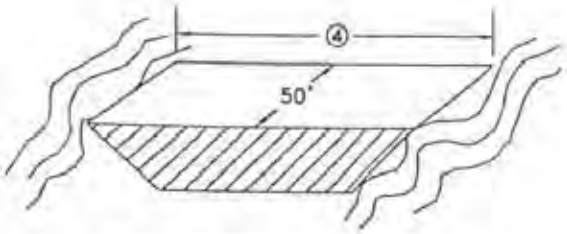
NOTES:
1. THIS DRAWING APPLIES TO STRUCTURES DESIGNED ACCORDING TO THE WETLAND RESTORATION STANDARD (657)

2. BEFORE START OF CONSTRUCTION, THE OWNERS OF ANY UTILITIES INVOLVED MUST BE NOTIFIED. THE EXCAVATOR IS RESPONSIBLE FOR GIVING THIS NOTICE BY CALLING "GOPHER STATE ONE-CALL" AT (651) 454-0002 (TWIN CITIES METRO AREA) OR (800) 252-1166 (ALL OTHER LOCATIONS) AT LEAST 48 HOURS PRIOR TO ANY EXCAVATION.

3. THIS DESIGN AND DRAWING MAY ONLY BE USED WHERE THE DRAINAGE AREA IS LESS THAN 50 ACRES, FILL HEIGHT IS LESS THAT 5', AND NO BASEFLOW EXISTS.



EMBANKMENT CROSS SECTION



ISOMETRIC PROFILE ALONG ℄ OF FILL

LOCATION MAP
not to scale

Section 9 T. 132 N. R. 44 W.

Orwell (Township) Otter Tail (County)

Drainage Area (acres) 20

Pool Area (acres) 0.8

Area to be Seeded (acres) . 1.0

① Top of Fill El..... 1090.5

② Low Point along Profile . 1088.7

③ Controlled Head (①) - (②). 1.8

④ ES Bottom Width ..... 60'
(TOP LENGTH OF EARHTFILL)

ENG JOB CLASS ____

TBM Description: NO TBM was established as a survey grade GPS was used to obtain MSL elevations.

Certification Statement: _____

Cooperator Fish & Wildlife Service

Site No. 1

Designed By Maria Fiscus Date 9/18/2013

Checked By _____ Date ____

Approved By _____ Date ____

Figure 2 - Site 2 Ditch Block

U.S. DEPARTMENT OF AGRICULTURE
NRCS

RIDGEWAY

A2-ENG-126
(2/10/2006)

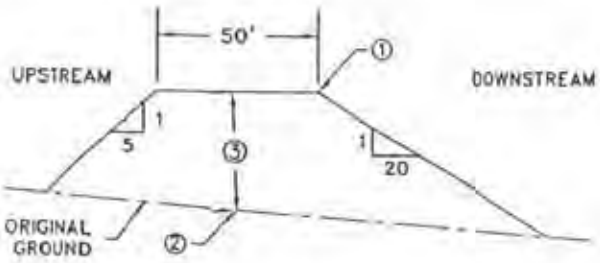
WETLAND RESTORATION STRUCTURE

FLOW OVER DITCH PLUG

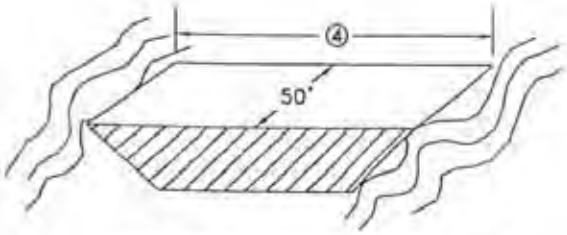
NOTES:
1. THIS DRAWING APPLIES TO STRUCTURES DESIGNED ACCORDING TO THE WETLAND RESTORATION STANDARD (657)

2. BEFORE START OF CONSTRUCTION, THE OWNERS OF ANY UTILITIES INVOLVED MUST BE NOTIFIED. THE EXCAVATOR IS RESPONSIBLE FOR GIVING THIS NOTICE BY CALLING "GOPHER STATE ONE-CALL" AT (651) 454-0002 (TWIN CITIES METRO AREA) OR (800) 252-1166 (ALL OTHER LOCATIONS) AT LEAST 48 HOURS PRIOR TO ANY EXCAVATION.

3. THIS DESIGN AND DRAWING MAY ONLY BE USED WHERE THE DRAINAGE AREA IS LESS THAN 50 ACRES, FILL HEIGHT IS LESS THAT 5', AND NO BASEFLOW EXISTS.



EMBANKMENT CROSS SECTION



ISOMETRIC PROFILE ALONG ℄ OF FILL

LOCATION MAP
not to scale

Section 9 T. 132 N. R. 44 W.

Orwell (Township) Otter Tail (County)

Drainage Area (acres) 20

Pool Area (acres) 1.3

Area to be Seeded (acres) . 1.0

① Top of Fill El..... 1091.5

② Low Point along Profile . 1089.0

③ Controlled Head ① - ②. 2.5

④ ES Bottom Width ..... 83'
(TOP LENGTH OF EARTHFILL)

ENG JOB CLASS ____

TBM Description: No TBM was established as a survey grade GPS was used to obtain MSL elevations

Certification Statement: _____

Cooperator USFWS

Site No. 2

Designed By Maria Ostrodka Date 9/19/12

Checked By _____ ____

Approved By _____ ____

Figure 3 - Site 3 Ditch Block

U.S. DEPARTMENT OF AGRICULTURE
NRCS

RIDGEWAY

A2-ENG-126
(2/10/2006)

WETLAND RESTORATION STRUCTURE

FLOW OVER DITCH PLUG

NOTES:
1. THIS DRAWING APPLIES TO STRUCTURES DESIGNED ACCORDING TO THE WETLAND RESTORATION STANDARD (657)

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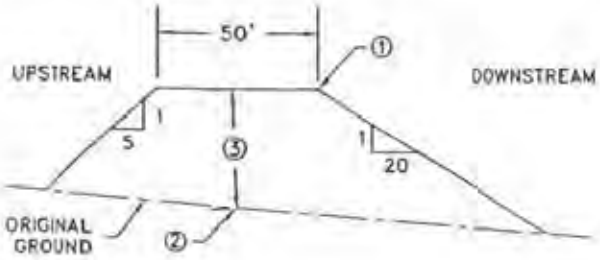
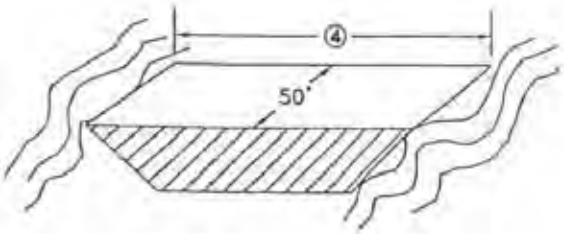
3. THIS DESIGN AND DRAWING MAY ONLY BE USED WHERE THE DRAINAGE AREA IS LESS THAN 50 ACRES, FILL HEIGHT IS LESS THAT 5', AND NO BASEFLOW EXISTS.



EMBANKMENT CROSS SECTION



ISOMETRIC PROFILE ALONG ℄ OF FILL

LOCATION MAP
not to scale

Section 9 T. 132 N. R. 44 W.

Orwell (Township) Otter Tail (County)

Drainage Area (acres) 6.0

Pool Area (acres) 0.6

Area to be Seeded (acres) . 1.0

① Top of Fill El..... 1082.1

② Low Point along Profile . 1079.0

③ Controlled Head ① - ②. 3.1

④ ES Bottom Width ..... 22'
(TOP LENGTH OF EARTHFILL)

ENG JOB CLASS ____

TBM Description: No TBM was established as a survey grade gps was used to obtain MSL elevations

Certification Statement: _____

Cooperator USFWS

Site No. 3

Designed By Maria Fosado Date 9/10/12

Checked By _____ Date ____

Approved By _____ Date ____

Figure 4 - Site 4 Ditch Block

U.S. DEPARTMENT OF AGRICULTURE
NRCS

RIDGEWAY

A2-ENG-126
(2/10/2006)

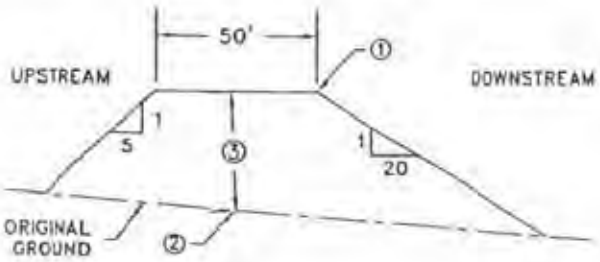
WETLAND RESTORATION STRUCTURE

FLOW OVER DITCH PLUG

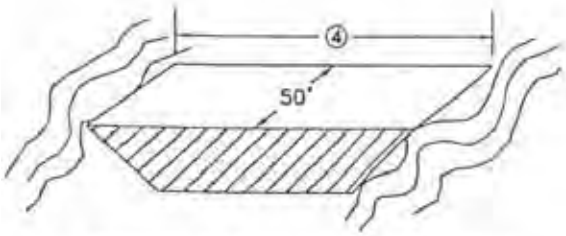
NOTES:
1. THIS DRAWING APPLIES TO STRUCTURES DESIGNED ACCORDING TO THE WETLAND RESTORATION STANDARD (657)

2. BEFORE START OF CONSTRUCTION, THE OWNERS OF ANY UTILITIES INVOLVED MUST BE NOTIFIED. THE EXCAVATOR IS RESPONSIBLE FOR GIVING THIS NOTICE BY CALLING "GOPHER STATE ONE-CALL" AT (651) 454-0002 (TWIN CITIES METRO AREA) OR (800) 252-1166 (ALL OTHER LOCATIONS) AT LEAST 48 HOURS PRIOR TO ANY EXCAVATION.

3. THIS DESIGN AND DRAWING MAY ONLY BE USED WHERE THE DRAINAGE AREA IS LESS THAN 50 ACRES, FILL HEIGHT IS LESS THAT 5', AND NO BASEFLOW EXISTS.



EMBANKMENT CROSS SECTION



ISOMETRIC PROFILE ALONG ℄ OF FILL

LOCATION MAP
not to scale

Section 9 T. 132 N. R. 44 W.

Otisville (Township) Otter Tail (County)

Drainage Area (acres) 20

Pool Area (acres) 1.0

Area to be Seeded (acres) . 1.0

① Top of Fill El..... 1079.6

② Low Point along Profile . 1077.8

③ Controlled Head (①) - (②). 1.8

④ ES Bottom Width 90
(TOP LENGTH OF EARTHFILL)

ENG JOB CLASS ____

TBM Description: NO TBM was established as a survey grade GPS was used to obtain MSL elevations

Cooperator USFWS

Site No. 4

Certification Statement: _____

Designed By Maria C Read Date 9/16/12

Checked By _____

Approved By _____

Appendix B: 10/26/15 Site Survey GPS Points

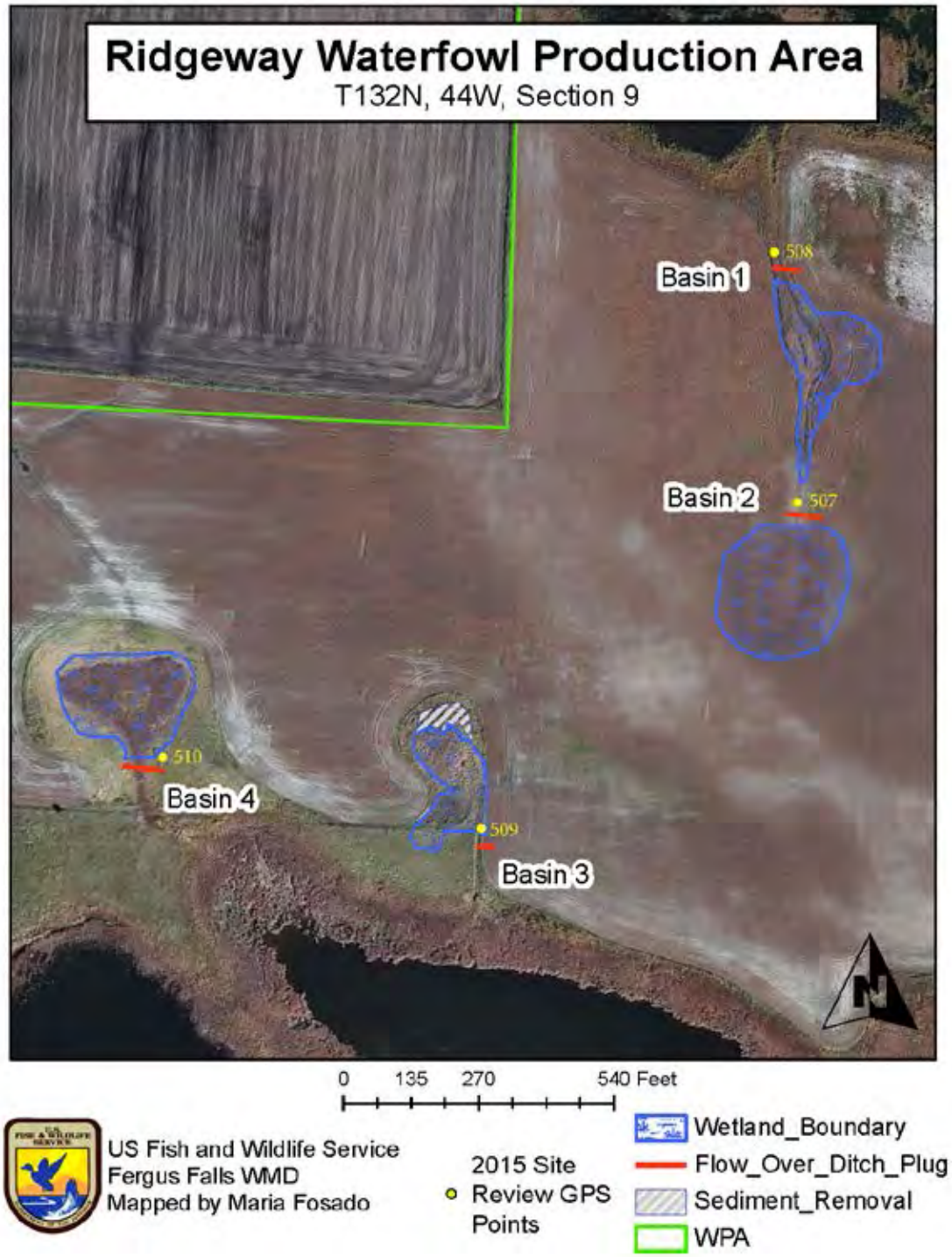


Figure 5 - GPS Survey points and locations of vegetation plot data.

Appendix C: Site Photographs

Figure 6 - Cattail and wetland buffer mowing at GPS 507, Basin 2.

Figure 7 - River Bulrush at GPS 509, Basin 3.

RESTORATION EVALUATION PROGRAM for LEGACY PROJECTS
Minnesota Board of Water and Soil Resources
Minnesota Department of Natural Resources

Project Evaluation Form

Project Background

Project Name: Wetland Restorations on WPA's – Nordby Site

Project Location: Grant County

Township/Range Section: T128N R43W Sec 11

Project Manager/Affiliated Organization, Contact: Fergus Falls Fish and Game Club

Fund: OHF Fiscal Year Funds: 2012 Project Start Date: 2011

Predominant Habitat type: Wetland Additional Habitat types: Prairie/Savana/Grassland, Aquatic

Project Status: Post-Establishment Phase

Project Goals and Planning

(Site Assessment Preparation from Plan Sets and Documents)

1. **What are the specific project components?**
   - Wetland Restoration/Creation
   - Ditch Plugs with Vegetated Spillways
   - Vegetation Reestablishment and Management

2. **What plans/record of project decisions/prescription worksheets are available? Provide location data?**

Conservation Partners Legacy Grant Application (2011), Conservation Partners Legacy Grant Program Accomplishment Report (2014). Nordby WPA Wetland Restoration Structure Plan set, USFWS Fergus Falls Wetland Management District

3. **What are the stated goals of the project?**
   - Establish temporary and seasonal wetland basins in areas within key habitat areas of the Minnesota River Prairie and the Red River Prairie according to the State Wildlife Action Plan.
   - Provide additional habitat for wetland birds, waterfowl, mammals, amphibians and insects.
   - Improve habitat for SGCN species.

4. **Were measures of restoration success identified in plans? Yes**

If yes, list specific measurements.

- Establishment of temporary and seasonal wetland basins within the WPA.

5. **Are plan Sets available? Yes Have new GIS maps been created? Yes**

If yes, provide in Appendix A and list Maps provided:

Appendix A - Construction Drawings

Appendix B - GPS Points

Appendix C- Site Photos (10/26/15)

6. **Provide list of best management practices, standards, guidelines identified in plan set?**
    1. Native seeds were used in the restoration.
    2. Quick establishing native vegetation species were selected to minimize potential for erosion.
    3. Wire mesh was installed in flow over ditch plugs where the potential for damage by burrowing muskrats exists.
    4. A stabilized overflow spillway was constructed for ditch plugs to minimize risk of ditch plug failure.
    5. Mowing of annual weeds and woody species has been conducted since project initiation.

Project Implementation

(Questions for Site Manager and Cooperating Professionals)

7. **Were alterations made to the original plan during construction? Discuss changes to the following:**

Yes

- Additional vegetation management including mowing of annual weeds and woody species was conducted by USFWS.

8. **In what ways did alterations to the plan or implementation change the proposed project outcome? Did this change derive from a desire to change outcomes?**

Proactive vegetation management such as the mowing that has already occurred improves site conditions and is important for long term sustainability of the created wetland features.

Site Assessment

(Field Review)

Date: 10/26/2015

Site Visit Participants: Jason Naber, Consultant, Emmons & Olivier Resources, Inc. Wade Johnson, Restoration Evaluations Coordinator, MN DNR; Chad Raitz, USFWS; Tony Rondeau, Fergus Falls Fish and Game Club

9. Surrounding Landscape Characteristics:

The adjacent watershed is managed as a Waterfowl Production Area (WPA) and is fully established to a native grassland ground cover. Outside of the WPA boundaries the land cover is dominated by row crop agriculture. Primary crops include corn, soybeans and to a lesser extent sugar beets.

10. Site Characteristics:

10a. Soils: The predominant soil units within the Nordby WPA are Langhei-Formdale clay loams, Odham silty clay and Flom silty clay loam. The wetland restoration sites within the Nordby WPA are located within all three soil types.

10b. Topography: This site has gently rolling topography that includes gentle rises, swales and depressions. Slopes are generally level in the restoration locations with steeper slopes from 12 to 20%.

10c. Hydrology: The site's hydrology is primarily from surface runoff. Permanent open water features within the WPA and adjacent to the WPA indicate the surficial water elevation is lower that the restored wetland features.

10d. Vegetation A: Vegetation represented in the restored wetland basins include (in order of prevalence) narrow leaf cattail, softstem bulrush, green bulrush, and reed canary grass. .

10e. Vegetation B: The vegetation comprising the upland area adjacent to the restored wetlands is primarily native prairie grasses and forbs. Representative species include Indian grass, big bluestem, little bluestem, switch grass wild rye and some prairie cord grass. Native forb species do not comprise a significant coverage within the planted prairie areas. Invasive herbaceous species found adjacent to the restored wetland areas included reed canary grass. Past mowing of sweet clover provided good control.

Is the plan based on current science? Yes

Restoring wetland hydrology to these basins with ditch plugs is a recognized method for establishing the desired wetland habitat.

If no, explain in detail. NA

11. List indicators of project outcomes at this stage of project:

- The current conditions of the site are characteristic of a seasonal wetland habitat.
- Vegetation: Vegetation data points were taken on October 26, 2015 for each of the three basins found on the Nordby site. In all cases the restored wetlands supported a robust stand of hydrophytic vegetation. Narrow leaf cattail was in each site. The cattails provide cover for wildlife as evidenced by the sign (beds, tracks, trails) found within the basins.
- Soils and Sedimentation: As evidenced by the dominant hydrophyte community, the soil appears to be sufficiently hydrated. No evidence of sedimentation or erosion was found on the site.
- Summary: The combination of ditch blocks, scrapes and reseeding has sufficiently achieved the restoration outcomes of providing additional habitat for wetland birds, waterfowl, mammals, amphibians and insects.

12. Does the project plan/implementation of the project plan reasonable allow for achieving proposed project outcome?

Yes, data on the restored wetland and upland buffer habitat conditions collected on October 26th 2015 indicate the site has achieved desired outcomes.

13. Are corrections or modifications needed to meet proposed outcomes?

Ongoing control of narrow leaf cattail and reed canary grass are important to maintaining the targeted seasonal wetland habitat.

14. Do proposed or planned future steps, including long term management appear practical and reasonable? What are the potential challenges, limitations?

Ongoing maintenance of sweet clover within the site and around its perimeter will be needed to sustain the quality of the adjacent upland areas. This maintenance can be accomplished through a variety of activities such as burning and mowing. As evidenced by recent management activities, the USFWS is committed to the success of these wetland restorations.

15. Do any of the project activities, planned or implemented, likely detract from existing or potential habitat? Explain.

No.

16. Are follow-up assessments needed? Explain.

Yes, continued monitoring and control of narrow leaf cattail and reed canary grass is recommended.

17. Additional comments on the restoration project.

The site provides considerable habitat benefits over the previous row crop land cover. The created wetland areas also provide important cover for wildlife and important seasonal wetlands for migratory birds.

Project Evaluation

18. The project will:

a. Likely not meet proposed outcomes ☐
b. Minimally meet proposed outcomes ☐
c. Meet proposed outcomes ☒
d. Likely exceed proposed outcomes ☐
e. Greatly exceed proposed outcomes ☐

Confidence of outcome determination

a. Low ☐
b. Medium ☐
c. High ☒

19. Provide explanation of reason(s) for determination.

The project has improved wildlife habitat and provided important wetland features within a Waterfowl Production Area located in an area of Minnesota where a very minimal percentage of native habitat persists. The USFWS along with other project partners are committed to management of the site to maintain desired habitat benefits.

20. Site Assessor(s) Conducting Review:

Jason Naber, Consultant, Emmons & Olivier Resources, Inc.; Wade Johnson, Restoration Evaluations Coordinator, MN DNR.

Appendix A: Construction Drawings:

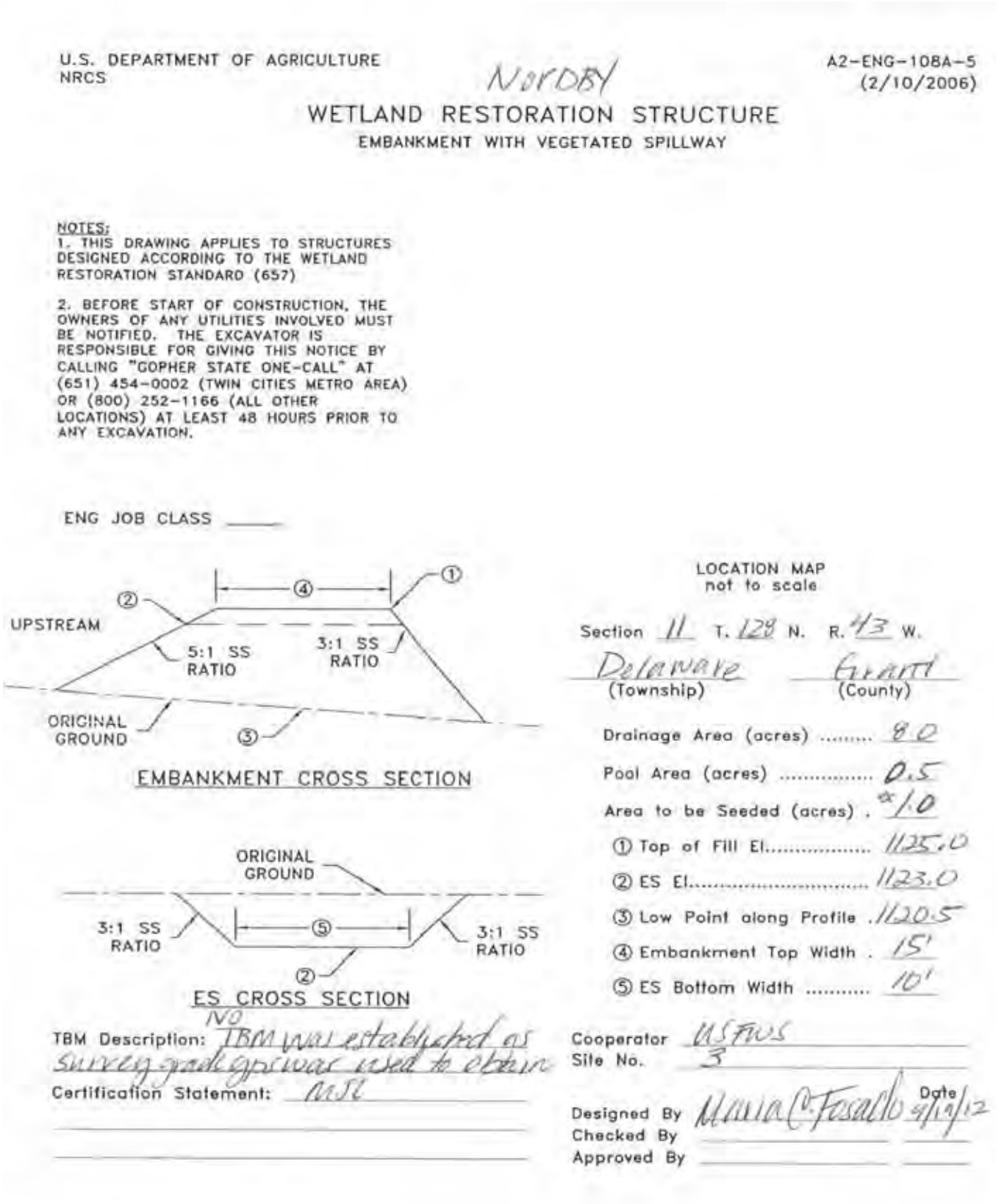
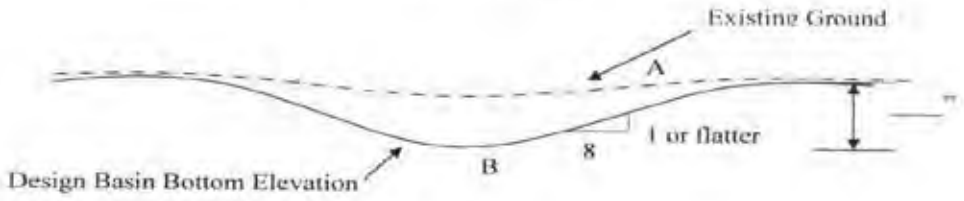
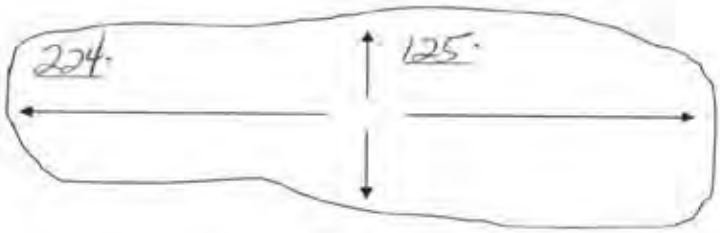


Figure 1 - Site 1 Ditch Block

NORDBY

Wetland Scrape





1. Excavate to Depth of 12 in middle
2. Side slopes shall be 8:1 or flatter
3. Size: 28,000 sq. ft.
4. Spread spoil on non-wetlands

Total Quantity of Earth Fill 579 YD³

Drainage Area (acres) 8.0

Area to be Seeded (sq. ft.) ≈10

Total Acres 0.5

Existing Ground: 1121.4

Design Basin Bottom Elevation: 1120.4

Basin #: 3

Landowner: USFWS

Date: 9/19/12

Designed By: Maria Posado

T. 128 N. R. 73 W. Sec. 11

Figure 2 - Site 1 Wetland Scrape

U.S. DEPARTMENT OF AGRICULTURE
NRCS

NORDBY

A2-ENG-108A-5
(2/10/2006)

WETLAND RESTORATION STRUCTURE

EMBANKMENT WITH VEGETATED SPILLWAY

NOTES:
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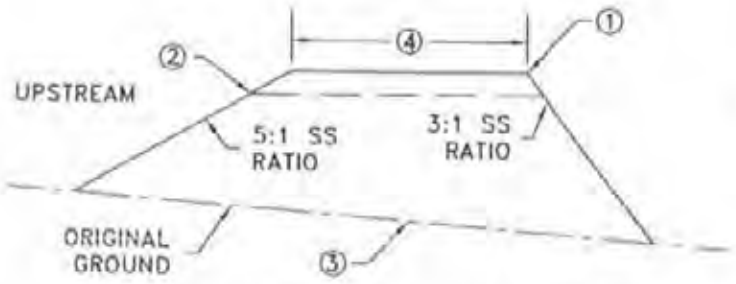
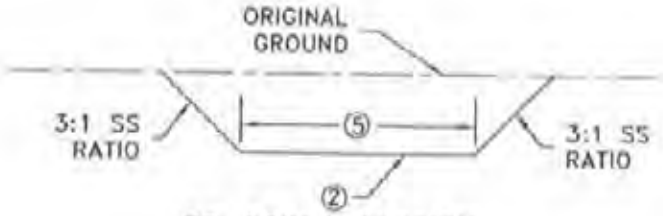
ENG JOB CLASS ____



EMBANKMENT CROSS SECTION



ES CROSS SECTION

LOCATION MAP
not to scale

Section 11 T. 128 N. R. 45 W.

Delaware (Township) Grant (County)

Drainage Area (acres) 35

Pool Area (acres) 4.8

Area to be Seeded (acres) ± 1.0

① Top of Fill El..... 1107.0

② ES El..... 1105.0

③ Low Point along Profile . 1100.0

④ Embankment Top Width . 15'

⑤ ES Bottom Width ..... 10'

TBM Description: No TBM was established as survey grade GPS was used to obtain MSL

Certification Statement:

Cooperator USFWS

Site No. 2

Designed By Mario Ofosado Date 9/19/17

Checked By

Approved By

Figure 3 - Site 2 Ditch Block

U.S. DEPARTMENT OF AGRICULTURE
NRCS

NorDBY

A2-ENG-108A-5
(2/10/2006)

WETLAND RESTORATION STRUCTURE

EMBANKMENT WITH VEGETATED SPILLWAY

NOTES:
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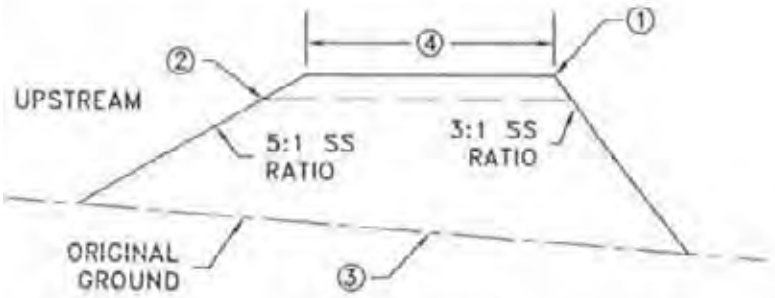
2. BEFORE START OF CONSTRUCTION, THE OWNERS OF ANY UTILITIES INVOLVED MUST BE NOTIFIED. THE EXCAVATOR IS RESPONSIBLE FOR GIVING THIS NOTICE BY CALLING "GOPHER STATE ONE-CALL" AT (651) 454-0002 (TWIN CITIES METRO AREA) OR (800) 252-1166 (ALL OTHER LOCATIONS) AT LEAST 48 HOURS PRIOR TO ANY EXCAVATION.

ENG JOB CLASS ____



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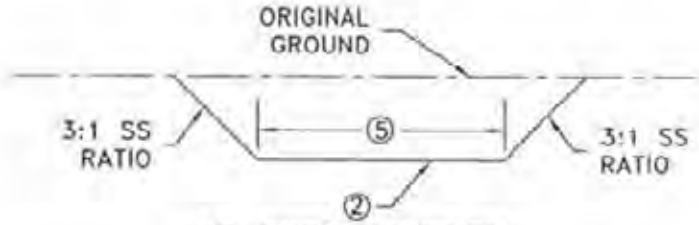


ES CROSS SECTION

LOCATION MAP
not to scale

Section 11 T. 128 N. R. 43 W.

Delaware (Township) Grant (County)

Drainage Area (acres) 8.0

Pool Area (acres) 0.5

Area to be Seeded (acres) . *1.0

① Top of Fill El..... 1125.0

② ES El..... 1123.0

③ Low Point along Profile . 1120.5

④ Embankment Top Width . 15'

⑤ ES Bottom Width ..... 10'

TBM Description: NO TBM was established as survey grade gps was used to obtain

Certification Statement: NSE

Cooperator USFWS

Site No. 3

Designed By Maria C. Fasano Date 9/19/12

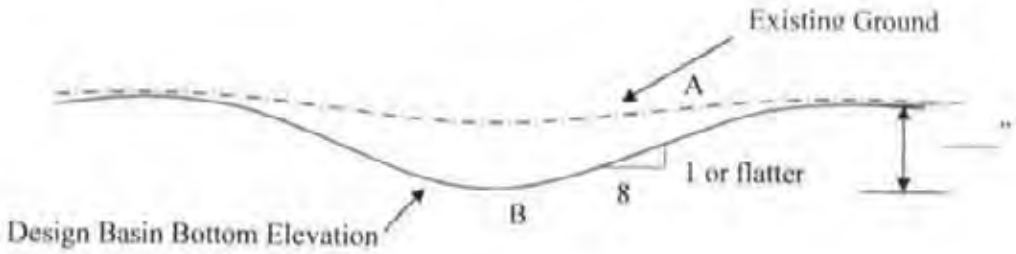
Checked By

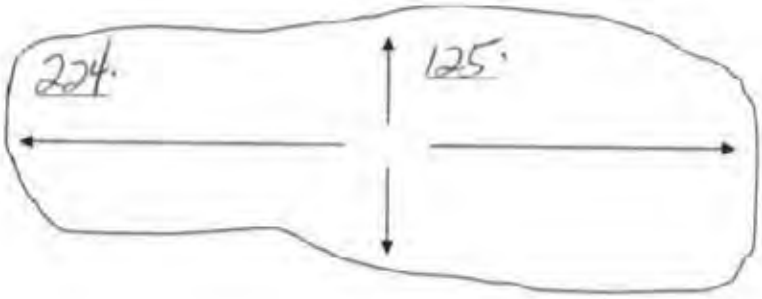
Approved By

Figure 4 - Site 3 Ditch Block

NORDBY

Wetland Scrape





1. Excavate to Depth of 12 in middle
2. Side slopes shall be 8:1 or flatter
3. Size: 28,000 sq. ft.
4. Spread spoil on non-wetlands

Total Quantity of Earth Fill 519 YD^3

Drainage Area (acres) 80

Area to be Seeded (sq. ft.) ≈10

Total Acres 0.5

Existing Ground: 1121.4

Design Basin Bottom Elevation: 1120.4

Basin #: 3

Landowner: USFWS

Date: 9/19/12

Designed By: Maria Tosado

T. 128 N. R. 43 W. Sec. 11

Figure 5 - Site 3 Wetland Scrape

Appendix B: 10/26/15 Site Survey GPS Points

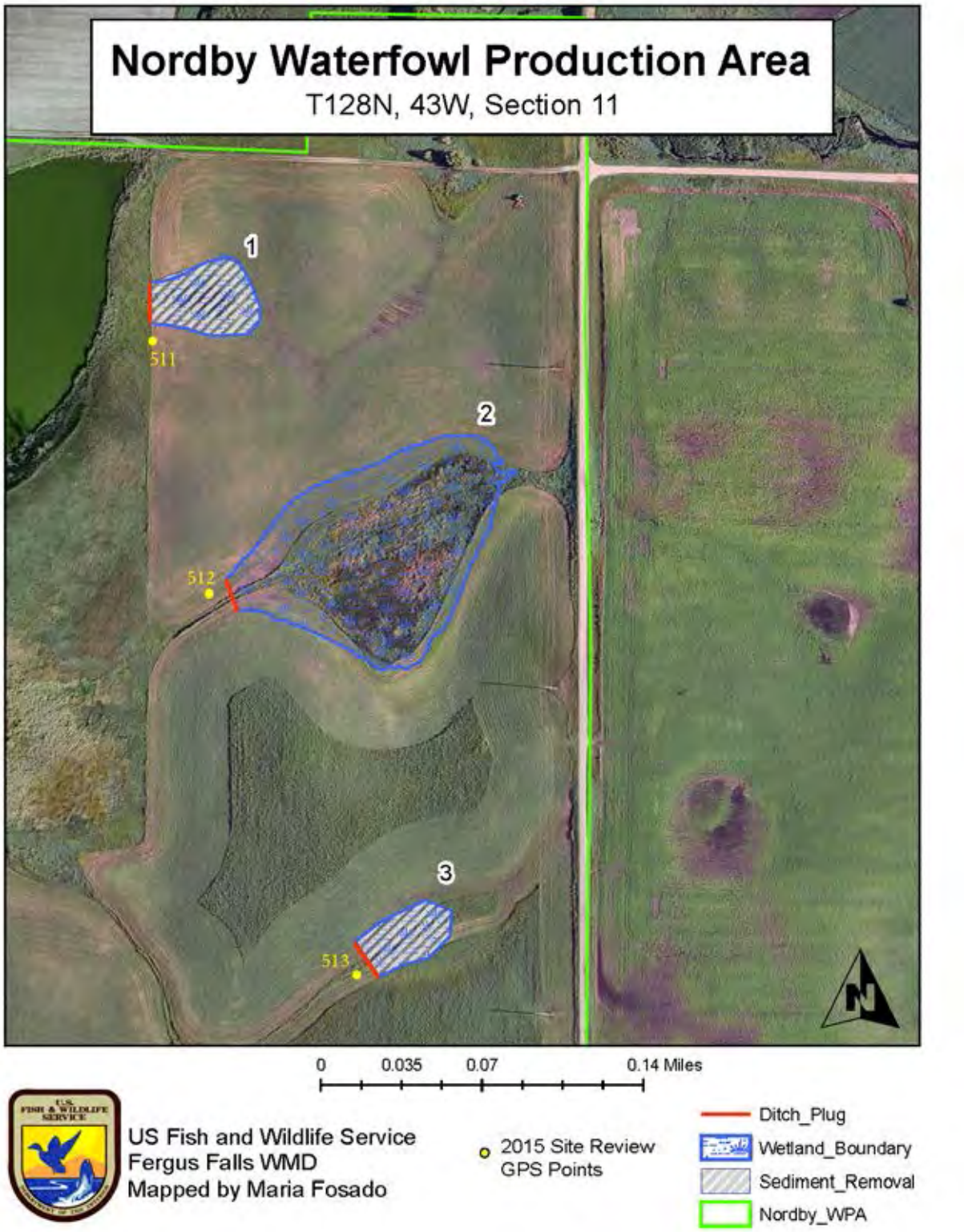


Figure 6 - GPS Survey points and locations of vegetation plot data

Appendix C: Site Photographs

Figure 7 - Basin #1 at GPS 511

Figure 8 –Basin #3 at GPS 513

RESTORATION EVALUATION PROGRAM for LEGACY PROJECTS
Minnesota Board of Water and Soil Resources
Minnesota Department of Natural Resources

Project Evaluation Form

Project Background

Project Name: Wetland Restorations on WPA's – Vukonich Site

Project Location: Grant

Township/Range Section: T137N R43W Sec 9

Project Manager/Affiliated Organization, Contact: Fergus Falls Fish and Game Club

Fund: OHF Fiscal Year Funds: 2012 Project Start Date: 2011

Predominant Habitat Type: Wetland Additional Habitat types: Prairie/Savana/Grassland, Aquatic

Project Status: Post-Establishment Phase

Project Goals and Planning

(Site Assessment Preparation from Plan Sets and Documents).

1. **What are the specific project components?**
   - Wetland Restoration/Creation
   - Ditch Plugs with Vegetated Spillways
   - Vegetation Reestablishment and Management

2. **What plans/record of project decisions/prescription worksheets are available? Provide location data?**

Conservation Partners Legacy Grant Application (2011), Conservation Partners Legacy Grant Program Accomplishment Report (2014). Vukonich WPA Wetland Restoration Structure Plan set, USFWS Fergus Falls Wetland Management District.

3. **What are the stated goals of the project?**
   - Establish temporary and seasonal wetland basins in areas within key habitat areas of the Minnesota River Prairie and the Red River Prairie according to the State Wildlife Action Plan.
   - Provide additional habitat for wetland birds, waterfowl, mammals, amphibians and insects.
   - Improve habitat for SGCN species.

4. **Were measures of restoration success identified in plans? Yes**

If yes, list specific measurements.

- Establishment of temporary and seasonal wetland basins within the WPA.

5. **Are plan Sets available? Yes Have new GIS maps been created? Yes**

If yes, provide in Appendix A and list Maps provided:

Appendix A - Construction Drawings

Appendix B - GPS Points

Appendix C - Site Photos (10/26/15)

6. **Provide list of best management practices, standards, guidelines identified in plan set? Are these based on best current science? If not, what parameters diverge from these practices? Do these divergences affect outcomes?**

    1. Native seeds were used in the restoration.
    2. Quick establishing native vegetation species were selected to minimize potential for erosion.
    3. Wire mesh was installed in flow over ditch plugs where the potential for damage by burrowing muskrats exists.
    4. A stabilized overflow spillway was constructed for ditch plugs to minimize risk of ditch plug failure.
    5. Mowing of annual weeds and woody species has been conducted since project initiation.

Project Implementation

(Questions for Site Manager and Cooperating Professionals)

7. **Were alterations made to the original plan during construction? Discuss changes to the following:**

Yes

- Additional vegetation management including mowing of annual weeds and woody species was conducted by USFWS.

8. **In what ways did alterations to the plan or implementation change the proposed project outcome? Did this change derive from a desire to change outcomes?**

Proactive vegetation management such as the mowing that has already occurred improves site conditions and is important for long term sustainability of the created wetland features.

Site Assessment

(Field Review)

Date: 10/26/2015

Site Visit Participants: Jason Naber, Consultant, Emmons & Olivier Resources, Inc. Wade Johnson, Restoration Evaluations Coordinator, MN DNR; Chad Raitz, USFWS; Tony Rondeau, Fergus Falls Fish and Game Club.

9. Surrounding Landscape Characteristics:

The adjacent watershed is managed as a Waterfowl Production Area (WPA) and is fully established to a native grassland ground cover. Outside of the WPA boundaries the land cover is dominated by row crop agriculture. Primary crops include corn, soybeans and to a lesser extent sugar beets.

10. Site Characteristics:

10a. Soils: The predominant soil units within the Vukonich WPA are the partially hydric Hamerly-Parnell complex, Aazdahl clay loam, and Vallers clay loam. The wetland restoration sites within the Vukonich WPA are located within the Hamerly-Parnel silt loam.

10b. Topography: This site nearly level topography with subtle swales and depressions. Slopes are generally from 1 to 3%.

10c. Hydrology: The site's hydrology is primarily from surface runoff. Permanent open water features within the WPA and adjacent to the WPA indicate the surficial water elevation is lower that the restored wetland features.

10d. Vegetation A: Vegetation represented in the restored wetland basins include (in order of prevalence) narrow leaf cattail, river bulrush, softstem bulrush, willow, cottonwood and reed canary.

10e. Vegetation B: The vegetation comprising the upland area adjacent to the restored wetlands is primarily native prairie grasses and forbs. Representative species include Indian grass, big bluestem, little bluestem, prairie cord grass and switch grass. Native forb species do not comprise a significant coverage within the planted prairie areas. Invasive herbaceous species found adjacent to the restored wetland areas included reed canary grass and sweet clover. Willow shrubs and cottonwood saplings were recently mowed along the area buffering the restored wetlands and within the restored wetland basins.

Is the plan based on current science? Yes

Restoring wetland hydrology to these basins with ditch plugs is an recognized method for establishing the desired wetland habitat.

If no, explain in detail. NA

11. List indicators of project outcomes at this stage of project:

- The current conditions of the site are characteristic of a seasonal wetland habitat.
- Vegetation: Vegetation data points were taken on October 26, 2015 at five of the 12 restored sites. In all cases the restored wetlands supported hydrophytic vegetation. Narrow leaf cattail was prevalent throughout and created dense vegetative monotypes. Some willow species as well as saplings cottonwoods were scattered within the wetland areas. The structure of these sturdy species provides cover for wildlife as evidenced by the sign (beds, tracks, trails) found within the basins.
- Soils and Sedimentation: As evidenced by the dominant hydrophyte community, the soil appears to be sufficiently hydrated. No evidence of sedimentation or erosion was found on the site.
- Summary: The combination of ditch blocks, scrapes, and reseeding has sufficiently achieved the restoration outcomes of providing additional habitat for wetland birds, waterfowl, amphibians and insects.

12. Does the project plan/implementation of the project plan reasonable allow for achieving proposed project outcome?

Yes, data on the restored wetland and upland buffer habitat conditions collected on October 26th 2015 indicate the site has achieved desired outcomes.

13. Are corrections or modifications needed to meet proposed outcomes?

Ongoing control of narrow leaf cattail, reed canary grass and woody species are important to maintaining the targeted seasonal wetland habitat.

14. Do proposed or planned future steps, including long term management appear practical and reasonable? What are the potential challenges, limitations?

Woody species such as willow and cottonwood will continue to threaten the functional integrity of the site. Ongoing maintenance within the site and around its perimeter will be needed to sustain the desired habitat. This maintenance can be accomplished through a variety of activities such as burning and mowing. As evidenced by recent management activities, the USFWS is committed to the success of these wetland restorations.

15. Do any of the project activities, planned or implemented, likely detract from existing or potential habitat? Explain.

No.

16. Are follow-up assessments needed? Explain.

Yes, continued monitoring and control of narrow leaf cattail and woody species is recommended.

17. Additional comments on the restoration project.

The site provides considerable habitat benefits over the previous row crop land cover. The created wetland areas also provide important cover for wildlife and important seasonal wetlands for migratory birds.

Project Evaluation

18. The project will:

a. Likely not meet proposed outcomes ☐
b. Minimally meet proposed outcomes ☐
c. Meet proposed outcomes ☒
d. Likely exceed proposed outcomes ☐
e. Greatly exceed proposed outcomes ☐

Confidence of outcome determination

a. Low ☐
b. Medium ☐
c. High ☒

19. Provide explanation of reason(s) for determination.

The project has improved wildlife habitat and provided important wetland features within a Waterfowl Production Area located in an area of Minnesota where a very minimal percentage of native habitat persists. The USFWS along with other project partners are committed to management of the site to maintain desired habitat benefits.

20. Site Assessor(s) Conducting Review:

Jason Naber, Consultant, Emmons & Olivier Resources, Inc.; Wade Johnson, Restoration Evaluations Coordinator, MN DNR.

Appendix A: Construction Drawings:

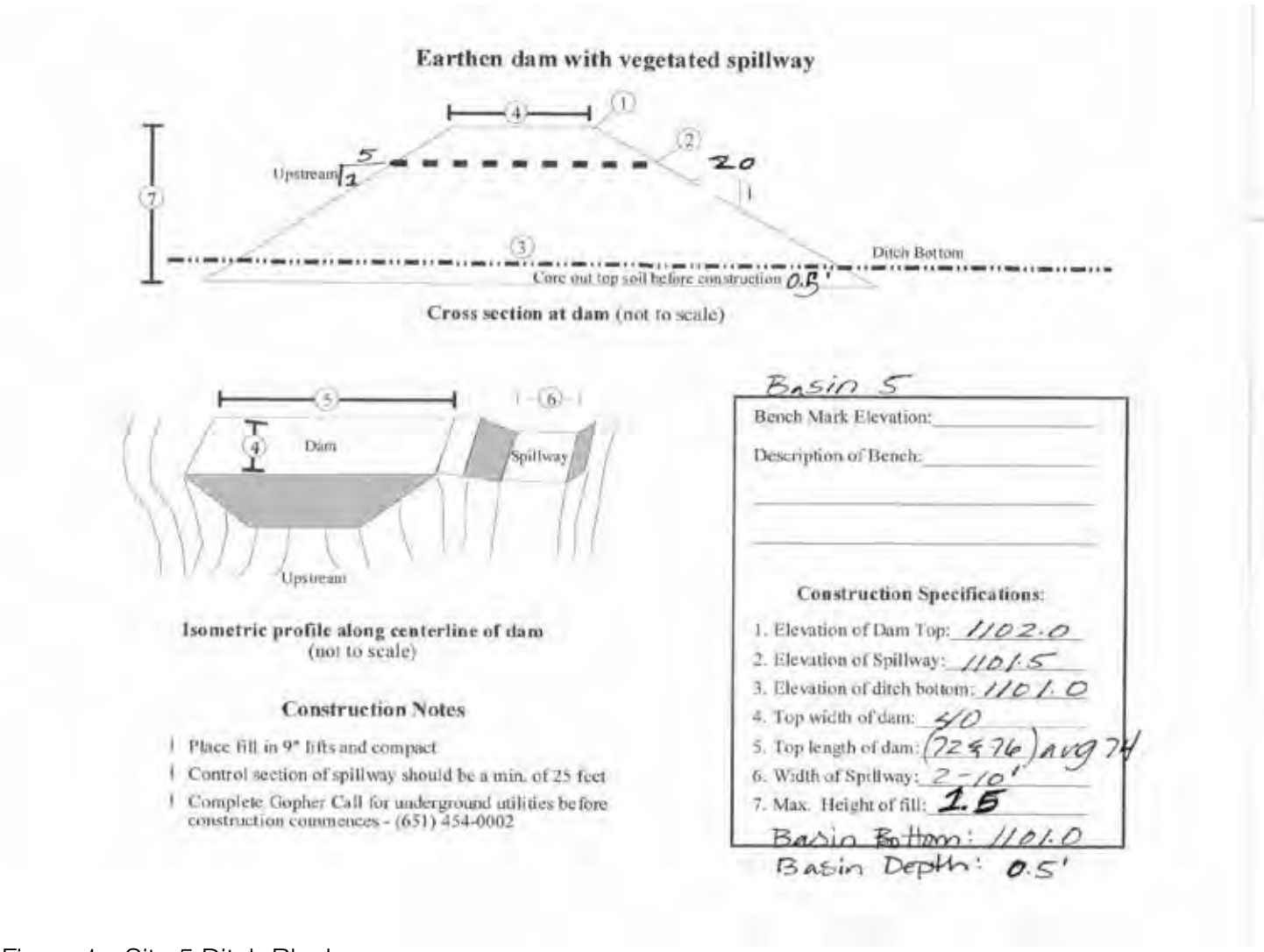


Figure 1 - Site 5 Ditch Block

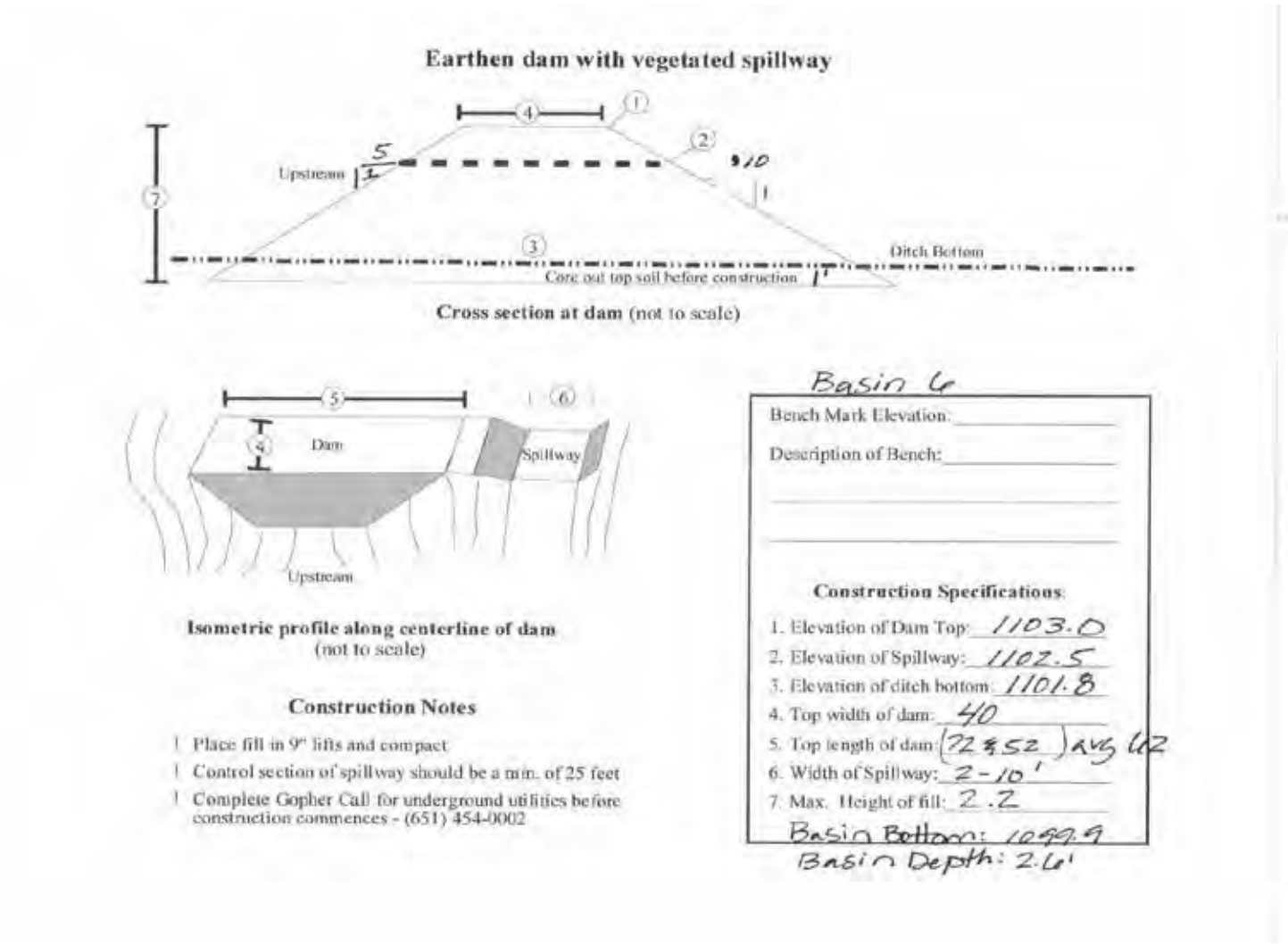
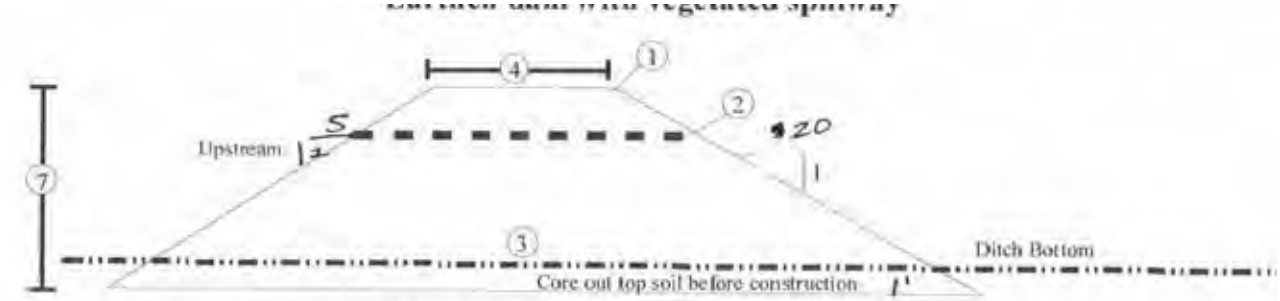
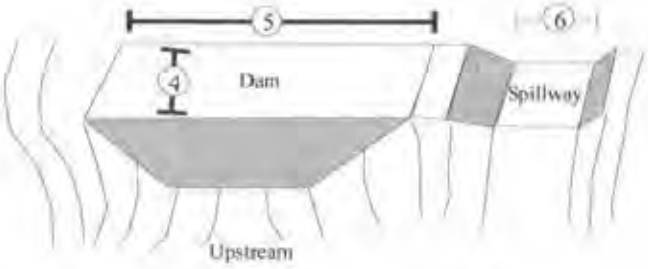


Figure 2 - Site 6 Ditch Block



Cross section at dam (not to scale)



Isometric profile along centerline of dam
(not to scale)

Construction Notes

- Place fill in 9" lifts and compact
- Control section of spillway should be a min. of 25 feet
- Complete Gopher Call for underground utilities before construction commences - (651) 454-0002

Basin 7

Bench Mark Elevation: _____

Description of Bench: _____

Construction Specifications:

1. Elevation of Dam Top: 1103.5
2. Elevation of Spillway: 1103.0
3. Elevation of ditch bottom: 1101.5
4. Top width of dam: 50
5. Top length of dam: (33 + 27) = 30 AVG
6. Width of Spillway: 2-10'
7. Max. Height of fill: 3'

Basin Bottom: 1100.7
Basin Depth: 2.3'

Figure 3 - Site 7 Ditch Block

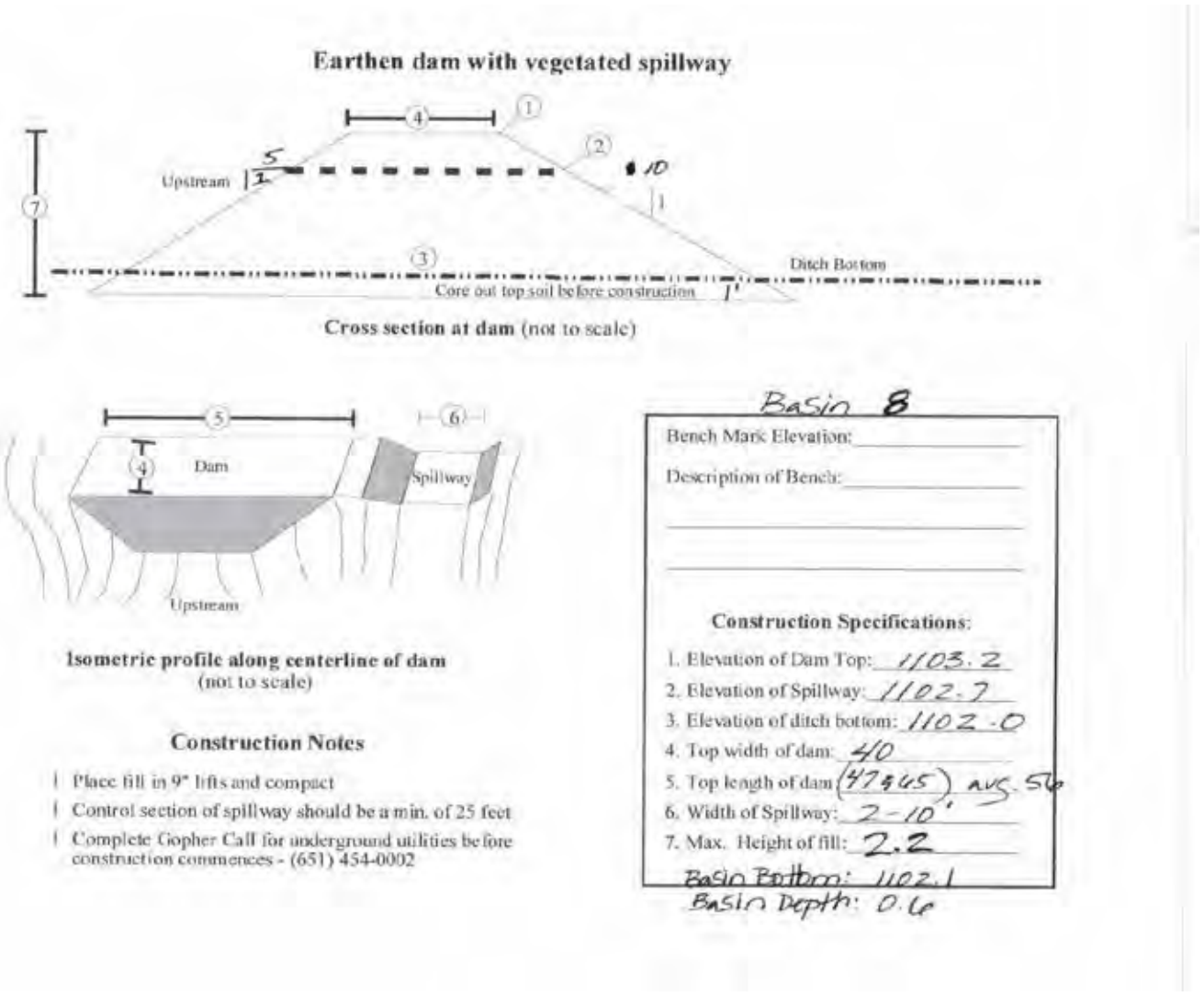


Figure 4 - Site 8 Ditch Block

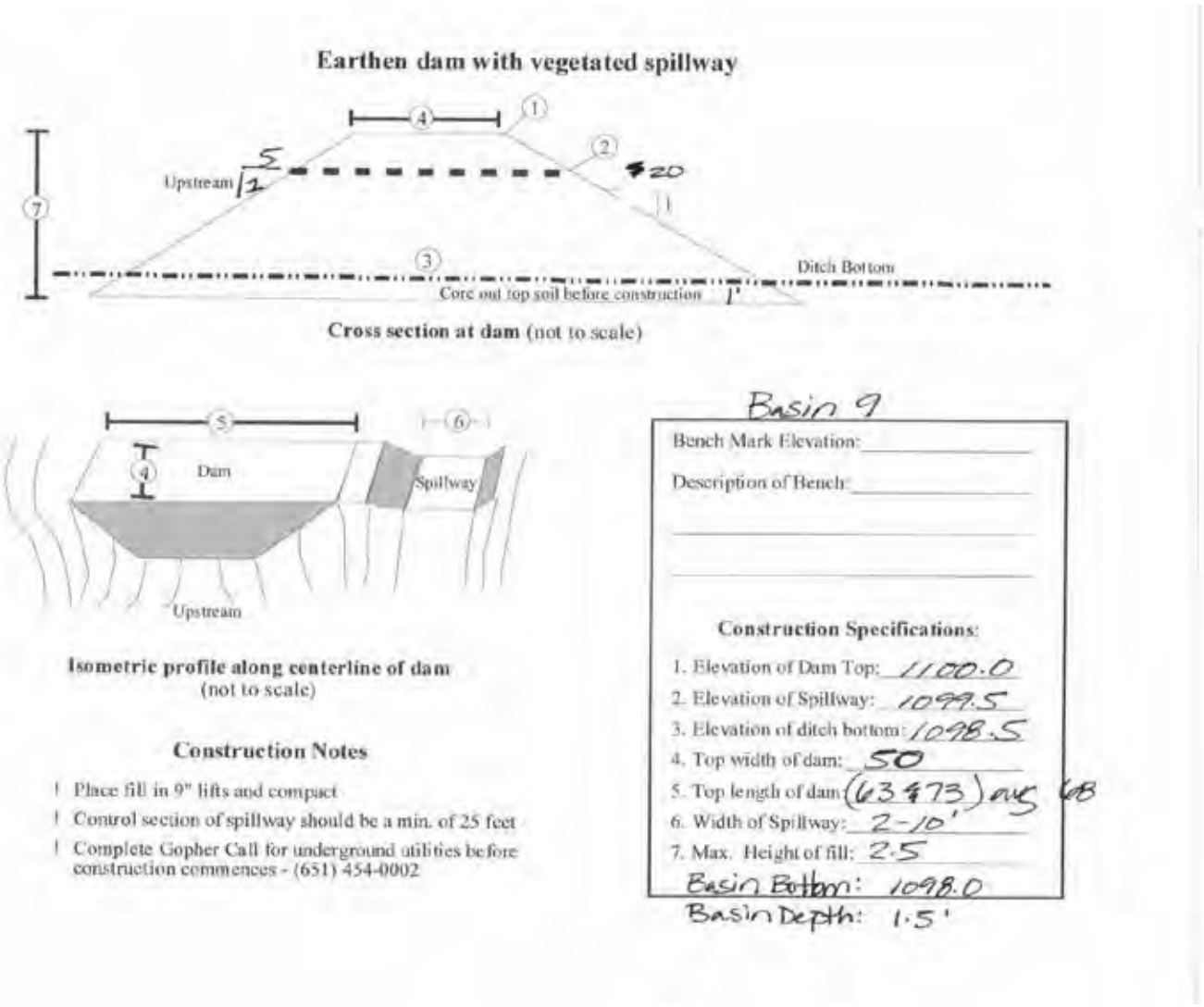


Figure 5 - Site 9 Ditch Block

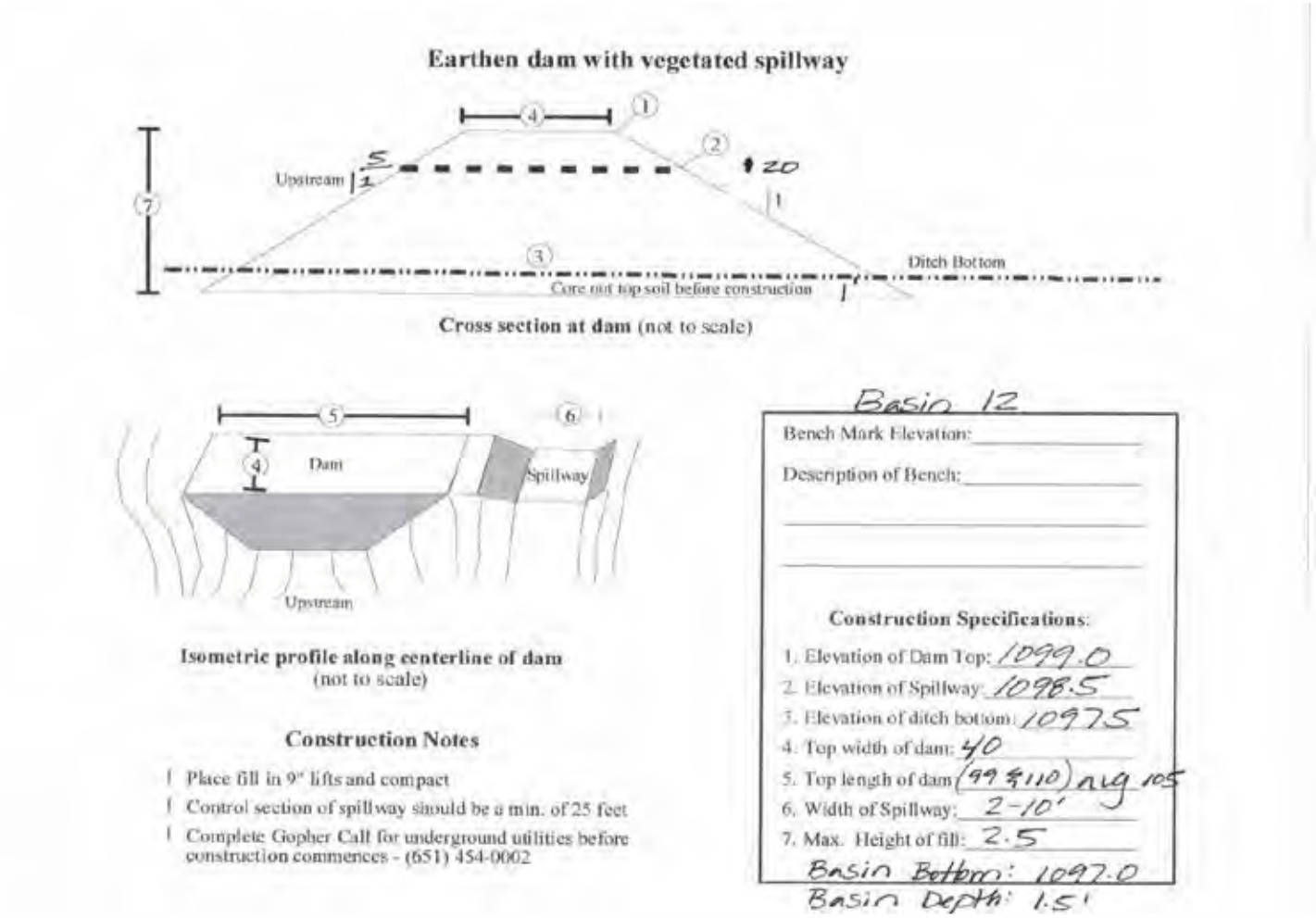


Figure 6 - Site 12 Ditch Block

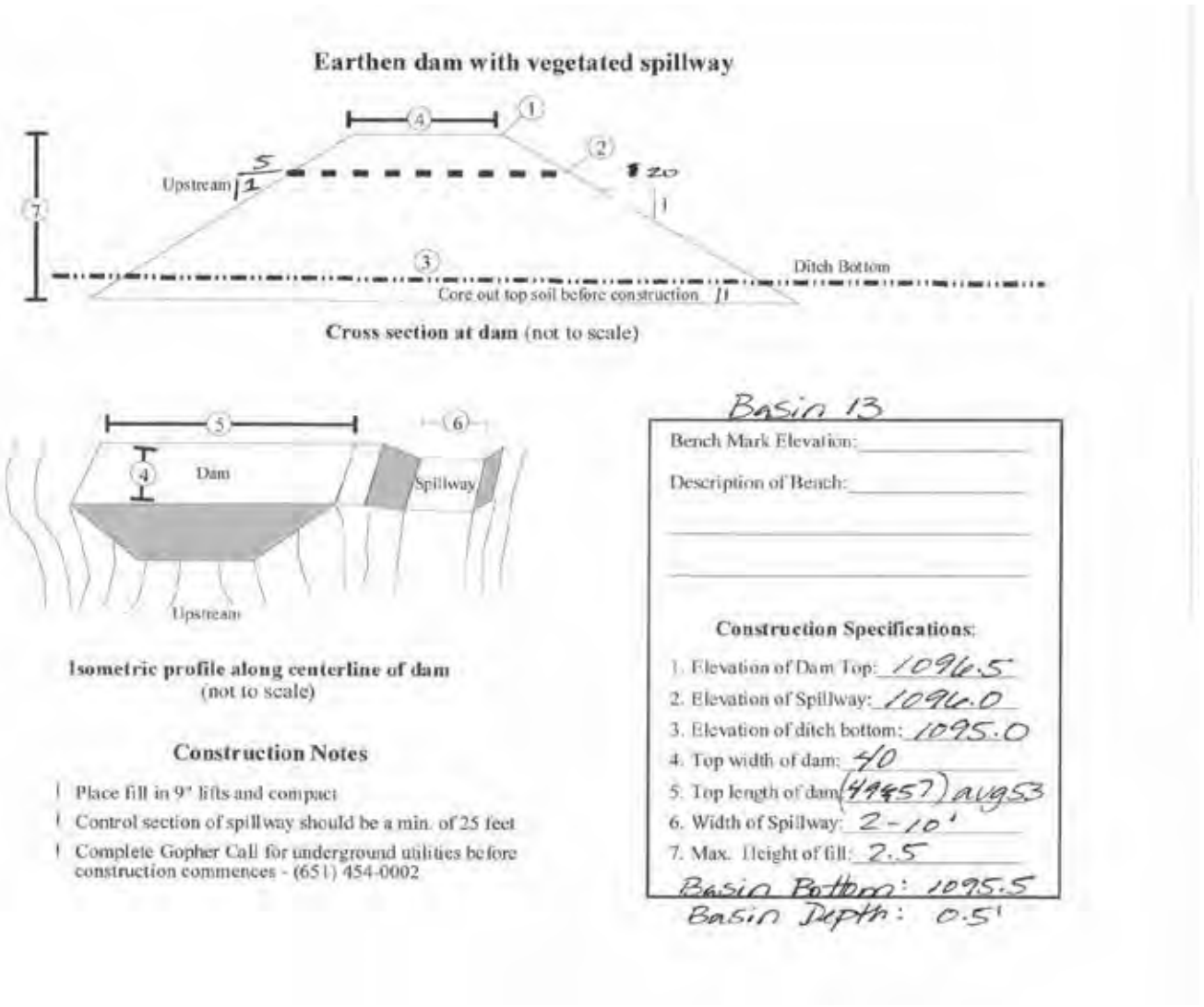


Figure 7 - Site 13 Ditch Block

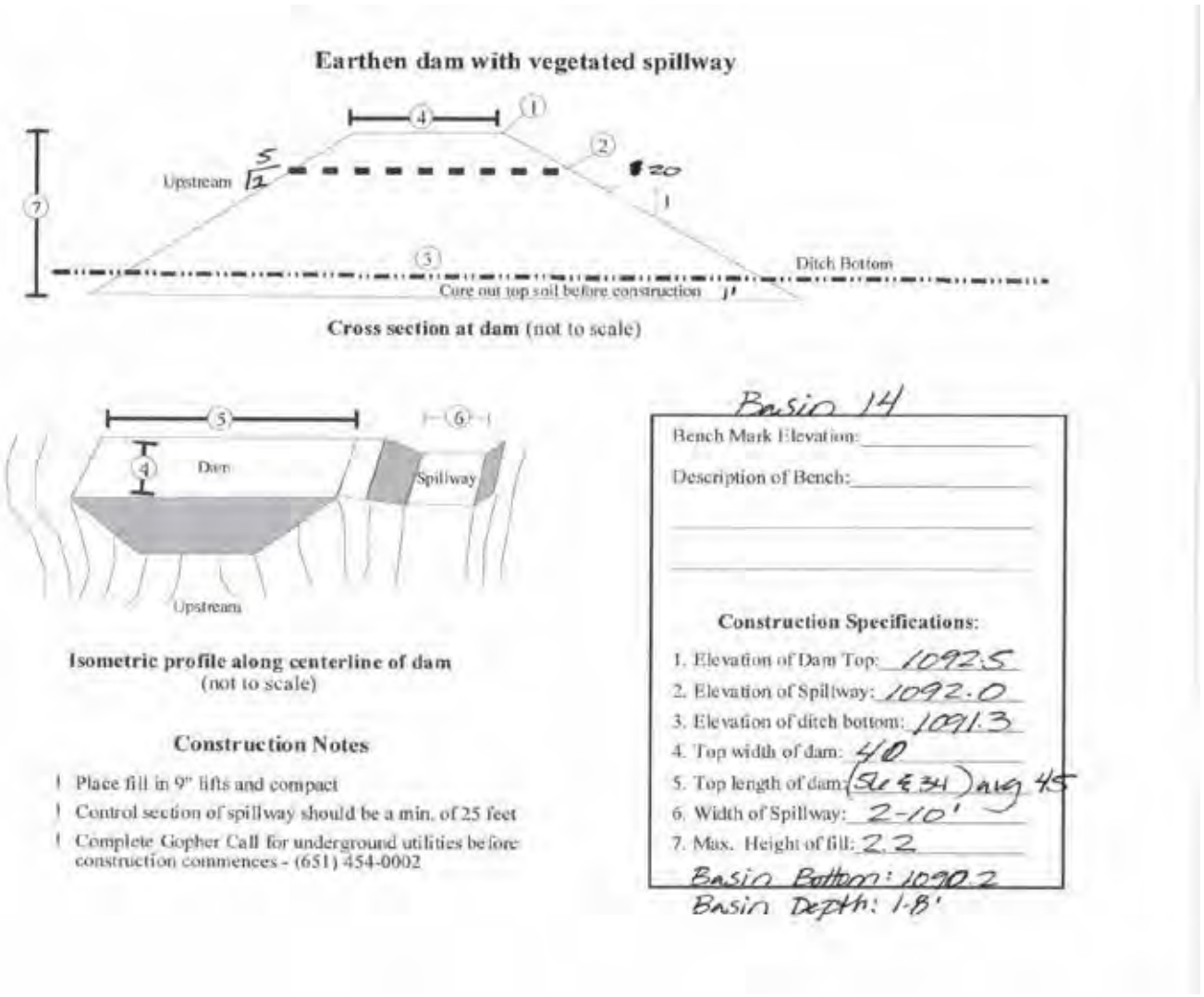


Figure 8 - Site 14 Ditch Block

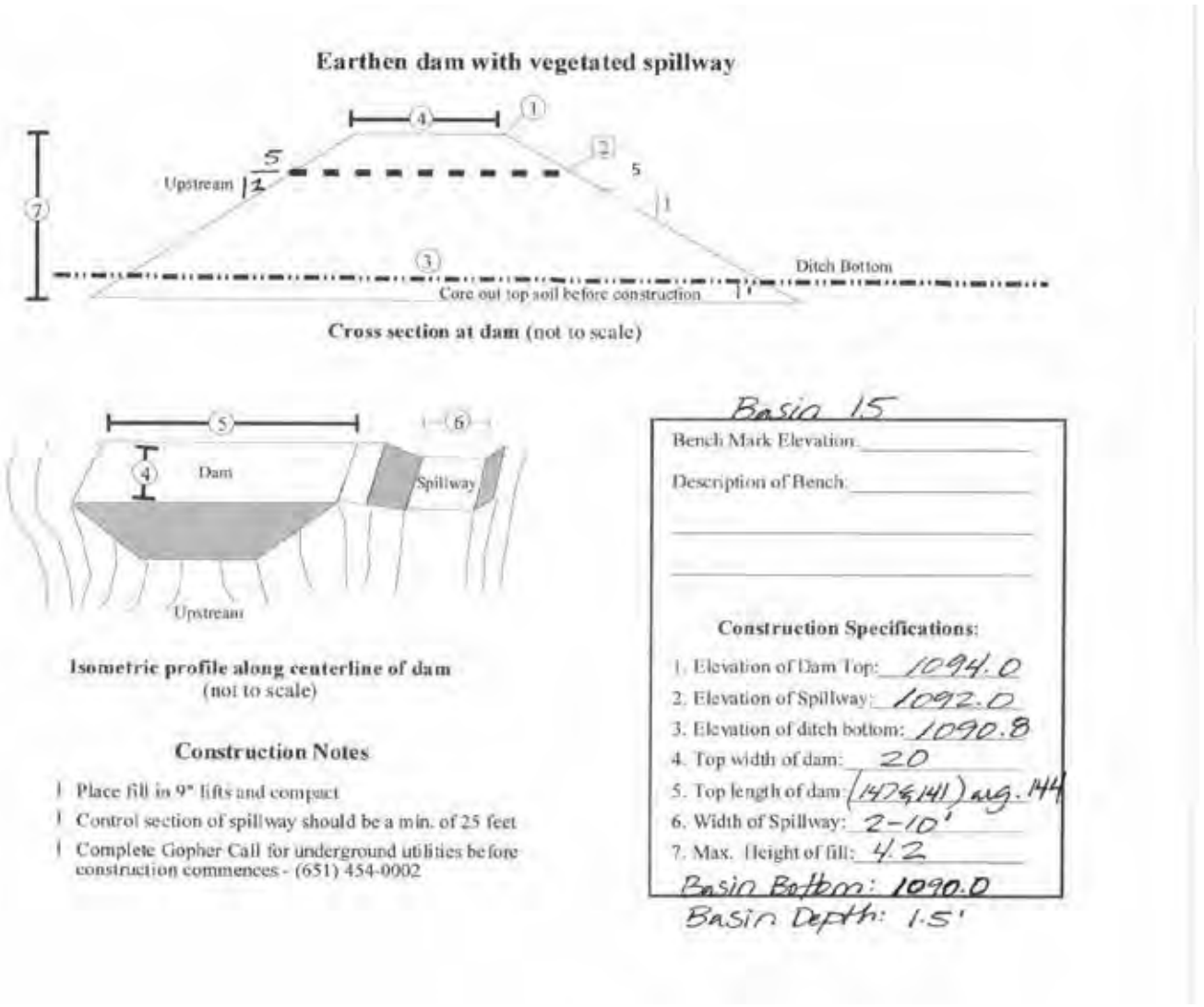


Figure 9 - Site 15 Ditch Block

Appendix B: 10/26/15 Site Survey GPS Points

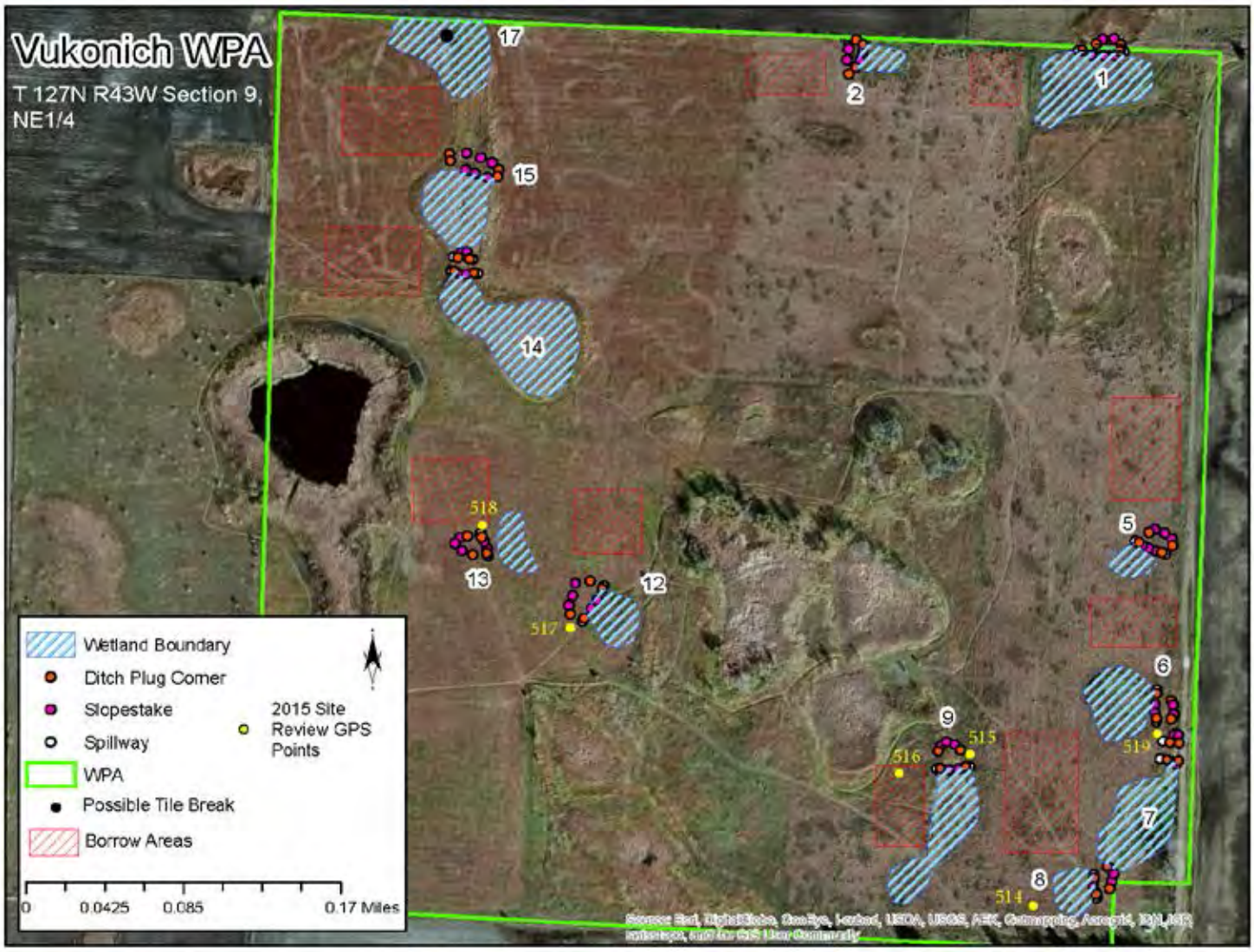


Figure 10 - GPS Survey points and locations of vegetation plot data

Appendix C: Site Photographs

Figure 11 Basin #12 at GPS 517

Figure 12 - Scrape at Basin #9, GPS 516

RESTORATION EVALUATION PROGRAM for LEGACY PROJECTS
Minnesota Board of Water and Soil Resources
Minnesota Department of Natural Resources

Project Evaluation Form

Project Background

Project Name: Wetland Restorations on WPA's – Art Hawkins Site

Project Location: Otter Tail

Township/Range Section: T127N R43W Sec 17

Project Manager/Affiliated Organization, Contact: Fergus Falls Fish and Game Club

Fund: OHF Fiscal Year Funds: 2012 Project Start Date: 2011

Predominant Habitat type: Wetland Additional Habitat types: Prairie/Savana/Grassland, Aquatic

Project Status: Post-Establishment Phase

Project Goals and Planning

(Site Assessment Preparation from Plan Sets and Documents)

1. **What are the specific project components?**
   - Wetland Restoration/Creation
   - Ditch Plugs with Vegetated Spillways
   - Vegetation Reestablishment and Management

2. **What plans/record of project decisions/prescription worksheets are available? Provide location data?**

Conservation Partners Legacy Grant Application (2011), Conservation Partners Legacy Grant Program Accomplishment Report (2014). Art Hawkins WPA Wetland Restoration Structure Plan set, USFWS Fergus Falls Wetland Management District.

3. **What are the stated goals of the project?**
   - Establish temporary and seasonal wetland basins in areas within key habitat areas of the Minnesota River Prairie and the Red River Prairie according to the State Wildlife Action Plan.
   - Provide additional habitat for wetland birds, waterfowl, mammals, amphibians and insects.
   - Improve habitat for SGCN species.

4. **Were measures of restoration success identified in plans? Yes**

If yes, list specific measurements.

- Establishment of temporary and seasonal wetland basins within the WPA.

5. **Are plan Sets available? Yes Have new GIS maps been created? Yes**

If yes, provide in Appendix A and list Maps provided:

Appendix A - Construction Drawings

Appendix B - GPS Points

Appendix C - Site Photos (10/26/15)

6. **Provide list of best management practices, standards, guidelines identified in plan set? Are these based on best current science? If not, what parameters diverge from these practices? Do these divergences affect outcomes?**

    1. Native seeds were used in the restoration.
    2. Quick establishing native vegetation species were selected to minimize potential for erosion.
    3. Wire mesh was installed in flow over ditch plugs where the potential for damage by burrowing muskrats exists.
    4. A stabilized overflow spillway was constructed for ditch plugs to minimize risk of ditch plug failure.
    5. Mowing of annual weeds and woody species has been conducted since project initiation.

Project Implementation

(Questions for Site Manager and Cooperating Professionals)

7. **Were alterations made to the original plan during construction? Discuss changes to the following:**

Yes

- Additional vegetation management including mowing of annual weeds and woody species was conducted by USFWS.

8. **In what ways did alterations to the plan or implementation change the proposed project outcome? Did this change derive from a desire to change outcomes?**

Proactive vegetation management such as the mowing that has already occurred improves site conditions and is important for long term sustainability of the created wetland features.

Site Assessment

(Field Review)

Date: 10/26/2015

Site Visit Participants: Jason Naber, Consultant, Emmons & Olivier Resources, Inc. Wade Johnson, Restoration Evaluations Coordinator, MN DNR; Chad Raitz, USFWS; Tony Rondeau, Fergus Falls Fish and Game Club.

9. Surrounding Landscape Characteristics:

The adjacent watershed is managed as a Waterfowl Production Area (WPA) and is fully established to a native grassland ground cover. Outside of the WPA boundaries the land cover is dominated by row crop agriculture. Primary crops include corn, soybeans and to a lesser extent sugar beets.

10. Site Characteristics:

10a. Soils: The predominant soil units within the Art Hawkins WPA are Hamerly-Parnell complex, Formdale-Aasdahl-Flom complex, Hamerly clay loam, Oldham silty clay, Glyndon silty clay loam and Aazdahl clay loam. The wetland restoration sites within the Art Hawkins WPA are located within every soil type listed above accept Oldham silty clay.

10b. Topography: This site has gently rolling topography that includes sublte rises, swales and depressions. Slopes are generally from 1 to 3%.

10c. Hydrology: The site's hydrology is primarily from surface runoff. Permanent open water features within the WPA and adjacent to the WPA indicate the surficial water elevation is lower that the restored wetland features.

10d. Vegetation A: Vegetation represented in the restored wetland basins include (in order of prevalence) softstem bulrush, narrow leaf cattail, mud plantain, river bulrush and cocklebur.

10e. Vegetation B: The vegetation comprising the upland area adjacent to the restored wetlands is primarily native prairie grasses and forbs. Representative species include Canada wild rye, Indian grass, big bluestem, little bluestem and switch grass. Native forb species do not comprise a significant coverage within the planted prairie areas. Invasive herbaceous species found adjacent to the restored wetland areas included reed canary grass, thistle and sweet clover.

Is the plan based on current science? Yes

Restoring wetland hydrology to these basins with ditch plugs is a recognized method for establishing the desired wetland habitat.

If no, explain in detail. NA

11. List indicators of project outcomes at this stage of project:

- The current conditions of the site are characteristic of a seasonal wetland habitat.
- Vegetation: Vegetation data points were taken on October 26, 2015 at six of the 8 restored wetland sites within the Art Hawkins WPA. In all cases the restored wetlands supported hydrophytic vegetation. Several of the basins supported annual species such as witch grass and foxtail.
- Soils and Sedimentation: As evidenced by the dominant hydrophyte community, the soil appears to be sufficiently hydrated. No evidence of sedimentation or erosion was found on the site.
- Summary: The combination of ditch blocks, tile plugs and reseeding has sufficiently achieved the restoration outcomes of providing additional habitat for wetland birds, waterfowl, mammals, amphibians and insects.

12. Does the project plan/implementation of the project plan reasonable allow for achieving proposed project outcome?

Yes, data on the restored wetland and upland buffer habitat conditions collected on October 26, 2015 indicate the site has achieved desired outcomes.

13. Are corrections or modifications needed to meet proposed outcomes?

Ongoing control of narrow leaf cattail, reed canary grass, sweet clover and weedy annual species are important to maintaining the targeted seasonal wetland habitat.

14. Do proposed or planned future steps, including long term management appear practical and reasonable? What are the potential challenges, limitations?

Ongoing vegetation maintenance within the wetlands will be needed to sustain the desired habitat. This maintenance can be accomplished through a variety of activities such as burning and mowing. As evidenced by recent management activities, the USFWS is committed to the success of these wetland restorations.

15. Do any of the project activities, planned or implemented, likely detract from existing or potential habitat? Explain.

No.

16. Are follow-up assessments needed? Explain.

Yes, continued monitoring and control of narrow leaf cattail and weedy annual species is recommended.

17. Additional comments on the restoration project.

The site provides considerable habitat benefits over the previous row crop land cover. The created wetland areas also provide important cover for wildlife and important seasonal wetlands for migratory birds.

Project Evaluation

18. The project will:

a. Likely not meet proposed outcomes ☐
b. Minimally meet proposed outcomes ☐
c. Meet proposed outcomes ☒
d. Likely exceed proposed outcomes ☐
e. Greatly exceed proposed outcomes ☐

Confidence of outcome determination

a. Low ☐
b. Medium ☐
c. High ☒

19. Provide explanation of reason(s) for determination.

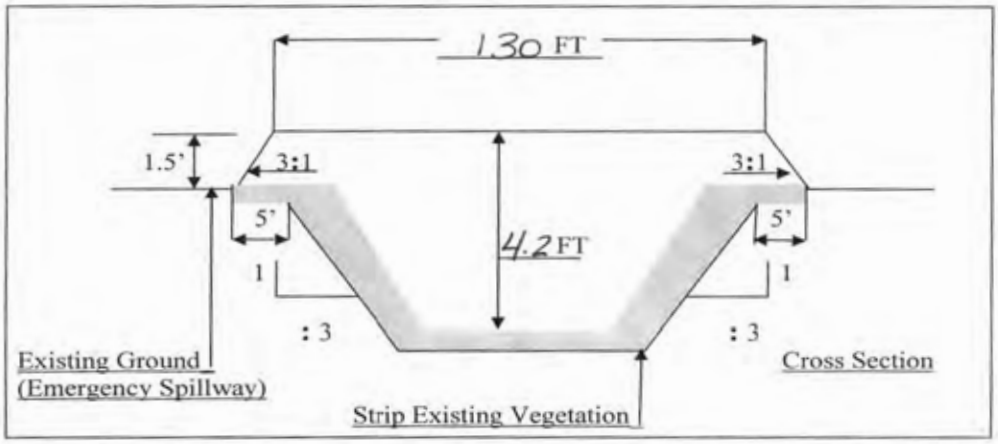
The project has improved wildlife habitat and provided important wetland features within a Waterfowl Production Area located in an area of Minnesota where a very minimal percentage of native habitat persists. The USFWS along with other project partners are committed to management of the site to maintain desired habitat benefits.

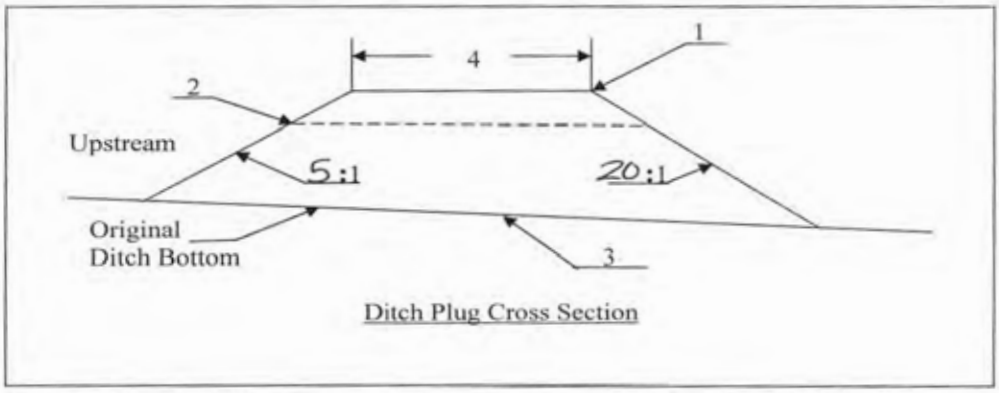
20. Site Assessor(s) Conducting Review:

Jason Naber, Consultant, Emmons & Olivier Resources, Inc.; Wade Johnson, Restoration Evaluations Coordinator, MN DNR.

Appendix A: Construction Drawings:

Ditch Plug with Existing Ground-Emergency Spillway





1. Strip all sod from ditch bed and side slopes under fill zone. Excavate side slope as shown.
2. Place fill in 8" (in) lifts traversing the entire fill with construction equipment before placing next lift.
3. Borrow the fill material from adjoining field or ditch side slopes upstream of the ditch plug after removing existing vegetation.
4. Level emergency spillway (existing ground) to a minimum bottom width of 10' adjacent to plug.
5. Seed disturbed area with mixture as specified in project plan.

T. 127 N. R. 43 W. Sec. 17

Total Quantity of Earth Fill — YD^3

Drainage Area (acres) 20

Area to be Seeded (acres) NA

1. Top of Fill (Elev.) 1082
2. ES- Existing Ground (Elev.) 1081
3. Ditch Bottom Elevation 1077.8
4. Ditch Plug Top Width 50

Basin #: 1

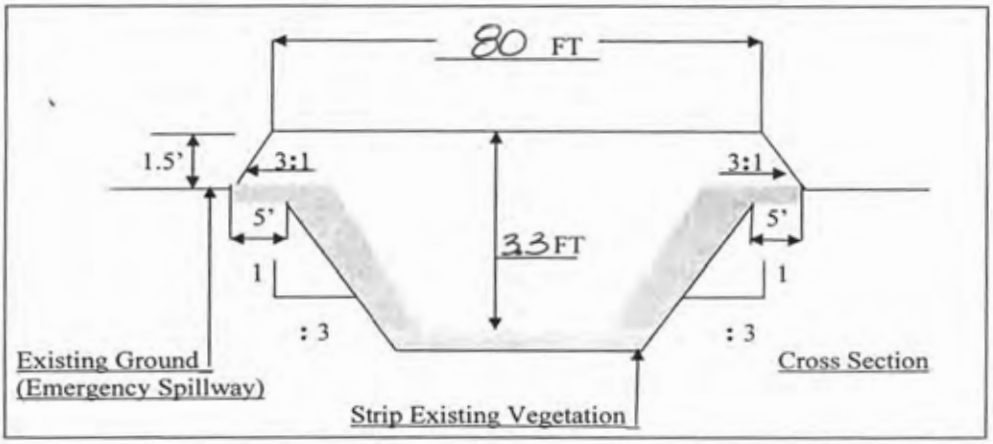
Landowner: USFWS

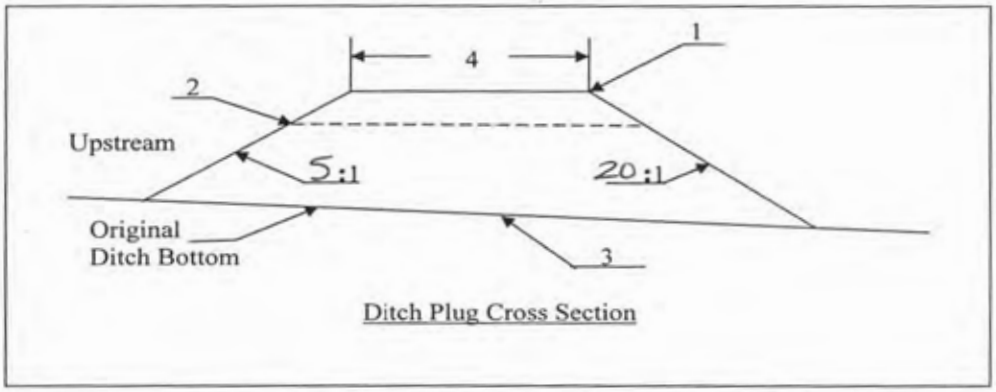
Date: 7/9/13

Designed By: M. Fosado

Figure 1 - Site 1 Ditch Block

Ditch Plug with Existing Ground-Emergency Spillway





1. Strip all sod from ditch bed and side slopes under fill zone. Excavate side slope as shown.
2. Place fill in 8" (in) lifts traversing the entire fill with construction equipment before placing next lift.
3. Borrow the fill material from adjoining field or ditch side slopes upstream of the ditch plug after removing existing vegetation.
4. Level emergency spillway (existing ground) to a minimum bottom width of 10' adjacent to plug.
5. Seed disturbed area with mixture as specified in project plan.

T. 127 N. R. 43 W. Sec. 17

Total Quantity of Earth Fill ____ YD^3

Drainage Area (acres) 5

Area to be Seeded (acres) NA

1. Top of Fill (Elev.) 1083.2
2. ES- Existing Ground (Elev.) 1082.2
3. Ditch Bottom Elevation 1079.9
4. Ditch Plug Top Width 50

Basin #: 2

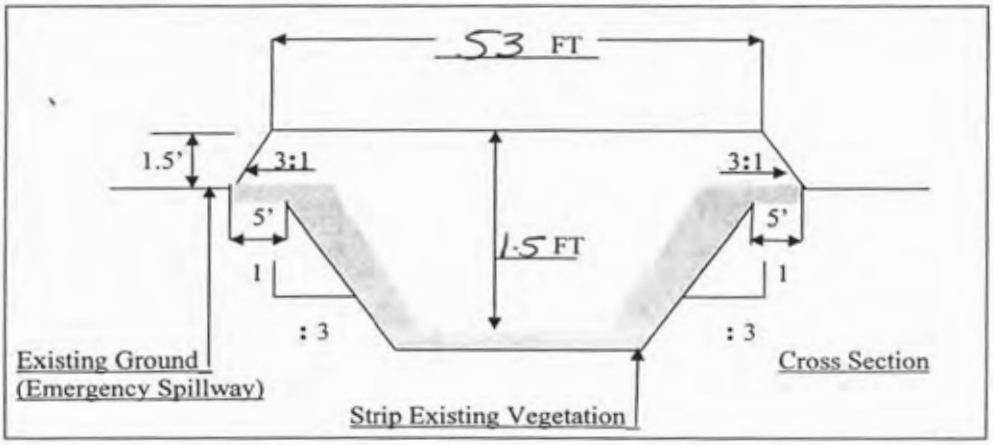
Landowner: USFWS

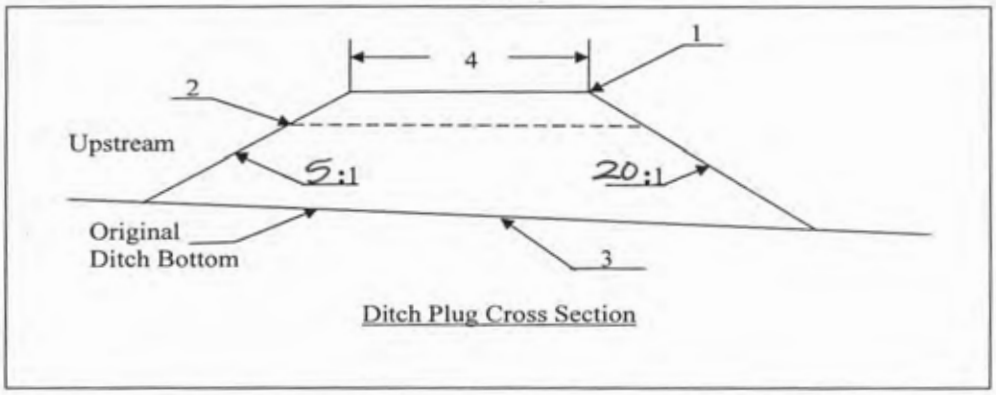
Date: 7/3/13

Designed By: M. Fosado

Figure 2 - Site 2 Ditch Block

Ditch Plug with Existing Ground-Emergency Spillway





1. Strip all sod from ditch bed and side slopes under fill zone. Excavate side slope as shown.
2. Place fill in 8" (in) lifts traversing the entire fill with construction equipment before placing next lift.
3. Borrow the fill material from adjoining field or ditch side slopes upstream of the ditch plug after removing existing vegetation.
4. Level emergency spillway (existing ground) to a minimum bottom width of 10' adjacent to plug.
5. Seed disturbed area with mixture as specified in project plan.

T. 127 N. R. 43W. Sec. 17

Total Quantity of Earth Fill — YD^3

Drainage Area (acres) 6

Area to be Seeded (acres) NA

1. Top of Fill (Elev.) 1082.0
2. ES- Existing Ground (Elev.) 1081.0
3. Ditch Bottom Elevation 1079.5
4. Ditch Plug Top Width 50

Basin #: 3

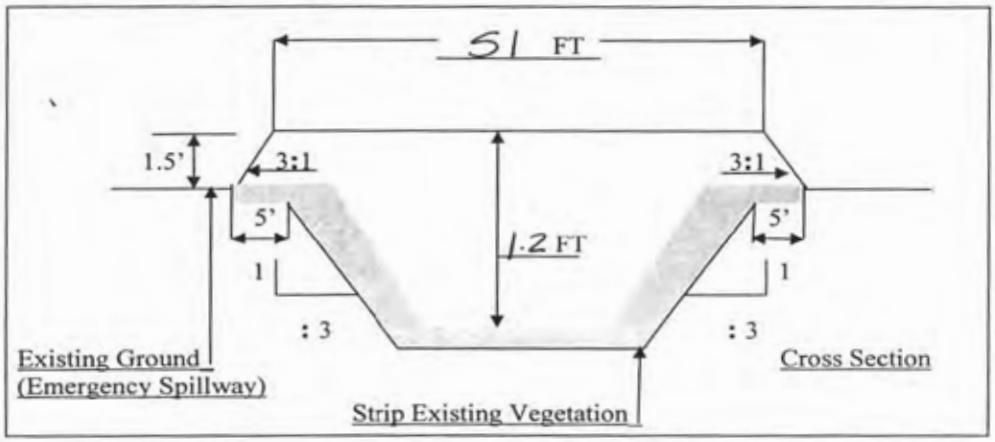
Landowner: USFWS

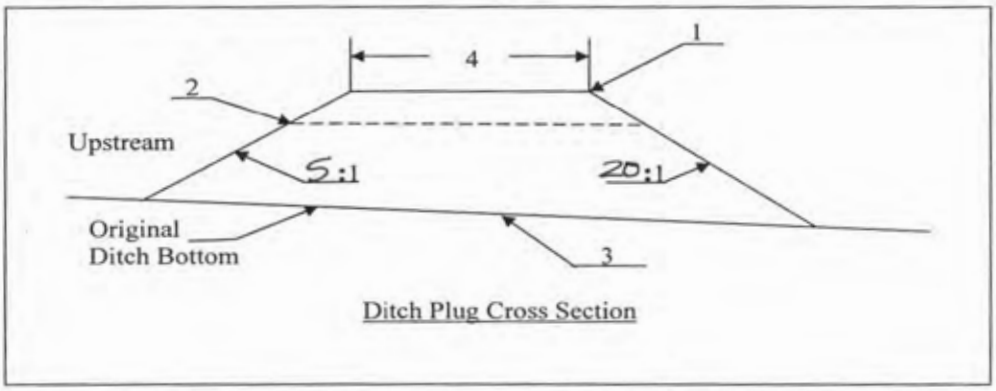
Date: 7/3/13

Designed By: M. Fosado

Figure 3 - Site 3 Ditch Block

Ditch Plug with Existing Ground-Emergency Spillway





1. Strip all sod from ditch bed and side slopes under fill zone. Excavate side slope as shown.
2. Place fill in 8" (in) lifts traversing the entire fill with construction equipment before placing next lift.
3. Borrow the fill material from adjoining field or ditch side slopes upstream of the ditch plug after removing existing vegetation.
4. Level emergency spillway (existing ground) to a minimum bottom width of 10' adjacent to plug.
5. Seed disturbed area with mixture as specified in project plan.

T. 127N. R. 43W. Sec. 17

Total Quantity of Earth Fill ——— YD^3

Drainage Area (acres) 14

Area to be Seeded (acres) NA

1. Top of Fill (Elev.) 1082.0
2. ES- Existing Ground (Elev.) 1081.0
3. Ditch Bottom Elevation 1079.8
4. Ditch Plug Top Width 50

Basin #: 4

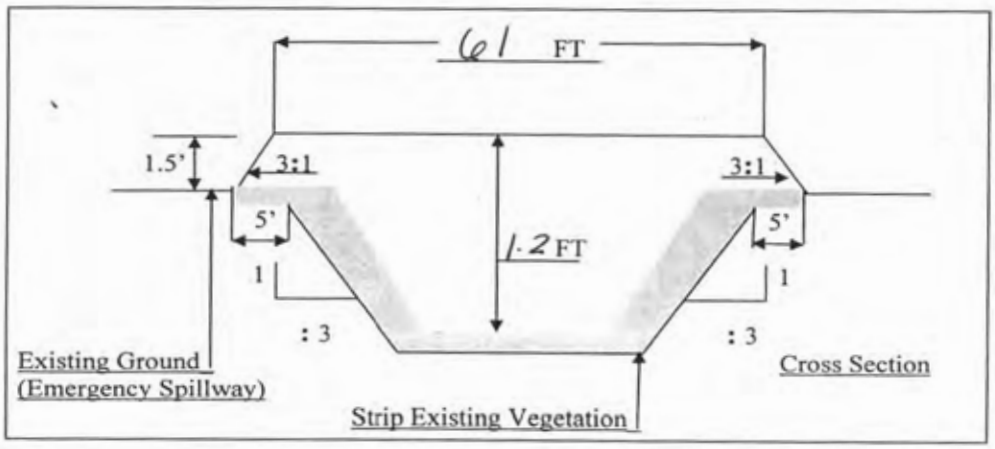
Landowner: USFWS

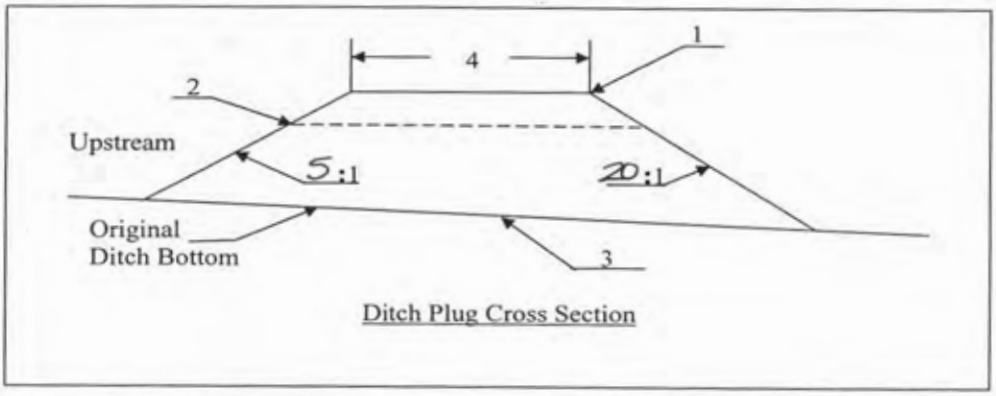
Date: 7/3/13

Designed By: M. Fosado

Figure 4 - Site 4 Ditch Block

Ditch Plug with Existing Ground-Emergency Spillway





1. Strip all sod from ditch bed and side slopes under fill zone. Excavate side slope as shown.
2. Place fill in 8" (in) lifts traversing the entire fill with construction equipment before placing next lift.
3. Borrow the fill material from adjoining field or ditch side slopes upstream of the ditch plug after removing existing vegetation.
4. Level emergency spillway (existing ground) to a minimum bottom width of 10' adjacent to plug.
5. Seed disturbed area with mixture as specified in project plan.

T. 127 N. R. 43 W. Sec. 17

Total Quantity of Earth Fill — YD^3

Drainage Area (acres) 4

Area to be Seeded (acres) NA

1. Top of Fill (Elev.) 1080.7
2. ES- Existing Ground (Elev.) 1080.1
3. Ditch Bottom Elevation 1079.5
4. Ditch Plug Top Width 50

Basin #: 5

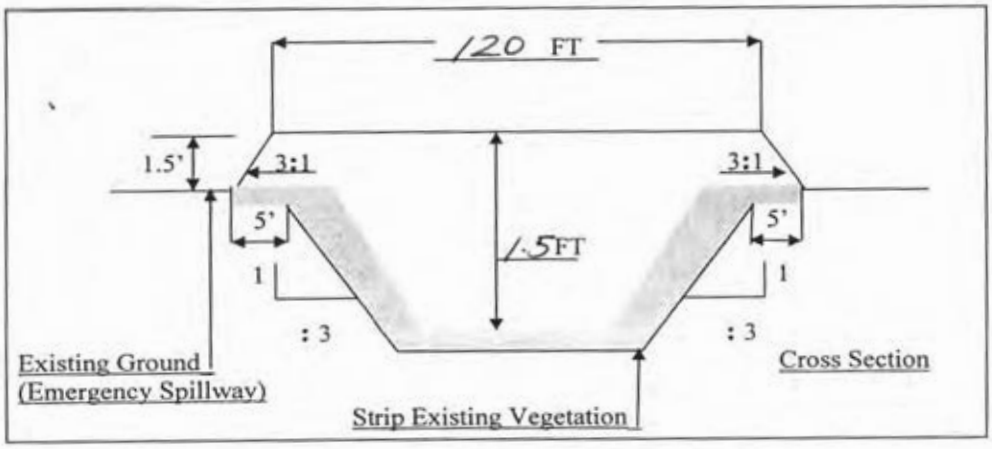
Landowner: USFWS

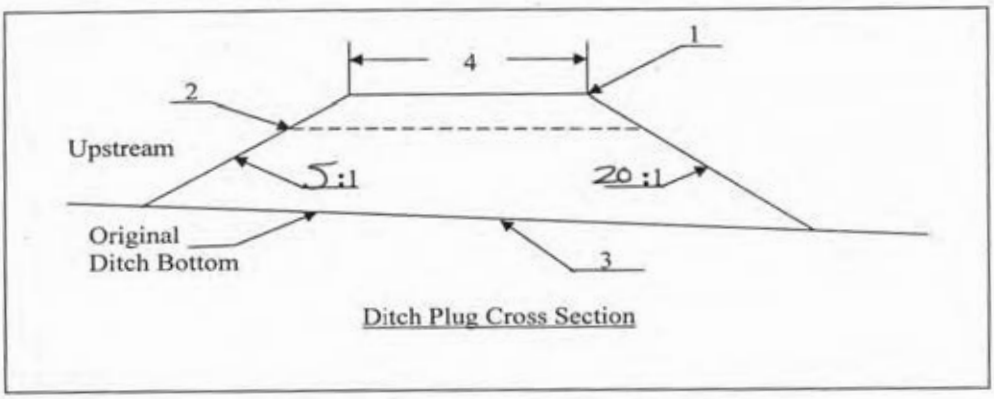
Date: 7/8/13

Designed By: M. Fosado

Figure 5 - Site 5 Ditch Block

Ditch Plug with Existing Ground-Emergency Spillway





1. Strip all sod from ditch bed and side slopes under fill zone. Excavate side slope as shown.
2. Place fill in 8" (in) lifts traversing the entire fill with construction equipment before placing next lift.
3. Borrow the fill material from adjoining field or ditch side slopes upstream of the ditch plug after removing existing vegetation.
4. Level emergency spillway (existing ground) to a minimum bottom width of 10' adjacent to plug.
5. Seed disturbed area with mixture as specified in project plan.

T. 127N. R. 43 W. Sec. 17

Total Quantity of Earth Fill ——— YD^3

Drainage Area (acres) 3

Area to be Seeded (acres) NA

1. Top of Fill (Elev.) 1083.1
2. ES- Existing Ground (Elev.) 1082.5
3. Ditch Bottom Elevation 1081.6
4. Ditch Plug Top Width 50

Basin #: 6

Landowner: USFWS

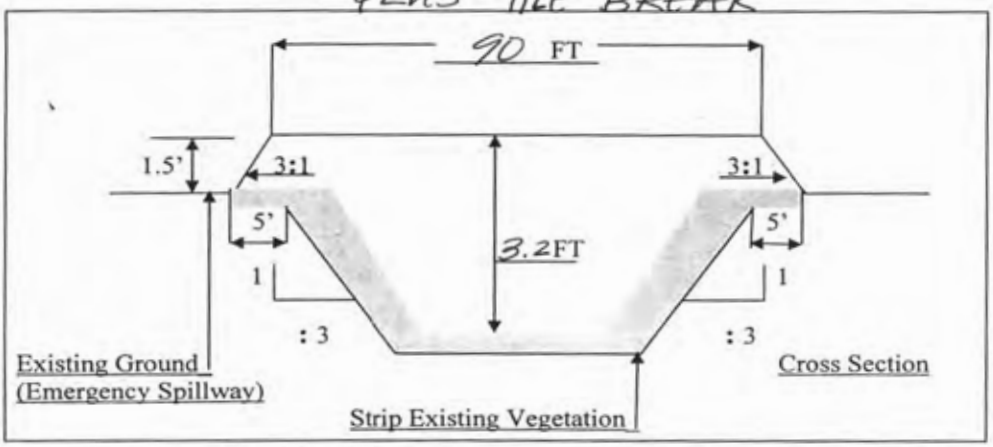
Date: 7/8/13

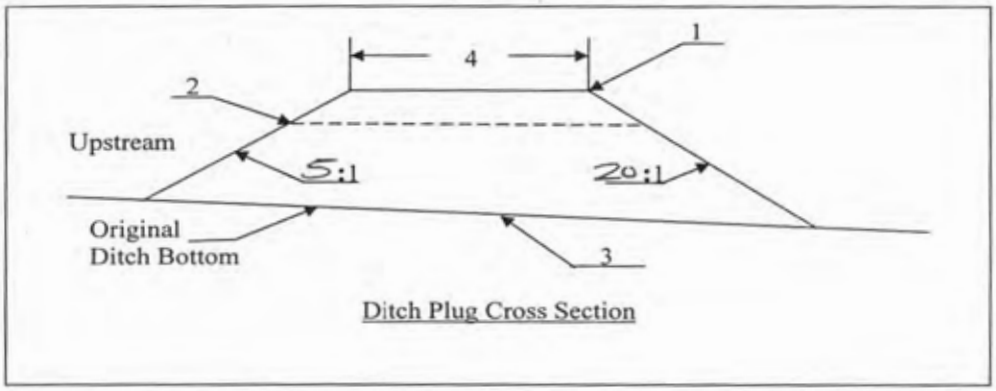
Designed By: M. Fosado

Figure 6 - Site 6 Ditch Block

Ditch Plug with Existing Ground-Emergency Spillway

PLNS TILE BREAK





1. Strip all sod from ditch bed and side slopes under fill zone. Excavate side slope as shown.
2. Place fill in 8" (in) lifts traversing the entire fill with construction equipment before placing next lift.
3. Borrow the fill material from adjoining field or ditch side slopes upstream of the ditch plug after removing existing vegetation.
4. Level emergency spillway (existing ground) to a minimum bottom width of 10' adjacent to plug.
5. Seed disturbed area with mixture as specified in project plan.

T. 127 N. R. 43 W. Sec. 17

Total Quantity of Earth Fill ——— YD^3

Drainage Area (acres) 3

Area to be Seeded (acres) NA

1. Top of Fill (Elev.) 1083.2
2. ES- Existing Ground (Elev.) 1082.2
3. Ditch Bottom Elevation 1080.0
4. Ditch Plug Top Width 50

Basin #: 7

Landowner: USFWS

Date: 7/8/13

Designed By: M. Fosado

Figure 7 - Site 7 Ditch Block

U.S. DEPARTMENT OF AGRICULTURE
NRCS

A2-ENG-109TB
(10/31/2002)

WETLAND RESTORATION STRUCTURE
TILE BREAK

NOTES:

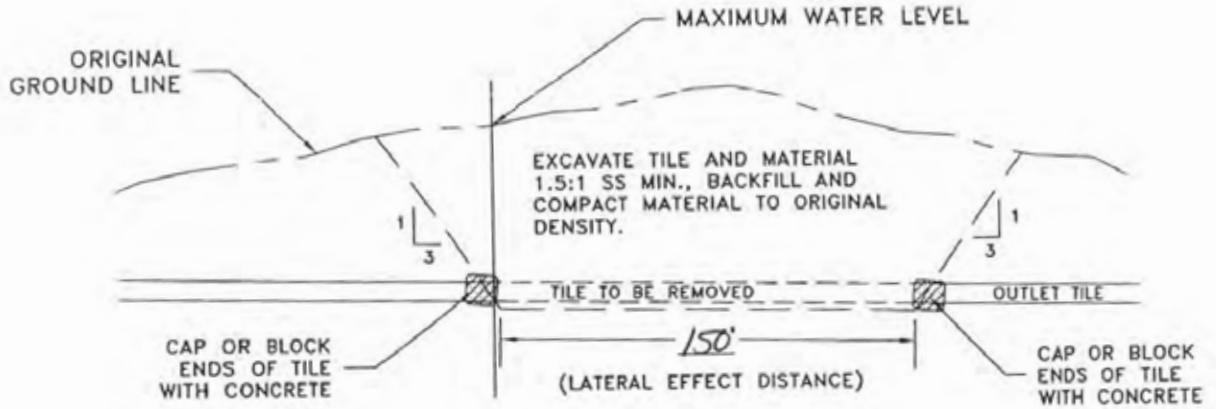
1. BEFORE START OF CONSTRUCTION, THE OWNERS OF ANY UTILITIES INVOLVED MUST BE NOTIFIED. THE EXCAVATOR IS RESPONSIBLE FOR GIVING THIS NOTICE BY CALLING "GOPHER STATE ONE-CALL" AT (651) 454-0002 (TWIN CITIES METRO AREA) OR (800) 252-1166 (ALL OTHER LOCATIONS) AT LEAST 48 HOURS PRIOR TO ANY EXCAVATION.

LOCATION MAP
not to scale

ENG JOB CLASS ____

Section 17 T. 127 N. R. 43 W.

Macsville (Township) Grant (County)



Drainage Area (acres) 3
Approx. Pond Area (acres)..... 2.5

Cooperator USFWS

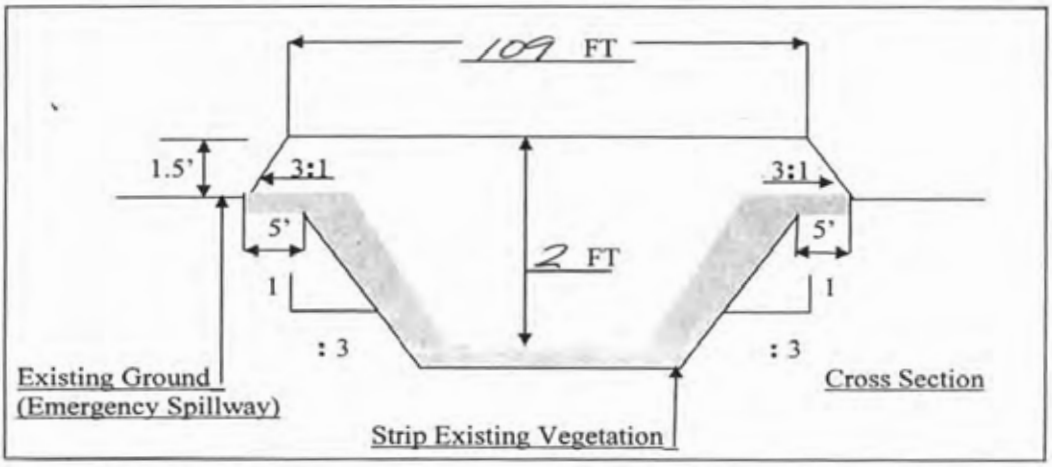
Site No. 7

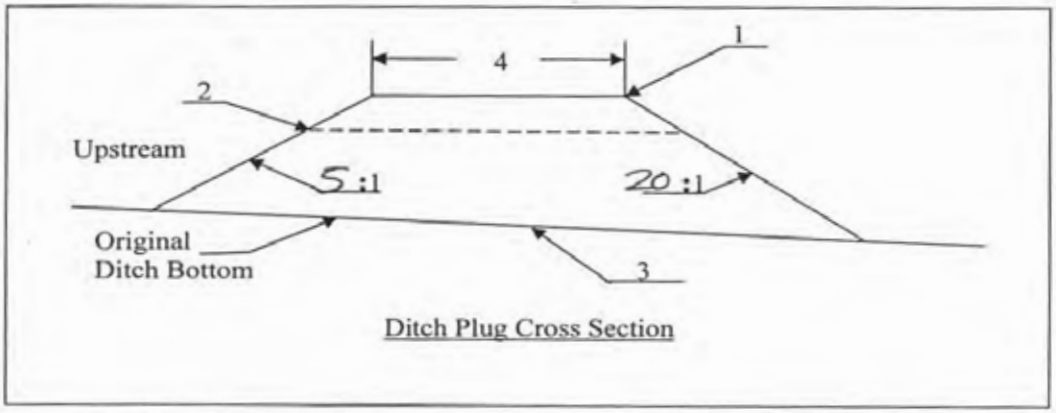
TBM Description: No TBM; Surveyed w/ Trimble R8 (survey grade gps)

Designed By M. Fosado Date 7/8/13
Checked By ____ ____
Approved By ____ ____

Figure 8 - Site 7 Tile Break

Ditch Plug with Existing Ground-Emergency Spillway





1. Strip all sod from ditch bed and side slopes under fill zone. Excavate side slope as shown.
2. Place fill in 8" (in) lifts traversing the entire fill with construction equipment before placing next lift.
3. Borrow the fill material from adjoining field or ditch side slopes upstream of the ditch plug after removing existing vegetation.
4. Level emergency spillway (existing ground) to a minimum bottom width of 10' adjacent to plug.
5. Seed disturbed area with mixture as specified in project plan.

T. 127 N. R. 43 W. Sec. 17

Total Quantity of Earth Fill — YD^3

Drainage Area (acres) 2

Area to be Seeded (acres) NA

1. Top of Fill (Elev.) 1084.2
2. ES- Existing Ground (Elev.) 1083.6
3. Ditch Bottom Elevation 1082.2
4. Ditch Plug Top Width 50

Basin #: 8

Landowner: USFWS

Date: 7/8/13

Designed By: M. Fasado

Figure 9 - Site 8 Ditch Block

Appendix B: 10/26/15 Site Survey GPS Points

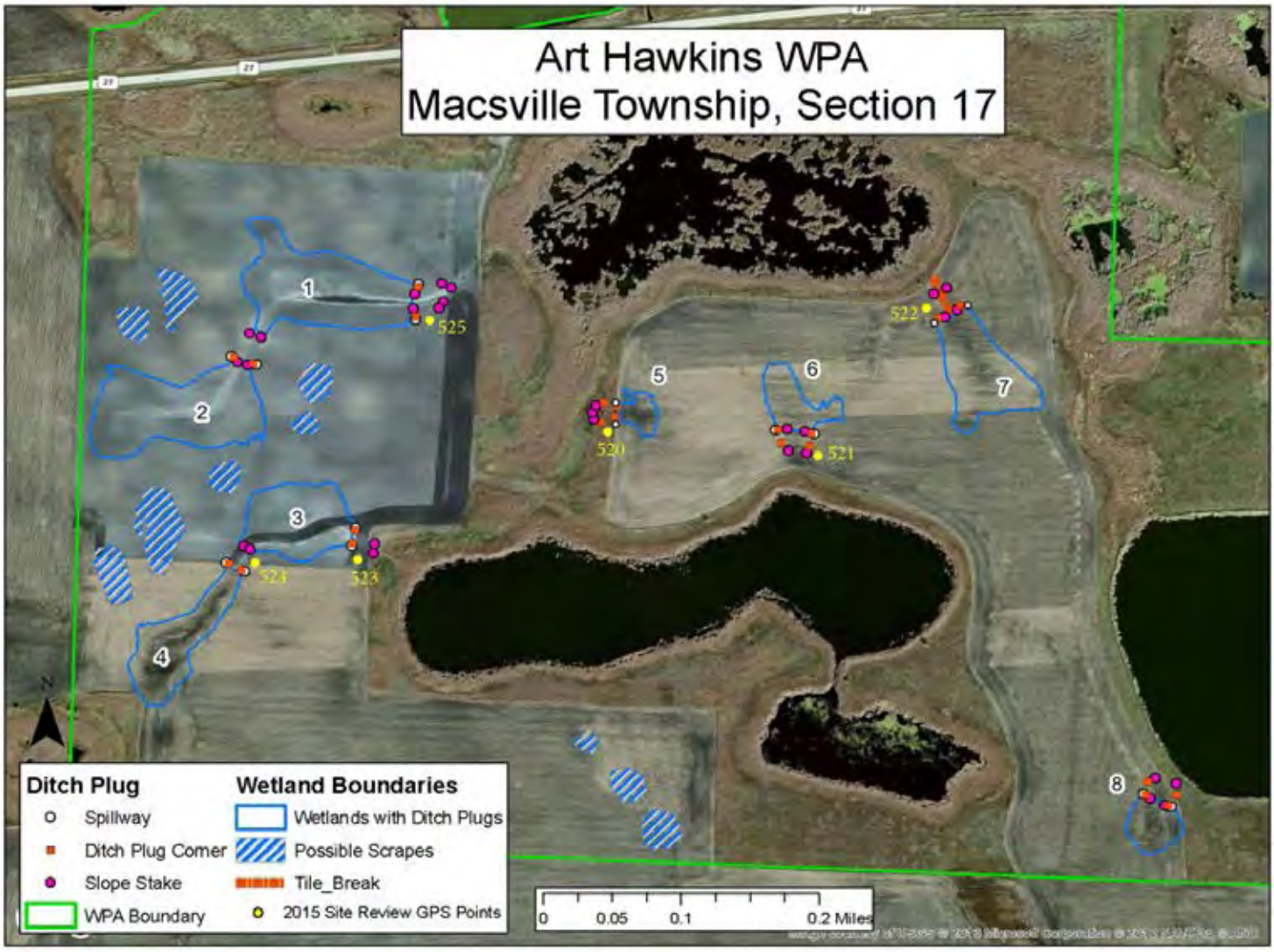


Figure 5 - GPS Survey points and locations of vegetation plot data

Appendix C: Site Photographs

Figure 10 - Basin 5 GPS 520

Figure 11 - Basin 7 GPS 522

Figure 12 - Basin 4 GPS 524

Figure 13 - Basin 1 GPS 525

RESTORATION EVALUATION PROGRAM for LEGACY PROJECTS
Minnesota Board of Water and Soil Resources
Minnesota Department of Natural Resources

PROJECT EVALUATION FORM

PROJECT BACKGROUND

Project Name: William O'Brien State Park **Date of Review: 05.26.15**

Site Assessment Attendees – Reviewers: Paul Bockenstedt, Stantec; Wade Johnson MN DNR

Project manager: Anton Benson, Resource Specialist MN DNR, PAT, Wayne Boerner, Park Manager, MN DNR, PAT – Property owners: MN DNR Parks & Trails

Project Location: County Washington Township/Range/Section S35, T32N, R20W; S31, T32N, R19W

Project Manager/Affiliated organization, Contact: Anton Benson, Resource Specialist MN DNR, PAT Anton.Benson@state.mn.us, Wayne Boerner, Park Manager MN DNR, PAT wayne.boerner@state.mn.us

Fund: OHF ☐ CWF ☐ PTF ☒ Fiscal Year Funds - FY 2009 Project Start Date 2008

Predominant Habitat Type: Prairie/Savanna/Grassland ☒ Wetland ☐ Forest ☐ Aquatic ☐

1. Goal(s) of the restoration

Restore degraded, nonnative grass-dominated old field/pasture (46 acres) and former crop ground (15 acres) to diverse, native prairie.

Quantifiable measures of restoration progress: Convert 61 acres of disturbed land to diverse native grass and flower cover.

What plans/record of project decisions/prescription worksheets are available? Where are they located?

PAT Resource Specialist and Park Manager records include planning documents, maps, seed mix design/sourcing information, management timeline records and similar. PAT has good file information on timing, tools and methods used, records of seed purchased, and similar.

2. What is the status of the project?

Treatment/establishment phase ☐ Post-establishment phase ☒

3. Has the plan or project implementation been modified from the original plan? If yes, why and how?

No, however, additional supplementary native seeding using seed harvested at other prairie restoration sites within the park has been completed by PAT staff to further bolster restoration efforts (fall 2009).

Have alterations in plan or implementation changed the proposed outcomes? While the positive impact cannot be quantified, supplementary seeding using park-harvested seed has almost certainly improved the outcome for these projects.

PROJECT ASSESSMENT

4. Site description (by reviewer): Sites include:

a. A 46 acre hilltop that was row cropped prior to becoming state park and since then had been dominated by nonnative, cool season grasses and forbs for decades.

b. A recently purchased 15-acre parcel that was row cropped up to the time of being seeded to native grasses and flowers.

Soils: silty loam to loamy sand (according the USDA NRCS Soil Survey) over till of Superior Lobe Wisconsin glacial origin.

Topography: Slightly rolling; hill tops.

Hydrology: Well drained soils on hill tops, with the exception of a few very small depressional areas with higher soil moisture (likely only surficial water present for brief periods/high infiltration rate).

Vegetation (structure, dominant species % cover, invasive species (MN DNR) % cover, other): Former vegetation on top of Wedge Hill was dominated by nonnative, cool season grasses, including: smooth brome, quackgrass, Canada bluegrass, as well as weedy nonnative forbs (hoary alyssum, leafy spurge, Canada thistle, Canada goldenrod and similar). Former crop ground was in corn-bean rotation, finishing on soybeans the summer before seeding.

5. Survey methods used (include deliverable format, number of pages):

Survey included spot checks and meander vegetation survey.

6. Is the plan based on current science (best management practices, standards, and guidelines)?

Yes. In both cases the site preparation, materials and restoration methods are within the customary standard of care for prairie restoration. Specifically:

- Wedge Hill—treatment of pre-existing nonnative vegetation two times with non-specific contact and broadleaf herbicide to control existing vegetation, prescribed burning for site preparation and broadcast seeding (3 events).
- Former crop ground included drill/broadcast seeding of prairie grasses/forbs in fall and supplemental broadcast seeding.
- Grow-in maintenance at both locations included periodic site-wide mowing, spot herbicide application and spot mowing during the initial grow-in maintenance phase of the effort.

7. **List indicators of project outcomes at this project stage:**
    - A total of 44 native grass and forb species were recorded between the two restoration areas, the vast majority of which were present in the native seed mix drilled/broadcast at the site. This is good to very good.
    - Although the total cover of native forbs is modest and the forb species richness/density in any particular area is not high, it is within the range of expectations for a restoration within this type of setting.
    - Total cover of native grasses and forbs—good to very good (avg. >85%).
    - Total cover of invasive, nonnative vegetation (avg. <10%).
    - Total bare ground (avg. <5%).

8. **Does the project plan/implementation of the project plan reasonably allow for achieving proposed project outcome(s)?**

Yes, this project began in 2008 and is now beyond the initial grow-in maintenance phase and has achieved the proposed project outcome.

9. **Are corrections or modifications needed to meet proposed outcomes? Explain.**

No. Proposed outcomes have been met.

10. **Has anything been done or planned that would detract from existing or potential habitat? Explain.**

No. MN DNR, PAT has successfully concluded the grow-in maintenance phase of this project and the restored habitats exhibit the desired habitat outcomes. Future management is planned for and conducted by MN DNR, PAT staff on a regular schedule.

11. **Are proposed future steps, including long-term management, practical and reasonable? Explain.**

Yes. MN DNR, PAT has an established and highly capable resource management program and mechanisms in place to plan for and implement desired activities to achieve long-term management objectives.

12. **Are follow-up assessments needed? Explain.**

No additional assessments are required. Established vegetation meets desired goals.

13. Additional comments on the restoration project.

Restoration of the top of Wedge Hill to prairie had been on the park natural resource management goals list for over 30 years. Access to PTF funding enabled this work to occur, restoring an important piece of native habitat on the east side of Wm O'Brien State Park. Similarly, having access to PTF enabled timely restoration of the newly acquired parcel, allowing it to be integrated into broader management unit objectives and management activities schedules.

Similar to other PAT projects that I have reviewed, I recommend that MN DNR, PAT consider designing seed mixes using a seeds per square foot (rather than an ounces/pounds per acre) approach to better understand the on-the-ground amount of seed being installed. Generally, PAT seed mixes have a very low amount of forbs vs. grasses when looked at on a seeds/sf basis.

Site is under management by MN DNR, PAT, whose resource management program will ensure that reasonable future maintenance and care will be undertaken to sustain or improve the quality of the restoration. The on-the-ground prairie restoration results in both project areas are successful and important components of the broader park natural resources management plan at Wm O'Brien State Park.

PROJECT

The project will:

- a. Likely not meet proposed outcomes ☐
- b. Minimally meet proposed outcomes ☐
- c. Meet proposed outcomes ☐
- d. Likely exceed proposed outcomes ☒
- e. Greatly exceed proposed outcomes ☐

Confidence of outcome determination

- 1. Low ☐
- 2. Medium ☐
- 3. High ☒

Provide an explanation of the reason(s) for the determination. Total desirable native cover currently meets or exceeds goal and generally anticipated outcomes for quality prairie seeding. Total native grass and flower cover generally exceeds 85%, with minimal nonnative/non-desirable plant species present. The vast majority of native forbs seeded at these two sites are present and generally widespread, with the total forb abundance and diversity meeting or exceeding what is customary for quality prairie restoration efforts.

Site Assessment Lead(s) Conducting Site Review:

Paul Bockenstedt, Ecologist/Project Manager, Stantec.

RESTORATION EVALUATION PROGRAM for LEGACY PROJECTS
Minnesota Board of Water and Soil Resources
Minnesota Department of Natural Resources

PROJECT EVALUATION FORM

PROJECT BACKGROUND

Project Name: Wild River State Park **Date of Review: 5.26.15**

Site Assessment Attendees – Reviewers: Paul Bockenstedt, Stantec; Wade Johnson MN DNR

Project manager: Virginia Blakesly, Resource Specialist MN DNR, PAT; Paul Kurvers, Park Manager MN DNR, PAT

Property owners: MN DNR Parks & Trails

Project Location: County Chisago Township/Range/Section S8, T35N, R 19W

Project Manager/Affiliated organization, Contact: Virginia Blakesly, Resource Specialist MN DNR Parks and Trails, virginia.blakesly@state.mn.us

Fund: OHF ☐ CWF ☐ PTF ☒ Fiscal Year Funds - FY 2011 Project Start Date 2010

Predominant Habitat Type: Prairie/Savanna/Grassland ☒ Wetland ☐ Forest ☐ Aquatic ☐

1. **Goal(s) of the restoration**

Restore 100 acres of degraded, nonnative grass-dominated old field/pasture to diverse, native prairie.

Quantifiable objectives of the restoration. Convert 100 acres of disturbed former potato field dominated by nonnative, cool season grasses to diverse prairie species (10 spp. native grasses seeded, and 29 spp. native forbs seeded).

What plans/record of project decisions/prescription worksheets are available? Where are they located?

PAT Resource Specialist and Park Manager records include planning documents, maps, seed mix design/sourcing information, management timelines and similar.

2. **What is the status of the project? Treatment/establishment phase ☐ Post-establishment phase ☒**

3. **Has the plan or project implementation been modified from the original plan? If yes, why and how?**

No

Have alterations in plan or implementation changed the proposed outcomes? Not Applicable.

PROJECT ASSESSMENT

4. **Site description (by reviewer): Site is former row crop (potato) field and pasture on a terrace of the St. Croix River in Wild River State Park.**

Soils: loamy sand to loamy fine sand, overlying till of Superior Lobe Wisconsin glacial origin.

Topography: Slightly rolling

Hydrology: Very well drained, with the exception of a few very small depressional areas with higher soil moisture (that do not appear to have surficial water present, with rare exception).

Vegetation (structure, dominant species % cover, invasive species (MN DNR) % cover, other): Former vegetation was dominated by nonnative, cool season grasses, including: smooth brome, quackgrass, Canada bluegrass, as well as weedy nonnative forbs (hoary alyssum, hairy vetch and similar). Minor amounts of early successional native grasses and flowers were present, including species such as panic grasses.

Surrounding conditions (adjacent land use/veg.): site lies within Wild River State Park, surrounding vegetation types include dry to mesic oak woodland and grassland. Inclusion of planted pines along old field border (running north-south interior of restoraiton units).

5. **Survey methods used (include deliverable format, number of pages):**

Survey method includes on-foot meander survey.

6. **Is the plan based on current science (best management practices, standards, and guidelines)?**

Yes, the approach employed was within the bounds of appropriate and customary best management practicies (i.e. burn/spray as site preparation for prairie seeding, with disking select areas with more problematic weeds, as well as not spraying or disking areas that had some prior remnant native vegetation present).

7. **List indicators of project outcomes at this project stage:**

Total native ground cover is generally good (>70%) and typical for this type of site (droughty, sandy soil) with heavy prior nonnative grass/weed pressure). Total number of native species expressed from seed mix and remnant is good (10 native grasses and sedges; 27 native forbs observed, inlcuding volunteer native species and those contributed to the project by volunteer seed harvesters).

Nonnative cover (~20) is within reasonable expectations for a sandy site with heavy remnant weed seed bank. Bare ground/sandy patches comprise approximately 10% total cover—characteristic for this setting and attractive to uncommon wildlife that utilize this type of habitat (e.g. several Species in Greatest Conservation Need currently utilize this restored area, including bull snake, Henslow's sparrow, and at least one species of jumping spider (MN DNR, PAT staff personal communication).

8. **Does the project plan/implementation of the project plan reasonably allow for achieving proposed project outcome(s)?**

Yes, importantly MN DNR, PAT has been able to consistently manage this site during the grow-in maintenance phase—this is especially important for sandy sites such as this with heavy adventive weed pressure.

9. **Are corrections or modifications needed to meet proposed outcomes? Explain.**

No—it is our opinion that the proposed project outcomes are being met.

10. **Has anything been done or planned that would detract from existing or potential habitat? Explain.**

No.

11. **Are proposed future steps, including long-term management, practical and reasonable? Explain.**

Yes. MN DNR, PAT will continue managing to reduce nonnative weeds and foster natives through a combination of spot mowing/spraying and the timely application of prescribed fire.

12. **Are follow-up assessments needed? Explain.**

No. We believe that the project currently meets project objectives and that MN DNR, PAT will continue to apply correct management activities to the site.

13. **Additional comments on the restoration project.**

As with most PTF and MN DNR, PAT projects, this restoration included a number of resources that were integrated to successfully complete the work, including volunteer-collected native seed from the park, parks staff standards hours and others. Restoration of this sand prairie is a significantly large and important piece in the overall restoration and management of natural areas at Wild River State Park.

I recommend that MN DNR, PAT consider designing restoration seed mixes using a seeds per square foot (rather than an ounces/pounds per acre) approach to better understand the on-the-ground amount of seed being installed. This approach will allow for a design that provides a more accurate picture of that amount of forb vs. grass seed actually installed.

PROJECT EVALUATION

The project will:

a. Likely not meet proposed outcomes ☐
b. Minimally meet proposed outcomes ☐
c. Meet proposed outcomes ☐
d. Likely exceed proposed outcomes ☒
e. Greatly exceed proposed outcomes ☐

Confidence of outcome determination

1. Low ☐
2. Medium ☐
3. High ☒

Provide an explanation of the reason(s) for the determination. Total cover of native grasses/forbs meets or exceeds expectations at this stage of the restoration process for similar settings (sandy, droughty soils). Overall, there is a good expression of natives. Prior maintenance work and probability for long-term success through PAT's ongoing efforts are highly valuable. Utilization of area by at least three animal/invertebrate Species in Greatest Conservation Need (MN DNR, PAT personal communication) also supports the assertion that the restoration effort has been and will continue to be successful.

Site Assessment Lead(s) Conducting Site Review:

Paul Bockenstedt, Project Manager/Ecologist, Stantec Inc.

RESTORATION EVALUATION PROGRAM for LEGACY PROJECTS
Minnesota Board of Water and Soil Resources
Minnesota Department of Natural Resources

PROJECT EVALUATION FORM

PROJECT BACKGROUND

Project Name: St. Croix State Park **Date of Review: 5.27.15**

Site Assessment Attendees – Reviewers: Paul Bockenstedt, Stantec; Wade Johnson MN DNR

Project manager: Cathy Handrick, Resource Specialist MN DNR, PAT; Rick Dunkley, Park Manager MN DNR, PAT

Property owners: MN DNR Parks & Trails

Project Location: County: Pine **Township/Range/Section:** S16, T40N, R 18W

Project Manager/Affiliated organization, Contact: Cathy Handrick, Resource Specialist

MN DNR Parks and Trails, cathy.handrick@state.mn.us (formerly managed by Tavis Westbrook, MN DNR, PAT Resource Specialist)

Fund: OHF ☐ CWF ☐ PTF ☒ Fiscal Year Funds - FY 2011 Project Start Date 2010

Predominant Habitat Type: Prairie/Savanna/Grassland ☒ Wetland ☐ Forest ☐ Aquatic ☐

1. **Goal(s) of the restoration**

Restore 41 acres of grassland/brushland within blowdown area at St. Croix State Park through a combination of integrated salvage logging (coarse woody debris removal), brush mowing and prescribed burning.

Quantifiable objectives of the restoration. MN DNR St. Croix Park Restoration Addendum specifically states: “For pine savannas and open grasslands and woodlands, within 12 years following prescribed fire treatments, a 25-50% reduction in the abundance of live woody stems will be achieved within restoration areas.” Also noted in field by MN DNR staff are the parallel goals of removing coarse woody debris from 41 acres of blowdown area, increase total native grass, sedge and forb cover.

What plans/record of project decisions/prescription worksheets are available? Where are they located? PAT Resource Specialist and Park Manager records include planning documents (St. Croix Park Restoration Addendum), maps, management records/vendor invoice records and similar.

2. **What is the status of the project? Treatment/establishment phase ☒ Post-establishment phase ☐**

3. **Has the plan or project implementation been modified from the original plan? If yes, why and how?**

No

Have alterations in plan or implementation changed the proposed outcomes? Not Applicable

PROJECT ASSESSMENT

4. **Site description (by reviewer): Site is in a nearly level terrace of the St. Croix River and lies within a large, landscape-scale blowdown area at St. Croix State Park.**

Soils: loam to loamy sand with organic surficial layer present in many areas

Topography: Nearly level to slightly rolling

Hydrology: Moderately well-drained soils with no obvious wetland areas within the 41-acre treatment area.

Vegetation (structure, dominant species % cover, invasive species [MN DNR] % cover, other): Pre-blow down/intense vegetation management cover included mixed conifer/deciduous trees forest with patchy canopy and moderately thick shrub layer of hazel, dogwood and others. Post-blowdown/ treatment canopy cover approximately 5-10% with shrub/sapling tree layer that is moderate to sparse in thickness. Herbaceous layer inlcudes a diverse assemblage of sedges, grasses and forbs characteristic for quality open woodland/brushland areas. Significant resprouting of brush common and expected in this type of situation.

Surrounding conditions (adjacent land use/veg.): Site is interior within St. Croix State Park, surrounding vegetation types include dry to mesic woodlands and wetlands.

5. **Survey methods used (include deliverable format, number of pages):**

Survey method includes on-foot meander survey of vegetation, incidental wildlife observations and in-field interview with MN DNR, PAT staff.

6. **Is the plan based on current science (best management practices, standards, and guidelines)?**

Yes, MN DNR, PAT staff have done a very nice job of developing a supplementary resource management plan in response to a landscape-scale blowdown in 2008. The timing, tools and methods planned and employed are well within the bounds of appropriate and customary best management practicies to achieve the goals identified for this cover type in the park resource management plan addendum.

7. **List indicators of project outcomes at this project stage:**

Expressed total woody tree and shrub cover has been reduced to levels within goals for the site. Total native herbaceous ground cover levels have improved and native sedge, grass and flower species stimulated. Brushland wildlife species are utilizing the site, inlcuding sharptail grouse (personal communication MN DNR, PAT staff).

8. **Does the project plan/implementation of the project plan reasonably allow for achieving proposed project outcome(s)?**

Yes, importantly MN DNR, PAT has been able to actively manage this site during this phase of the restoration effort (currently in year three after creation of the restoration plan addendum).

9. **Are corrections or modifications needed to meet proposed outcomes? Explain.**

No—it is our opinion that the proposed project outcomes are being met or exceeded at this stage in the restoration effort.

10. **Has anything been done or planned that would detract from existing or potential habitat? Explain.**

No.

11. **Are proposed future steps, including long-term management, practical and reasonable? Explain.**

Yes. MN DNR, PAT will continue managing for brushland cover type using a combination of prescribe fire and brush mowing to achieve sustained outcomes of low brush/tree levels.

12. **Are follow-up assessments needed? Explain.**

No. We believe that the project has met intended objectives and that MN DNR, PAT will continue to apply correct management activities to the site.

13. **Additional comments on the restoration project.**

Similar to most PTF and MN DNR, PAT projects, this restoration included a number of funding and staff resources that were integrated to successfully complete overall natural areas restoration, including salvage logging prescribed burning, parks staff standards hours, and others. Their ability to successfully integrate a variety of staffing/funding resources over time has and will enable a high likelihood of success.

PROJECT EVALUATION

The project will:

a. Likely not meet proposed outcomes ☐
b. Minimally meet proposed outcomes ☐
c. Meet proposed outcomes ☐
d. Likely exceed proposed outcomes ☐
e. Greatly exceed proposed outcomes ☒

Confidence of outcome determination

1. Low ☐
2. Medium ☐
3. High ☒

Provide an explanation of the reason(s) for the determination. Total cover of trees/shrubs has been reduced (but must diligently be sustained); native grass, sedge and forbs cover meets or exceeds expectations at this stage of the restoration process for similar settings. Species characteristic for brushlands (including sharptail grouse, a Species in Greatest Conservation Need) indicates that early gains have been very good on this effort. PAT resource program's continued attention to this effort will ensure a high probability for long-term success.

Site Assessment Lead(s) Conducting Site Review:

Paul Bockenstedt, Project Manager/Ecologist, Stantec.

RESTORATION EVALUATION PROGRAM for LEGACY PROJECTS
Minnesota Board of Water and Soil Resources
Minnesota Department of Natural Resources

PROJECT EVALUATION FORM

PROJECT BACKGROUND

Project Name: Crow Wing State Park Prairie Reconstruction
Date of Review: 05.27.15

Site Assessment Attendees – Reviewers: Paul Bockenstedt, Stantec; Wade Johnson MN DNR

Project manager: Tavis Westbrook, Resource Specialist MN DNR, PAT – Property owners: MN DNR, PAT

Project Location: County Crow Wing Township/Range/Section S24/25, T44N, R32W

Project Manager/Affiliated organization, Contact: Tavis Westbrook, Resource Specialist MN DNR, PAT tavis.westbrook@state.mn.us

Fund: OHF ☐ CWF ☐ PTF ☒ Fiscal Year Funds - FY 2009 Project Start Date 2008

Predominant Habitat Type: Prairie/Savanna/Grassland ☒ Wetland ☐ Forest ☐ Aquatic ☐

1. **Goal(s) of the restoration**

Reconstruct prairie in nonnative grass-dominated old fields and former field borders (46 acres)

Quantifiable objectives of the restoration Reconstruct 100 acres of prairie in old field/disturbed land.

What plans/record of project decisions/prescription worksheets are available? Where are they located?

PAT resource management program records include planning documents, maps, seed mix design, plant plug species lists, management timeline records and similar. PAT has file information on timing, tools and methods used. Documents are retained by DNR, PAT Resource Specialist.

2. **What is the status of the project? Treatment/establishment phase ☐ Post-establishment phase ☒**

3. **Has the plan or project implementation been modified from the original plan? If yes, why and how?**

No.

Have alterations in plan or implementation changed the proposed outcomes? Not applicable.

PROJECT ASSESSMENT

4. **Site description (by reviewer):**

Sites include: Three old field areas (with small inclusions of former homestead and pasture/barnyard), two adjacent to each other and the third approximately 1/4 mile to the north. Landform/soils characterized by sandy Mississippi River Valley deposits. Sites are nearly level to gently rolling terrace of the Mississippi River.

Soils: NRCS Soil Survey Data: Hubbard loamy sand Mississippi River Valley.

Topography: Nearly level to very gently rolling.

Hydrology: Excessively drained soils (uplands), with the exception of a few very small depressional areas with higher soil moisture (likely only surficial water present for brief periods/high infiltration rate).

Vegetation (structure, dominant species % cover, invasive species (MN DNR) % cover, other): Former vegetation reported by MN DNR, PAT staff to be nonnative, cool season grasses, including: smooth brome, quackgrass, Canada bluegrass, as well as weedy nonnative forbs (hoary alyssum, leafy spurge, Canada goldenrod and similar).

Surrounding conditions (adjacent land use/veg.): surrounding land is all within Crow Wing State Park. Adjacent vegetation types include conifer plantation and oak woodland of moderate quality. Housing development occurs on the east side of the north unit, adjacent to highway.

5. **Survey methods used (include deliverable format, number of pages):**

Survey included spot checks and meander vegetation survey, recording of observed wildlife, on-site interview with PAT staff.

6. **Is the plan based on current science (best management practices, standards, and guidelines)?**

Yes. Site preparation, materials and restoration methods are within the bounds of restoration practices within the industry. Specifically:

- Cut/treat pre-existing volunteer/invading trees in restoration area (woody debris piled and burned).
- Treatment of pre-existing, nonnative vegetation two times with non-specific contact (glyphosate) herbicide.
- Prescribed burning for site preparation.
- Drill seeding using a drill specifically designed for seeding natives.
- Planting of 10,000 plugs of native grasses and flowers.
- Grow-in maintenance included periodic site-wide mowing, spot herbicide application and spot mowing during the initial grow-in maintenance phase of the effort.

7. **List indicators of project outcomes at this project stage:**
    - Total native grass cover is approximately 90+%.
    - Although the total cover of native forbs is modest and the forb species richness/density in any particular area is not high, it is within the range of expectations for a restoration on droughty, sandy soils.
    - Total cover of native grasses and forbs—good to very good (>90%).
    - Total cover of invasive, nonnative vegetation (<5%).
    - Total bare ground (<5%).

8. **Does the project plan/implementation of the project plan reasonably allow for achieving proposed project outcome(s)?**

Yes, this project began in 2008 and is now beyond the initial grow-in maintenance phase and has achieved the proposed project outcome.

9. **Are corrections or modifications needed to meet proposed outcomes? Explain.**

No. Proposed outcomes have been met.

10. **Has anything been done or planned that would detract from existing or potential habitat? Explain.**

No. MN DNR, PAT has successfully concluded the grow-in maintenance phase of this project and the restored habitats exhibit the desired outcomes.

11. **Are proposed future steps, including long-term management, practical and reasonable? Explain.**

Yes. MN DNR, PAT has an established and highly capable resource management program with mechanisms in place to plan for and implement desired long-term management objectives.

12. **Are follow-up assessments needed? Explain.**

No additional assessments are required. Established vegetation meets or exceeds goals.

13. Additional comments on the restoration project.

PAT staff did nice job of design/implementation, including choosing species appropriate for seeding and/or planting as plugs. PAT staff was also diligent with planning and following through with grow-in maintenance. The one recommendation I have is that that MN DNR, PAT consider designing seed mixes using a seeds per square foot (rather than an ounces/pounds per acre) approach to better understand the on-the-ground amount of seed being installed. This provides a more accurate way of understanding the amount of forbs vs. grasses being installed.

Site is under management by MN DNR, PAT, whose resource management program will ensure that reasonable future maintenance and care will be undertaken to sustain or improve the quality of the restoration. The on-the-ground prairie restoration results in both project areas are successful and important components of the broader park natural resources management plan at Crow Wing State Park.

PROJECT EVALUATION

The project will:

- a. Likely not meet proposed outcomes ☐
- b. Minimally meet proposed outcomes ☐
- c. Meet proposed outcomes ☐
- d. Likely exceed proposed outcomes ☒
- e. Greatly exceed proposed outcomes ☐

Confidence of outcome determination

- 1. Low ☐
- 2. Medium ☐
- 3. High ☒

Provide an explanation of the reason(s) for the determination. Total desirable native cover currently meets or exceeds what is generally anticipated for sites with similar conditions/circumstances. Total native grass and flower cover generally exceeds 90%, with minimal non-desirable plant species present. All eight seeded native grass species were observed and 13 of 17 native forbs seeded were observed. Six of 22 species installed as live plant plugs were observed. Although native grasses are dominant, the restoration is representative of outcomes for sites with excessively drained sandy soils—total native cover meets or exceeds what is customary for prairie restoration efforts in this type of setting.

Site Assessment Lead(s) Conducting Site Review: Paul Bockenstedt, Ecologist/Project Manager, Stantec.