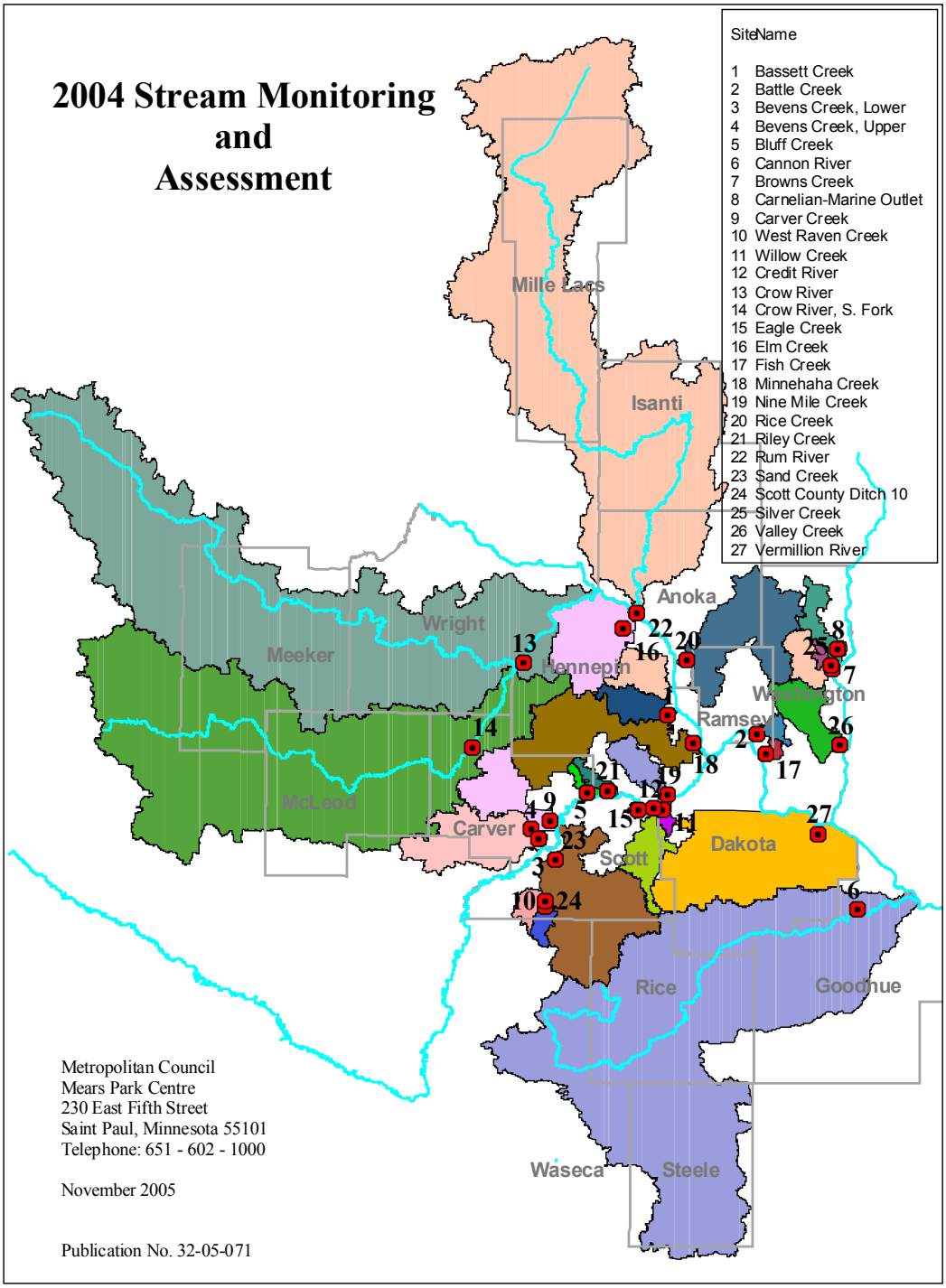
2004 Stream Monitoring and Assessment



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EXECUTIVE SUMMARY

The Metropolitan Council has conducted environmental monitoring of stream water quantity and quality since 1989. The Metropolitan Council and its partners currently operate monitoring stations on 25 streams in the seven-county metropolitan area.

This report presents the assessment of 2004 and historical water quality and water quantity dynamics for 27 sites on 25 Metropolitan Area streams. The Metropolitan Council and monitoring partners collected the data used in this report with the exception of Elm and Rice Creeks, which were monitored by the United States Geological Survey and the Rice Creek Watershed District, respectively. The streams assessed in this report and the respective main stem rivers into which they discharge are listed below:

Mississippi River: Bassett Creek, Battle Creek, Cannon River, Crow River, Elm Creek, Fish Creek, Minnehaha Creek, Rum River, Rice Creek, and Vermillion River

Minnesota River: Bevens Creek, Bluff Creek, Carver Creek, Credit River, Eagle Creek, Nine Mile Creek, Riley Creek, Sand Creek, Scott County Ditch 10, West Raven Stream, and Willow Creek

St. Croix River: Browns Creek, Carnelian-Marine Outlet, Silver Creek and Valley Creek

Water quantity and quality variables assessed in this report are stream flow rate and volume, total suspended solids, total phosphorus, total dissolved phosphorus, total Kjeldahl nitrogen, and nitrate nitrogen (nitrate).

2004 and historical pollutant loads and streamflow:

For most of the Metropolitan Area, 2004 was a year of near to slightly below normal precipitation. Bassett Creek, Battle Creek, Bluff Creek, Browns Creek, Carnelian Marine Outlet, Carver Creek, Fish Creek, Minnehaha Creek, Nine Mile Creek, Riley Creek, Silver Creek and Valley Creek had precipitation deficits ranging from –11% to –14%. Therefore the flow in these streams was less than expected during a typical year.

The Mississippi River tributaries had moderate flow-weighted mean concentrations of total phosphorus, total suspended solids, and nitrate with the exception of total phosphorus and nitrate concentrations discharged by the Cannon River, Crow River, South Fork Crow River, and the Vermillion River which had high flow weighted mean concentrations. In particular, the Vermillion River had comparatively high nutrient (total phosphorus and nitrate) concentrations for both 2004 and for the historical annual average. The effluent discharged into the Vermillion from the Empire Wastewater Treatment Plant in Empire Township is a significant source of the river's nutrient load.

The Minnesota River tributaries varied in flow-weighted mean concentrations of nutrients and total suspended solids. Sand Creek, Bevens Creek – Upper and Lower,

and West Raven Creek had comparatively high concentrations of total phosphorus, total suspended solids, and nitrate. Bluff Creek and Riley Creek had high concentrations of total phosphorus and total suspended solids. Scott County Ditch 10 had high concentrations of total phosphorus and nitrate. Nine Mile Creek, Eagle Creek, Willow Creek, and Credit River discharged comparatively low concentrations of total phosphorus, total suspended solids, and nitrate to the Minnesota River. Due to road and bridge construction at the site, Carver Creek did not have any flow data for 2004.

The St. Croix River tributaries had comparatively low flow-weighted mean concentrations for total phosphorus, nitrate and total suspended solids. Of note is the flow-weighted mean nitrate concentration at Valley Creek, which is five times greater than the next highest nitrate concentrations in Browns Creek. Studies conducted by researchers at the Science Museum of Minnesota's St. Croix Watershed Research Station have shown that discharge of nitrate-contaminated groundwater via springs is the primary source of the high nitrate concentrations in Valley Creek.

Trend Analysis:

Trend analysis (examination of stream data for changes over time) was performed on flow-weighted mean concentrations of the 25 streams. The analysis did identify some changes in water quality and quantity over time.

Of note, however, is Nine Mile Creek, a tributary of the Minnesota River. Trend analysis indicated an improvement in water quality and decreases in pollutant loads since 1993, when the Nine Mile Creek Watershed District completed the Lower Valley Project. This project stabilized scarps and restored streambed stability in the Nine Mile Creek segment just south of Old Shakopee Road to just upstream of the stream outlet to the Minnesota River. The segment where the water quality trends were detected is located just upstream of the monitoring station.

ACKNOWLEDGEMENTS

This report was prepared by Judy Sventek (Environmental Planning Analyst; phone: 651-602-1156) and Steve Kloiber (Environmental Planning Analyst; phone: 651-602-1056) both of the Metropolitan Council's Environmental Services Division Environmental Quality Assurance Department. Questions about the content of this report can be referred directly to them.

Data were collected and verified by environmental monitoring staff in the Metropolitan Council's Environmental Services Division Environmental Quality Assurance Department. Special thanks go to Tim Pattock, Mike Ahlf, Cassandra Champion, Leigh Harrod, Karen Jensen, Hong Wang, Kent Johnson and Marcel Jouseau.

Metropolitan Council staff wishes to thank our local partners who have been working with Metropolitan Council staff to operate and maintain stream monitoring stations throughout the Metropolitan Area. Special thanks go to Anoka County Soil and Water Conservation District, Bassett Creek Watershed Management Commission, Black Dog Watershed Management Organization, Carver County Environmental Services, Carnelian-Marine Watershed District, Dakota County Soil and Water Conservation District, Elm Creek Watershed Management Organization, Lower Minnesota River Watershed District, Minneapolis Park and Recreation Board, Ramsey-Washington-Metro Watershed District, Rice Creek Watershed District, Riley-Purgatory-Bluff Creek Watershed District, Scott County Soil and Water Conservation District, St. Croix Watershed Research Station, United States Geological Survey, Valley Branch Watershed District, Washington County Soil and Water Conservation District and Wright County SWCD.

Finally Metropolitan Council staff wishes to thank the Minnesota Legislature and the Minnesota Pollution Control Agency for providing funding for several of the stations discussed in this report.

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INTRODUCTION

Growth Trends and Challenges for Surface Water Protection

During the last three decades, the population of the seven-county metropolitan area increased by nearly 800,000. The 2000 Census Bureau figures show that in the 1990s, the Metro Area experienced its largest population growth of any decade in history. This growth has brought prosperity – new jobs, rising incomes, new tax revenue, and the highest rate of home ownership in the nation. However, growth also brings challenges for protecting our natural resources. Stormwater runoff from both urban and rural landscapes transports nonpoint source pollution into Metro Area lakes, rivers and streams. Nonpoint pollution is generated by the many diverse land uses in the Metro Area and the everyday activities of its human population. Human activities that create nonpoint source pollution include, among others: applying excessive fertilizer to lawns; plowing fields or operating construction sites in a manner that results in soil erosion; discarding grass clippings into streets or directly into storm drains; and driving cars that leak fluids and exhaust hydrocarbon particulates into the air.

Nonpoint source pollution begins when agricultural production and urban development causes alterations of the natural landscape. Undisturbed vegetation and natural drainage systems filter out pollutants generated by stormwater runoff, and thus minimize impacts on the receiving waters. The efficiency of these natural drainage systems is reduced or negated by an increase in impervious surfaces created by growth, including new structures, wider roads and compacted soils. Numerous scientific studies have shown a direct correlation between increased impervious cover in a watershed and degraded stream water quality. Both the volume and rate of runoff increase in a landscape altered by impervious surfaces and some agricultural practices, and the runoff transports more pollutants into receiving waters.

Metropolitan Council Water Resource Programs

Collectively the nonpoint and point source water resource programs at the Metropolitan Council form the policy basis for achieving the Metropolitan Council's no adverse impact goal: "*water quality leaving the Metro Area is as good as the water quality entering the Metro Area, and is in compliance with federal and state regulations"* (Metropolitan Council, 2004). No adverse impact means that as a region, we must live within the capacity of the water resource systems to assimilate the activities of our population without furthering harm to our water resources.

The Metropolitan Council has several programs in place that can be used to measure our efforts to meet the no adverse impact goal: our water quantity and quality monitoring programs for streams, rivers and lakes. The Metropolitan Council has been monitoring Metro Area streams since 1989. To achieve greater coverage, in 1995, the Metropolitan Council began working with local partners to monitor a broader network of Metropolitan Area streams. This report also includes information on the Elm and Rice Creek stations, which are monitored by the United States Geological Survey (USGS) and the Rice Creek Watershed District, respectively. Data is collected from 25 streams at 27 monitoring stations.

METROPOLITAN COUNCIL STREAM MONITORING PROGRAM

Monitoring Sites and Watershed Characteristics

The Metropolitan Council and local partners are currently monitoring 27 sites on 25 streams in the Metro Area (Table 1 and Figure 1). These streams are tributary to either the Minnesota, Mississippi or St. Croix Rivers. Monitoring sites are generally located near the stream mouths, but are far enough upstream to avoid backwater conditions when the major rivers are at flood stage.

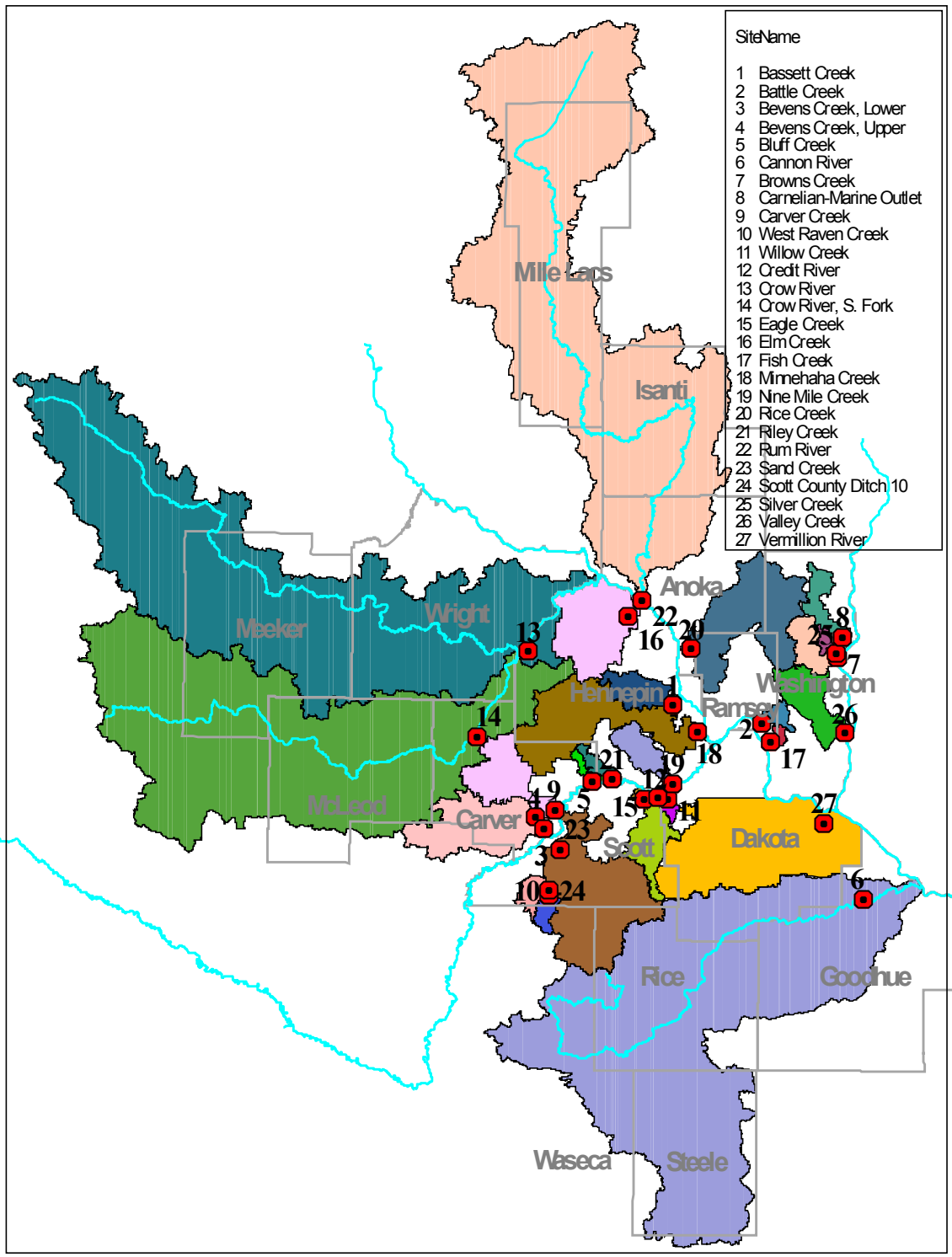
Table 1. Metropolitan Council Stream Monitoring Sites and Partners

Stream	Monitoring Start	Participating Cooperator
Bassett Creek	2000	Minneapolis Parks and Recreation Board
Battle Creek	1996	Ramsey-Washington Metro WD
Bevens Creek – Lower	1989	Metropolitan Council
Bevens Creek – Upper	1992	Metropolitan Council
Bluff Creek	1990	Metropolitan Council
Browns Creek	1998	Washington SWCD
Cannon River	1999	Dakota SWCD
Carnelian-Marine Outlet	1995	Carnelian-Marine WD
Carver Creek	1989	Metropolitan Council
Credit River	1989	Metropolitan Council
Crow River	1999	Wright SWCD
Eagle Creek	1999	Lower Minnesota WD
*Elm Creek	1995	Elm Creek WMO, USGS
Fish Creek	1995	Ramsey-Washington Metro WD
Minnehaha Creek	1999	Minneapolis Park & Recreation Board
Nine Mile Creek	1989	Metropolitan Council
*Rice Creek	1995	Rice Creek WD
Riley Creek	1999	Riley-Purgatory-Bluff Creek WD
Rum River	1996	Anoka SWCD
Sand Creek	1989	Metropolitan Council
Scott County Ditch 10	1999	Scott County SWCD
Silver Creek	1998	Carnelian-Marine WD
South Fork Crow River	2001	Carver County
Valley Creek	1999	Valley Branch WD
Vermillion River	1995	Dakota SWCD
Willow Creek	1999	Black Dog WMO
West Branch Raven Creek	1999	Scott County SWCD

*These sites are no longer part of the Metropolitan Council monitoring network.

Notes: SWCD (Soil and Water Conservation District)
WD (Watershed District)
WMO (Watershed Management Organization)
USGS (United States Geological Survey)

Figure 1. Metropolitan Council Stream Monitoring Sites



Watershed areas for the 25 streams range from 1.2 to 2,622 square miles and land cover ranges from predominantly agricultural to predominantly urban (Table 2). Additional stream and watershed information, including detailed land cover maps for each watershed, can be found in the Metropolitan Council's 2003 stream monitoring reports: *Metropolitan Council Environmental Services 2003 Stream Monitoring Report* (Metropolitan Council, 2004) and the *2003 Stream Monitoring and Assessment for 11 Metropolitan Area Streams* report (Metropolitan Council, 2004).

Table 2. Stream Monitoring Sites

Monitoring Site	Major Basin	Dominant Land Use	Year Initiated	Watershed Size (miles^2)
Bassett Creek	Mississippi – Upper	Urban	2000	40
Battle Creek	Mississippi – Upper	Urban/Transitional	1996	11.5
Bevens Creek – Lower	Minnesota – Lower	Agricultural	1989	130
Bevens Creek – Upper	Minnesota – Lower	Agricultural	1992	90
Bluff Creek	Minnesota – Lower	Rural/Transitional	1990	5.7
Browns Creek	St. Croix	Rural/Transitional	1998	28.6
Cannon River	Mississippi – Lower	Agricultural	1999	1,340
Carnelian-Marine Outlet	St. Croix	Rural/Transitional	1995	30
Carver Creek	Minnesota – Lower	Agricultural	1989	83
Credit River	Minnesota – Lower	Rural/Transitional	1989	51
Crow River	Mississippi – Upper	Agricultural	1999	2,622
Eagle Creek	Minnesota – Lower	Urban/Transitional	1999	1.2
Elm Creek	Mississippi – Upper	Urban/Transitional	1995	85
Fish Creek	Mississippi – Upper	Urban/Transitional	1995	5.1
Minnehaha Creek	Mississippi – Upper	Urban/Transitional	1999	177
Nine Mile Creek	Minnesota – Lower	Urban	1989	38
Rice Creek	Mississippi – Upper	Urban/Transitional	1995	185
Riley Creek	Minnesota – Lower	Urban/Transitional	1999	10.5
Rum River	Mississippi – Upper	Agricultural/Forest	1996	1,552
Sand Creek	Minnesota – Lower	Agricultural	1989	233
Scott County Ditch 10	Minnesota – Lower	Agricultural	1999	16.5
Silver Creek	St. Croix	Rural/Transitional	1998	7.5
South Fork Crow River	Mississippi – Upper	Agricultural	2001	1,135
Valley Creek	St. Croix	Mixed/Transitional	1999	13.2
Vermillion River	Mississippi – Lower	Agricultural	1995	270
Willow Creek	Minnesota – Lower	Urban	1999	8.2
West Raven Stream	Minnesota – Lower	Agricultural	1999	14.9

METHODS

Monitoring Methods

The following information is a generalized summary of the monitoring equipment and methods used at all Metropolitan Council stream monitoring stations. For more detailed information on equipment and methods, please refer to the *2003 Stream Monitoring and Assessment for 11 Metropolitan Area Streams* report (Metropolitan Council, 2004) or visit the stream monitoring section of the Metropolitan Council's website: http://www.metrocouncil.org/environment/RiversLakes. The Metropolitan Council's quality assurance program for stream monitoring can be found on the Metropolitan Council's website at http://www.metrocouncil.org/environment/RiversLakes/Streams/index.htm.

Precipitation Monitoring
The 2004 precipitation information was acquired from the Minnesota Climatology Working Group's rain gauge network. For each monitoring site, daily precipitation data were obtained from one or several rain gauges in the same watershed or in an adjoining watershed (see Table 3 in Results section).

Continuous Monitoring of Flow, Conductivity and Temperature
Each monitoring station is equipped with a datalogger that continuously records 15- minute data for water level (stage), flow, conductivity, and temperature, generating approximately 25,000 records per variable during the open-water season. The open-water season varies from site-to-site and year-to-year, but a typical operational period for the automated equipment is from mid-March through the end of November. When winter ice cover creates very difficult conditions for accurate flow and rating curve measurements, winter flows are estimated.

Water Quality Monitoring
Water chemistry samples are collected during both baseflow and runoff conditions. Baseflow conditions are typically represented by monthly grab samples. Runoff conditions are typically represented by flow-weighted composite samples collected via autosampler during all runoff events (generally 10-15 events) in the open water season.

Baseflow and event samples are analyzed for a variety of water quality variables including total chloride, hardness, total metals (Cu, Cd, Cr, Ni, Pb, Zn), total Kjeldahl nitrogen, nitrate-nitrogen, total and dissolved phosphorus, total and volatile suspended solids, and turbidity. Transparency tube measurements are obtained in the field. The variables listed above are not always analyzed at all sites on every sampling occasion. The variables and frequency of analysis depend upon the sample condition (such as holding time requirements and available sample volume) and water quality concerns for a given stream. The Metropolitan Council laboratory analyzes water chemistry samples for all sites except Elm Creek and Rice Creek.

Biological Monitoring
Macroinvertebrate samples are collected once or twice annually (spring and/or fall) at 12 monitoring sites, using the multi-habitat method. Samples are analyzed by the Department of Entomology at the University of Minnesota, with all macroinvertebrates identified to the genus level, if possible. A variety of metrics, including the Hilsenhoff Biotic Index, are used to determine the health of the

macroinvertebrate community at each of the 12 monitoring sites. Macroinvertebrate monitoring results and metrics for 2004 can be found in Appendix C.

Laboratory Analytical Procedures

The Metropolitan Council laboratory analyzes all water samples obtained for the stream monitoring program, except Elm Creek and Rice Creek samples. The Metropolitan Council laboratory is certified under the State of Minnesota laboratory certification program. The Minnesota Department of Health, which is the certifying agency for Minnesota, has assigned the laboratory a certification number of 027-123-172. The analytical methods can be found in the *2003 Stream Monitoring and Assessment for 11 Metropolitan Area Streams* report (Metropolitan Council, 2004).

Data Assessment Methods

Loading Calculations

The term load refers to the total amount or mass of a water quality pollutant delivered by a stream to its receiving water during a given time period, often seasonally or annually. Loading calculations (Appendix D) were completed using the computer model FLUX, a standard assessment technique developed for the United States Army Corps of Engineers (Walker, 1999). The FLUX model is a DOS-based calculation tool that allows the user to estimate loads and flow-weighted mean concentrations for water quality variables, using grab sample concentration data and continuous stream flow records. FLUX incorporates six calculation techniques to map the streamflow and concentration relationship developed from the sample record onto the entire record to calculate total mass discharge and associated error statistics.

The Results and Discussion sections of this report include information on the load estimates and flow-weighted mean concentrations for total phosphorus, total dissolved phosphorus, total Kjeldahl nitrogen, nitrate, and total suspended solids.

Trend Analysis

Trend analysis was performed on annual pollutant loads and annual mean flow-weighted concentrations calculated using FLUX for each stream, using the Kendall Tau test ($p \leq 0.05$) (SPSS version 10.0).

RESULTS

In 2001, 2002 and 2003 Metropolitan Council staff prepared stream monitoring reports that included annual monitoring data from 28-30 Metropolitan Council Metro Area and outstate stream monitoring stations (Metropolitan Council, 2003, 2004, and 2005). For the 2003 stream data, Metropolitan Council staff also prepared a stream assessment report (Metropolitan Council, 2004) that included a more detailed assessment of 11 streams in the metropolitan area: a subset of the streams in the Metropolitan Council's monitoring program and two additional streams (Elm and Rice Creeks) monitored by other agencies (USGS and Rice Creek Watershed District, respectively). The 2003 stream assessment report included analysis of 2003 monitoring data, a historical pollutant loading assessment for the 11 streams completed with the FLUX computer model, and ranking of the streams according to three water quality criteria. The 2004 stream assessment report expands upon the 2003 stream assessment report and includes an assessment for all of the streams in the Metropolitan Council's program as well as for Rice and Elm Creeks. As in the 2003 stream assessment report, this report will include an analysis of 2004 monitoring data, and a historical pollutant loading assessment for the 27 stations on the 25 Metro Area streams completed with the FLUX computer model.

2004 Climate

Annual statewide total precipitation data for the year 2004 and departure from normal precipitation data as obtained from the Minnesota State Climatology Office can be found at http://climate.umn.edu/img/annual/p2004.gif. Data from the State Climatology Office show the 2004 precipitation totals for the region. In most of the region, precipitation totals ranged from 32-36 inches. Precipitation in the northwest tip of Anoka County ranged from 36-40 inches and precipitation in the southern half of Washington County and a small portion of southern Ramsey County, southeast Hennepin County and northern Dakota County ranged from 28-32 inches. In summary, precipitation for the Metro Area ranged from 28-40 inches and the annual precipitation departure from normal ranged from –2 inches below normal to 6 inches above normal.

Figure 2 shows the monthly total precipitation and departure from normal precipitation for 2004 at the Minneapolis-St. Paul International Airport weather station. Figure 2 indicates that the airport site was slightly drier than normal in 2004. The 30-year (1971-2000) annual average precipitation at the Minneapolis-St. Paul International Airport is 29.41 inches and the total precipitation at the airport site in 2004 was 27.39 inches. Generally, there was below normal precipitation in the winter, close to normal precipitation in the spring, below normal precipitation in the summer and above normal precipitation in the fall.

Figure 2. 2004 and Normal Monthly Precipitation at Minneapolis-St. Paul Airport

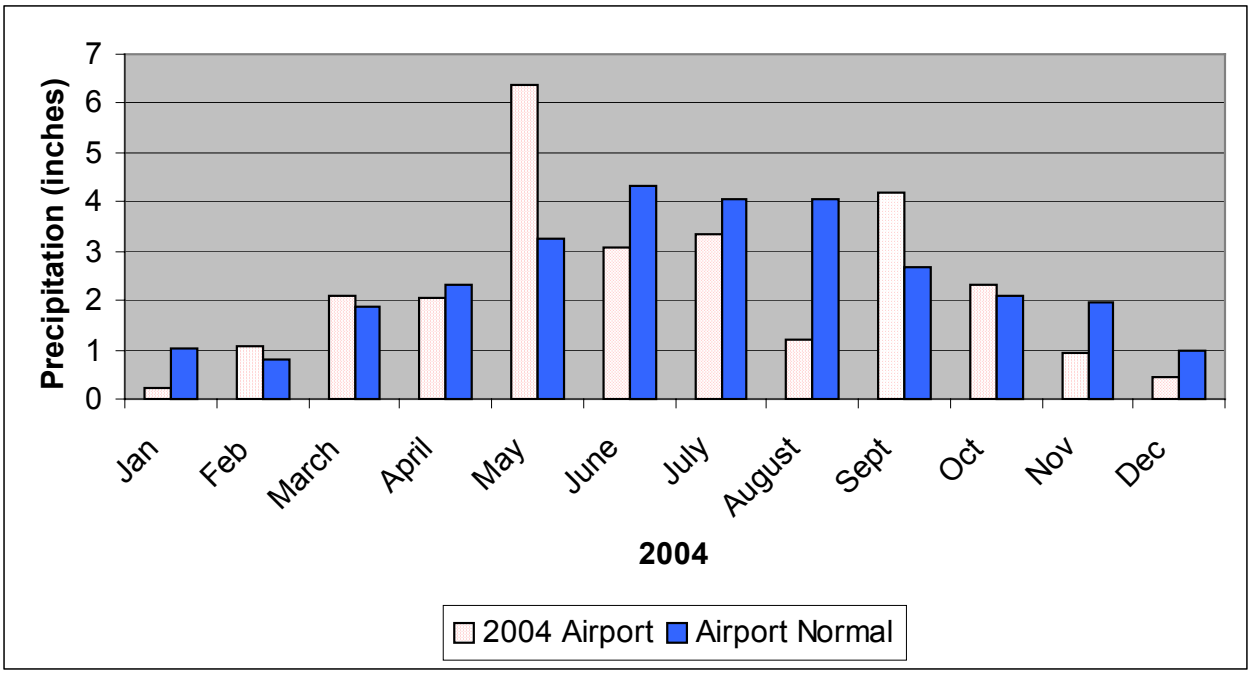
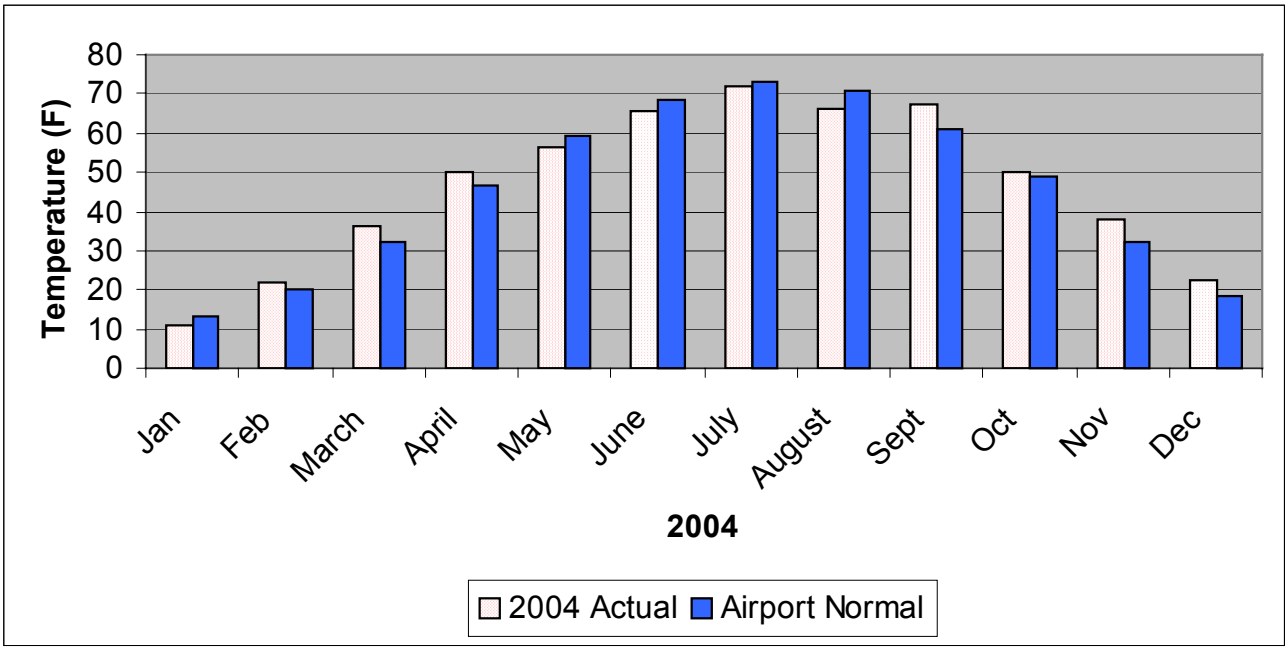


Figure 3 shows the monthly average temperature and departure from normal temperature for 2004 at the airport weather station. The average monthly temperature for 2004 ranged from 11.2 F in January to 72.2 F in July. Overall the 2004 average monthly temperatures were very close to the normal average monthly temperatures.

Figure 3. 2004 and Normal Monthly Air Temperatures at Minneapolis-St. Paul Airport



Because annual precipitation amounts vary across the Metro Area, each stream was analyzed using data from the meteorological station or stations closest to that stream (Table 3). While the 2004 annual precipitation at the Minneapolis-St. Paul International airport station was 27.39 inches compared to the 30-year average of 29.41 inches, the actual deficit or surplus varied by watershed. The 2004 deficit was greatest for Bluff, Carver, Nine Mile, and Riley Creeks in the Minnesota River Basin, for Bassett, Battle, Minnehaha and Fish Creeks in the Mississippi River Basin and for the St. Croix tributaries. The 2004 precipitation deficit in the Bluff and Carver Creeks was 14% while the 2004 deficit was 13% for the St. Croix tributaries and Riley Creek. Several of the Minnesota River tributaries (Sand Creek and Bevens Creek) and the far western (South Fork of the Crow River) and southern tributaries (Cannon River) of the Mississippi River experienced above-normal precipitation in 2004.

2004 Stream Flow

Appendix A includes the hydrographs for all streams. Each hydrograph portrays the 2004 flow record, showing the daily average flow (solid black line), and daily precipitation. For all sites, except Rice and Elm Creeks, the hydrographs also show the date at which grab and composite samples were collected. Finally, each hydrograph shows the total flow volume and annual water yield.

Water Chemistry Data

Appendix B summarizes the chemical and physical data collected during 2004 for each stream. For each stream, the number of samples analyzed and the mean, minimum and maximum concentrations are reported for alkalinity, total COD, chloride, sulfate, total Kjeldahl nitrogen, total nitrate, total nitrite, dissolved orthophosphorus, total phosphorus, total dissolved phosphorus, total suspended solids, volatile suspended solids, and turbidity.

An analysis of the chemical data collected during 2004 shows that the mean total phosphorus concentrations are highest for Bevens Creek - Lower, Bevens Creek - Upper, Bluff Creek, Cannon River, South Fork Crow River, Sand Creek, Scott County Ditch 10 and West Raven Creek with concentrations ranging from 400-580 ppb. Mean total phosphorus concentrations are lowest for Carnelian Marine Outlet, Eagle Creek and Valley Creek, with concentrations ranging from 20-90 ppb.

The mean total suspended solids concentrations are highest for Bevens Creek – Lower, Bevens Creek - Upper, Bluff Creek, Cannon River, Nine Mile Creek, Riley Creek, Sand Creek, and West Raven Creek respectively with concentrations ranging from 105-329 ppm and lowest for Carnelian Marine Outlet, Elm Creek, Eagle Creek, Minnehaha Creek and Rum River with concentrations ranging from 2-20 ppm. Phosphorus and solids may be high due to intense agricultural activity, streambank erosion, failing septage systems and excessive use of fertilizers.

The state water quality standard for turbidity as established by the Minnesota Pollution Control Agency, is 25 NTUs. In 2004, six streams had mean turbidity levels that exceeded 25 NTUs, including Bevens Creek – Lower and Upper, Riley Creek, Sand Creek, Scott County Ditch 10 and West Raven Creek. 17 of the 25 streams had more than 10% of their turbidity samples exceeding 25 NTUs. Currently the PCA determines compliance with standards on an annual basis when samples from a site meet the standard 90% of the time.

Generally the more urbanized streams have higher chloride concentrations. The 2004 data support this statement. In 2004, the streams with the highest chloride concentrations are Bassett Creek, Battle

Creek, Fish Creek, Minnehaha Creek, Nine Mile Creek, and Willow Creek with mean chloride concentrations of 153, 166, 110, 107, 94, and 109, respectively.

Macroinvertebrate Data

Table 4 includes the 2004 macroinvertebrate metrics for the 12 stream monitoring stations (Battle Creek, Bevens Creek - Lower, Bluff Creek, Browns Creek, Credit River, Eagle Creek, Fish Creek, Minnehaha Creek, Sand Creek, Silver Creek, Vermillion River, and Valley Creek) where biological monitoring is conducted. Macroinvertebrate data are analyzed to the genus level. Appendix C includes the organism count, common name, class, order, family, sub-family and genus information for all samples collected and analyzed for each stream. The Hilsenhoff Biotic Index values in Table 5 indicate that water quality was fair (fairly significant organic pollution) in Minnehaha Creek, good (some organic pollution) in Battle Creek, Bluff Creek and Credit River, very good (slight organic pollution) in Bevens, Browns, Eagle, Fish, Sand, Silver and Valley Creeks, and excellent (no apparent organic pollution) in the Vermillion River.

Impaired Waters

Many streams in the metropolitan area are listed as impaired waters by the Minnesota Pollution Control Agency (Table 6). For each affected reach and associated pollutant or stressor, a total maximum daily load (TMDL) study and management plan must be completed by the Minnesota Pollution Control Agency. Table 6 also includes the anticipated start and end date for the TMDL studies. Fifteen of the 25 streams assessed in this report are on the 2004 Impaired Waters List for one or more pollutant violation. Ten of the stream reaches, 70% of which drain to the Minnesota River, are listed for turbidity violations. For more urban watersheds, general and construction site erosion, streambank erosion, or resuspension of particles from creek bottoms may be the cause of higher turbidity levels. For more rural watersheds, agricultural runoff, streambank erosion, or resuspension of particles from creek bottoms may be the cause of higher turbidity levels. Five stream reaches on three streams are impaired for fecal coliform, Bevens Creek, Carver Creek and the Vermillion River. Those stream sections affected by fecal coliform may have atypical discharges of farm animal wastes or discharges from malfunctioning individual on-site sewage disposal systems.

Table 3. Meteorological Stations and Annual Precipitation Data for Each Stream

Stream	Receiving River	Proximate Meteorological Stations	2004 Precip (inches)	1990 –2004 Average Annual Precip, (inches)	2004 Precip. Difference (%)
Bassett	Mississippi	MSP airport (Sta. #215435)	27.39	30.96	-11%
Battle	Mississippi	St. Paul/St. Paul U of M/Vadnais Lake (Sta. #217377 + #218450 +#218477)	30.37	34.2	-11%
Bevens Creek – Lower	Minnesota	Jordan (Sta. #214176)	34.81	32.60	+6%
Bevens Creek – Upper	Minnesota	Jordan (Sta. #214176)	34.81	32.60	+6%
Bluff	Minnesota	Chanhassen/Chaska (Sta. # 211448 + #21465)	27.09	31.65	-14%
Browns	St Croix	Stillwater (Sta. #218037)	30.05	34.62	-13%
Cannon	Mississippi	Red Wing Dam #3/Red Wing (Sta. #216822 + #216817)	34.52	31.17	+10%
Carnelian-Marine	St. Croix	Stillwater (Sta. #218037)	30.05	34.62	-13%
Carver	Minnesota	Chanhassen/Chaska (Sta. # 211448 + #21465)	27.09	31.65	-14%
Credit	Minnesota	Shakopee (70 115N 22W 14)	32.91	32.81	0
Crow	Mississippi	Rockford (Sta. #217020 + Sta. 119N 24W 7)	29.75	30.03	0
Eagle	Minnesota	Shakopee (70 115N 22W 14)	32.91	32.81	0
Elm	Mississippi	New Hope / MSP airport (Sta. #215838 + #215435)	32.76	34.34	-5%
Fish	Mississippi	St. Paul/St. Paul U of M/Vadnais Lake (Sta. #217377 + #218450 +#218477)	30.37	34.2	-11%
Minnehaha	Mississippi	MSP airport (Sta. #215435)	27.39	30.96	-11%
Nine Mile	Minnesota	MSP airport (Sta. #215435)	27.39	30.96	-11%
Rice	Mississippi	Vadnais Lake/ St. Paul/St. Paul UofMn (Sta. #218477 +#217377 +218450)	31.11	33.47	-7%
Riley	Minnesota	Chaska/Chanhassen (Sta. #211465 & #211448)	27.74	31.89	-13%
Rum	Mississippi	St. Francis (Sta. #211390)	35.32	35.39	0%
Sand	Minnesota	Jordan (Sta. # 214176)	34.81	32.60	+6%
Scott Cty Ditch 10	Minnesota	Jordan (Sta. # 214176)	34.81	32.60	+6%
Silver	St. Croix	Stillwater (Sta. #218037)	30.05	34.62	-13%
South Fork Crow River	Mississippi	Waconia Twp (Sta. 10 116N 25W 2)	38.79	33.10	+15%
Valley	St Croix	Stillwater (Sta. #218037)	30.05	34.62	-13%
Vermillion	Mississippi	Hastings Dam (Sta. #213567)	32.95	32.73	0
Willow	Minnesota	Shakopee (70 115N 22W 14)	32.91	32.81	0
West Raven	Minnesota	Jordan (Sta. # 214176)	34.81	32.60	+6%

Table 4. 2004 Macroinvertebrate Metrics

River	Date	Total Taxa	Mean Tolerance Value	Total EPT* Taxa	% EPT* Taxa	% EPT* Individuals	Total Diptera Taxa	% Diptera Taxa	% Diptera Individuals	% Chironomidae Individuals
Battle Creek	10/11/04	24	5.5	2	8	39	17	71	30	18
Bevens Creek - Lower	10/17/04	35	4.9	9	26	41	19	54	41	35
Bluff Creek	10/17/04	29	5.4	6	21	11	15	52	31	29
Browns Creek	10/07/04	45	4.7	12	27	60	22	49	14	10
Credit River	10/17/04	49	4.9	8	16	23	29	59	36	32
Eagle Creek	10/16/04	20	5.0	1	5	81	15	75	9	4
Fish Creek	10/11/04	28	5.4	4	14	27	17	61	10	9
Minnehaha Creek	10/11/04	26	5.5	6	23	17	15	58	79	76
Sand Creek	10/17/04	38	4.7	14	37	59	20	53	28	20
Silver Creek	10/07/04	35	4.7	9	26	32	18	51	45	39
Vermillion River	10/15/04	33	4.3	12	36	71	15	45	16	5
Valley Creek	10/07/04	48	4.9	15	31	39	25	52	10	9
* EPT = Ephemeroptera, Plecoptera, and Trichoptera										

Table 5. Hilsenhoff Biotic Index*

River	Date	HBI*	Water Quality	Degree of Organic Pollution
Battle Creek	10/11/04	4.62	Good	Some organic pollution
Bevens Creek – Lower	10/17/04	4.41	Very Good	Slight organic pollution
Bluff Creek	10/17/04	4.87	Good	Some organic pollution
Browns Creek	10/07/04	3.74	Very Good	Slight organic pollution
Credit River	10/17/04	4.91	Good	Some organic pollution
Eagle Creek	10/16/04	4.21	Very Good	Slight organic pollution
Fish Creek	10/11/04	4.07	Very Good	Slight organic pollution
Minnehaha Creek	10/11/04	5.83	Fair	Fairly significant organic pollution
Sand Creek	10/17/04	4.34	Very Good	Slight organic pollution
Silver Creek	10/07/04	4.26	Very Good	Slight organic pollution
Vermillion River	10/15/04	2.10	Excellent	No apparent organic pollution
Valley Creek	10/07/04	4.12	Very Good	Slight organic pollution
* Hilsenhoff Biotic Index (HBI) modified to include non-arthropod taxa				

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Table 6. 2004 MPCA 303(d) Impaired Waters List

Stream Reach	Yr	Affected use	Pollutant or stressor	TMDL start/ completion
Battle Creek; Battle Cr Lk to Mississippi R	02	Aquatic life	Impaired biota	2008//2015
Bevens Creek; Silver Cr to Minnesota R	02	Swimming	Fecal coliform	2005//2008
Bevens Creek; Silver Cr to Minnesota R	02	Aquatic life	Turbidity	2005//2009
Bevens Creek; Headwaters (Washington Lk) to Silver Cr	02	Aquatic life	Chloride	2005//2007
Bevens Creek; Headwaters (Washington Lk) to Silver Cr	02	Swimming	Fecal coliform	2005//2008
Bevens Creek; Headwaters (Washington Lk) to Silver Cr	02	Aquatic life	Turbidity	2005//2009
Bluff Creek; Headwaters to Minnesota R	02	Aquatic life	Turbidity	2005//2009
Browns Creek; Headwaters to trout stream portion	02	Aquatic life	Impaired biota	2004//2008
Cannon River; Northfield Dam to Lk Byllesby inlet	98	Aquatic life	Mercury[1]FCA	2002//2015
Carver Creek; Headwaters to Minnesota R	02	Swimming	Fecal coliform	2005//2009
Carver Creek; Headwaters to Minnesota R	02	Aquatic life	Turbidity	2005//2009
Credit River; Headwaters to Minnesota R	02	Aquatic life	Turbidity	2006//2010
Crow River; South Fk Crow R to Mississippi R	02	Aquatic life	Impaired biota	2004//2011
Crow River; South Fk Crow R to Mississippi R	02	Aquatic life	Turbidity	2004//2009
Crow River, South Fk; Buffalo Cr to Crow R	02	Aquatic life	Impaired biota	2005//2012
Crow River, South Fk; Buffalo Cr to Crow R	98	Aquatic life	Mercury[1]FCA	2002//2015
Crow River, South Fk; Otter Cr to Buffalo Cr	98	Aquatic life	Mercury[1]FCA	2002//2015
Elm Creek, Headwaters to Mississippi R	02	Aquatic Life	Low Oxygen[2,5]	2008//2012
Nine Mile Creek; Headwaters to Minnesota R	02	Aquatic life	Turbidity	2005//2009
Riley Creek; Riley Lk to Minnesota R	02	Aquatic life	Turbidity	2005//2009
Rum River; Trott Bk to Mississippi R	98	Aquatic life	Mercury[1]FCA	2002//2015
Rum River; Cedar Cr to Trott Bk	98	Aquatic life	Mercury[1]FCA	2002//2015
Rum River; Seelye Bk to Cedar Cr	98	Aquatic life	Mercury[1]FCA	2002//2015
Rum River; Stanchfield Cr to Seelye Bk	98	Aquatic life	Mercury[1]FCA	2002//2015
Sand Creek; Porter Cr to Minnesota R	02	Aquatic life	Turbidity	2006//2010
Shingle Creek; Headwaters to Mississippi R	98	Aquatic life	Chloride	2002//2006
Vermillion River/Vermillion Slough; Hastings Dam to Mississippi R	98	Aquatic life	PCB FCA	2002//2015
Vermillion River/Vermillion Slough; Hastings Dam to Mississippi R	94	Aquatic life	Turbidity	2001//2005
Vermillion River; S Br Vermillion R to the Hastings Dam	96	Swimming	Fecal coliform	1999//2002
Vermillion River; S Br Vermillion R to the Hastings Dam	98	Aquatic life	PCB FCA	2002//2015
Vermillion River; Below trout stream portion to South Br Vermillion R	94	Aquatic life	Fecal coliform	1999//2002

Vermillion River; Headwaters to trout stream portion	98	Aquatic life	PCB FCA	2002//2015
Vermillion River; Trout stream portion	98	Aquatic life	PCB FCA	2002//2015
Vermillion River/Vermillion Slough; Hastings Dam to Mississippi R	98	Aquatic life	Mercury[1]FCA	2002//2015
Vermillion River; S Br Vermillion R to the Hastings Dam	98	Aquatic life	Mercury[1]FCA	2002//2015
Vermillion River; Below trout stream portion to South Br Vermillion R	98	Aquatic life	Mercury[1]FCA	2002//2015
Vermillion River; Headwaters to trout stream portion	98	Aquatic life	Mercury[1]FCA	2002//2015
Vermillion River; Trout stream portion	98	Aquatic life	Mercury[1]FCA	2002//2015

* The information in Table 7 is a subset of the MPCA 2004 303(d) impaired waters list.

Notes:

1] Impacts of mercury are mainly regional in expression, so the initial approach will be to complete regional or statewide mercury TMDL reports. This approach could change based on basin planning activities. U.S. EPA Region 5 understands there must be a federal responsibility for the national & international air-borne component of these TMDL reports. "FCA" means Fish Consumption Advisory.
2] Low Oxygen & excess ammonia TMDL report scheduling is dependent upon low flow conditions. The draft schedule may be changed accordingly.
5] When excess ammonia or low dissolved oxygen concentrations is tied to excess nutrients in the watershed, the recommended schedule may have to be lengthened accordingly.

DISCUSSION

A discussion of both the 2004 and historical data records follows. Water quality parameters to be discussed include flow volume, total phosphorus, total dissolved phosphorus, total suspended solids, total Kjeldahl nitrogen, nitrate, and other minor miscellaneous monitoring data. Discussion is divided into two general sections:

- comparison of streams based on 2004 and historical pollutant loads and concentrations as calculated by FLUX.
- identification of potential trends in stream volume or water quality

Several points should be considered while reviewing the data analyses. The total annual precipitation measured at the Minneapolis/St. Paul International Airport in 2004 was 27.39 inches, as compared to the average annual precipitation of 29.41 inches for the climate-normal period of 1971 – 2000. As discussed earlier in the report, analysis of data from meteorological stations throughout the Metro Area indicates precipitation is also spatially variable (Table 3). Therefore each stream was analyzed using data from the nearest meteorological station.

2004 and Historical Average Stream Data Comparisons

The 2004 hydrographs in Appendix A show that the Cannon River had the greatest total annual flow volume (32 billion ft^3), followed by the Crow River (25 billion ft^3), the Rum River (25 billion ft^3) and the South Fork Crow River (14 billion ft^3). The watershed area of the Crow, Rum, Cannon, and South Fork Crow River Rivers are 2,622, 1,522, 1, 340 and 1,135 square miles respectively. These rivers are the four largest rivers in this analysis. Fish Creek and Silver Creek had the lowest total annual flow volume. Fish and Silver Creeks had total annual flow volumes of 93 million ft^3 and 39 million fts^3, respectively. Watershed area and rank for Fish and Silver Creeks are 5.1 square miles (26^{th} largest watershed) and 7.5 square miles (24^{th} largest watershed). Total flow volume quite clearly is strongly influenced by watershed area in these streams.

The runoff coefficient was determined by dividing the total annual flow volume by the area and by precipitation. When calculating runoff coefficients, the assumption was made that most of the streams had little input from groundwater. The 2004 and historic average runoff coefficients for Metro Area streams in the monitoring network are presented in Figure 4. This parameter indicates the proportion of annual precipitation over the watershed that reaches the stream as stormwater runoff. A high runoff coefficient indicates a watershed with much impervious area or a large network of agricultural drainage tiles and ditches – characteristics that prevent infiltration of precipitation and promote water delivery to the stream. Runoff coefficients for the streams except for Eagle and Valley Creeks ranged from 0.06 – 0.38. Runoff coefficients for Eagle and Valley Creeks were 3.01 and 0.58, respectively. Runoff coefficients will be incongruously high for streams with a large inflow of groundwater such as Eagle and Valley Creeks.

The 2004 and historical average data for total phosphorus, total suspended solids, total dissolved phosphorus, total Kjeldahl nitrogen, and nitrate were plotted for comparison of the streams. Flow-weighted mean concentrations (as calculated using FLUX) are presented in Figure 4 and water and pollutant areal yield (total flow volume or total mass load divided by watershed area) are presented in Figure 5.

The Vermillion River had the highest 2004 and historical flow-weighted mean concentration for total dissolved phosphorus. The Empire Wastewater Treatment Plant is the greatest influence on the concentration. Sand Creek, Bevens Creek - Upper and Lower, Bluff Creek, Crow River, South Fork Crow River, Scott County Ditch 10 and West Raven Creek also each have relatively high flow-weighted mean concentrations of total dissolved phosphorus ranging from 0.166-0.518 mg/l. The high levels for these streams are likely due to the agricultural nature and size of their watersheds. Valley Creek, Silver Creek, Eagle Creek, and Carnelian Marine Outlet had low 2004 and historical annual total dissolved phosphorus concentrations ranging from 0.012-0.030 mg/l, probably due to the small watershed size and relatively rural and urban transitional nature of their watersheds.

Bevens Creek - Upper and Lower, and Sand Creek had the highest 2004 (2.33-3.01mg/l) and historical (2.28-3.06 mg/l) flow-weighted mean concentrations of total Kjeldahl nitrogen. West Raven Creek also had relatively high flow-weighted mean concentrations of total Kjeldahl nitrogen for 2004 (2.43 mg/l). There is no historic data for this parameter at the West Raven Creek site. Bevens Creek - Upper and Lower, and Scott County Ditch 10 had the highest 2004 (7.9-15.9 mg/l) and historical (7.9-12.3 mg/l) flow-weighted mean concentrations for nitrate. The higher nitrate and total Kjeldahl nitrogen concentrations are likely due to the agricultural nature of these watersheds.

The Vermillion River, Bevens Creek – Upper and Lower, Riley Creek, Sand Creek and West Raven had the highest total phosphorus flow-weighted mean concentrations, ranging from 0.60-0.64 mg/l in 2004. The annual average total phosphorus concentration in the Empire Wastewater Treatment Plant effluent discharge to the Vermillion River is 4.8 mg/l, thereby serving as a major source of phosphorus to the river. The Empire Wastewater Treatment Plant effluent will be diverted from the Vermillion River and discharged directly into the Mississippi River within the next few years. Carnelian Marine Outlet, Eagle, Valley, Minnehaha and Silver Creeks had the lowest total phosphorus flow-weighted mean concentrations, ranging from 0.02-0.09 mg/l.

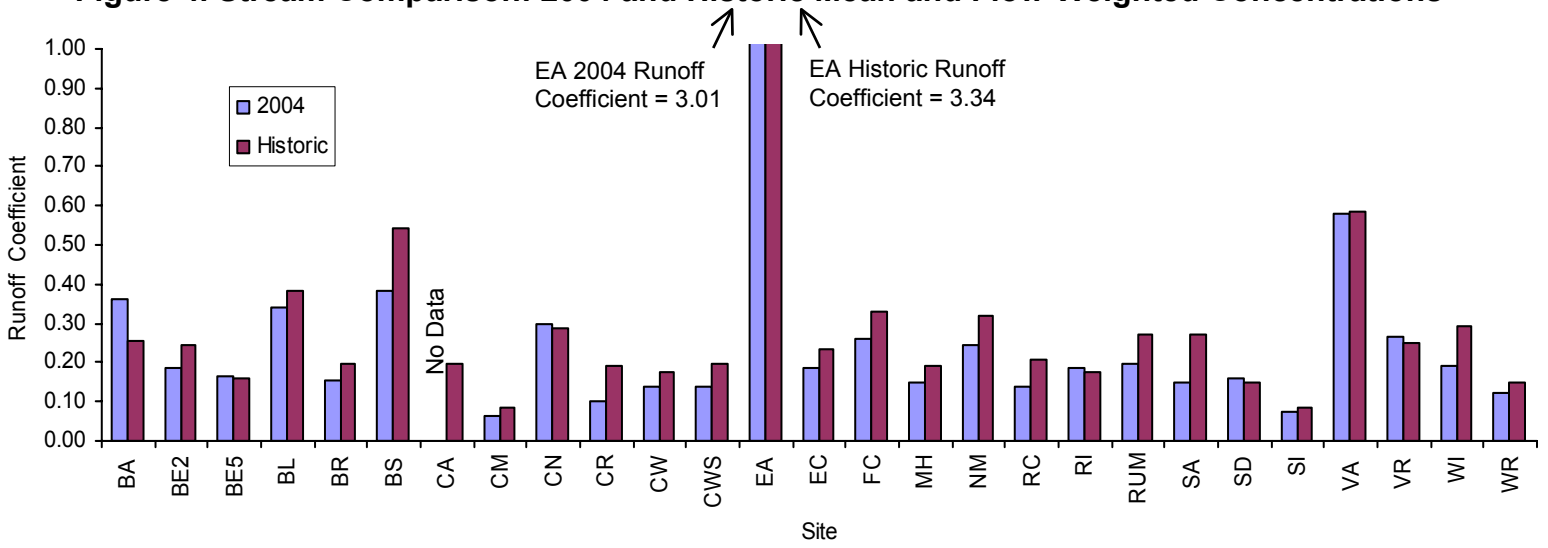
Riley Creek, Bluff Creek, Bevens Creek - Upper and Lower, West Raven Creek and Sand Creek had the highest 2004 flow-weighted mean concentrations of total suspended solids ranging from 237-639 mg/l (2004 flow data was not available for Carver Creek). Riley Creek, Sand Creek, Bluff Creek, Bevens Creek - Upper and Lower, and Carver Creek had the highest historical flow-weighted mean concentrations of total suspended solids ranging from 216-434 mg/l. The higher total suspended solids concentrations are likely due to the agricultural nature of these watersheds. Carnelian Marine Outlet, Eagle Creek, Elm Creek, Minnehaha Creek, Rum River, Silver Creek and Valley Creek had the lowest 2004 flow-weighted mean concentrations of total suspended solids ranging from 2-23 mg/l.

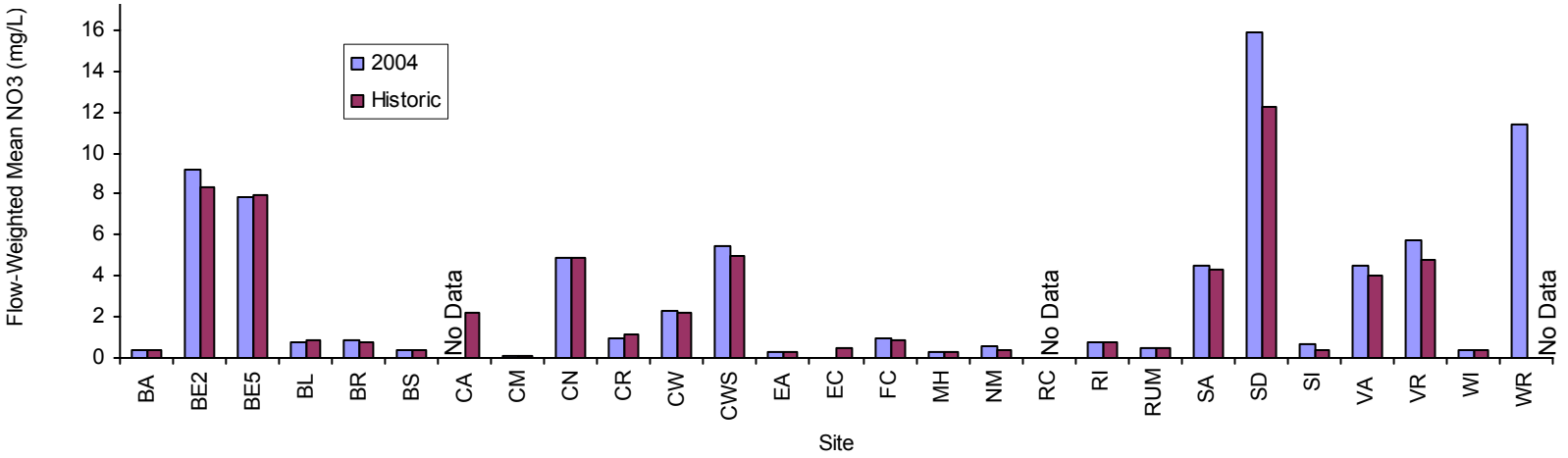
Figure 5 illustrates the water and pollutant yields of each watershed. The water yield (total annual flow divided by the watershed area) standardizes flow volumes so watershed area is excluded from analysis of the annual volumes in each stream. Thus, stream water yields can be directly compared to one another, thereby providing a general indication of watershed characteristics, precipitation variability, and groundwater effects. Water yield is expressed in centimeters. In 2004, Eagle Creek had the greatest water yield (251.6 centimeters), followed by Valley Creek (44.3 centimeters), Battle Creek (28 centimeters), Bassett Creek (26.6 centimeters), Cannon River (26.1 centimeters), Bluff Creek (23.3 centimeters) and the Vermillion River (22.1 centimeters). Flows in Eagle and Valley Creeks are strongly augmented by groundwater inputs, thus increasing the water yield. Silver Creek (5.7 centimeters), Carnelian Marine Outlet (4.9 centimeters) and Credit River (8.2 centimeters) had the lowest water yields in 2004.

The pollutant yield is calculated by dividing the total annual pollutant load by the watershed area of the stream, and is expressed in kg/ha. This analysis standardizes annual loads by removing the effect of the watershed size. A small stream may have a relatively low annual total phosphorus load, but may have a high yield of total phosphorus per hectare, indicating poor management of nutrients within the watershed. The majority of the Minnesota River tributaries (Bevens Creek - Upper and Lower, Bluff, Riley, and Sand Creeks) have the largest per-hectare total suspended solids and nutrients yields. These watersheds are generally agricultural or rural and urban transitional in nature. Eagle Creek also has a relatively high total suspended solids yield.

Bevens Creek - Upper and Lower, Bluff Creek, Eagle Creek and the Vermillion River have the highest total phosphorus yields ranging from 0.88-2.22 kg/ha. Bevens Creek - Upper and Lower, Cannon River, Scott County Ditch 10, Valley Creek, Vermillion River and West Raven Creek have the highest nitrate yields ranging from 11.62-22.59 kg/ha. All of these watersheds except for Eagle Creek are primarily agricultural in nature. Eagle Creek is mostly urban/transitional.

Figure 4. Stream Comparison: 2004 and Historic Mean and Flow-Weighted Concentrations





BA = Battle Creek	CA = Carver Creek	EA = Eagle Creek	RI = Riley Creek	VR = Vermillion River
BE2 = Bevens Creek, Lower	CM = Carnelian Marine Outlet	EC = Elm Creek	RUM = Rum River	WI = Willow Creek
BE5 = Bevens Creek, Upper	CN = Cannon River	FC = Fish Creek	SA = Sand Creek	WR = West Raven Creek
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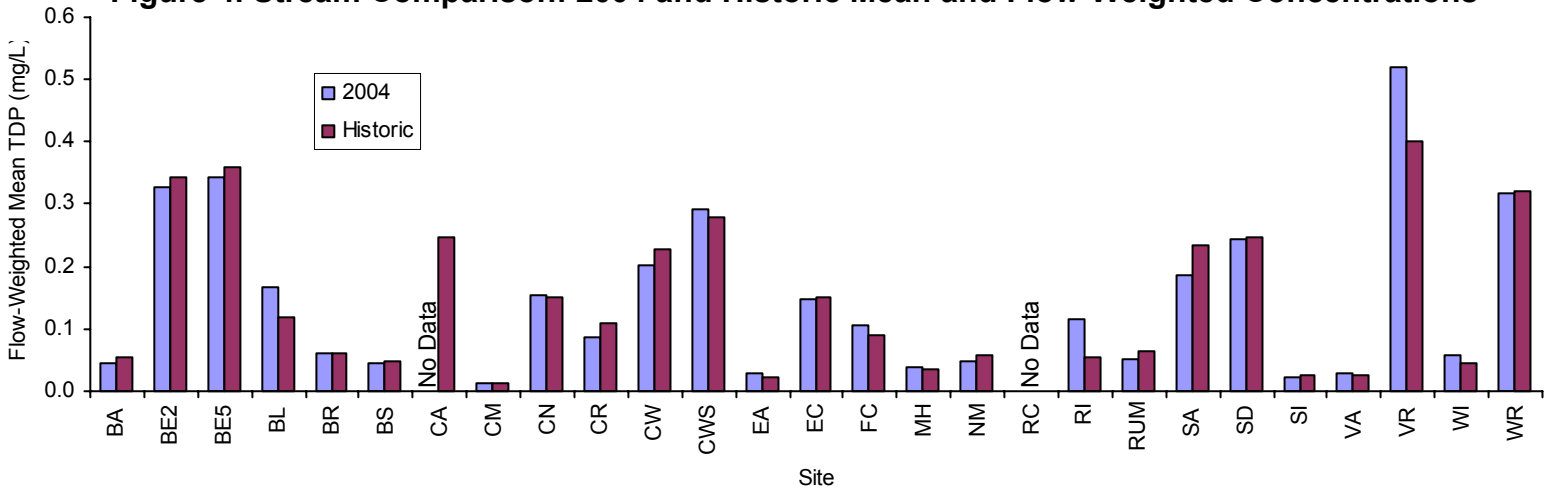

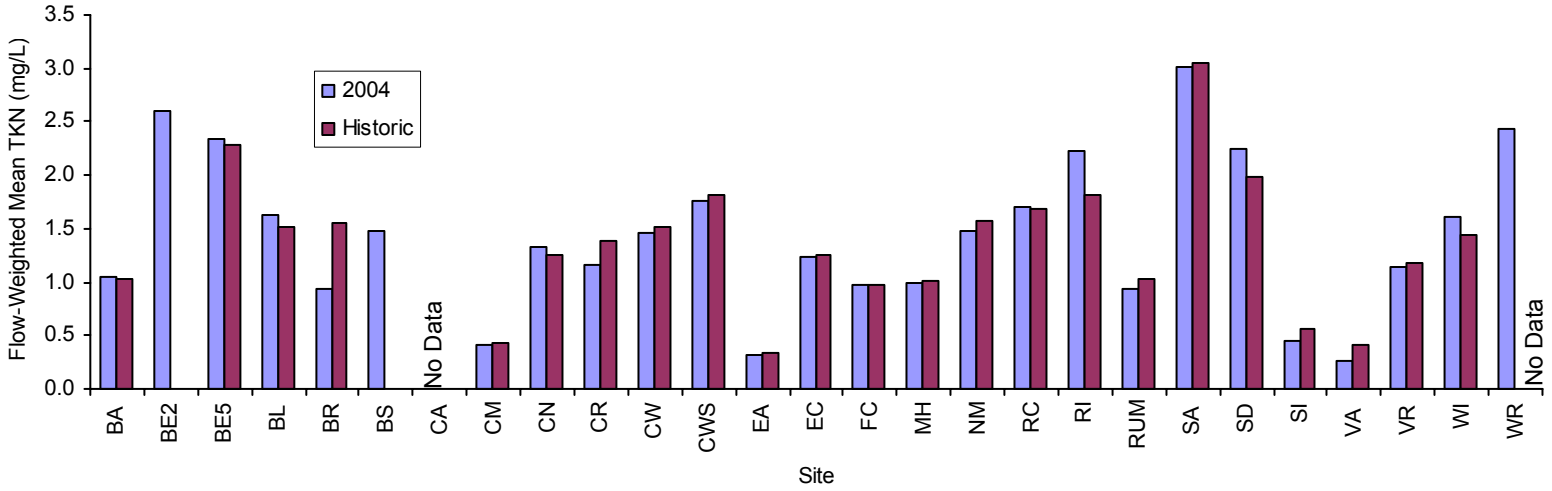

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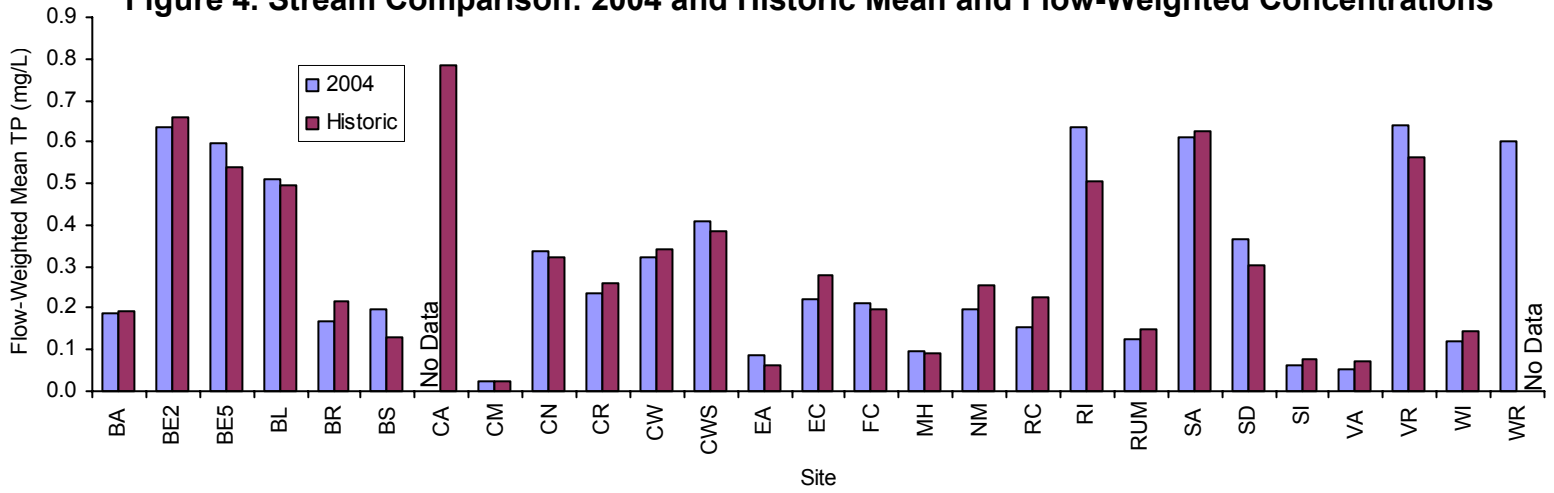

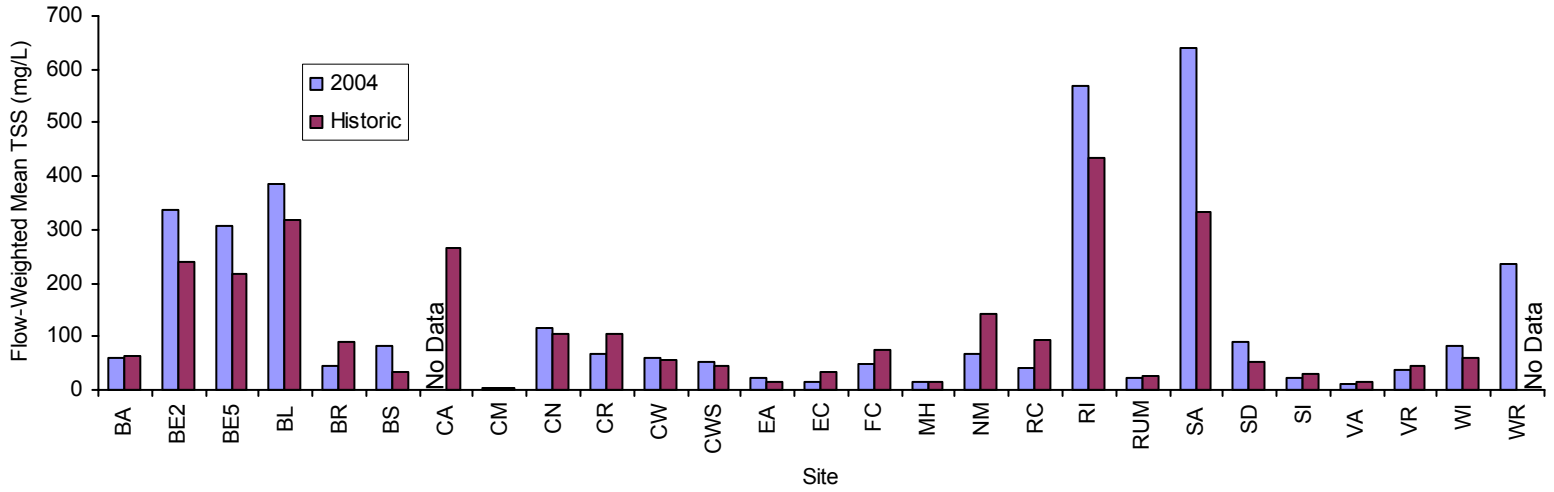

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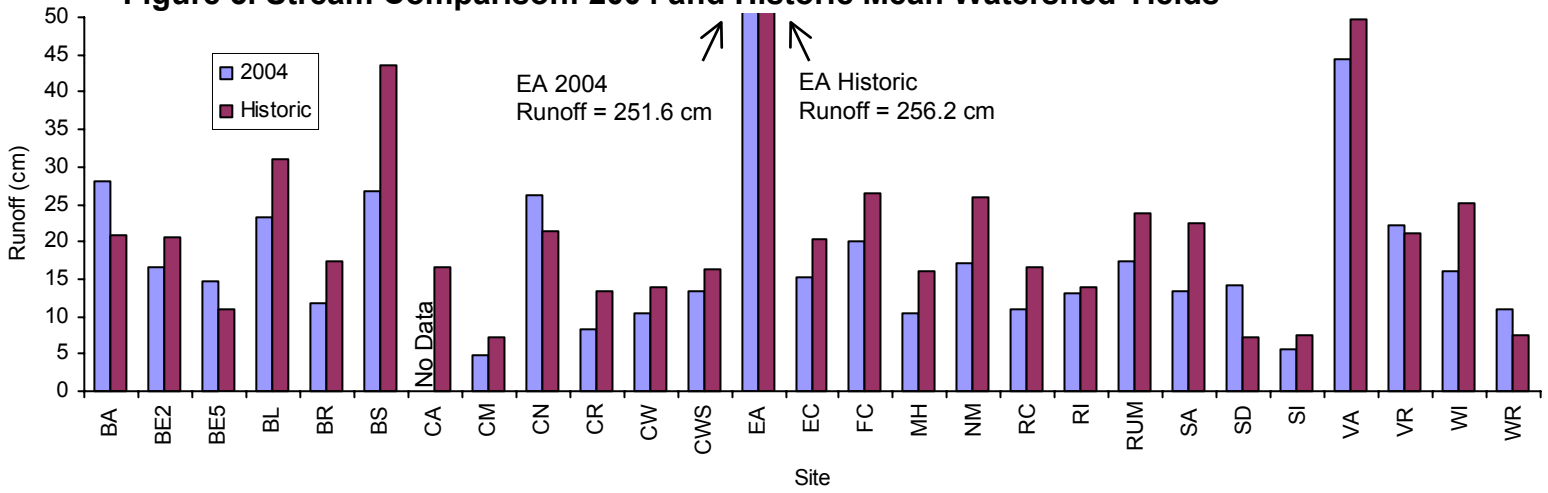
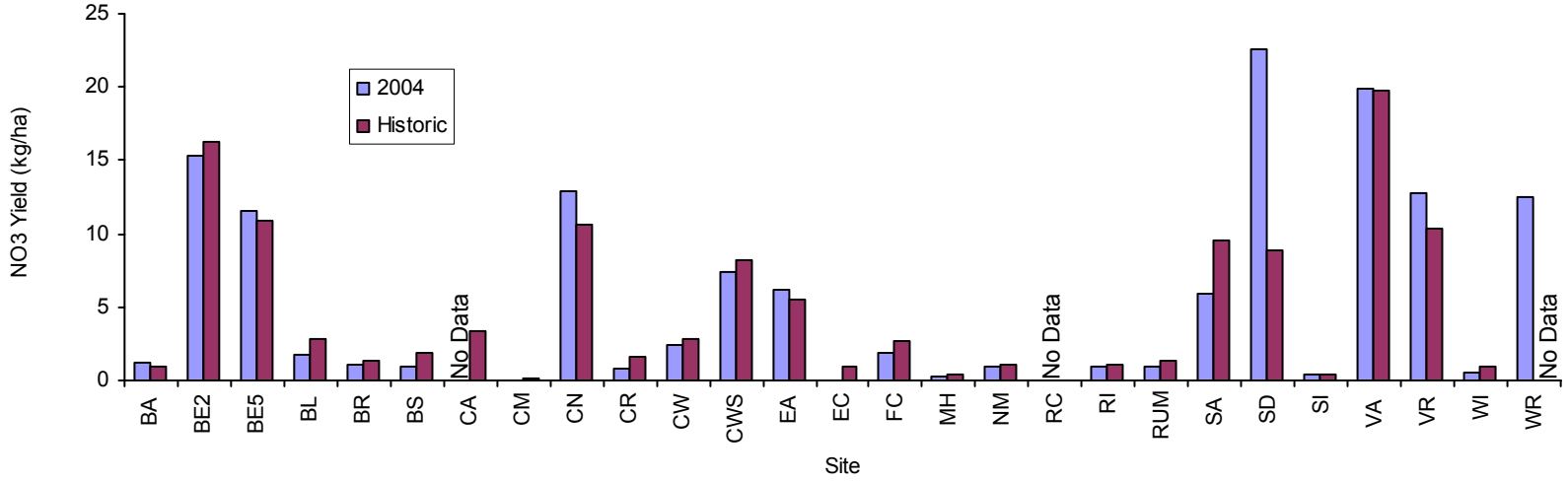
Figure 5. Stream Comparison: 2004 and Historic Mean Watershed Yields





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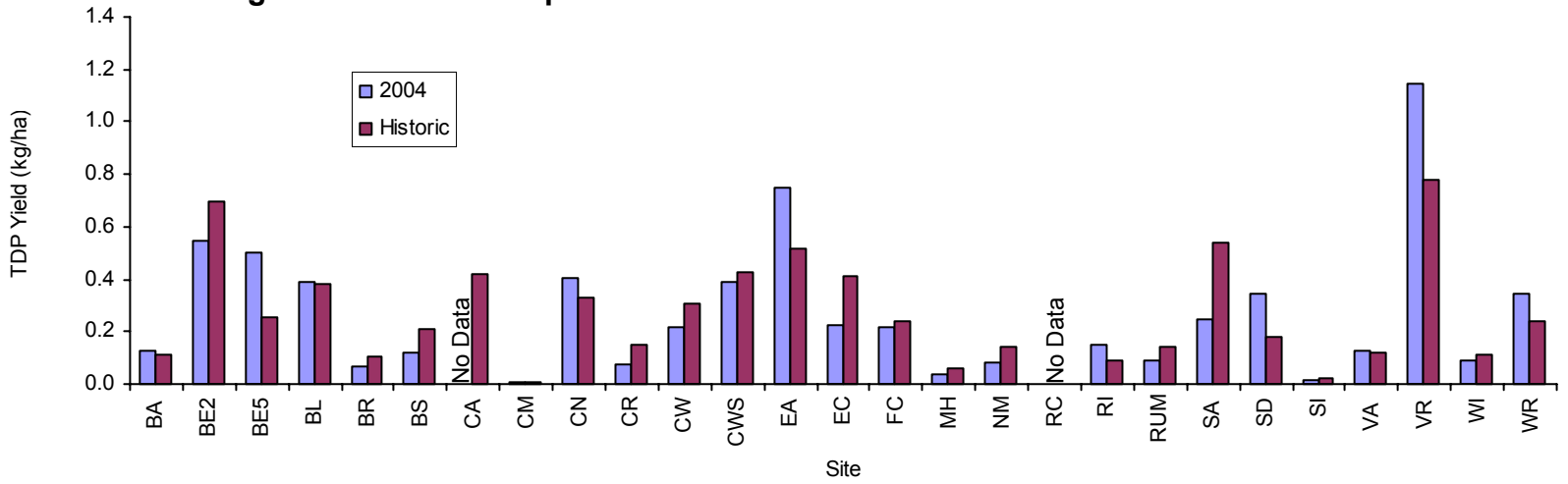

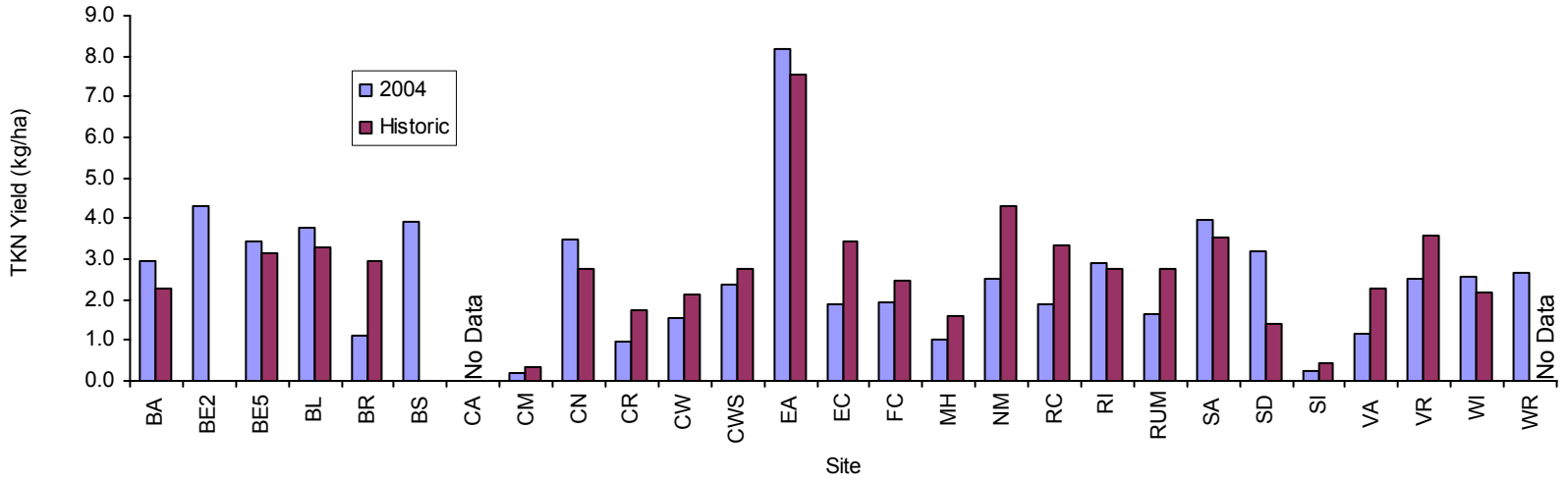

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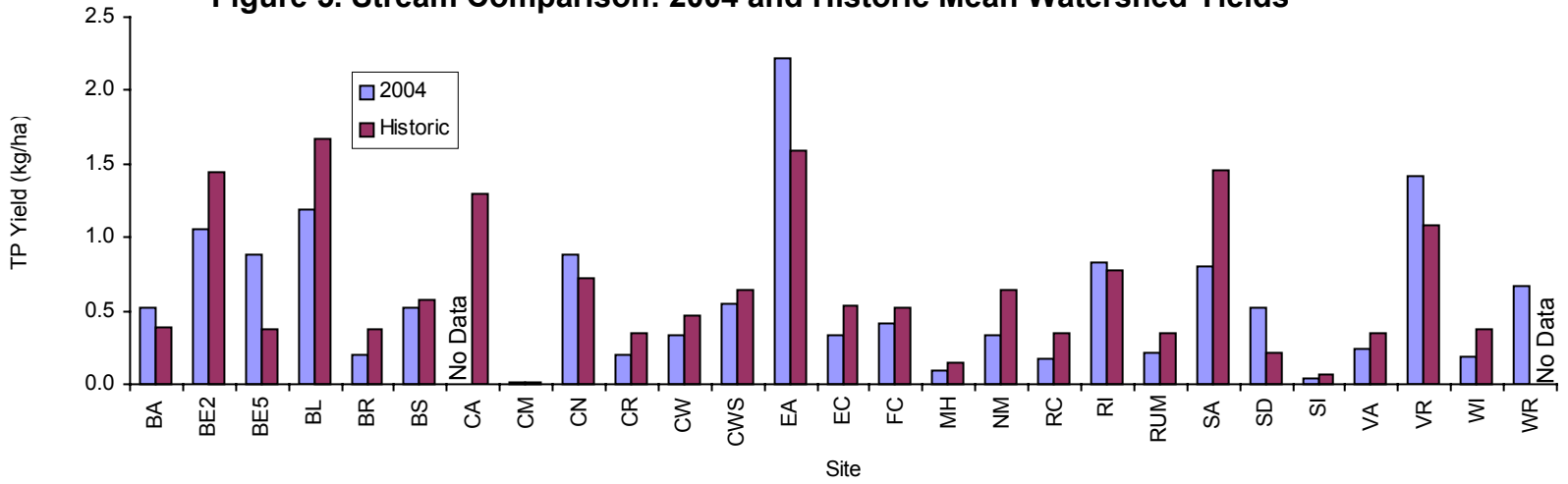

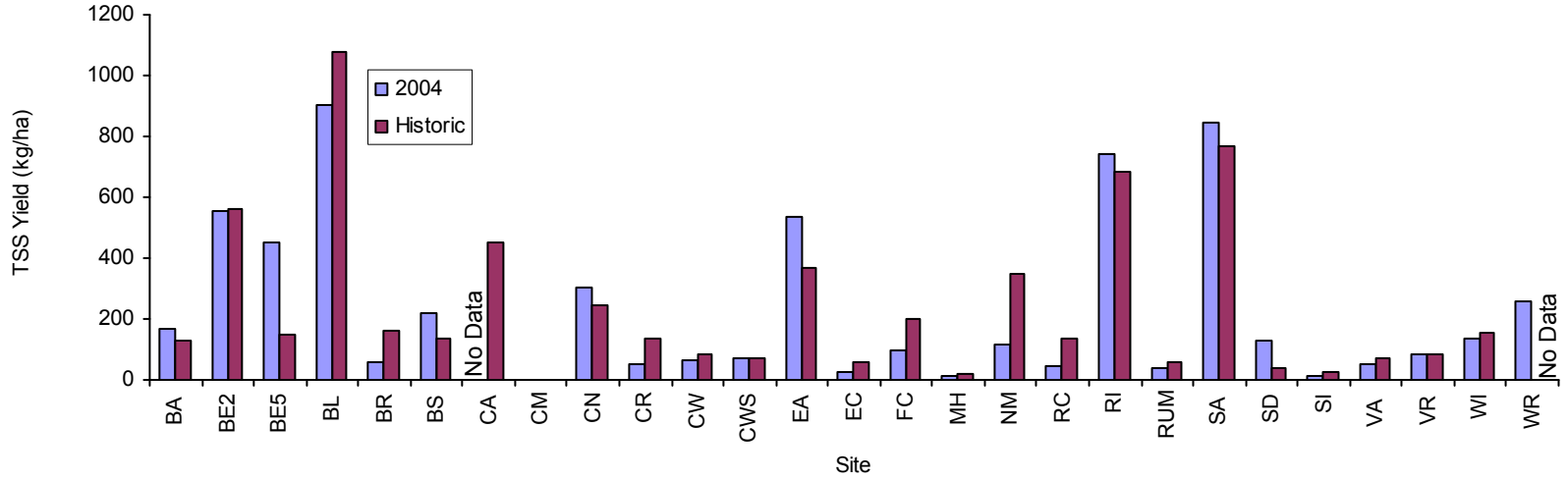

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Trend Analysis

Trend analysis was performed on annual loads and flow-weighted mean concentrations of pollutants (calculated using FLUX for each stream), using the Kendall Tau test ($p \leq 0.05$) (SPSS version 10.0). The Kendall Tau test was appropriate for this analysis, as it does not require normal distribution of data. Correlation coefficients (tau-b) for the Kendall Tau test range in value from -1 (a perfect negative relationship) to +1 (a perfect positive relationship). A value of 0 indicates no linear relationship. Correlation coefficients significant at the 0.05 (95% certainty) level are identified with a single asterisk, and those significant at the 0.01 (99% certainty) level are identified with two asterisks. Therefore the closer the coefficient is to 1 or –1, the stronger the indication of possible trend.

The stream monitoring program administered by the Metropolitan Council has been designed to collect data necessary to assess annual pollutant loads delivered by each stream to the recipient main stem river. While the stream monitoring program was not designed to assess trends, trend analysis may be performed on the annual results.

The Kendall Tau test did identify some potential trends (Table 7). However, identification of a potential trend may not mean that an actual trend exists. Presence of supplemental evidence helps to explain changes in water quality or quantity. For future versions of this report, local governmental units will be surveyed regarding changes in watershed land use or installation of BMP or restoration projects. Determination of changes in watershed land use practices or policies and annual reassessment of monitoring data will be necessary to help explain the trends.

Evidence exists to explain trends in Nine Mile Creek water quality. The Nine Mile Creek Watershed District completed the Lower Valley Project around 1993. This project stabilized scarps and restored streambed stability in the Nine Mile Creek segment just south of Old Shakopee Road to just upstream of the stream outlet to the Minnesota River. It is likely that concentrations of TSS, TP, and TDP have decreased as a result of the stabilization project.

Table 7. Results of Kendall Tau Trend Analysis

Site	Variable	Tau-b	N	Sig. (2-tailed)	Confidence
Bevens Creek – Lower	TP mg/l	-.600(**)	15	0.002	Good
Bluff Creek	NO3 mg/l	-.692(**)	13	0.001	Good
Bluff Creek	TP kg	-.436(*)	13	0.038	Fair
Elm Creek	NO3 mg/l	.667(*)	9	0.012	Fair
Elm Creek	TSS mg/l	-.683(**)	16	0.000	Good
Nine Mile Creek	NO3 kg	.451(*)	14	0.025	Fair
Nine Mile Creek	NO3 mg/l	.451(*)	14	0.025	Fair
Nine Mile Creek	TDP mg/l	-.560(**)	14	0.005	Good
Nine Mile Creek	TP mg/l	-.692(**)	14	0.001	Good
Nine Mile Creek	TSS mg/l	-.802(**)	14	0.000	Good
Sand Creek	TDP kg	-.448(*)	15	0.020	Good
Sand Creek	TP mg/l	-.505(**)	15	0.009	Good
Sand Creek	TSS mg/l	.467(*)	15	0.015	Good
Vermillion River	NO3 mg/l	.714(*)	7	0.024	Fair
Vermillion River	TDP kg	.644(**)	10	0.009	Good

* Only results for streams showing a potential trend are reported in the table.

CONCLUSIONS

This report has presented descriptive water quality data assessments for 27 sites on 25 streams: Bassett, Battle, Bevens Creek - Lower, Bevens Creek - Upper, Browns, Bluff, Carver, Eagle, Elm, Fish, Minnehaha, Nine Mile, Rice, Riley, Sand, Silver, Valley and Willow Creeks, Cannon, Credit, Crow, South Fork Crow River, Rum and Vermillion Rivers, and Carnelian-Marine Outlet, Scott County Ditch 10, and West Raven Stream.

Comparisons of the 2004 flow-weighted mean concentrations indicate that:

- The Vermillion River delivered the highest flow-weighted mean concentrations of total phosphorus and nitrate to the Mississippi River.
- Sand Creek delivered the highest flow-weighted mean concentrations of total suspended solids and Scott County Ditch 10 delivered the highest flow-weighted mean concentrations of nitrate to the Minnesota River.
- The St. Croix Tributaries had comparatively low flow-weighted mean concentrations of total suspended solids, total phosphorus, and nitrate compared to the other streams monitored.
- The Vermillion River flow and pollutant load is affected by effluent discharge from the Empire Wastewater Treatment Plant.

Comparisons of 2004 watershed yields indicate that:

- Bluff, Sand and Riley Creeks had the highest pollutant yields (kg/ha) of total suspended solids.
- Bevens Creek - Upper and Lower, Bluff Creek, Eagle Creek and the Vermillion River had the highest pollutant yields (kg/ha) of total phosphorus.
- Scott County Ditch 10, Valley Creek, and Bevens Creek - Upper and Lower, Cannon River, Vermillion River and West Raven Stream had the highest pollutant yields (kg/ha) of nitrate.
- In general, the streams tributary to the Minnesota River had the greatest total suspended solids, total phosphorus and nitrate yields (kg/ha) of the 27 sites assessed.
- Valley Creek showed low pollutant yields except for nitrate, which is likely influenced by substantial groundwater discharge to the creek.

RECOMMENDATIONS

The Metropolitan Council's stream monitoring program collects not only daily flow rate but also a wide range of data on chemical, physical and biological parameters. This report shows that data collected since1989 provides a detailed picture of water quality in the Metro Area streams. The data collected will support management decisions made to improve water quality in all of the Metro Area streams.

The following recommendations are made to strengthen the Metropolitan Council's stream monitoring program and to provide beneficial data for both the Metropolitan Council's Pollutant Load project and the MPCA's Total Maximum Daily Load Program.

1. The Metropolitan Council's stream monitoring program currently focuses on collection and assessment of chemical and physical data. This year the Metropolitan Council increased its macroinvertebrate sampling program (macroinvertebrate data have been obtained for 12 streams since 2001, with genus-level ID beginning in 2004). Macroinvertebrate data are needed to assess the ecological health of these streams. Macroinvertebrate samples should be collected and assessed to at least the genus level. Samples should be collected at least twice annually at all sites for comparison with standard biotic indices such as the Hilsenhoff Biotic Index and/or the Shannon-Wiener Diversity Index.

2. Metropolitan Council staff should conduct a survey of watershed districts, soil and water conservation districts, counties and cities to identify changes in land use, construction of major projects, or stream bank erosion within watersheds that may affect, either positively or negatively, the quality of the stream. The completion date of specific projects should be noted to aid in trend analysis interpretation.

3. Metropolitan Council staff are currently designing a set of protocols to ensure continued quality assurance of sample collection and handling (stream monitoring QAPP is complete and available on the web), prompt reviewing and proofing of data, and prompt availability of final stream data for use by other agencies and the public. It is recommended that these protocols be instituted as soon as completed during 2006.

4. Metropolitan Council staff need to develop a grading system similar to the lake monitoring grading system to aid in quick and easy determination of the condition of area streams.

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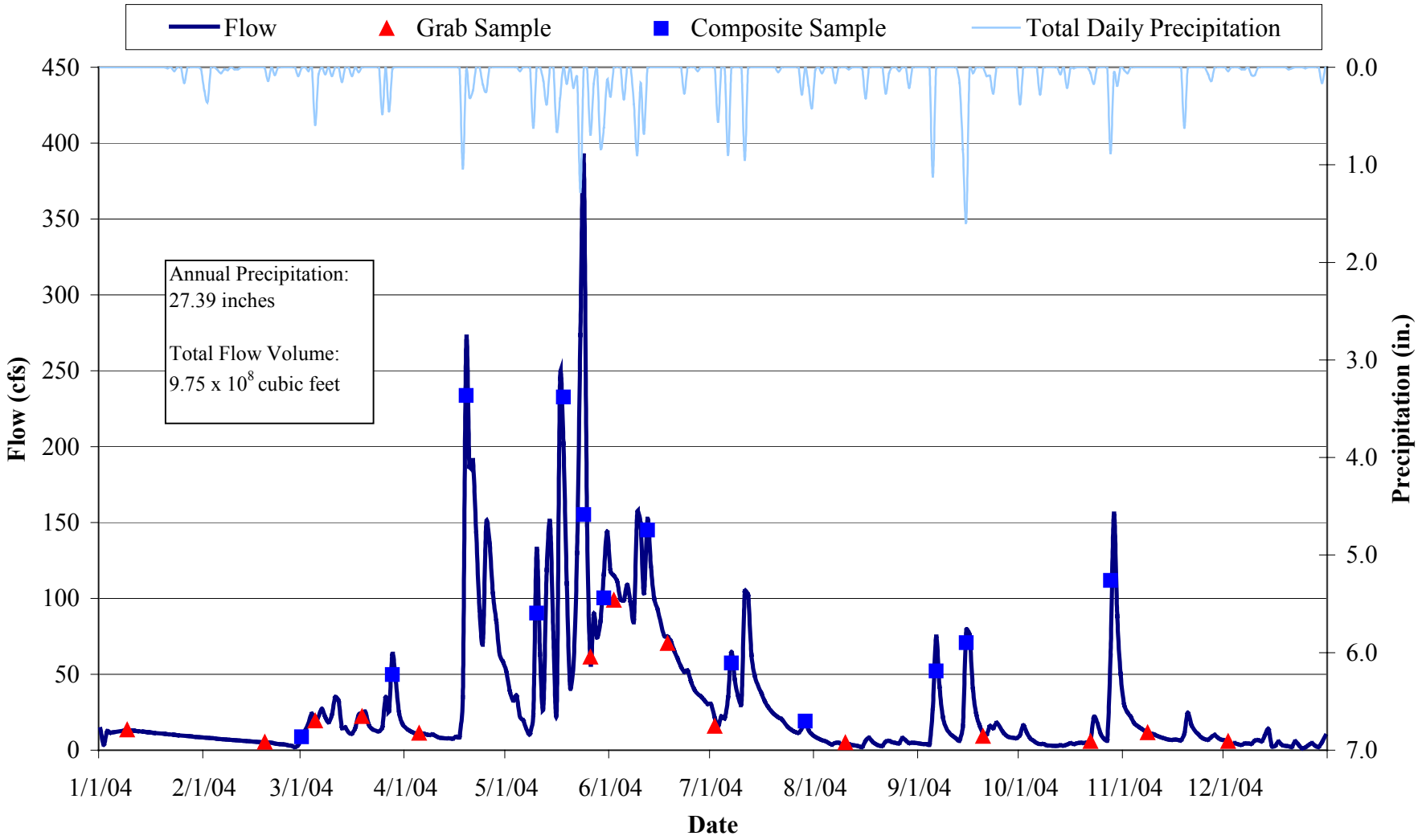
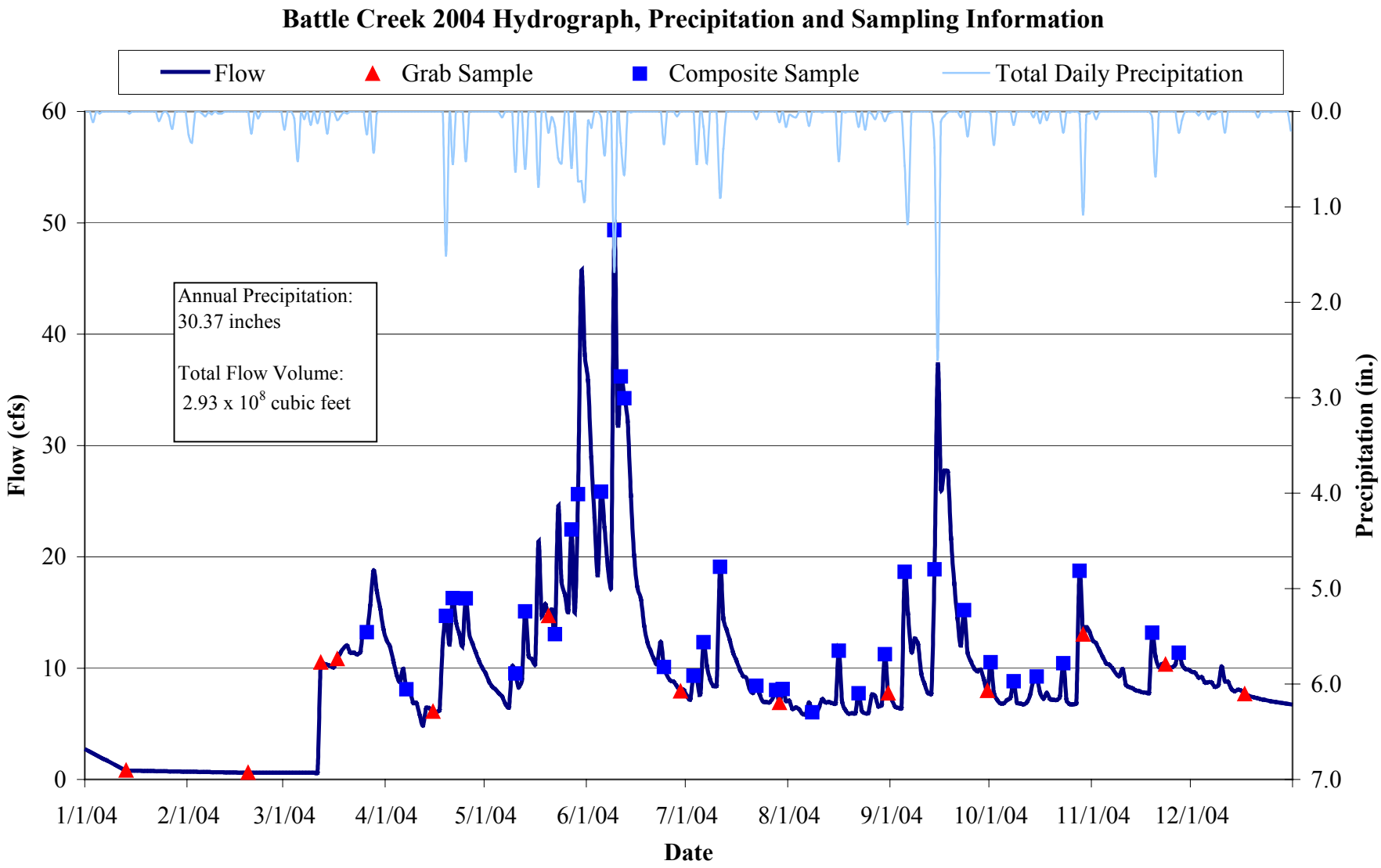
APPENDIX A: HYDROGRAPHS

Annual hydrographs illustrate the seasonal variations in flow rate and peak flows characteristic of a stream. Flow variations are due to annual snow depth; rate of spring snowmelt; the magnitude of spring, summer and fall rainfall; the relationship of time between storms and resulting soil dryness (also referred to as "antecedent conditions"); the amount of impervious surface in the watershed; and the buffering influence of ponds, lakes, and wetlands on flow rate. The hydrograph may also be used to assess the monitoring program used to sample a stream. To best determine water quality conditions in a stream, samples should be taken during a variety of flow regimes, such as at maximum flow for storm events, during intermediate flows, and during baseflow conditions. Most samples should be collected at high flows as most chemical constituents are transported in the stream at that time.

Bassett Creek 2004 Hydrograph, Precipitation and Sampling Information




Battle Creek 2004 Hydrograph, Precipitation and Sampling Information
Flow
Grab Sample
Composite Sample
Total Daily Precipitation
Annual Precipitation:
30.37 inches
Total Flow Volume:
2.93 x 10^8 cubic feet
Flow (cfs)
Precipitation (in.)
Date
60
50
40
30
20
10
0
0.0
1.0
2.0
3.0
4.0
5.0
6.0
7.0
1/1/04
2/1/04
3/1/04
4/1/04
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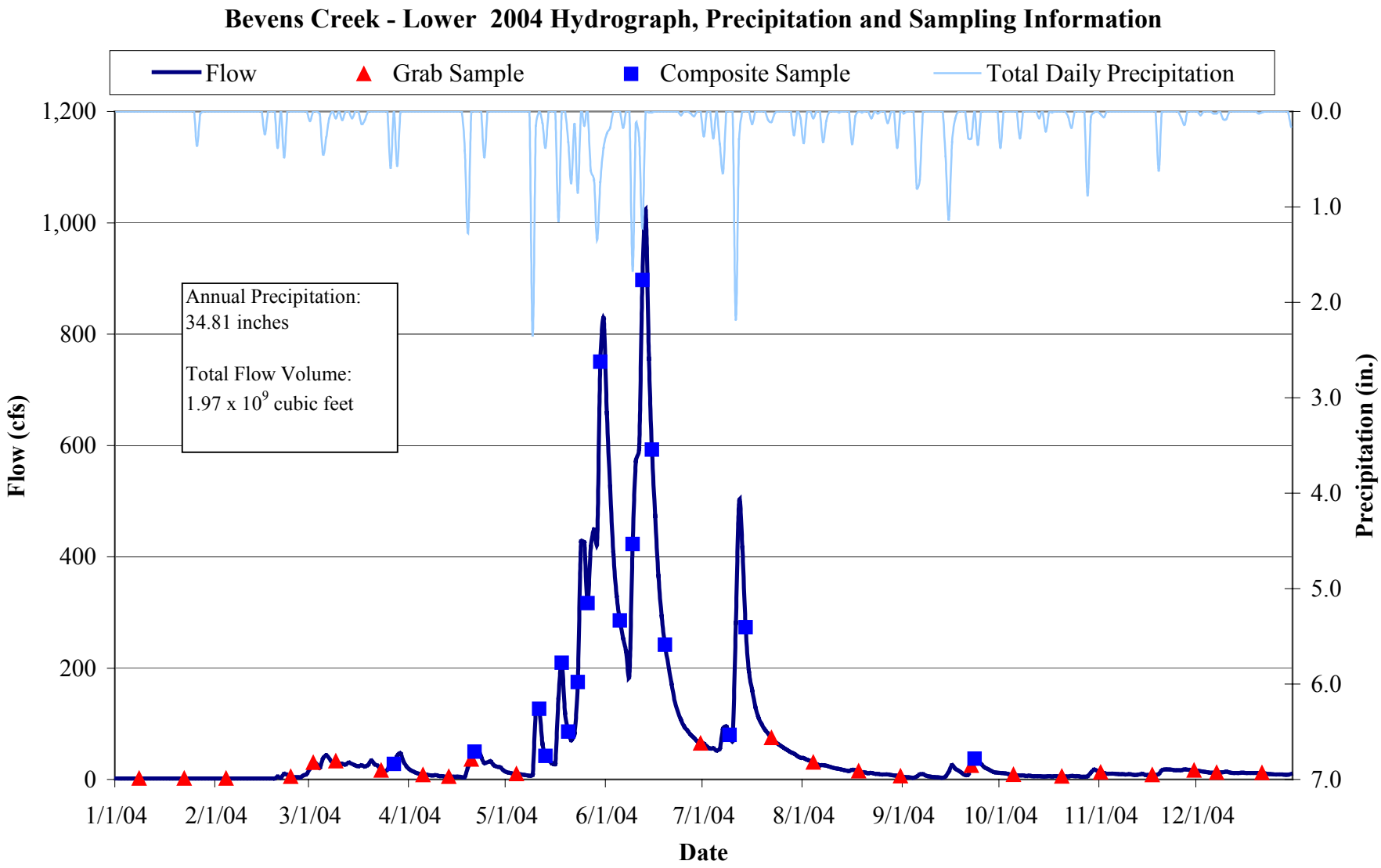
8/1/04
9/1/04
10/1/04
11/1/04
12/1/04


Bevens Creek - Lower 2004 Hydrograph, Precipitation and Sampling Information
Flow
Grab Sample
Composite Sample
Total Daily Precipitation
Annual Precipitation:
34.81 inches
Total Flow Volume:
1.97 x 10^9 cubic feet
Flow (cfs)
Precipitation (in.)
Date
1,200
1,000
800
600
400
200
0
0.0
1.0
2.0
3.0
4.0
5.0
6.0
7.0
1/1/04
2/1/04
3/1/04
4/1/04
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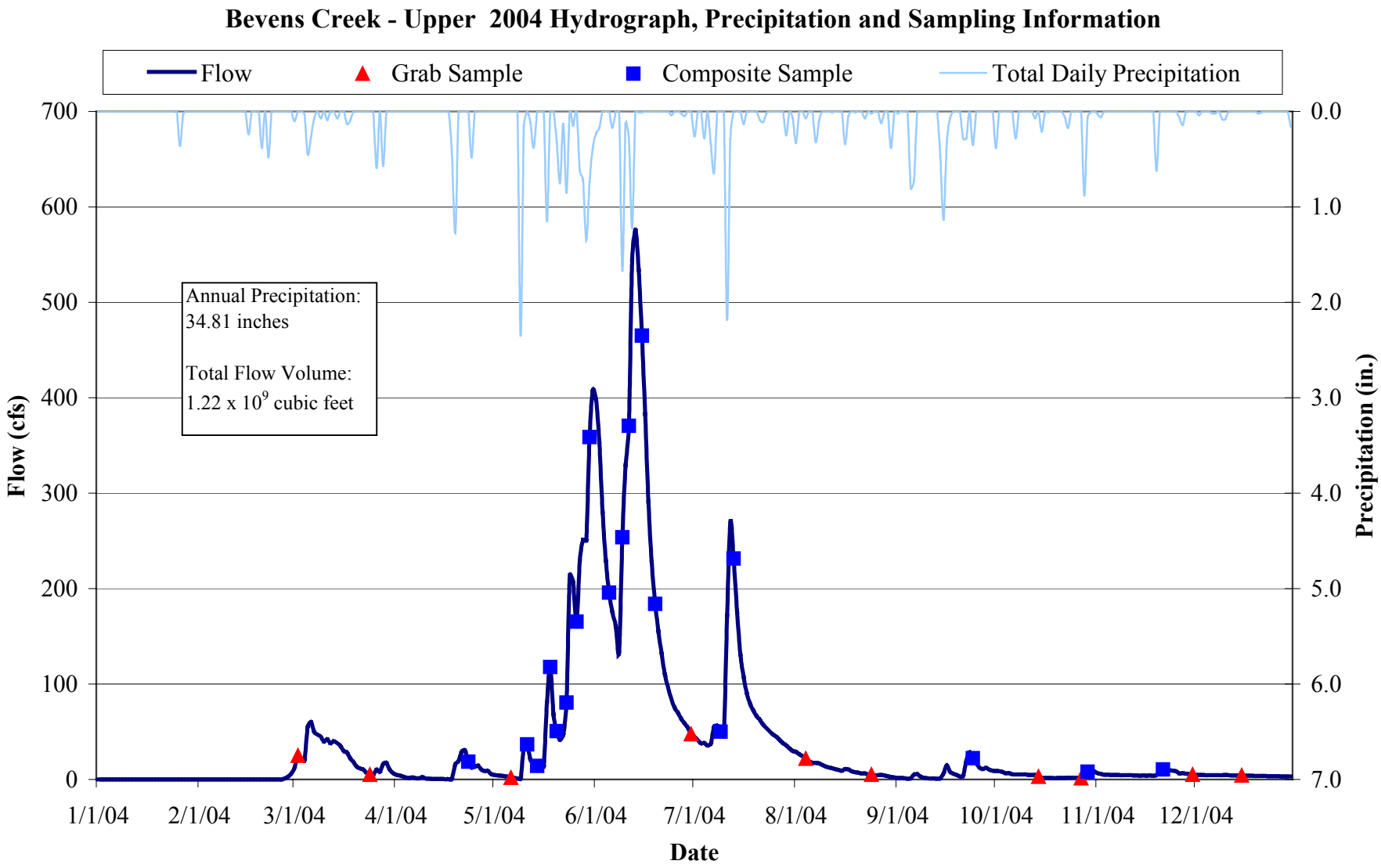
7/1/04
8/1/04
9/1/04
10/1/04
11/1/04
12/1/04


Bevens Creek - Upper 2004 Hydrograph, Precipitation and Sampling Information
Flow
Grab Sample
Composite Sample
Total Daily Precipitation
Annual Precipitation:
34.81 inches
Total Flow Volume:
1.22 x 10^9 cubic feet
Flow (cfs)
Precipitation (in.)
Date
700
600
500
400
300
200
100
0
0.0
1.0
2.0
3.0
4.0
5.0
6.0
7.0
1/1/04
2/1/04
3/1/04
4/1/04
5/1/04
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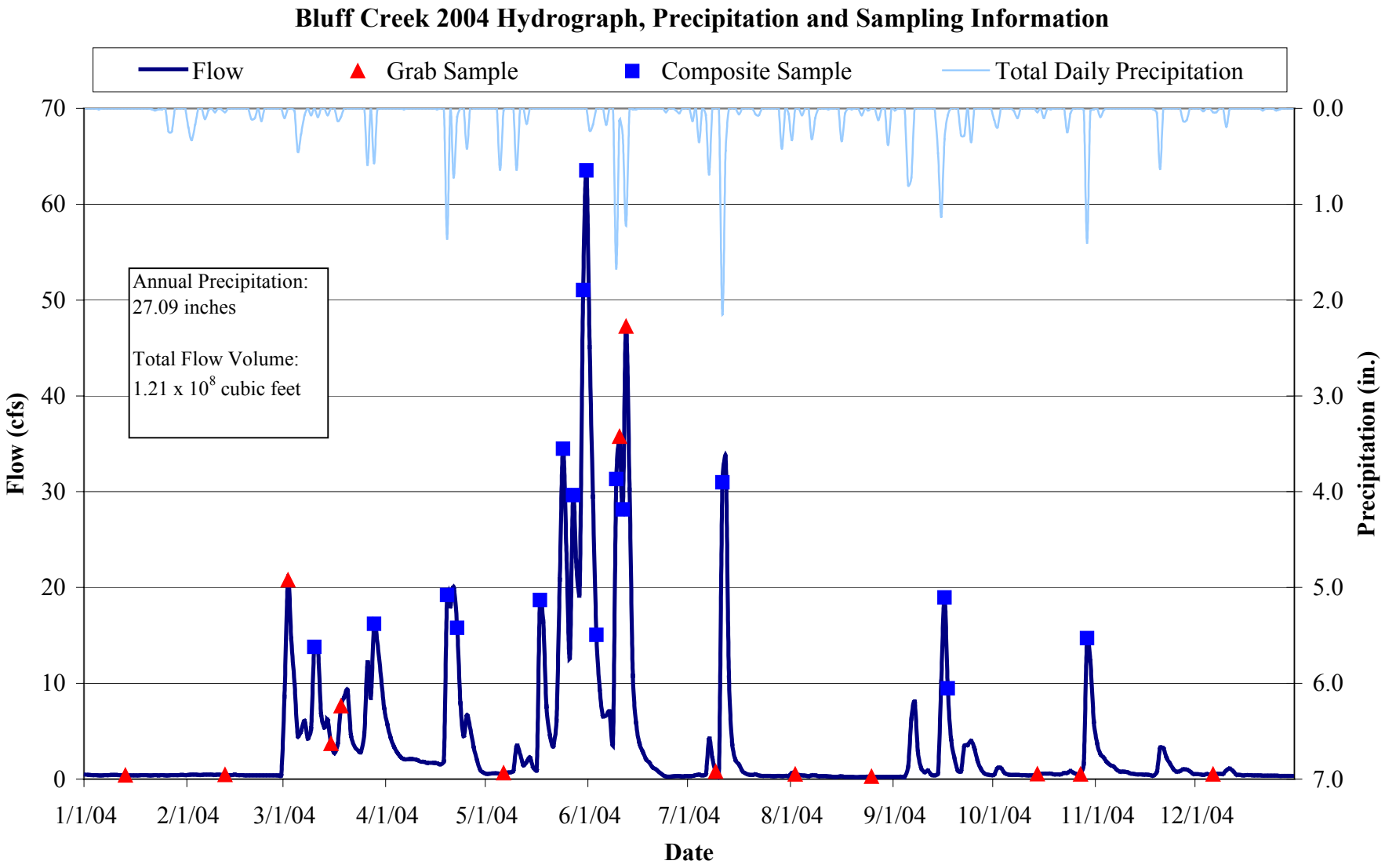
9/1/04
10/1/04
11/1/04
12/1/04


Bluff Creek 2004 Hydrograph, Precipitation and Sampling Information
Flow
Grab Sample
Composite Sample
Total Daily Precipitation
Annual Precipitation:
27.09 inches
Total Flow Volume:
1.21 x 10^8 cubic feet
Flow (cfs)
Precipitation (in.)
Date
0
10
20
30
40
50
60
70
0.0
1.0
2.0
3.0
4.0
5.0
6.0
7.0
1/1/04
2/1/04
3/1/04
4/1/04
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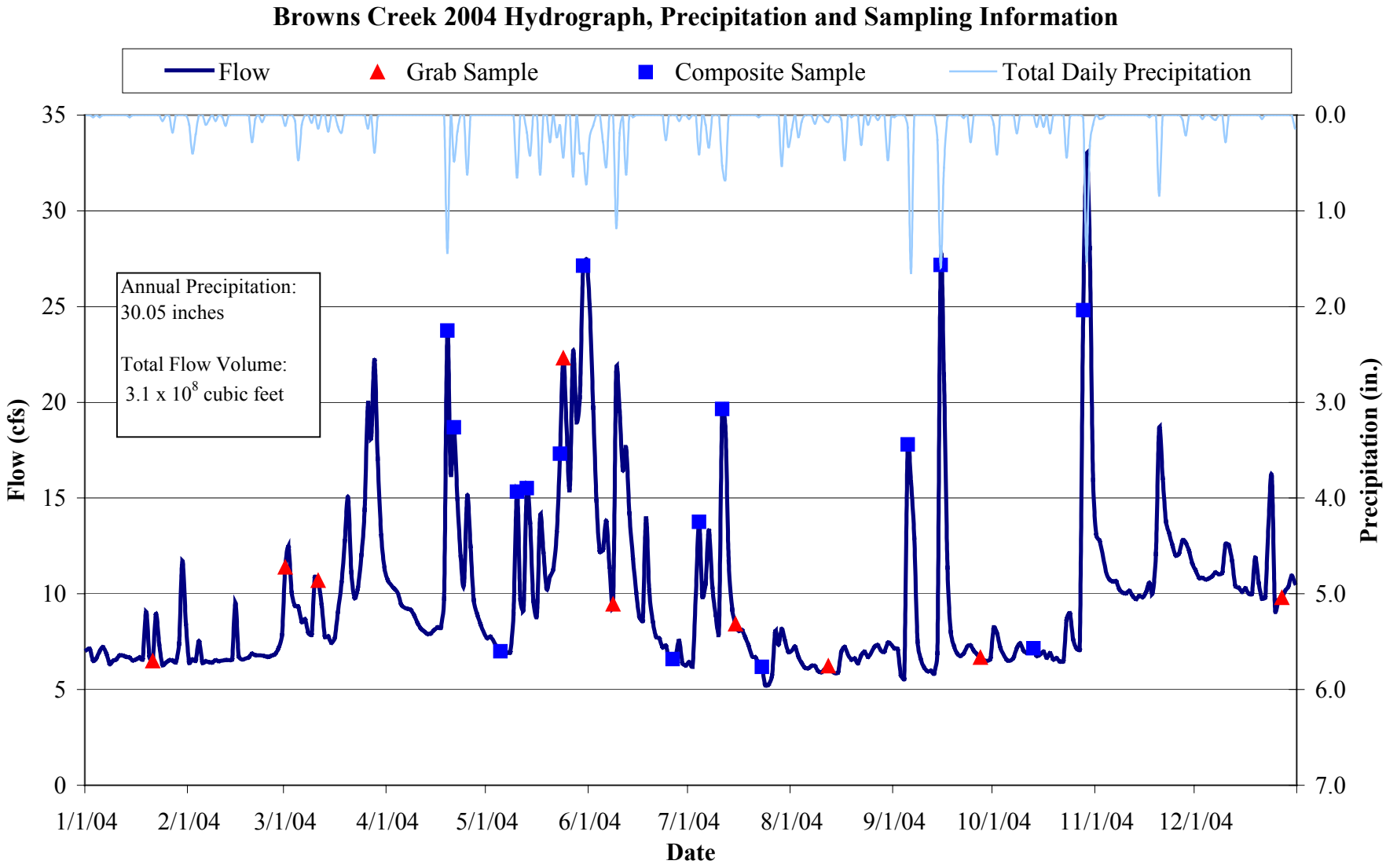
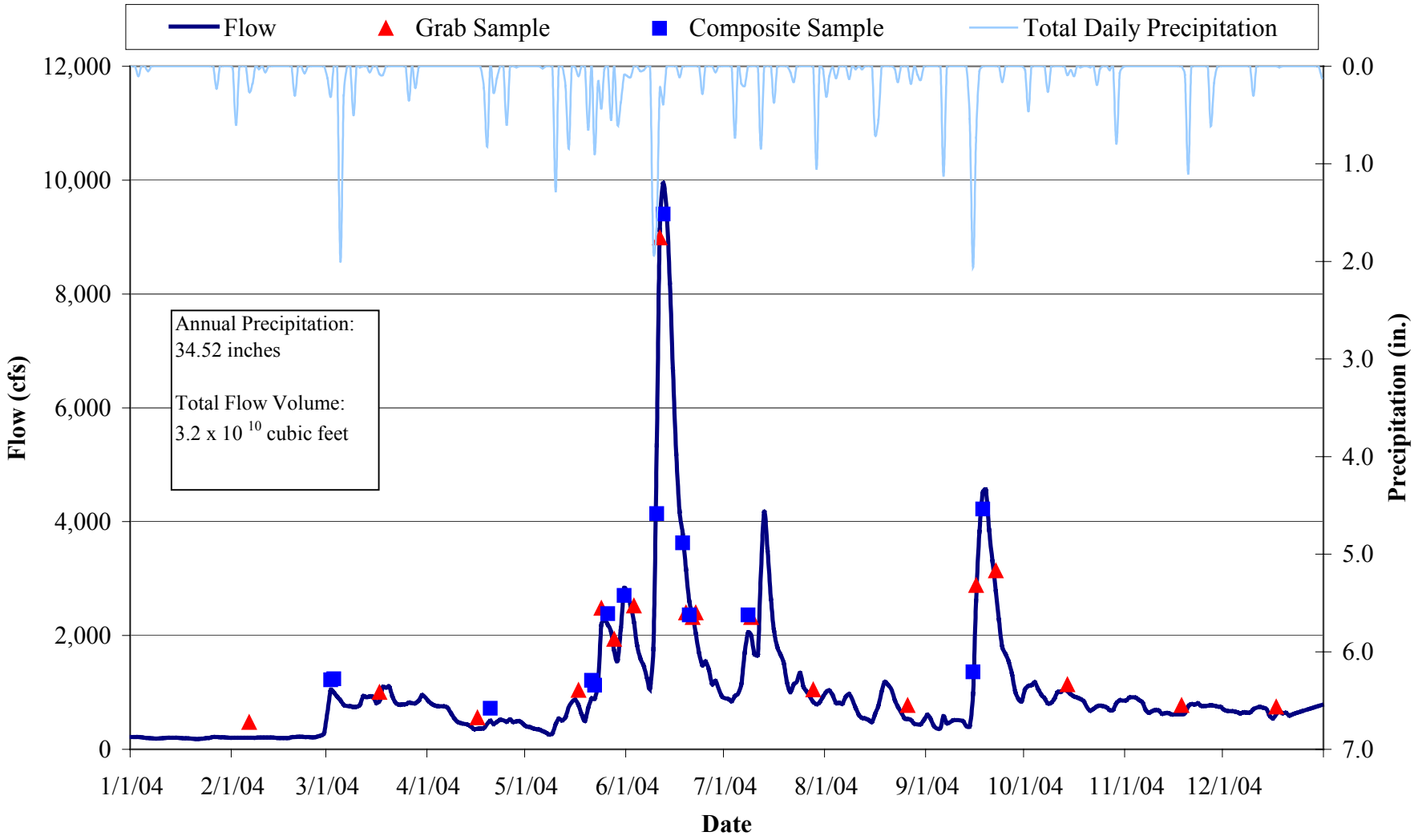
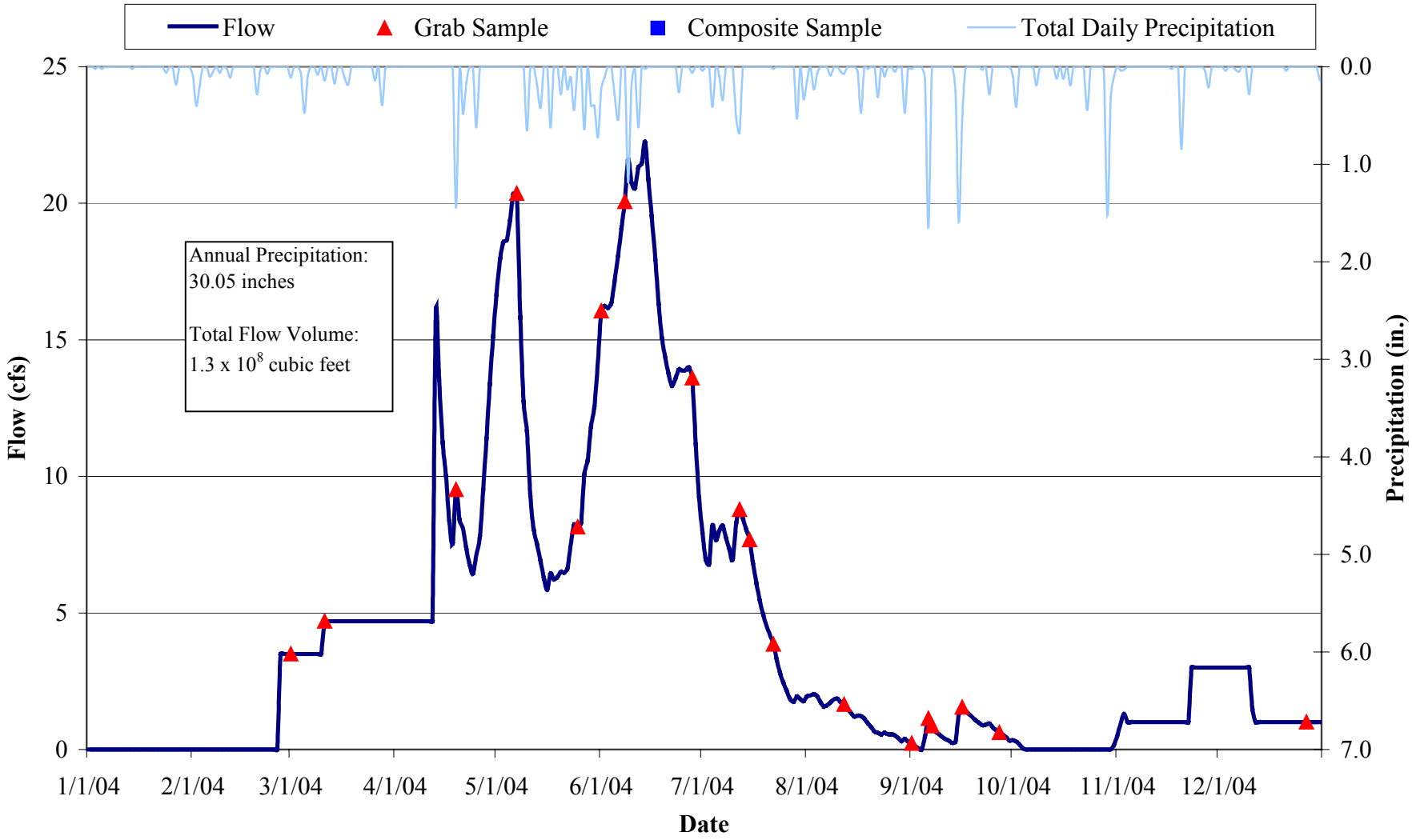
9/1/04
10/1/04
11/1/04
12/1/04

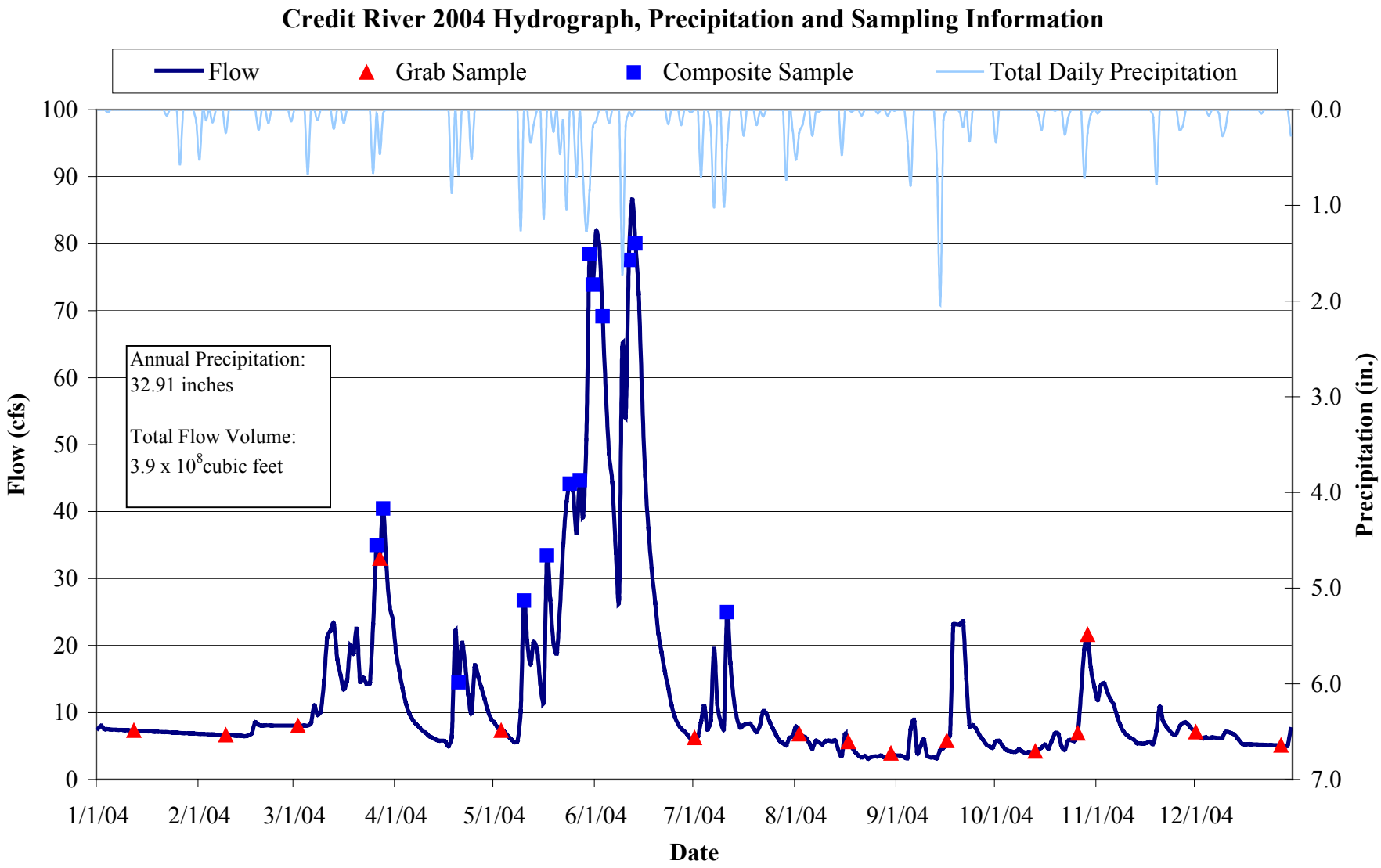

Browns Creek 2004 Hydrograph, Precipitation and Sampling Information
Flow
Grab Sample
Composite Sample
Total Daily Precipitation
Annual Precipitation:
30.05 inches
Total Flow Volume:
3.1 x 10^8 cubic feet
Flow (cfs)
Precipitation (in.)
Date
0
5
10
15
20
25
30
35
0.0
1.0
2.0
3.0
4.0
5.0
6.0
7.0
1/1/04
2/1/04
3/1/04
4/1/04
5/1/04
6/1/04
7/1/04
8/1/04
9/1/04
10/1/04
11/1/04
12/1/04

Cannon River 2004 Hydrograph, Precipitation and Sampling Information

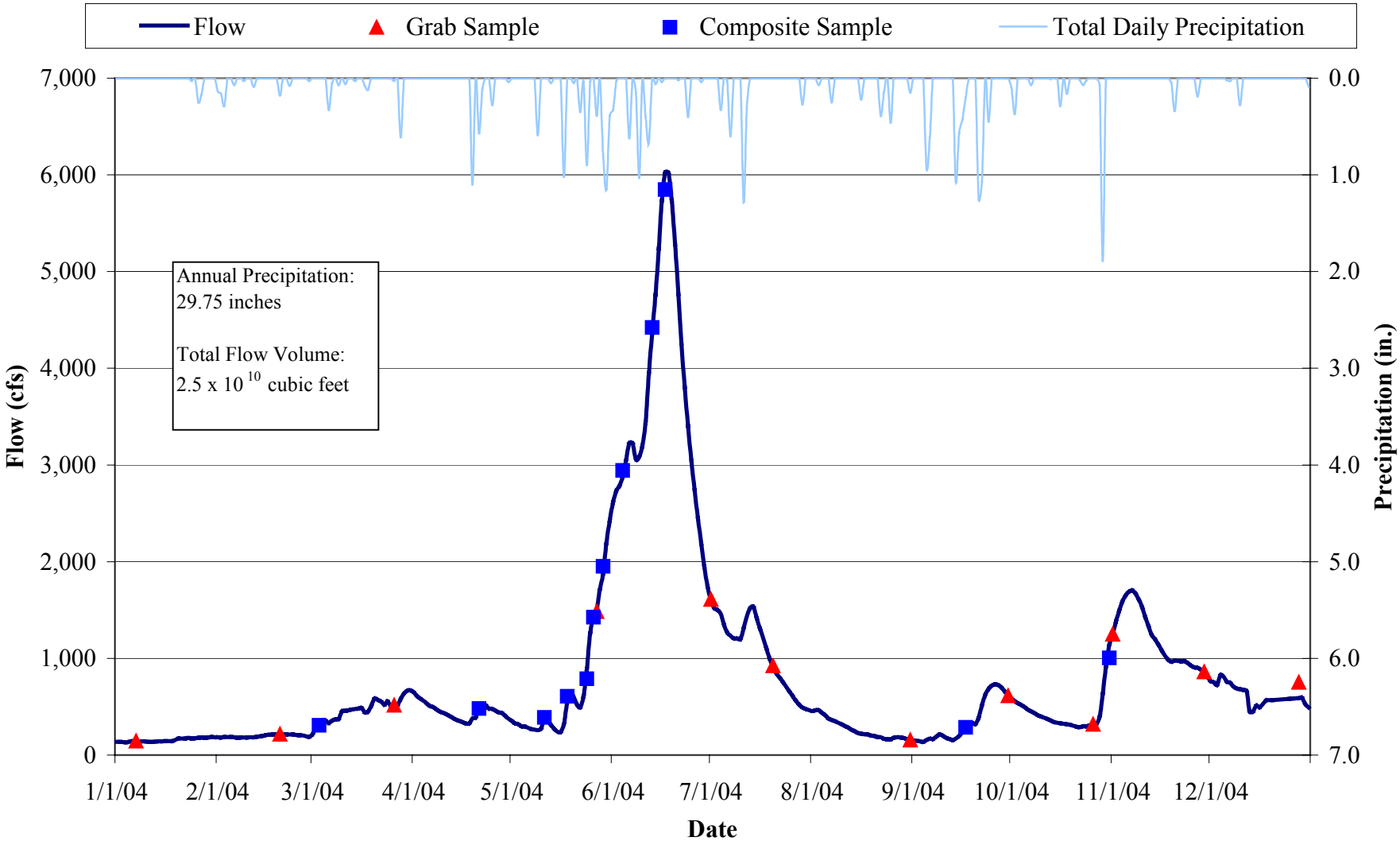


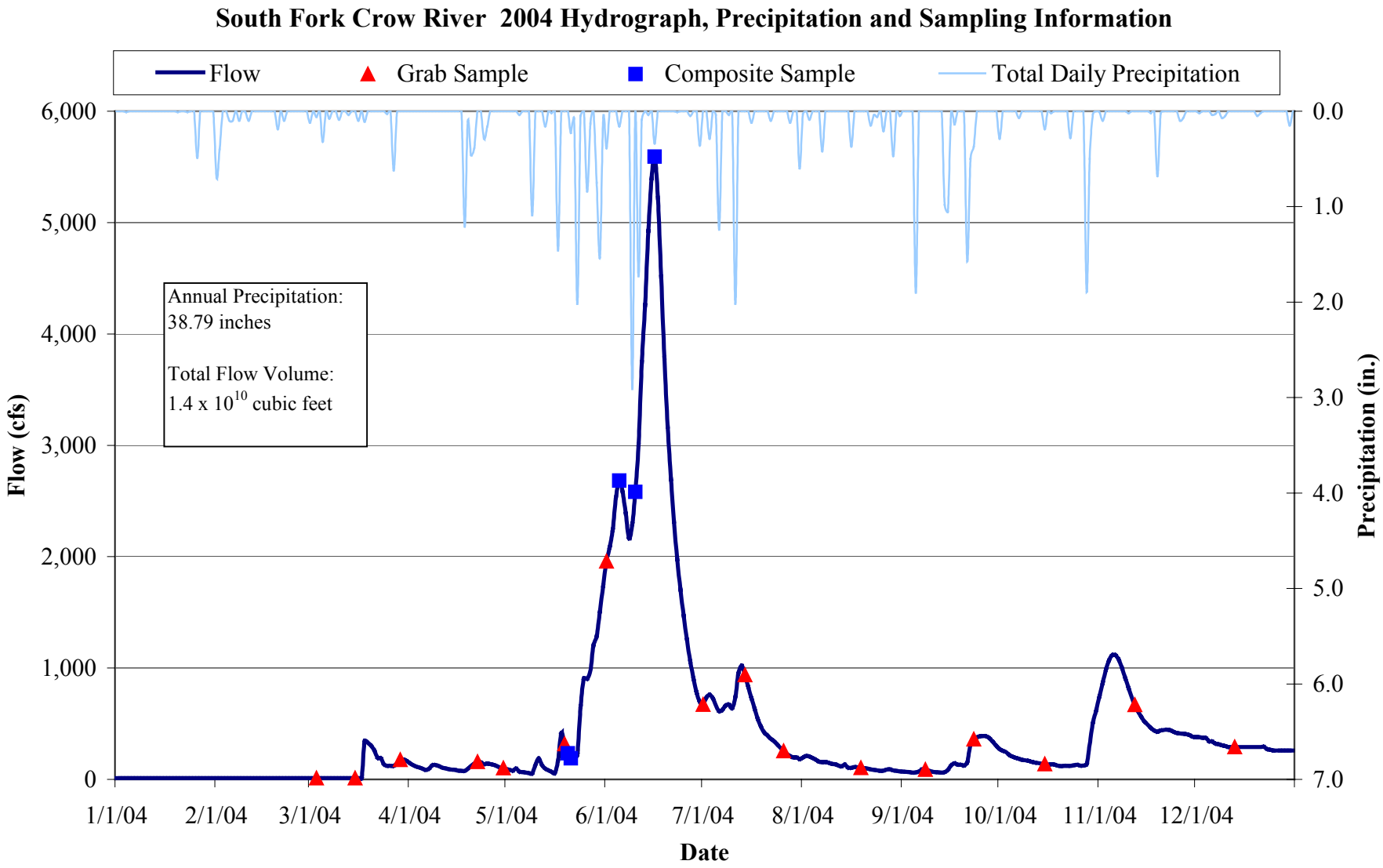
Carnelian Marine Outlet 2004 Hydrograph, Precipitation and Sampling Information



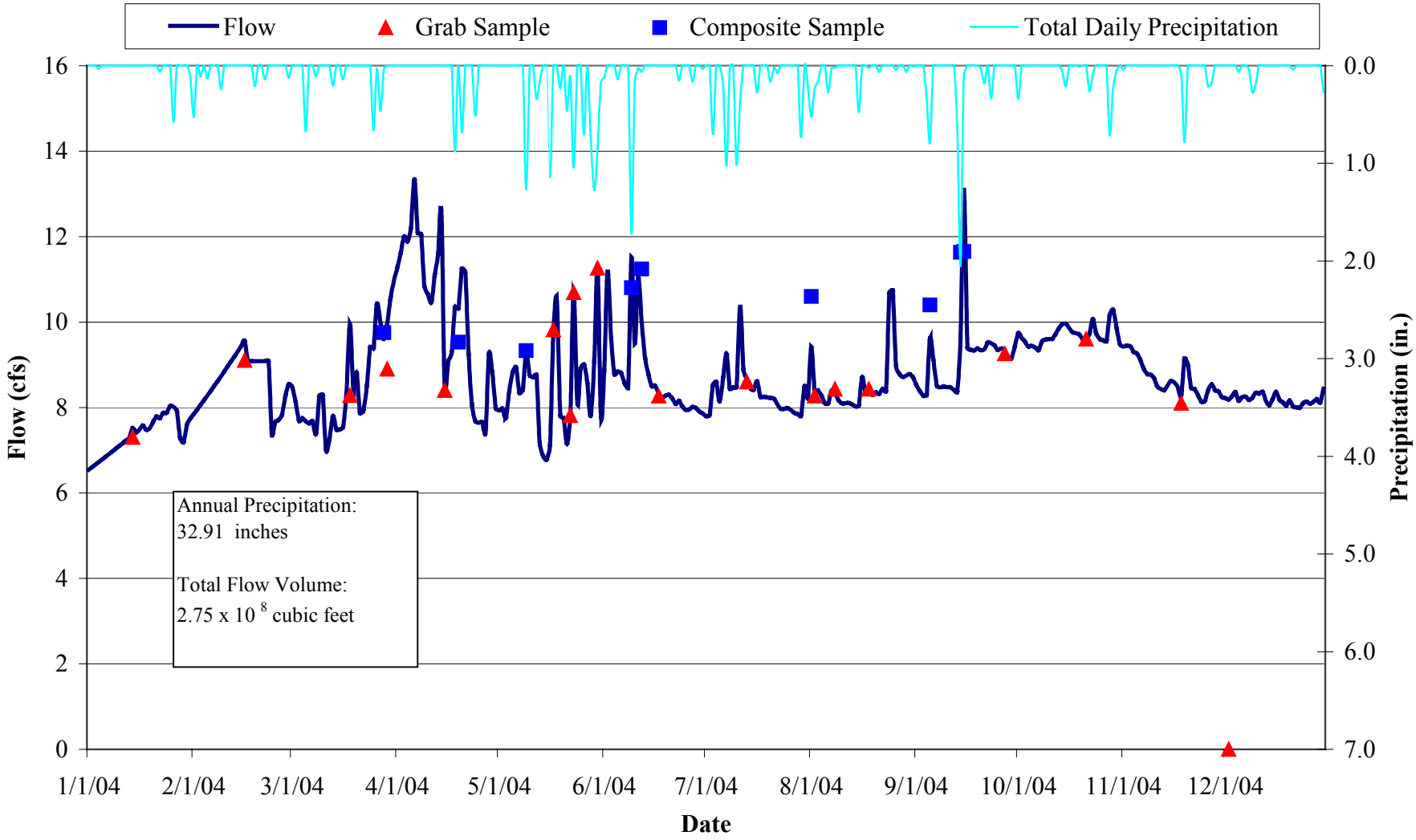

Credit River 2004 Hydrograph, Precipitation and Sampling Information
Flow
Grab Sample
Composite Sample
Total Daily Precipitation
Annual Precipitation:
32.91 inches
Total Flow Volume:
3.9 x 10^8 cubic feet
Flow (cfs)
Precipitation (in.)
Date
100
90
80
70
60
50
40
30
20
10
0
0.0
1.0
2.0
3.0
4.0
5.0
6.0
7.0
1/1/04
2/1/04
3/1/04
4/1/04
5/1/04
6/1/04
7/1/04
8/1/04
9/1/04
10/1/04
11/1/04
12/1/04

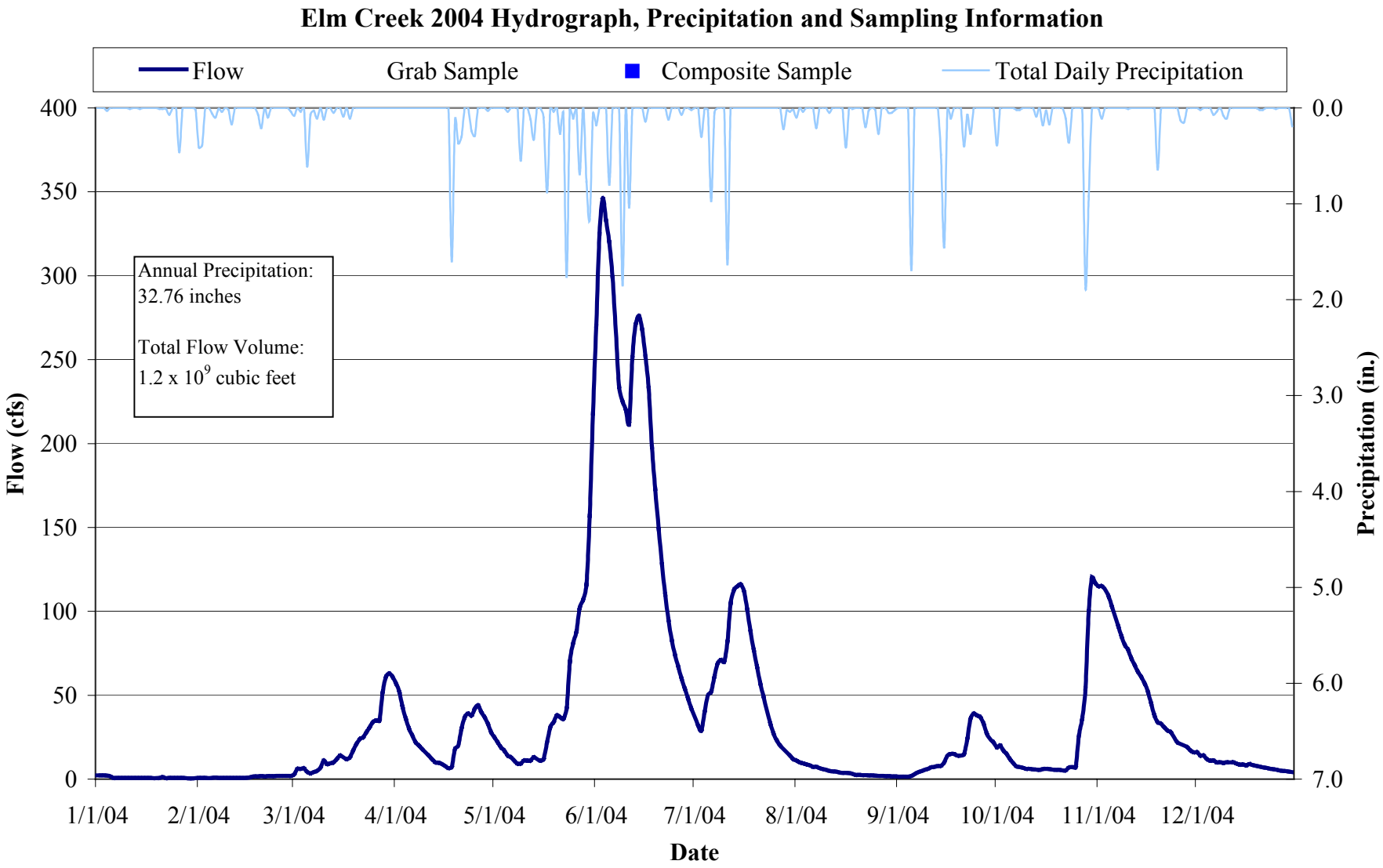
Crow River 2004 Hydrograph, Precipitation and Sampling Information




South Fork Crow River 2004 Hydrograph, Precipitation and Sampling Information
Flow
Grab Sample
Composite Sample
Total Daily Precipitation
Annual Precipitation:
38.79 inches
Total Flow Volume:
1.4 x 10^10 cubic feet
Flow (cfs)
Precipitation (in.)
Date
6,000
5,000
4,000
3,000
2,000
1,000
0
0.0
1.0
2.0
3.0
4.0
5.0
6.0
7.0
1/1/04
2/1/04
3/1/04
4/1/04
5/1/04
6/1/04
7/1/04
8/1/04
9/1/04
10/1/04
11/1/04
12/1/04

Eagle Creek 2004 Hydrograph, Precipitation and Sampling Information




Elm Creek 2004 Hydrograph, Precipitation and Sampling Information
Flow
Grab Sample
Composite Sample
Total Daily Precipitation
Annual Precipitation:
32.76 inches
Total Flow Volume:
1.2 x 10^9 cubic feet
Flow (cfs)
Precipitation (in.)
Date
400
350
300
250
200
150
100
50
0
0.0
1.0
2.0
3.0
4.0
5.0
6.0
7.0
1/1/04
2/1/04
3/1/04
4/1/04
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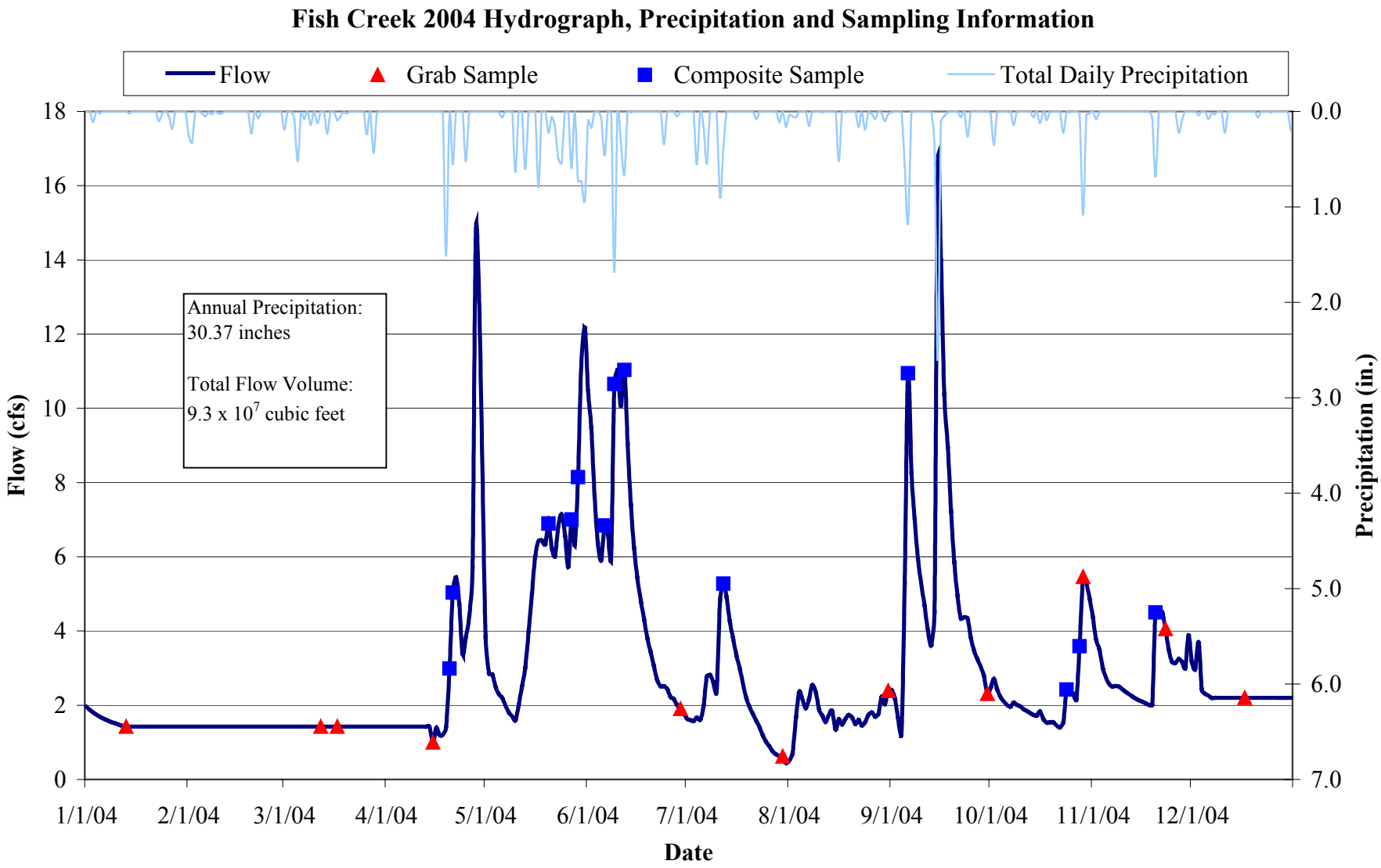
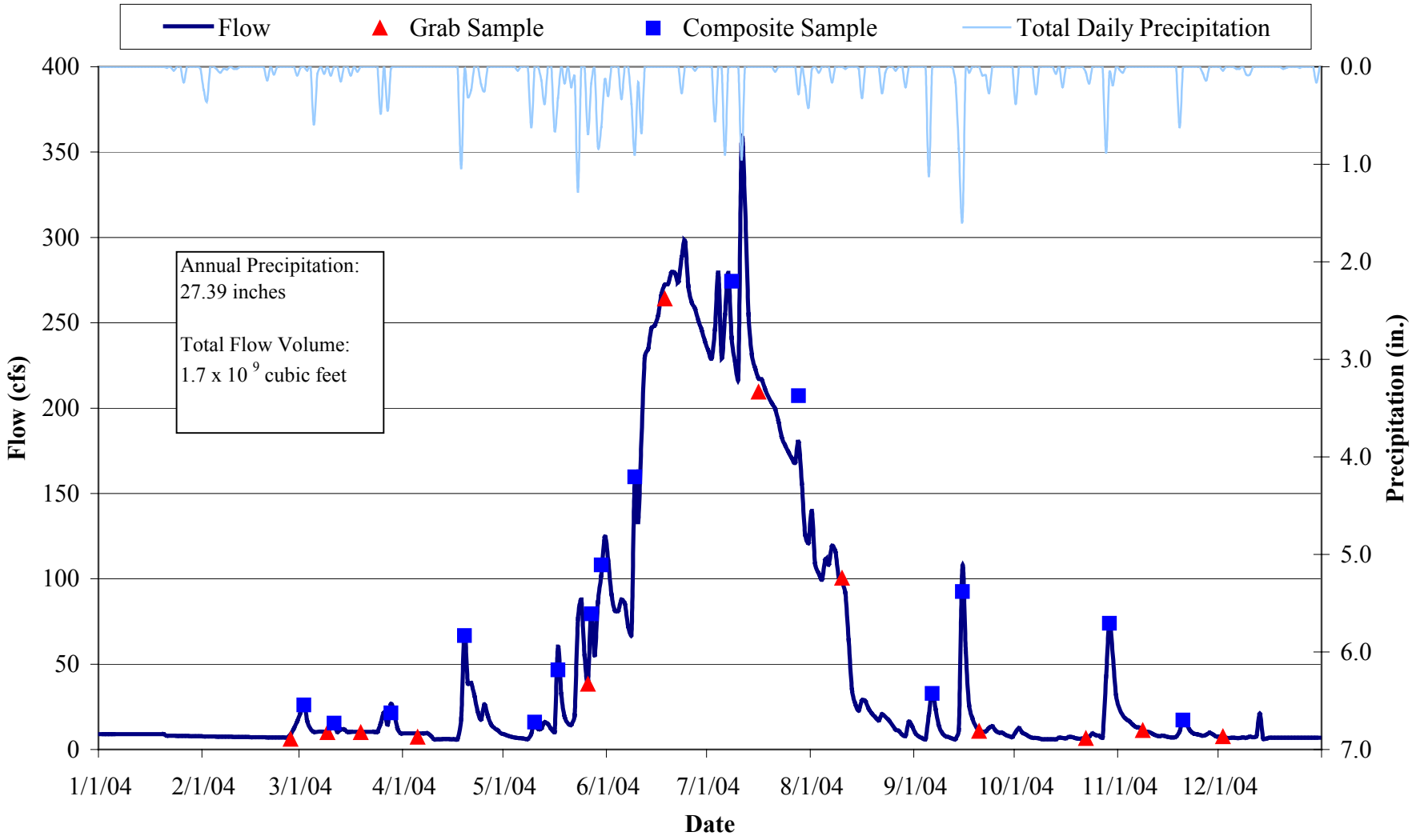
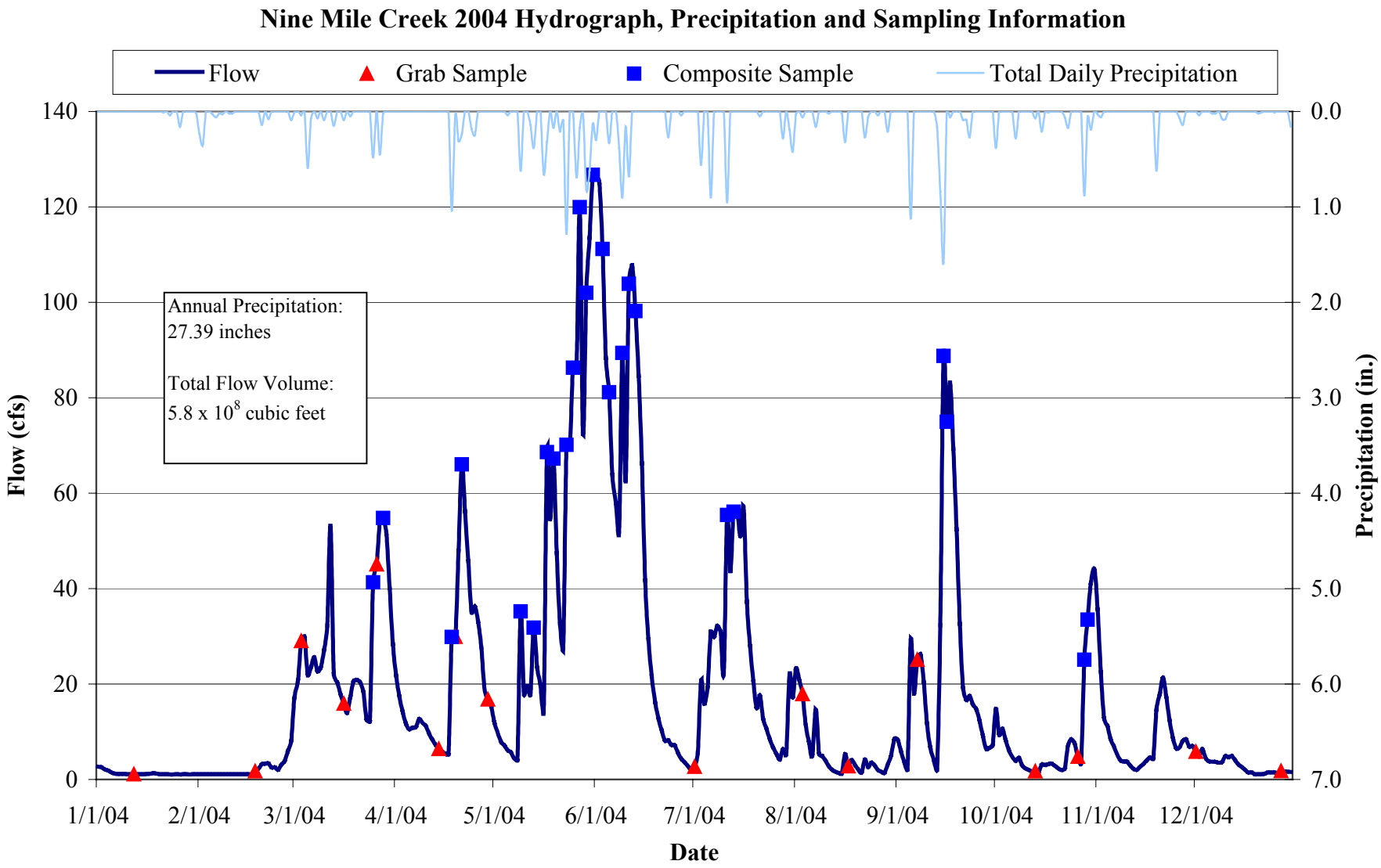
9/1/04
10/1/04
11/1/04
12/1/04


Fish Creek 2004 Hydrograph, Precipitation and Sampling Information
Flow
Grab Sample
Composite Sample
Total Daily Precipitation
Annual Precipitation:
30.37 inches
Total Flow Volume:
9.3 x 10^7 cubic feet
Flow (cfs)
Precipitation (in.)
Date
0
2
4
6
8
10
12
14
16
18
0.0
1.0
2.0
3.0
4.0
5.0
6.0
7.0
1/1/04
2/1/04
3/1/04
4/1/04
5/1/04
6/1/04
7/1/04
8/1/04
9/1/04
10/1/04
11/1/04
12/1/04

Minnehaha Creek 2004 Hydrograph, Precipitation and Sampling Information




Nine Mile Creek 2004 Hydrograph, Precipitation and Sampling Information
Flow
Grab Sample
Composite Sample
Total Daily Precipitation
Annual Precipitation:
27.39 inches
Total Flow Volume:
5.8 x 10^8 cubic feet
Flow (cfs)
Precipitation (in.)
Date
140
120
100
80
60
40
20
0
0.0
1.0
2.0
3.0
4.0
5.0
6.0
7.0
1/1/04
2/1/04
3/1/04
4/1/04
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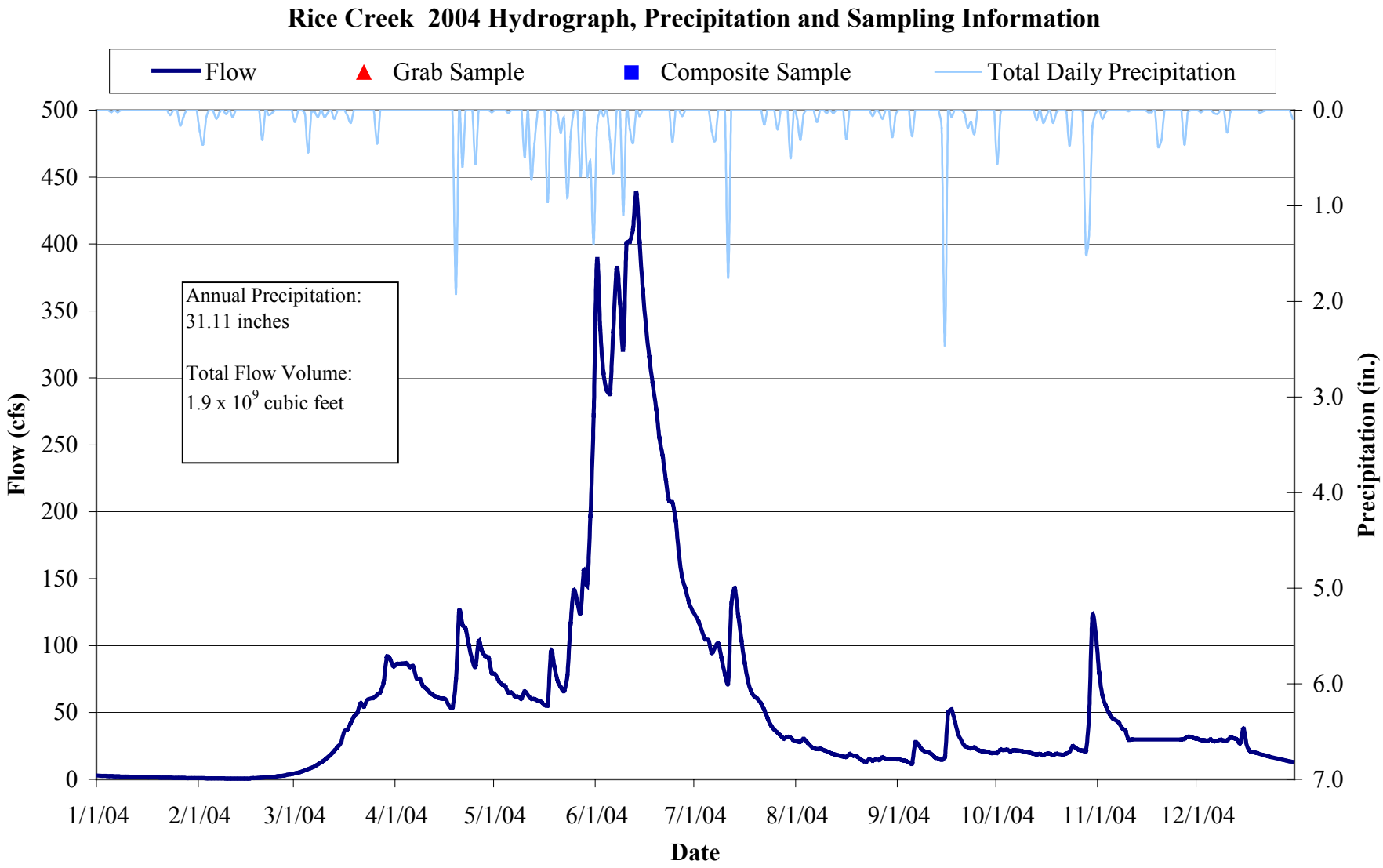
12/1/04


Rice Creek 2004 Hydrograph, Precipitation and Sampling Information
Flow
Grab Sample
Composite Sample
Total Daily Precipitation
Annual Precipitation:
31.11 inches
Total Flow Volume:
1.9 x 10^9 cubic feet
Flow (cfs)
Precipitation (in.)
Date
500
450
400
350
300
250
200
150
100
50
0
0.0
1.0
2.0
3.0
4.0
5.0
6.0
7.0
1/1/04
2/1/04
3/1/04
4/1/04
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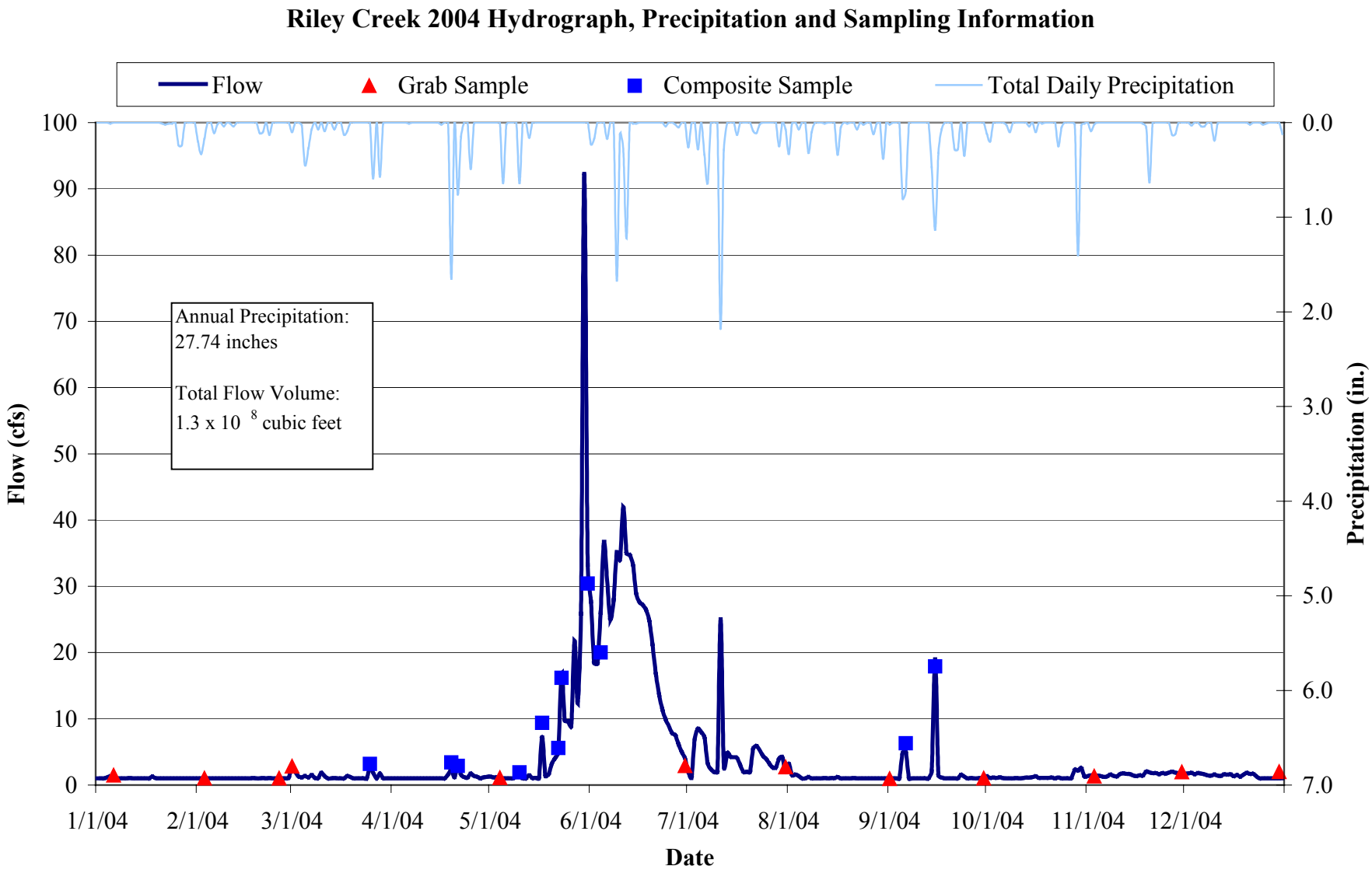
9/1/04
10/1/04
11/1/04
12/1/04


Riley Creek 2004 Hydrograph, Precipitation and Sampling Information
Flow
Grab Sample
Composite Sample
Total Daily Precipitation
Annual Precipitation:
27.74 inches
Total Flow Volume:
1.3 x 10 8 cubic feet
Flow (cfs)
Precipitation (in.)
Date
100
90
80
70
60
50
40
30
20
10
0
0.0
1.0
2.0
3.0
4.0
5.0
6.0
7.0
1/1/04
2/1/04
3/1/04
4/1/04
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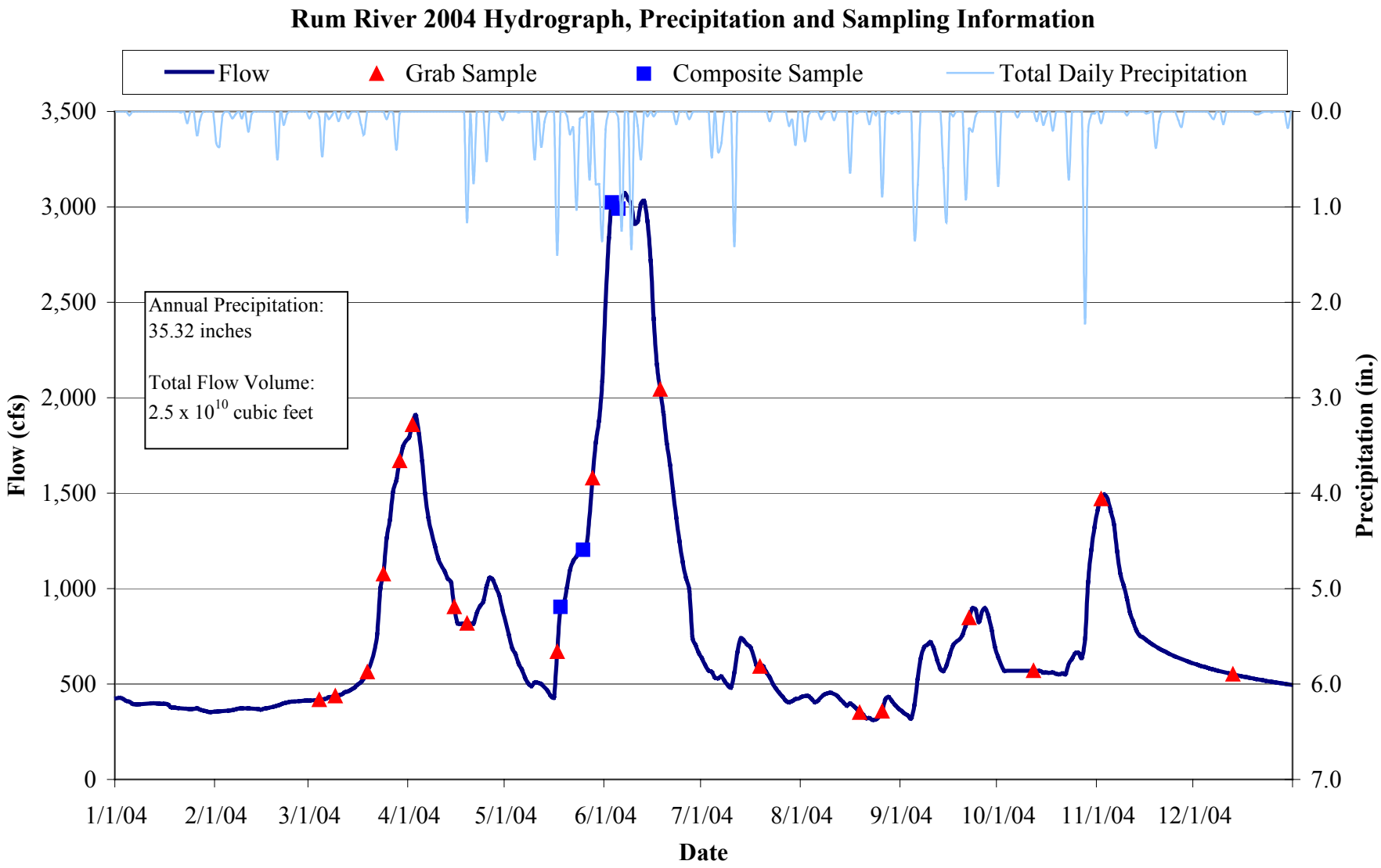
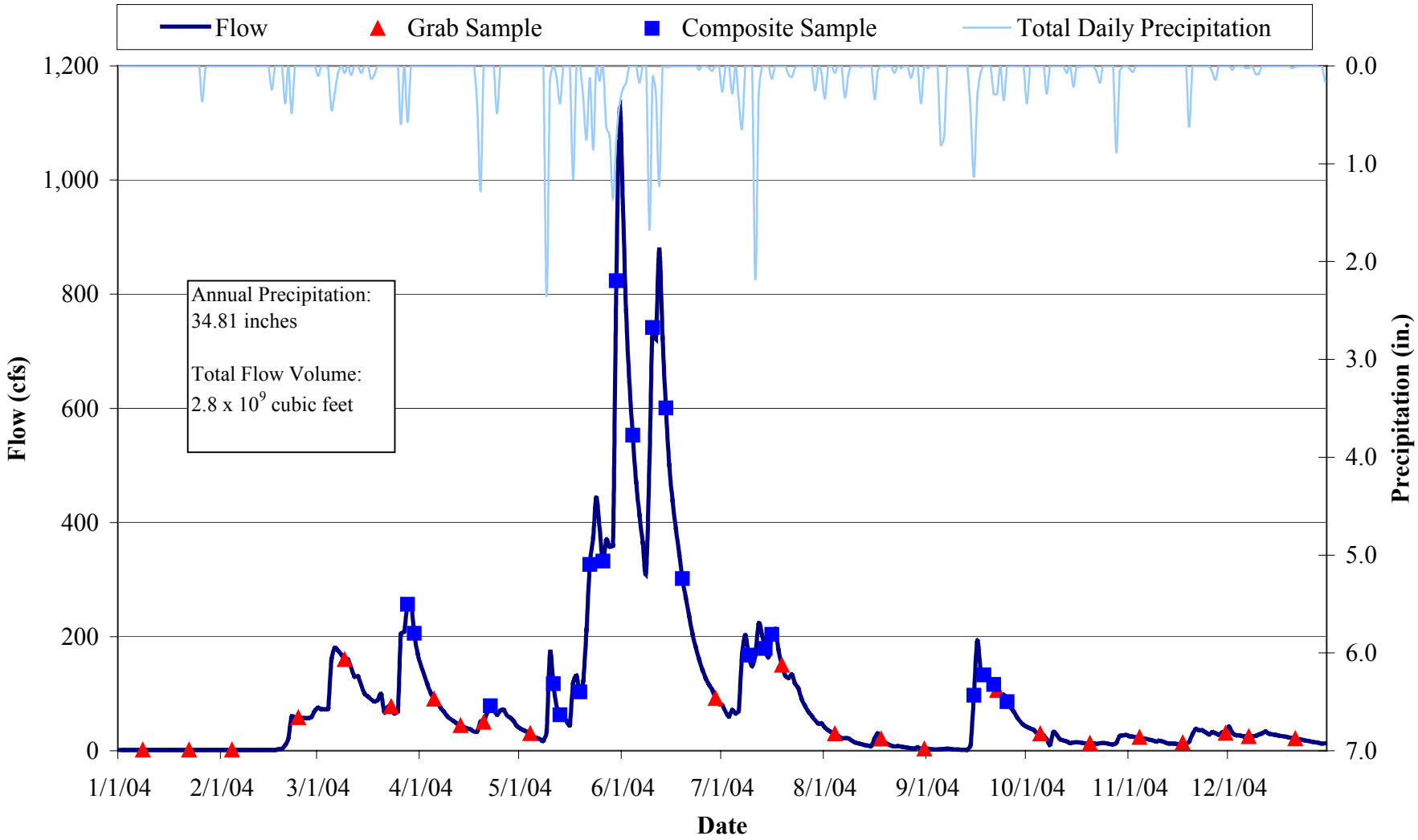
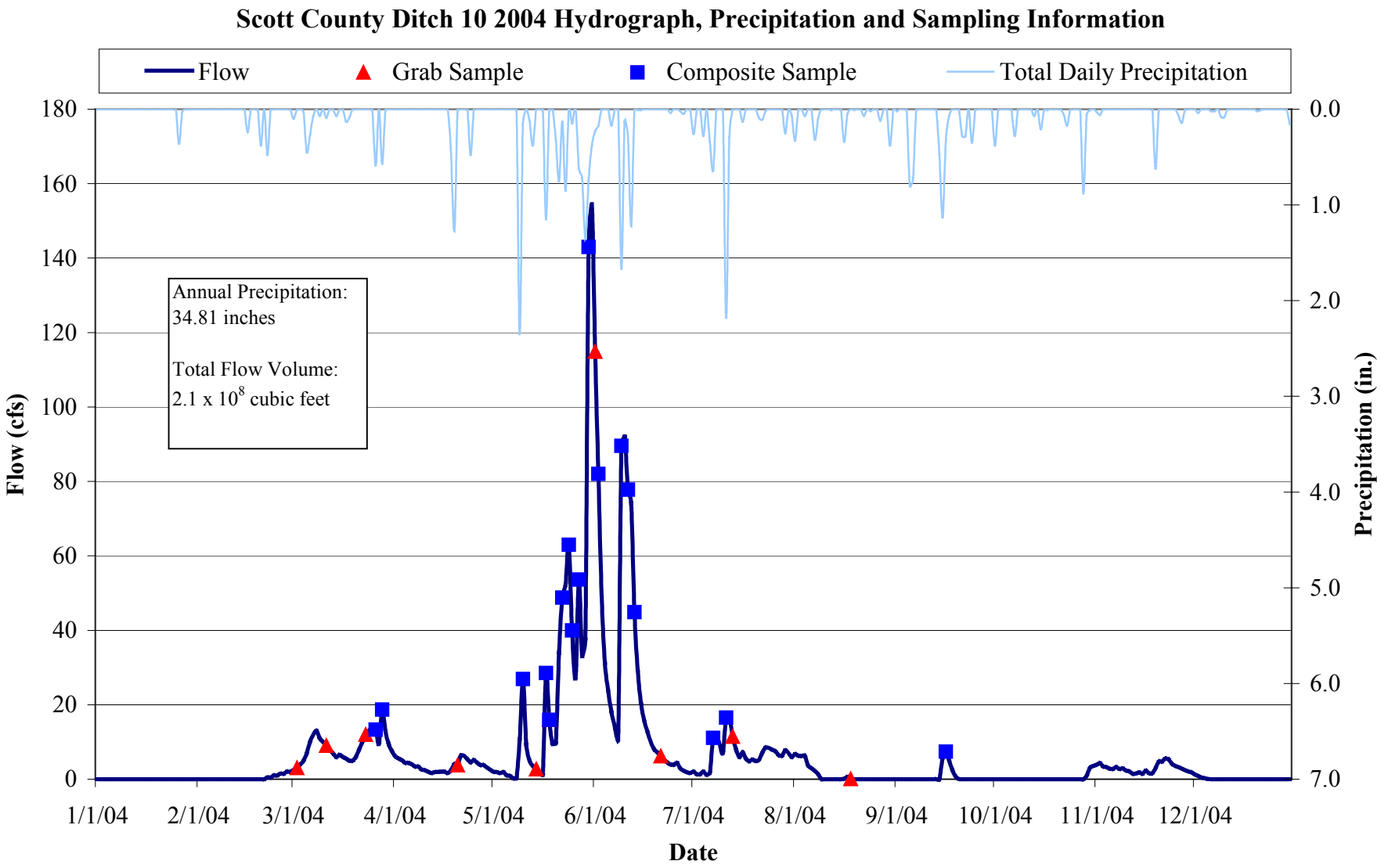
9/1/04
10/1/04
11/1/04
12/1/04


Rum River 2004 Hydrograph, Precipitation and Sampling Information
Flow
Grab Sample
Composite Sample
Total Daily Precipitation
Annual Precipitation:
35.32 inches
Total Flow Volume:
2.5 x 10^10 cubic feet
Flow (cfs)
Precipitation (in.)
Date
3,500
3,000
2,500
2,000
1,500
1,000
500
0
0.0
1.0
2.0
3.0
4.0
5.0
6.0
7.0
1/1/04
2/1/04
3/1/04
4/1/04
5/1/04
6/1/04
7/1/04
8/1/04
9/1/04
10/1/04
11/1/04
12/1/04

Sand Creek 2004 Hydrograph, Precipitation and Sampling Information




Scott County Ditch 10 2004 Hydrograph, Precipitation and Sampling Information
Flow
Grab Sample
Composite Sample
Total Daily Precipitation
Annual Precipitation:
34.81 inches
Total Flow Volume:
2.1 x 10^8 cubic feet
Flow (cfs)
Precipitation (in.)
Date
180
160
140
120
100
80
60
40
20
0
0.0
1.0
2.0
3.0
4.0
5.0
6.0
7.0
1/1/04
2/1/04
3/1/04
4/1/04
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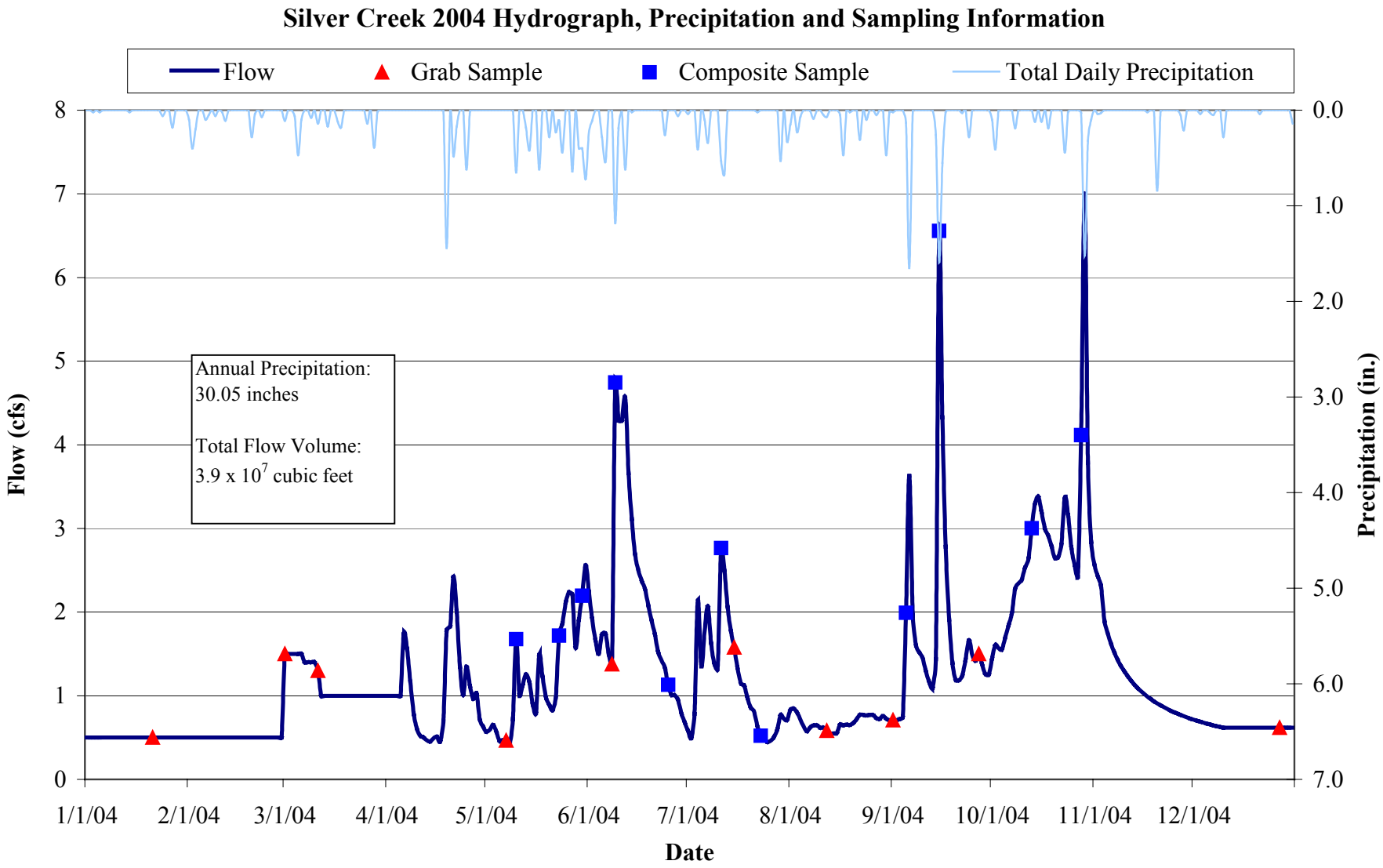
9/1/04
10/1/04
11/1/04
12/1/04


Silver Creek 2004 Hydrograph, Precipitation and Sampling Information
Flow
Grab Sample
Composite Sample
Total Daily Precipitation
Annual Precipitation:
30.05 inches
Total Flow Volume:
3.9 x 10^7 cubic feet
Flow (cfs)
Precipitation (in.)
Date
0
1
2
3
4
5
6
7
8
0.0
1.0
2.0
3.0
4.0
5.0
6.0
7.0
1/1/04
2/1/04
3/1/04
4/1/04
5/1/04
6/1/04
7/1/04
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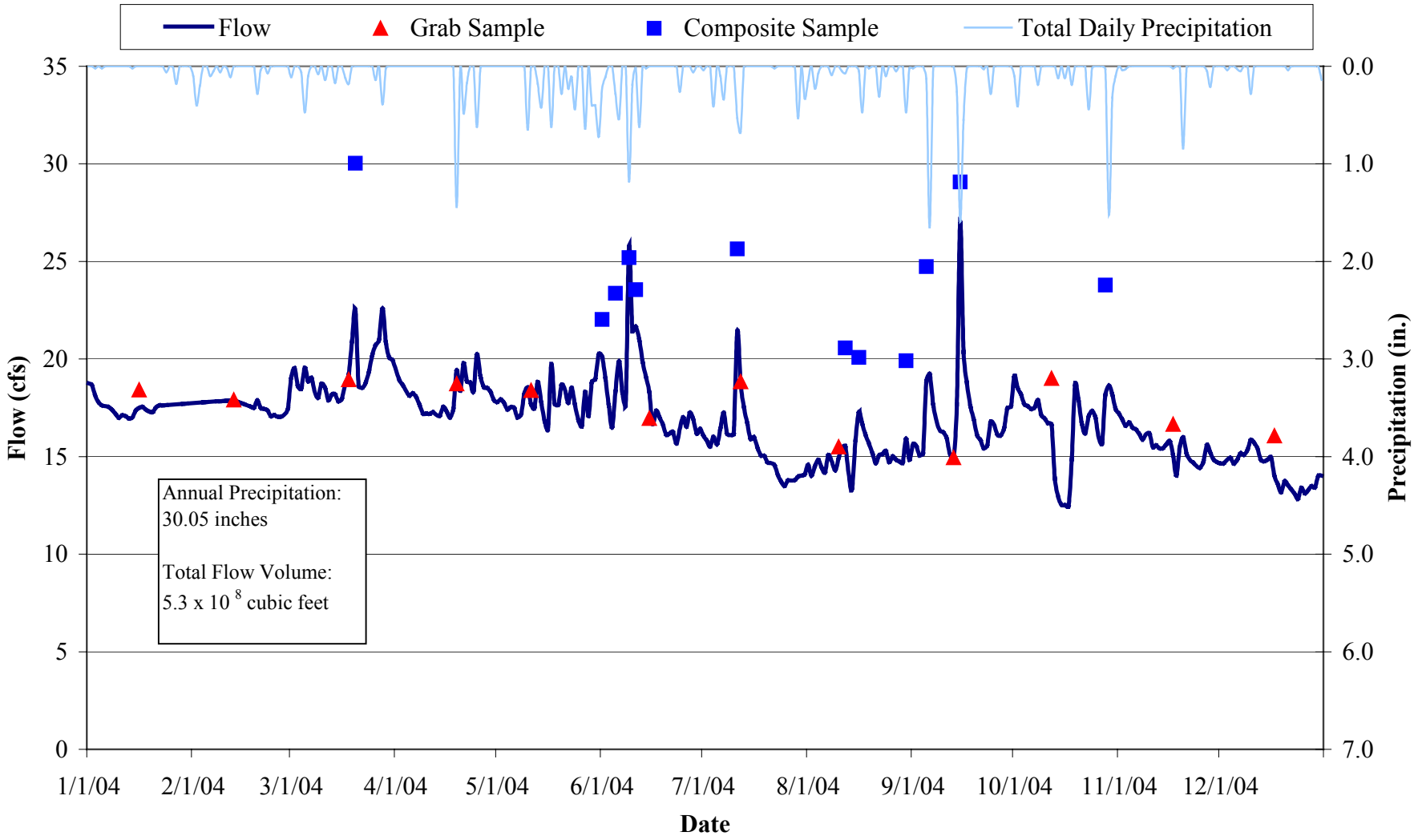
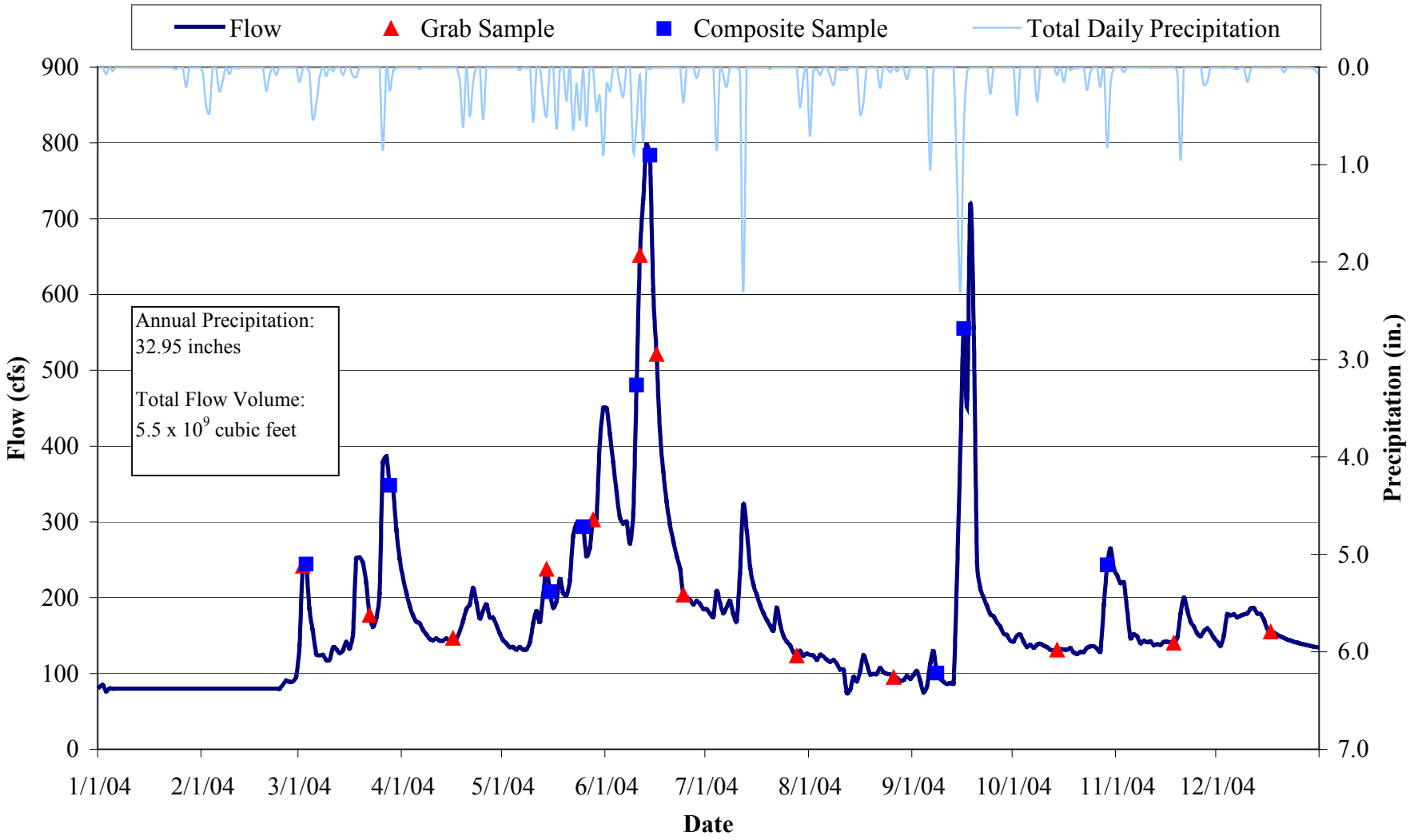
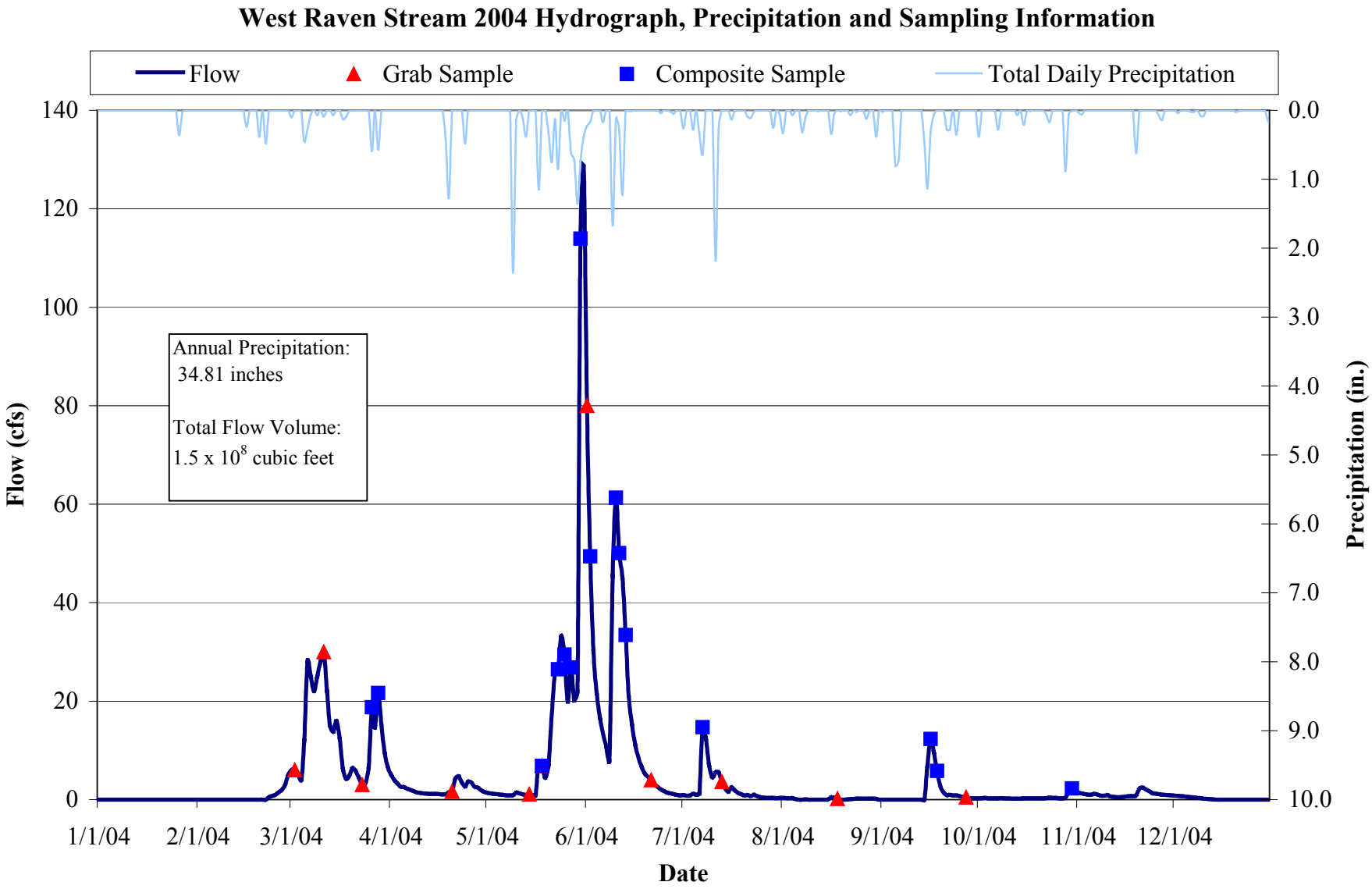
11/1/04
12/1/04

Valley Creek 2004 Hydrograph, Precipitation and Sampling Information

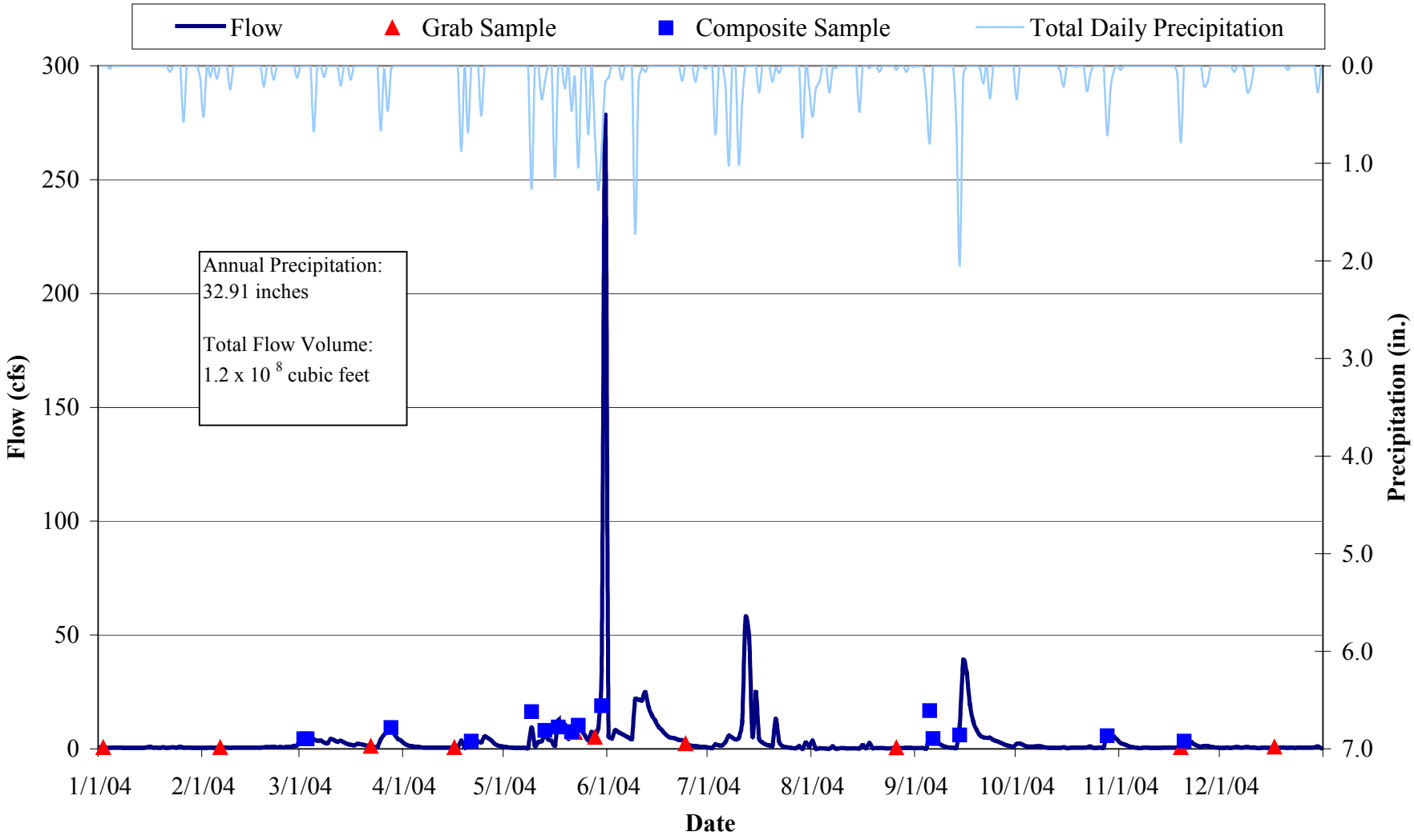


Vermillion River 2004 Hydrograph, Precipitation and Sampling Information




West Raven Stream 2004 Hydrograph, Precipitation and Sampling Information
Flow
Grab Sample
Composite Sample
Total Daily Precipitation
Annual Precipitation:
34.81 inches
Total Flow Volume:
1.5 x 10^8 cubic feet
Flow (cfs)
Precipitation (in.)
Date
140
120
100
80
60
40
20
0
0.0
1.0
2.0
3.0
4.0
5.0
6.0
7.0
8.0
9.0
10.0
1/1/04
2/1/04
3/1/04
4/1/04
5/1/04
6/1/04
7/1/04
8/1/04
9/1/04
10/1/04
11/1/04
12/1/04

Willow Creek 2004 Hydrograph, Precipitation and Sampling Information



APPENDIX B: SUMMARY OF 2004 MONITORING DATA

Alkalinity (mg/l as CaCo3)

Site	N	Mean	Min	Max
Bassett Creek	26	172	107	345
Battle Creek	45	118	49	251
Bevens Creek - Lower	36	237	115	397
Bevens Creek - Upper	22	203	69	396
Bluff Creek	27	207	87	323
Browns Creek	23	148	93	195
Cannon River	21	202	135	282
Carnelian Marine Outlet	17	104	92	120
Carver Creek	26	240	179	342
Credit River	23	223	133	347
Crow River	19	232	177	341
Eagle Creek	22	255	238	270
Elm Creek	n/a	n/a	n/a	n/a
Fish Creek	24	146	99	251
Minnehaha Creek	26	131	102	177
Nine Mile Creek	34	130	37	275
Rice Creek	n/a	n/a	n/a	n/a
Riley Creek	23	192	90	295
Rum River	21	122	78	160
Sand Creek	44	230	121	445
Scott County Ditch 10	22	189	83	339
Silver Creek	19	146	96	184
South Fork Crow River	18	222	172	307
Valley Creek	22	203	182	224
Vermillion River	19	202	94	242
West Raven Creek	22	222	70	348
Willow Creek	25	140	38	360

Total COD (mg/l)

Site	N	Mean	Min	Max
Bassett Creek	27	38	18	86
Battle Creek	47	36	16	121
Bevens Creek - Lower	39	55	5	127
Bevens Creek - Upper	26	70	40	110
Bluff Creek	28	50	6	167
Browns Creek	24	59	5	257
Cannon River	22	66	15	374
Carnelian Marine Outlet	17	17	10	24
Carver Creek	28	42	5	76
Credit River	26	40	5	86
Crow River	23	43	20	59
Eagle Creek	24	14	5	56
Elm Creek	n/a	n/a	n/a	n/a
Fish Creek	25	37	6	220
Minnehaha Creek	26	33	20	66
Nine Mile Creek	38	48	7	178
Rice Creek	n/a	n/a	n/a	n/a
Riley Creek	24	45	6	117
Rum River	22	36	16	66
Sand Creek	39	60	11	152
Scott County Ditch 10	25	60	28	157
Silver Creek	21	29	5	187
South Fork Crow River	21	48	28	71
Valley Creek	24	12	5	25
Vermillion River	18	34	7	121
West Raven Creek	25	60	28	202
Willow Creek	24	38	13	150

Chloride (mg/l)

Site	N	Mean	Min	Max
Bassett Creek	24	153	63	481
Battle Creek	44	166	38	1285
Bevens Creek - Lower	36	42	19	94
Bevens Creek - Upper	24	46	19	92
Bluff Creek	25	65	34	118
Browns Creek	24	17	11	27
Cannon River	21	30	19	58
Carnelian Marine Outlet	17	10	9	11
Carver Creek	27	41	25	70
Credit River	24	49	28	83
Crow River	22	41	17	123
Eagle Creek	21	20	18	23
Elm Creek	n/a	n/a	n/a	n/a
Fish Creek	24	110	41	155
Minnehaha Creek	26	107	46	259
Nine Mile Creek	35	94	12	469
Rice Creek	n/a	n/a	n/a	n/a
Riley Creek	24	52	14	143
Rum River	21	14	7	23
Sand Creek	39	59	24	217
Scott County Ditch 10	22	24	14	33
Silver Creek	19	17	15	22
South Fork Crow River	18	51	23	123
Valley Creek	22	19	17	20
Vermillion River	18	69	28	91
West Raven Creek	22	25	12	37
Willow Creek	25	109	5	213

Sulfate (mg/l)

Site	N	Mean	Min	Max
Bassett Creek	24	35	20	79
Battle Creek	45	13	4	34
Bevens Creek - Lower	34	64	2	127
Bevens Creek - Upper	22	46	11	127
Bluff Creek	24	23	9	37
Browns Creek	23	7	1	11
Cannon River	21	40	25	52
Carnelian Marine Outlet	17	2	1	9
Carver Creek	27	45	13	68
Credit River	19	23	10	34
Crow River	20	53	23	82
Eagle Creek	22	22	16	28
Elm Creek	n/a	n/a	n/a	n/a
Fish Creek	24	20	12	35
Minnehaha Creek	26	13	5	47
Nine Mile Creek	27	15	1	33
Rice Creek	n/a	n/a	n/a	n/a
Riley Creek	24	19	4	29
Rum River	21	10	1	17
Sand Creek	37	57	32	105
Scott County Ditch 10	21	64	18	328
Silver Creek	19	6	1	11
South Fork Crow River	20	85	62	135
Valley Creek	22	17	14	24
Vermillion River	18	36	23	45
West Raven Creek	22	53	12	318
Willow Creek	25	87	8	349

Total Kjeldahl nitrogen (mg/l as N)

Site	N	Mean	Min	Max
Bassett Creek	27	1.4	0.8	3.1
Battle Creek	47	1.1	0.5	4.3
Bevens Creek - Lower	41	2.0	0.2	5.6
Bevens Creek - Upper	27	2.5	1.2	5.4
Bluff Creek	28	1.5	0.1	5.6
Browns Creek	24	1.5	0.2	6.9
Cannon River	23	1.8	0.5	5.7
Carnelian Marine Outlet	17	0.4	0.3	0.6
Carver Creek	28	1.5	0.2	3.4
Credit River	27	1.2	0.1	2.9
Crow River	23	1.6	0.9	2.1
Eagle Creek	24	0.4	0.1	2.7
Elm Creek	19	1.2	0.5	2.4
Fish Creek	25	1.0	0.2	2.2
Minnehaha Creek	26	1.3	0.3	2.4
Nine Mile Creek	38	1.3	0.2	4.8
Rice Creek	9	1.6	0.9	3.2
Riley Creek	24	1.2	0.1	3.2
Rum River	22	1.0	0.5	1.4
Sand Creek	40	2.4	0.6	6.9
Scott County Ditch 10	27	2.3	0.5	5.3
Silver Creek	21	0.8	0.1	4.9
South Fork Crow River	21	2.0	1.0	3.8
Valley Creek	24	0.4	0.2	0.9
Vermillion River	19	1.3	0.4	5.6
West Raven Creek	27	2.1	0.7	4.2
Willow Creek	25	1.2	0.2	4.1

Total Nitrate (mg/l as N)

Site	N	Mean	Min	Max
Bassett Creek	27	0.38	0.03	0.79
Battle Creek	47	0.60	0.07	7.56
Bevens Creek - Lower	41	5.71	0.48	21.20
Bevens Creek - Upper	27	6.84	0.29	16.20
Bluff Creek	28	1.47	0.15	17.30
Browns Creek	24	0.67	0.08	1.65
Cannon River	23	5.00	2.14	8.65
Carnelian Marine Outlet	17	0.15	0.03	0.40
Carver Creek	28	1.89	0.49	5.17
Credit River	27	0.92	0.03	2.50
Crow River	23	2.87	0.03	6.67
Eagle Creek	24	0.23	0.06	0.89
Elm Creek	n/a	n/a	n/a	n/a
Fish Creek	25	0.91	0.12	1.96
Minnehaha Creek	26	0.33	0.03	1.29
Nine Mile Creek	38	0.84	0.10	11.00
Rice Creek	n/a	n/a	n/a	n/a
Riley Creek	24	1.23	0.03	2.39
Rum River	22	0.49	0.03	0.89
Sand Creek	40	3.52	0.16	10.60
Scott County Ditch 10	27	15.04	1.77	26.50
Silver Creek	21	0.77	0.03	1.57
South Fork Crow River	21	6.32	0.84	14.80
Valley Creek	24	4.34	3.41	5.07
Vermillion River	19	6.01	2.49	9.94
West Raven Creek	27	9.38	2.54	17.90
Willow Creek	25	0.46	0.09	1.32

Total nitrite (mg/l as N)

Site	N	Mean	Min	Max
Bassett Creek	27	0.02	0.02	0.07
Battle Creek	47	0.03	0.02	0.19
Bevens Creek - Lower	41	0.07	0.02	0.31
Bevens Creek - Upper	27	0.08	0.02	0.31
Bluff Creek	28	0.03	0.02	0.15
Browns Creek	24	0.02	0.02	0.05
Cannon River	23	0.07	0.02	0.13
Carnelian Marine Outlet	17	0.02	0.02	0.02
Carver Creek	28	0.05	0.02	0.16
Credit River	27	0.04	0.02	0.22
Crow River	23	0.03	0.02	0.07
Eagle Creek	24	0.02	0.02	0.03
Elm Creek	n/a	n/a	n/a	n/a
Fish Creek	25	0.03	0.02	0.13
Minnehaha Creek	26	0.02	0.02	0.04
Nine Mile Creek	38	0.03	0.02	0.34
Rice Creek	n/a	n/a	n/a	n/a
Riley Creek	24	0.03	0.02	0.07
Rum River	22	0.02	0.02	0.03
Sand Creek	40	0.05	0.02	0.27
Scott County Ditch 10	27	0.10	0.04	0.28
Silver Creek	21	0.02	0.02	0.06
South Fork Crow River	21	0.09	0.02	0.39
Valley Creek	24	0.05	0.02	0.33
Vermillion River	19	0.05	0.02	0.15
West Raven Creek	27	0.09	0.02	0.21
Willow Creek	25	0.02	0.02	0.13

Dissolved orthophosphorus (ug/l as P)

Site	N	Mean	Min	Max
Bassett Creek	27	0.03	0.00	0.07
Battle Creek	47	0.03	0.01	0.13
Bevens Creek - Lower	41	0.24	0.00	1.12
Bevens Creek - Upper	27	0.37	0.16	1.34
Bluff Creek	28	0.10	0.01	0.29
Browns Creek	24	0.06	0.02	0.13
Cannon River	23	0.14	0.02	0.44
Carnelian Marine Outlet	17	0.01	0.00	0.17
Carver Creek	28	0.04	0.00	0.31
Credit River	27	0.09	0.01	0.33
Crow River	23	0.15	0.00	0.56
Eagle Creek	24	0.01	0.01	0.02
Elm Creek	n/a	n/a	n/a	n/a
Fish Creek	25	0.08	0.01	0.17
Minnehaha Creek	26	0.02	0.00	0.07
Nine Mile Creek	38	0.02	0.00	0.09
Rice Creek	9	0.02	0.01	0.04
Riley Creek	24	0.05	0.01	0.36
Rum River	22	0.03	0.01	0.05
Sand Creek	40	0.21	0.03	0.63
Scott County Ditch 10	27	0.19	0.01	0.66
Silver Creek	21	0.03	0.00	0.05
South Fork Crow River	21	0.31	0.09	1.46
Valley Creek	24	0.01	0.01	0.03
Vermillion River	19	0.61	0.45	0.78
West Raven Creek	27	0.25	0.11	0.44
Willow Creek	25	0.03	0.00	0.15

Total phosphorus (ug/l as P)

Site	N	Mean	Min	Max
Bassett Creek	27	0.16	0.04	0.49
Battle Creek	47	0.21	0.03	1.66
Bevens Creek - Lower	41	0.45	0.01	1.53
Bevens Creek - Upper	27	0.58	0.18	1.87
Bluff Creek	28	0.45	0.02	2.24
Browns Creek	24	0.27	0.05	1.15
Cannon River	23	0.47	0.06	1.83
Carnelian Marine Outlet	17	0.02	0.01	0.04
Carver Creek	28	0.14	0.01	0.39
Credit River	27	0.26	0.01	0.56
Crow River	23	0.31	0.11	0.63
Eagle Creek	24	0.08	0.01	0.71
Elm Creek	19	0.16	0.04	0.30
Fish Creek	25	0.18	0.01	0.51
Minnehaha Creek	26	0.11	0.05	0.29
Nine Mile Creek	38	0.19	0.01	0.78
Rice Creek	10	0.17	0.07	0.48
Riley Creek	24	0.32	0.03	0.87
Rum River	22	0.12	0.04	0.19
Sand Creek	40	0.52	0.10	1.98
Scott County Ditch 10	27	0.40	0.07	1.24
Silver Creek	21	0.17	0.01	1.17
South Fork Crow River	21	0.52	0.15	1.76
Valley Creek	24	0.09	0.01	0.88
Vermillion River	19	0.77	0.41	2.21
West Raven Creek	27	0.46	0.09	1.31
Willow Creek	25	0.15	0.01	0.64

Total dissolved phosphorus (ug/l as P)

Site	N	Mean	Min	Max
Bassett Creek	27	0.04	0.01	0.14
Battle Creek	47	0.08	0.01	1.38
Bevens Creek - Lower	41	0.25	0.01	1.32
Bevens Creek - Upper	27	0.39	0.16	1.31
Bluff Creek	28	0.14	0.01	0.69
Browns Creek	24	0.07	0.03	0.26
Cannon River	23	0.15	0.01	0.50
Carnelian Marine Outlet	17	0.01	0.00	0.02
Carver Creek	28	0.07	0.01	0.33
Credit River	27	0.10	0.01	0.34
Crow River	23	0.18	0.01	0.55
Eagle Creek	24	0.01	0.01	0.04
Elm Creek	19	0.10	0.02	0.26
Fish Creek	25	0.11	0.02	0.29
Minnehaha Creek	26	0.05	0.01	0.19
Nine Mile Creek	38	0.05	0.01	0.28
Rice Creek	n/a	n/a	n/a	n/a
Riley Creek	24	0.06	0.01	0.38
Rum River	22	0.05	0.02	0.10
Sand Creek	40	0.23	0.06	0.68
Scott County Ditch 10	27	0.28	0.06	1.30
Silver Creek	21	0.03	0.01	0.07
South Fork Crow River	21	0.34	0.11	1.67
Valley Creek	24	0.05	0.01	0.82
Vermillion River	19	0.53	0.17	0.86
West Raven Creek	27	0.35	0.08	1.05
Willow Creek	25	0.04	0.01	0.16

Total suspended solids (mg/l)

Site	N	Mean	Min	Max
Bassett Creek	27	57	3	314
Battle Creek	47	50	1	324
Bevens Creek - Lower	41	218	1	1030
Bevens Creek - Upper	27	196	5	624
Bluff Creek	28	159	1	860
Browns Creek	24	78	1	216
Cannon River	23	190	2	1470
Carnelian Marine Outlet	17	2	1	8
Carver Creek	28	52	2	320
Credit River	27	50	1	226
Crow River	23	59	3	176
Eagle Creek	24	20	1	162
Elm Creek	19	9	5	21
Fish Creek	25	39	1	160
Minnehaha Creek	26	20	1	115
Nine Mile Creek	38	105	1	712
Rice Creek	8	81	9	413
Riley Creek	24	329	1	2690
Rum River	22	20	2	42
Sand Creek	40	178	2	1220
Scott County Ditch 10	27	85	8	556
Silver Creek	21	74	1	735
South Fork Crow River	21	49	1	136
Valley Creek	24	27	4	169
Vermillion River	19	62	2	348
West Raven Creek	27	107	1	1080
Willow Creek	25	57	1	482

Total volatile suspended solids (mg/l)

Site	N	Mean	Min	Max
Bassett Creek	27	12	1	56
Battle Creek	47	11	1	70
Bevens Creek - Lower	41	24	1	100
Bevens Creek - Upper	27	21	1	54
Bluff Creek	28	12	1	56
Browns Creek	24	28	1	88
Cannon River	23	28	1	230
Carnelian Marine Outlet	17	1	1	3
Carver Creek	28	8	1	32
Credit River	27	30	1	384
Crow River	23	12	1	29
Eagle Creek	24	6	1	50
Elm Creek	12	6	5	10
Fish Creek	25	7	1	21
Minnehaha Creek	26	7	1	38
Nine Mile Creek	38	25	1	184
Rice Creek	8	20	4	79
Riley Creek	24	53	1	604
Rum River	22	6	1	15
Sand Creek	40	28	1	128
Scott County Ditch 10	27	15	2	104
Silver Creek	21	17	1	145
South Fork Crow River	21	11	1	25
Valley Creek	24	6	1	28
Vermillion River	19	14	1	67
West Raven Creek	27	15	1	136
Willow Creek	25	14	1	117

Turbidity (ntu)

Site	N	Mean	Min	Max
Bassett Creek	26	13	2	50
Battle Creek	46	9	2	34
Bevens Creek - Lower	38	36	1	200
Bevens Creek - Upper	26	38	3	140
Bluff Creek	25	23	1	95
Browns Creek	24	12	3	55
Cannon River	13	12	2	55
Carnelian Marine Outlet	16	1	1	2
Carver Creek	27	12	2	50
Credit River	26	13	1	37
Crow River	19	14	4	29
Eagle Creek	20	6	2	33
Elm Creek	n/a	n/a	n/a	n/a
Fish Creek	24	13	1	50
Minnehaha Creek	24	5	2	17
Nine Mile Creek	37	19	1	85
Rice Creek	n/a	n/a	n/a	n/a
Riley Creek	16	28	2	150
Rum River	22	6	3	9
Sand Creek	39	30	2	170
Scott County Ditch 10	25	30	1	160
Silver Creek	21	11	1	100
South Fork Crow River	20	16	4	39
Valley Creek	15	2	1	5
Vermillion River	18	9	2	29
West Raven Creek	24	26	2	310
Willow Creek	23	8	1	50

APPENDIX C: 2004 MACROINVERTEBRATE DATA

Battle Creek 2004 Macroinvertebrate Organism List (Monitoring Date 10/11/2004)

Class	Order	Family	Sub-Family	Genus	Common Name	Organism Count
Crustacea	Amphipoda	Gammaridae		*Gammarus*	Scuds	44
Insecta	Coleoptera	Elmidae		*Stenelmis*	Riffle Beetles	122
Insecta	Diptera	Chironomidae	Chironominae	*Cryptochironomus*	Midges	6
Insecta	Diptera	Chironomidae	Chironominae	*Micropsectra*	Midges	1
Insecta	Diptera	Chironomidae	Chironominae	*Polypedilum*	Midges	47
Insecta	Diptera	Chironomidae	Chironominae	*Rheotanytarsus*	Midges	23
Insecta	Diptera	Chironomidae	Chironominae	*Saetheria*	Midges	41
Insecta	Diptera	Chironomidae	Chironominae	*Stictochironomus*	Midges	2
Insecta	Diptera	Chironomidae	Chironominae	*Sublettea*	Midges	28
Insecta	Diptera	Chironomidae	Chironominae	*Tanytarsus*	Midges	3
Insecta	Diptera	Chironomidae	Orthocladiinae	*Chaetocladius*	Midges	1
Insecta	Diptera	Chironomidae	Orthocladiinae	*Cricotopus*	Midges	10
Insecta	Diptera	Chironomidae	Orthocladiinae	*Nanocladius*	Midges	2
Insecta	Diptera	Chironomidae	Orthocladiinae	*Parametriocnemus*	Midges	33
Insecta	Diptera	Chironomidae	Orthocladiinae	*Thienemanniella*	Midges	7
Insecta	Diptera	Chironomidae	Tanypodinae	*Conchapelopia*	Midges	27
Insecta	Diptera	Empididae		*Hemerodromia*	Aquatic Dance Flies	7
Insecta	Diptera	Simuliidae		*Simulium*	Black Flies	148
Insecta	Diptera	Tipulidae		*Tipula*	Crane Flies	1
Insecta	Ephemeroptera	Baetidae		*Baetis*	Small Minnow Mayflies	501
Insecta	Hemiptera	Gerridae		*Aquarius*	Water Striders	2
Insecta	Odonata	Calopterygidae		*Calopteryx*	Broadwinged Damselflies	1
Insecta	Trichoptera	Hydropsychidae		*Hydropsyche*	Common Netspinners	3
Turbellaria					Planaria	244

Bevens Creek – Lower 2004 Macroinvertebrate Organism List (Monitoring Date 10/17/2004)

Class	Sub-Class	Order	Family	Sub-Family	Genus	Common Name	Organism Count
Clitellata	Oligochaeta					Segmented Worms	1
Insecta		Coleoptera	Dryopidae		*Postelichus*	Longtoed Water Beetles	1
Insecta		Coleoptera	Dytiscidae		*Neobidessus*	Predaceous Diving Beetles	1
Insecta		Coleoptera	Elmidae		*Dubiraphia*	Riffle Beetles	1
Insecta		Coleoptera	Elmidae		*Gonielmis*	Riffle Beetles	1
Insecta		Coleoptera	Elmidae		*Macronychus*	Riffle Beetles	3
Insecta		Coleoptera	Elmidae		*Stenelmis*	Riffle Beetles	31
Insecta		Diptera	Athericidae		*Atherix*	Watersnipe Flies	4
Insecta		Diptera	Chironomidae	Chironominae	*Cryptochironomus*	Midges	1
Insecta		Diptera	Chironomidae	Chironominae	*Microtendipes*	Midges	6
Insecta		Diptera	Chironomidae	Chironominae	*Polypedilum*	Midges	186
Insecta		Diptera	Chironomidae	Chironominae	*Rheotanytarsus*	Midges	29
Insecta		Diptera	Chironomidae	Chironominae	*Saetheria*	Midges	3
Insecta		Diptera	Chironomidae	Chironominae	*Tanytarsus*	Midges	1
Insecta		Diptera	Chironomidae	Orthocladiinae	*Brillia*	Midges	5
Insecta		Diptera	Chironomidae	Orthocladiinae	*Corynoneura*	Midges	1
Insecta		Diptera	Chironomidae	Orthocladiinae	*Cricotopus*	Midges	212
Insecta		Diptera	Chironomidae	Orthocladiinae	*Eukiefferiella*	Midges	1
Insecta		Diptera	Chironomidae	Orthocladiinae	*Parametriocnemus*	Midges	16
Insecta		Diptera	Chironomidae	Orthocladiinae	*Thienemanniella*	Midges	8
Insecta		Diptera	Chironomidae	Orthocladiinae	*Tvetenia*	Midges	1
Insecta		Diptera	Chironomidae	Tanypodinae		Midges	207
Insecta		Diptera	Empididae		*Hemerodromia*	Aquatic Dance Flies	12
Insecta		Diptera	Simuliidae		*Simulium*	Black Flies	25
Insecta		Diptera	Tipulidae		*Dicranota*	Crane Flies	46
Insecta		Diptera	Tipulidae		*Tipula*	Crane Flies	2
Insecta		Ephemeroptera	Baetidae		*Baetis*	Small Minnow Mayflies	71
Insecta		Ephemeroptera	Heptageniidae		*Stenonema*	Flatheaded Mayflies	62
Insecta		Ephemeroptera	Isonychiidae		*Isonychia*	Brushlegged Mayflies	3
Insecta		Ephemeroptera	Tricorythidae		*Tricorythodes*	Little Stout Crawlers	1
Insecta		Plecoptera	Taeniopterygidae		*Taeniopteryx*	Taeniopterygid Broadbacks	7
Insecta		Trichoptera	Hydropsychidae			Common Netspinners	67
Insecta		Trichoptera	Hydropsychidae		*Cheumatopsyche*	Common Netspinners	38
Insecta		Trichoptera	Hydropsychidae		*Hydropsyche*	Common Netspinners	291
Insecta		Trichoptera	Hydroptilidae		*Ochrotrichia*	Micro Caddisflies	17

Bluff Creek 2004 Macroinvertebrate Organism List (Monitoring Date 10/17/2004)

Class	Order	Family	Sub-Family	Genus	Common Name	Organism Count
Crustacea	Amphipoda	Gammaridae		*Gammarus*	Scuds	401
Gastropoda	Ctenobranchiata	Lymnaeidae		*Stagnicola*	Snails	1
Insecta	Coleoptera	Dryopidae		*Postelichus*	Longtoed Water Beetles	1
Insecta	Coleoptera	Dytiscidae		*Laccophilus*	Predaceous Diving Beetles	1
Insecta	Coleoptera	Dytiscidae		*Uvarus*	Predaceous Diving Beetles	1
Insecta	Coleoptera	Elmidae		*Optioservus*	Riffle Beetles	1
Insecta	Collembola	Isotomidae			Springtail	4
Insecta	Diptera	Chironomidae	Chironominae	*Paracladopelma*	Midges	1
Insecta	Diptera	Chironomidae	Orthocladiinae	*Brillia*	Midges	1
Insecta	Diptera	Chironomidae	Orthocladiinae	*Corynoneura*	Midges	147
Insecta	Diptera	Chironomidae	Orthocladiinae	*Cricotopus*	Midges	1
Insecta	Diptera	Chironomidae	Orthocladiinae	*Eukiefferiella*	Midges	30
Insecta	Diptera	Chironomidae	Orthocladiinae	*Parametriocnemus*	Midges	10
Insecta	Diptera	Chironomidae	Orthocladiinae	*Paraphaenocladius*	Midges	2
Insecta	Diptera	Chironomidae	Orthocladiinae	*Tvetenia*	Midges	5
Insecta	Diptera	Chironomidae	Tanypodinae		Midges	7
Insecta	Diptera	Empididae		*Clinocera*	Aquatic Dance Flies	1
Insecta	Diptera	Muscidae		*Limnophora*		2
Insecta	Diptera	Psychodidae		*Psychoda*	Moth Flies	1
Insecta	Diptera	Simuliidae		*Simulium*	Black Flies	4
Insecta	Diptera	Tipulidae		*Dicranota*	Crane Flies	3
Insecta	Diptera	Tipulidae		*Tipula*	Crane Flies	4
Insecta	Ephemeroptera	Baetidae		*Baetis*	Small Minnow Mayflies	53
Insecta	Ephemeroptera	Heptageniidae		*Stenonema*	Flatheaded Mayflies	1
Insecta	Hemiptera	Corixidae		*Sigara*	Water Boatman	1
Insecta	Plecoptera	Capniidae		*Allocapnia*	Slender Winter Stoneflies	18
Insecta	Plecoptera	Nemouridae			Nemourid Broadbacks	2
Insecta	Trichoptera	Hydropsychidae		*Cheumatopsyche*	Common Netspinners	1
Insecta	Trichoptera	Hydropsychidae		*Hydropsyche*	Common Netspinners	1

Browns Creek 2004 Macroinvertebrate Organism List (Monitoring Date 10/7/2004)

Class	Order	Family	Sub-Family	Genus	Common Name	Organism Count
Crustacea	Amphipoda	Gammaridae		*Gammarus*	Scuds	15
Crustacea	Isopoda	Asellidae		*Asellus*	Aquatic Sowbug	7
Gastropoda	Pulmonata	Physidae		*Physella*	Snails	9
Insecta	Coleoptera	Dytiscidae		*Laccophilus*	Predaceous Diving Beetles	7
Insecta	Coleoptera	Dytiscidae		*Neobidessus*	Predaceous Diving Beetles	10
Insecta	Coleoptera	Elmidae		*Macronychus*	Riffle Beetles	3
Insecta	Coleoptera	Elmidae		*Optioservus*	Riffle Beetles	134
Insecta	Coleoptera	Elmidae		*Stenelmis*	Riffle Beetles	31
Insecta	Coleoptera	Hydrophilidae		*Tropisternus*	Water Scavenger Beetles	2
Insecta	Diptera	Chironomidae	Chironominae	*Polypedilum*	Midges	1
Insecta	Diptera	Chironomidae	Diamesinae	*Diamesa*	Midges	3
Insecta	Diptera	Chironomidae	Diamesinae	*Pagastia*	Midges	1
Insecta	Diptera	Chironomidae	Orthocladiinae		Midges	7
Insecta	Diptera	Chironomidae	Orthocladiinae	*Brillia*	Midges	6
Insecta	Diptera	Chironomidae	Orthocladiinae	*Corynoneura*	Midges	16
Insecta	Diptera	Chironomidae	Orthocladiinae	*Eukiefferiella*	Midges	3
Insecta	Diptera	Chironomidae	Orthocladiinae	*Nanocladius*	Midges	4
Insecta	Diptera	Chironomidae	Orthocladiinae	*Parametriocnemus*	Midges	1
Insecta	Diptera	Chironomidae	Orthocladiinae	*Stilocladius*	Midges	4
Insecta	Diptera	Chironomidae	Orthocladiinae	*Thienemanniella*	Midges	4
Insecta	Diptera	Chironomidae	Orthocladiinae	*Tvetenia*	Midges	2
Insecta	Diptera	Chironomidae	Prodiamesinae	*Odontomesa*	Midges	16
Insecta	Diptera	Chironomidae	Prodiamesinae	*Prodiamesa*	Midges	9
Insecta	Diptera	Chironomidae	Tanypodinae		Midges	5
Insecta	Diptera	Dixidae		*Dixa*	Dixid Midges	4
Insecta	Diptera	Empididae		*Hemerodromia*	Aquatic Dance Flies	4
Insecta	Diptera	Simuliidae		*Simulium*	Black Flies	3
Insecta	Diptera	Tipulidae		*Antocha*	Crane Flies	3
Insecta	Diptera	Tipulidae		*Dicranota*	Crane Flies	20
Insecta	Diptera	Tipulidae		*Hexatoma*	Crane Flies	1

Insecta	Diptera	Tipulidae		*Tipula*	Crane Flies	3
Insecta	Ephemeroptera	Baetidae		*Baetis*	Small Minnow Mayflies	283
Insecta	Ephemeroptera	Heptageniidae		*Stenonema*	Flatheaded Mayflies	18
Insecta	Hemiptera	Belostomatidae	Belostomatinae		Giant Water Bugs	3
Insecta	Hemiptera	Corixidae		*Hesperocorixa*	Water Boatman	1
Insecta	Plecoptera	Capniidae		*Allocapnia*	Slender Winter Stoneflies	32
Insecta	Plecoptera	Perlodidae			Perlodidae	45
Insecta	Trichoptera	Brachycentridae		*Brachycentrus*	Humpless Case Makers	37
Insecta	Trichoptera	Glossosomatidae		*Glossosoma*	Saddlecase Makers	29
Insecta	Trichoptera	Hydropsychidae			Common Netspinners	4
Insecta	Trichoptera	Hydropsychidae		*Cheumatopsyche*	Common Netspinners	16
Insecta	Trichoptera	Hydropsychidae		*Hydropsyche*	Common Netspinners	7
Insecta	Trichoptera	Lepidostomatidae		*Lepidostoma*	Lepidostomatid Case Makers	13
Insecta	Trichoptera	Limnephilidae		*Hesperophylax*	Northern Case Makers	30
Insecta	Trichoptera	Philopotamidae		*Chimarra*	Fingernet Caddisflies	2

Credit River 2004 Macroinvertebrate Organism List (Monitoring Date 10/17/2004)

Class	Sub-Class	Order	Family	Sub-Family	Genus	Common Name	Organism Count
Clitellata	Oligochaeta					Segmented Worms	8
Crustacea		Amphipoda	Gammaridae		*Gammarus*	Scuds	2
Insecta		Coleoptera	Dytiscidae		*Laccophilus*	Predaceous Diving Beetles	1
Insecta		Coleoptera	Dytiscidae		*Neobidessus*	Predaceous Diving Beetles	5
Insecta		Coleoptera	Elmidae		*Dubiraphia*	Riffle Beetles	1
Insecta		Coleoptera	Elmidae		*Macronychus*	Riffle Beetles	3
Insecta		Coleoptera	Elmidae		*Optioservus*	Riffle Beetles	177
Insecta		Coleoptera	Elmidae		*Stenelmis*	Riffle Beetles	67
Insecta		Coleoptera	Scirtidae		*Cyphon*		1
Insecta		Diptera	Athericidae		*Atherix*	Watersnipe Flies	4
Insecta		Diptera	Ceratopogonidae			Biting Midges	2
Insecta		Diptera	Chironomidae	Chironominae	*Cladotanytarsus*	Midges	14
Insecta		Diptera	Chironomidae	Chironominae	*Dicrotendipes*	Midges	3
Insecta		Diptera	Chironomidae	Chironominae	*Micropsectra*	Midges	1
Insecta		Diptera	Chironomidae	Chironominae	*Microtendipes*	Midges	40
Insecta		Diptera	Chironomidae	Chironominae	*Paracladopelma*	Midges	2
Insecta		Diptera	Chironomidae	Chironominae	*Paratanytarsus*	Midges	1
Insecta		Diptera	Chironomidae	Chironominae	*Polypedilum*	Midges	8
Insecta		Diptera	Chironomidae	Chironominae	*Rheotanytarsus*	Midges	8
Insecta		Diptera	Chironomidae	Chironominae	*Sublettea*	Midges	1
Insecta		Diptera	Chironomidae	Chironominae	*Tanytarsus*	Midges	3
Insecta		Diptera	Chironomidae	Orthocladiinae	*Brillia*	Midges	2
Insecta		Diptera	Chironomidae	Orthocladiinae	*Corynoneura*	Midges	29
Insecta		Diptera	Chironomidae	Orthocladiinae	*Cricotopus*	Midges	210
Insecta		Diptera	Chironomidae	Orthocladiinae	*Eukiefferiella*	Midges	11
Insecta		Diptera	Chironomidae	Orthocladiinae	*Limnophyes*	Midges	9
Insecta		Diptera	Chironomidae	Orthocladiinae	*Nanocladius*	Midges	3
Insecta		Diptera	Chironomidae	Orthocladiinae	*Parakiefferiella*	Midges	12

Insecta		Diptera	Chironomidae	Orthocladiinae	*Parametriocnemus*	Midges	14
Insecta		Diptera	Chironomidae	Orthocladiinae	*Thienemanniella*	Midges	73
Insecta		Diptera	Chironomidae	Orthocladiinae	*Tvetenia*	Midges	61
Insecta		Diptera	Chironomidae	Tanypodinae		Midges	65
Insecta		Diptera	Chironomidae	Tanypodinae	*Labrundinia*	Midges	1
Insecta		Diptera	Simuliidae		*Simulium*	Black Flies	1
Insecta		Diptera	Tipulidae		*Antocha*	Crane Flies	4
Insecta		Diptera	Tipulidae		*Dicranota*	Crane Flies	30
Insecta		Diptera	Tipulidae		*Hexatoma*	Crane Flies	3
Insecta		Diptera	Tipulidae		*Tipula*	Crane Flies	1
Insecta		Ephemeroptera	Baetidae		*Baetis*	Small Minnow Mayflies	93
Insecta		Ephemeroptera	Heptageniidae		*Stenonema*	Flatheaded Mayflies	3
Insecta		Odonata	Calopterygidae		*Calopteryx*	Broadwinged Damselflies	1
Insecta		Plecoptera	Capniidae		*Allocapnia*	Slender Winter Stoneflies	26
Insecta		Plecoptera	Perlodidae			Perlodidae	16
Insecta		Plecoptera	Taeniopterygidae		*Taeniopteryx*	Taeniopterygid Broadbacks	20
Insecta		Trichoptera	Hydropsychidae			Common Netspinners	20
Insecta		Trichoptera	Hydropsychidae		*Cheumatopsyche*	Common Netspinners	4
Insecta		Trichoptera	Hydropsychidae		*Hydropsyche*	Common Netspinners	89
Pelecypoda		Eulamellibranchia	Sphaeriidae		*Pisidium*	Fingernail Clam	1
Turbellaria						Planaria	3

Eagle Creek 2004 Macroinvertebrate Organism List (Monitoring Date 10/16/2004)

Class	Order	Family	Sub-Family	Genus	Common Name	Organism Count
Crustacea	Amphipoda	Gammaridae		*Gammarus*	Scuds	60
Crustacea	Isopoda	Asellidae		*Asellus*	Aquatic Sowbug	10
Insecta	Coleoptera	Dytiscidae		*Neobidessus*	Predaceous Diving Beetles	1
Insecta	Diptera	Athericidae		*Atherix*	Watersnipe Flies	1
Insecta	Diptera	Chironomidae	Chironominae	*Phaenopsectra*	Midges	1
Insecta	Diptera	Chironomidae	Diamesinae	*Diamesa*	Midges	3
Insecta	Diptera	Chironomidae	Orthocladiinae		Midges	5
Insecta	Diptera	Chironomidae	Orthocladiinae	*Corynoneura*	Midges	4
Insecta	Diptera	Chironomidae	Orthocladiinae	*Eukiefferiella*	Midges	3
Insecta	Diptera	Chironomidae	Orthocladiinae	*Metriocnemus*	Midges	1
Insecta	Diptera	Chironomidae	Orthocladiinae	*Parametriocnemus*	Midges	1
Insecta	Diptera	Chironomidae	Orthocladiinae	*Thienemanniella*	Midges	4
Insecta	Diptera	Chironomidae	Orthocladiinae	*Tvetenia*	Midges	2
Insecta	Diptera	Chironomidae	Prodiamesinae	*Prodiamesa*	Midges	1
Insecta	Diptera	Dixidae		*Dixella*	Dixid Midges	1
Insecta	Diptera	Simuliidae		*Simulium*	Black Flies	30
Insecta	Diptera	Tipulidae		*Dicranota*	Crane Flies	1
Insecta	Diptera	Tipulidae		*Hexatoma*	Crane Flies	2
Insecta	Ephemeroptera	Baetidae		*Baetis*	Small Minnow Mayflies	547
Turbellaria					Planaria	1

Fish Creek 2004 Macroinvertebrate Organism List (Monitoring Date 10/11/2004)

Class	Sub-Class	Order	Family	Sub-Family	Genus	Common Name	Organism Count
Clitellata	Oligochaeta					Segmented Worms	13
Gastropoda		Pulmonata	Physidae		*Physella*	Snails	14
Insecta		Coleoptera	Curculionidae		*Rhinoncus*	Water Weevils	1
Insecta		Coleoptera	Elmidae		*Optioservus*	Riffle Beetles	645
Insecta		Coleoptera	Elmidae		*Stenelmis*	Riffle Beetles	87
Insecta		Coleoptera	Haliplidae		*Peltodytes*	Crawling Water Beetles	1
Insecta		Diptera	Chironomidae	Chironominae	*Cryptochironomus*	Midges	1
Insecta		Diptera	Chironomidae	Chironominae	*Polypedilum*	Midges	2
Insecta		Diptera	Chironomidae	Chironominae	*Rheotanytarsus*	Midges	38
Insecta		Diptera	Chironomidae	Diamesinae	*Diamesa*	Midges	1
Insecta		Diptera	Chironomidae	Orthocladiinae		Midges	3
Insecta		Diptera	Chironomidae	Orthocladiinae	*Chaetocladius*	Midges	1
Insecta		Diptera	Chironomidae	Orthocladiinae	*Corynoneura*	Midges	7
Insecta		Diptera	Chironomidae	Orthocladiinae	*Diplocladius*	Midges	1
Insecta		Diptera	Chironomidae	Orthocladiinae	*Eukiefferiella*	Midges	26
Insecta		Diptera	Chironomidae	Orthocladiinae	*Parametriocnemus*	Midges	40
Insecta		Diptera	Chironomidae	Orthocladiinae	*Thienemanniella*	Midges	6
Insecta		Diptera	Chironomidae	Orthocladiinae	*Tvetenia*	Midges	65
Insecta		Diptera	Chironomidae	Tanypodinae		Midges	8
Insecta		Diptera	Dolichopodidae		*Rhaphium*	Aquatic Longlegged Flies	1
Insecta		Diptera	Empididae		*Hemerodromia*	Aquatic Dance Flies	1
Insecta		Diptera	Simuliidae		*Simulium*	Black Flies	2
Insecta		Diptera	Tipulidae		*Tipula*	Crane Flies	1
Insecta		Ephemeroptera	Baetidae		*Baetis*	Small Minnow Mayflies	195
Insecta		Trichoptera	Hydropsychidae		*Cheumatopsyche*	Common Netspinners	2
Insecta		Trichoptera	Hydropsychidae		*Hydropsyche*	Common Netspinners	153
Insecta		Trichoptera	Leptoceridae		*Oecetis*	Longhorned Case Makers	1
Turbellaria						Planaria	8

Minnehaha Creek 2004 Macroinvertebrate Organism List (Monitoring Date 10/11/2004)

Class	Order	Family	Sub-Family	Genus	Common Name	Organism Count
Insecta	Coleoptera	Dytiscidae		*Laccophilus*	Predaceous Diving Beetles	1
Insecta	Coleoptera	Dytiscidae		*Neobidessus*	Predaceous Diving Beetles	2
Insecta	Coleoptera	Elmidae		*Stenelmis*	Riffle Beetles	105
Insecta	Diptera	Chironomidae	Chironominae	*Chironomus*	Midges	50
Insecta	Diptera	Chironomidae	Chironominae	*Cryptochironomus*	Midges	105
Insecta	Diptera	Chironomidae	Chironominae	*Dicrotendipes*	Midges	15
Insecta	Diptera	Chironomidae	Chironominae	*Microtendipes*	Midges	175
Insecta	Diptera	Chironomidae	Chironominae	*Nilothauma*	Midges	5
Insecta	Diptera	Chironomidae	Chironominae	*Parachironomus*	Midges	5
Insecta	Diptera	Chironomidae	Chironominae	*Polypedilum*	Midges	1185
Insecta	Diptera	Chironomidae	Chironominae	*Rheotanytarsus*	Midges	35
Insecta	Diptera	Chironomidae	Chironominae	*Saetheria*	Midges	25
Insecta	Diptera	Chironomidae	Chironominae	*Tanytarsus*	Midges	5
Insecta	Diptera	Chironomidae	Orthocladiinae	*Corynoneura*	Midges	20
Insecta	Diptera	Chironomidae	Orthocladiinae	*Cricotopus*	Midges	10
Insecta	Diptera	Chironomidae	Orthocladiinae	*Thienemanniella*	Midges	5
Insecta	Diptera	Chironomidae	Tanypodinae		Midges	515
Insecta	Diptera	Empididae		*Hemerodromia*	Aquatic Dance Flies	84
Insecta	Ephemeroptera	Caenidae		*Caenis*	Small Squaregills	37
Insecta	Ephemeroptera	Heptageniidae		*Stenonema*	Flatheaded Mayflies	5
Insecta	Odonata	Coenagrionidae			Narrowwinged Damselflies	3
Insecta	Trichoptera	Hydropsychidae			Common Netspinners	228
Insecta	Trichoptera	Hydropsychidae		*Cheumatopsyche*	Common Netspinners	178
Insecta	Trichoptera	Hydropsychidae		*Hydropsyche*	Common Netspinners	34
Insecta	Trichoptera	Leptoceridae		*Oecetis*	Longhorned Case Makers	1
Turbellaria					Planaria	7

Sand Creek 2004 Macroinvertebrate Organism List (Monitoring Date 10/17/2004)

Class	Sub-Class	Order	Family	Sub-Family	Genus	Common Name	Organism Count
Clitellata	Oligochaeta					Segmented Worms	9
Insecta		Coleoptera	Elmidae		*Stenelmis*	Riffle Beetles	29
Insecta		Collembola	Isotomidae			Springtail	5
Insecta		Diptera	Athericidae		*Atherix*	Watersnipe Flies	1
Insecta		Diptera	Chironomidae	Chironominae	*Chironomus*	Midges	1
Insecta		Diptera	Chironomidae	Chironominae	*Cladotanytarsus*	Midges	2
Insecta		Diptera	Chironomidae	Chironominae	*Cryptochironomus*	Midges	5
Insecta		Diptera	Chironomidae	Chironominae	*Micropsectra*	Midges	1
Insecta		Diptera	Chironomidae	Chironominae	*Microtendipes*	Midges	21
Insecta		Diptera	Chironomidae	Chironominae	*Polypedilum*	Midges	11
Insecta		Diptera	Chironomidae	Chironominae	*Rheotanytarsus*	Midges	15
Insecta		Diptera	Chironomidae	Orthocladiinae	*Corynoneura*	Midges	1
Insecta		Diptera	Chironomidae	Orthocladiinae	*Cricotopus*	Midges	4
Insecta		Diptera	Chironomidae	Orthocladiinae	*Nanocladius*	Midges	1
Insecta		Diptera	Chironomidae	Orthocladiinae	*Parametriocnemus*	Midges	2
Insecta		Diptera	Chironomidae	Orthocladiinae	*Rheocricotopus*	Midges	1
Insecta		Diptera	Chironomidae	Orthocladiinae	*Thienemanniella*	Midges	3
Insecta		Diptera	Chironomidae	Tanypodinae		Midges	24
Insecta		Diptera	Chironomidae	Tanypodinae	*Procladius*	Midges	1
Insecta		Diptera	Empididae		*Hemerodromia*	Aquatic Dance Flies	7
Insecta		Diptera	Simuliidae		*Simulium*	Black Flies	11
Insecta		Diptera	Tipulidae		*Dicranota*	Crane Flies	16
Insecta		Diptera	Tipulidae		*Tipula*	Crane Flies	1
Insecta		Ephemeroptera	Baetidae		*Baetis*	Small Minnow Mayflies	12
Insecta		Ephemeroptera	Caenidae		*Caenis*	Small Squaregills	1
Insecta		Ephemeroptera	Heptageniidae		*Stenonema*	Flatheaded Mayflies	24
Insecta		Ephemeroptera	Isonychiidae		*Isonychia*	Brushlegged Mayflies	1
Insecta		Ephemeroptera	Leptophlebiidae		*Paraleptophlebia*	Pronggills	1
Insecta		Ephemeroptera	Tricorythidae		*Tricorythodes*	Little Stout Crawlers	4
Insecta		Plecoptera	Capniidae		*Allocapnia*	Slender Winter Stoneflies	2
Insecta		Plecoptera	Perlidae		*Acroneuria*	Comon Stoneflies	2
Insecta		Plecoptera	Pteronarcyidae		*Pteronarcys*	Giant Stoneflies	1
Insecta		Plecoptera	Taeniopterygidae		*Taeniopteryx*	Taeniopterygid Broadbacks	25
Insecta		Trichoptera	Hydropsychidae		*Cheumatopsyche*	Common Netspinners	134
Insecta		Trichoptera	Hydropsychidae		*Hydropsyche*	Common Netspinners	27

Insecta		Trichoptera	Hydropsychidae		*Parapsyche*	Common Netspinners	28
Insecta		Trichoptera	Limnephilidae		*Limnephilus*	Northern Case Makers	2
Turbellaria						Planaria	14

Silver Creek 2004 Macroinvertebrate Organism List (Monitoring Date 10/7/2004)

Class	Sub-Class	Order	Family	Sub-Family	Genus	Common Name	Organism Count
Clitellata	Hirudinea	Arhynchobdellida	Haemopidae		*Haemopis*	Leeches	1
Crustacea		Amphipoda	Gammaridae		*Gammarus*	Scuds	99
Crustacea		Isopoda	Asellidae		*Asellus*	Aquatic Sowbug	4
Insecta		Coleoptera	Elmidae		*Optioservus*	Riffle Beetles	38
Insecta		Coleoptera	Elmidae		*Stenelmis*	Riffle Beetles	1
Insecta		Coleoptera	Hydrophilidae		*Hydrochara*	Water Scavenger Beetles	2
Insecta		Diptera	Chironomidae	Chironominae	*Rheotanytarsus*	Midges	1
Insecta		Diptera	Chironomidae	Orthocladiinae	*Brillia*	Midges	93
Insecta		Diptera	Chironomidae	Orthocladiinae	*Corynoneura*	Midges	44
Insecta		Diptera	Chironomidae	Orthocladiinae	*Eukiefferiella*	Midges	2
Insecta		Diptera	Chironomidae	Orthocladiinae	*Parachaetocladius*	Midges	1
Insecta		Diptera	Chironomidae	Orthocladiinae	*Parametriocnemus*	Midges	21
Insecta		Diptera	Chironomidae	Orthocladiinae	*Paraphaenocladius*	Midges	3
Insecta		Diptera	Chironomidae	Orthocladiinae	*Stilocladius*	Midges	1
Insecta		Diptera	Chironomidae	Orthocladiinae	*Thienemanniella*	Midges	74
Insecta		Diptera	Chironomidae	Orthocladiinae	*Tvetenia*	Midges	5
Insecta		Diptera	Chironomidae	Prodiamesinae	*Prodiamesa*	Midges	2
Insecta		Diptera	Chironomidae	Tanypodinae	*Conchapelopia*	Midges	1
Insecta		Diptera	Chironomidae	Tanypodinae	*Zavrelimyia*	Midges	4
Insecta		Diptera	Dixidae			Dixid Midges	1
Insecta		Diptera	Empididae		*Chelifera*	Aquatic Dance Flies	1
Insecta		Diptera	Simuliidae		*Simulium*	Black Flies	5
Insecta		Diptera	Tipulidae		*Dicranota*	Crane Flies	23
Insecta		Diptera	Tipulidae		*Tipula*	Crane Flies	13
Insecta		Ephemeroptera	Baetidae		*Baetis*	Small Minnow Mayflies	64
Insecta		Odonata	Aeshnidae		*Boyeria*	Darners	3
Insecta		Plecoptera	Capniidae		*Allocapnia*	Slender Winter Stoneflies	47
Insecta		Plecoptera	Nemouridae			Nemourid Broadbacks	20
Insecta		Trichoptera	Glossosomatidae		*Glossosoma*	Saddlecase Makers	10
Insecta		Trichoptera	Hydropsychidae		*Cheumatopsyche*	Common Netspinners	11
Insecta		Trichoptera	Hydropsychidae		*Hydropsyche*	Common Netspinners	3
Insecta		Trichoptera	Hydropsychidae		*Parapsyche*	Common Netspinners	21
Insecta		Trichoptera	Lepidostomatidae		*Lepidostoma*	Lepidostomatid Case Makers	27
Insecta		Trichoptera	Limnephilidae		*Hesperophylax*	Northern Case Makers	5
Turbellaria						Planaria	1

Valley Creek 2004 Macroinvertebrate Organism List (Monitoring Date 10/7/2004)

Class	Order	Family	Sub-Family	Genus	Common Name	Organism Count
Crustacea	Amphipoda	Gammaridae		***Gammarus***	Scuds	277
Crustacea	Isopoda	Asellidae		*Asellus*	Aquatic Sowbug	5
Gastropoda	Pulmonata	Planorbidae			Snails	19
Insecta	Coleoptera	Dytiscidae		*Neobidessus*	Predaceous Diving Beetles	1
Insecta	Coleoptera	Elmidae		*Optioservus*	Riffle Beetles	323
Insecta	Collembola	Isotomidae			Springtail	6
Insecta	Diptera	Chironomidae	Chironominae	*Micropsectra*	Midges	11
Insecta	Diptera	Chironomidae	Chironominae	*Polypedilum*	Midges	1
Insecta	Diptera	Chironomidae	Chironominae	*Rheotanytarsus*	Midges	17
Insecta	Diptera	Chironomidae	Chironominae	*Stempellinella*	Midges	6
Insecta	Diptera	Chironomidae	Diamesinae	*Diamesa*	Midges	61
Insecta	Diptera	Chironomidae	Diamesinae	*Pagastia*	Midges	3
Insecta	Diptera	Chironomidae	Orthocladiinae	*Corynoneura*	Midges	28
Insecta	Diptera	Chironomidae	Orthocladiinae	*Cricotopus*	Midges	28
Insecta	Diptera	Chironomidae	Orthocladiinae	*Eukiefferiella*	Midges	7
Insecta	Diptera	Chironomidae	Orthocladiinae	*Parachaetocladius*	Midges	2
Insecta	Diptera	Chironomidae	Orthocladiinae	*Parametriocnemus*	Midges	9
Insecta	Diptera	Chironomidae	Orthocladiinae	*Thienemanniella*	Midges	2
Insecta	Diptera	Chironomidae	Orthocladiinae	*Tvetenia*	Midges	8
Insecta	Diptera	Chironomidae	Prodiamesinae	*Odontomesa*	Midges	1
Insecta	Diptera	Chironomidae	Prodiamesinae	*Prodiamesa*	Midges	4
Insecta	Diptera	Chironomidae	Tanypodinae		Midges	23
Insecta	Diptera	Chironomidae	Tanypodinae	*Zavrelimyia*	Midges	1
Insecta	Diptera	Empididae		*Hemerodromia*	Aquatic Dance Flies	1
Insecta	Diptera	Muscidae		*Limnophora*		1
Insecta	Diptera	Simuliidae		*Simulium*	Black Flies	25
Insecta	Diptera	Tipulidae		*Antocha*	Crane Flies	2
Insecta	Diptera	Tipulidae		*Dicranota*	Crane Flies	3

Insecta	Diptera	Tipulidae		*Hexatoma*	Crane Flies	1
Insecta	Diptera	Tipulidae		*Pedicia*	Crane Flies	3
Insecta	Diptera	Tipulidae		*Tipula*	Crane Flies	1
Insecta	Ephemeroptera	Baetidae		*Baetis*	Small Minnow Mayflies	422
Insecta	Ephemeroptera	Caenidae		*Caenis*	Small Squaregills	1
Insecta	Ephemeroptera	Ephemerellidae		*Ephemerella*	Spiny Crawlers	1
Insecta	Ephemeroptera	Heptageniidae		*Stenonema*	Flatheaded Mayflies	2
Insecta	Hemiptera	Corixidae		*Sigara*	Water Boatman	1
Insecta	Trichoptera	Brachycentridae		*Brachycentrus*	Humpless Case Makers	58
Insecta	Trichoptera	Glossosomatidae		*Glossosoma*	Saddlecase Makers	41
Insecta	Trichoptera	Hydropsychidae			Common Netspinners	20
Insecta	Trichoptera	Hydropsychidae		*Cheumatopsyche*	Common Netspinners	9
Insecta	Trichoptera	Hydropsychidae		*Hydropsyche*	Common Netspinners	15
Insecta	Trichoptera	Hydroptilidae			Micro Caddisflies	2
Insecta	Trichoptera	Hydroptilidae		*Hydroptila*	Micro Caddisflies	1
Insecta	Trichoptera	Lepidostomatidae		*Lepidostoma*	Lepidostomatid Case Makers	2
Insecta	Trichoptera	Limnephilidae		*Pycnopsyche*	Northern Case Makers	1
Insecta	Trichoptera	Philopotamidae		*Chimarra*	Fingernet Caddisflies	4
Insecta	Trichoptera	Psychomyiidae		*Lype*	Nettube Caddisflies	1
Turbellaria					Planaria	19

Vermillion River 2004 Macroinvertebrate Organism List (Monitoring Date 10/15/2004)

Class	Sub-Class	Order	Family	Sub-Family	Genus	Common Name	Organism Count
Clitellata	Oligochaeta					Segmented Worms	3
Insecta		Coleoptera	Elmidae		*Ancyronyx*	Riffle Beetles	1
Insecta		Coleoptera	Elmidae		*Optioservus*	Riffle Beetles	37
Insecta		Coleoptera	Elmidae		*Stenelmis*	Riffle Beetles	24
Insecta		Diptera	Athericidae		*Atherix*	Watersnipe Flies	12
Insecta		Diptera	Chironomidae	Chironominae	*Cladotanytarsus*	Midges	1
Insecta		Diptera	Chironomidae	Chironominae	*Microtendipes*	Midges	2
Insecta		Diptera	Chironomidae	Chironominae	*Rheotanytarsus*	Midges	2
Insecta		Diptera	Chironomidae	Orthocladiinae	*Brillia*	Midges	2
Insecta		Diptera	Chironomidae	Orthocladiinae	*Cricotopus*	Midges	11
Insecta		Diptera	Chironomidae	Orthocladiinae	*Eukiefferiella*	Midges	3
Insecta		Diptera	Chironomidae	Orthocladiinae	*Thienemanniella*	Midges	1
Insecta		Diptera	Chironomidae	Orthocladiinae	*Tvetenia*	Midges	8
Insecta		Diptera	Empididae		*Hemerodromia*	Aquatic Dance Flies	1
Insecta		Diptera	Simuliidae		*Simulium*	Black Flies	5
Insecta		Diptera	Stratiomyidae			Aquatic Soldier Flies	1
Insecta		Diptera	Tipulidae		*Antocha*	Crane Flies	36
Insecta		Diptera	Tipulidae		*Dicranota*	Crane Flies	3
Insecta		Diptera	Tipulidae		*Tipula*	Crane Flies	1
Insecta		Ephemeroptera	Baetidae		*Baetis*	Small Minnow Mayflies	8
Insecta		Ephemeroptera	Baetiscidae		*Baetisca*	Armored Mayflies	1
Insecta		Ephemeroptera	Caenidae		*Caenis*	Small Squaregills	1
Insecta		Ephemeroptera	Heptageniidae		*Stenonema*	Flatheaded Mayflies	23
Insecta		Odonata	Calopterygidae		*Hetaerina*	Broadwinged Damselflies	1
Insecta		Plecoptera	Perlidae		*Acroneuria*	Comon Stoneflies	1
Insecta		Plecoptera	Perlodidae			Perlodidae	4
Insecta		Plecoptera	Pteronarcyidae		*Pteronarcys*	Giant Stoneflies	5
Insecta		Plecoptera	Taeniopterygidae		*Taeniopteryx*	Taeniopterygid Broadbacks	37
Insecta		Trichoptera	Brachycentridae		*Brachycentrus*	Humpless Case Makers	2
Insecta		Trichoptera	Hydropsychidae		*Hydropsyche*	Common Netspinners	310
Insecta		Trichoptera	Leptoceridae		*Ceraclea*	Longhorned Case Makers	1
Insecta		Trichoptera	Psychomyiidae		*Psychomyia*	Nettube Caddisflies	3
Turbellaria						Planaria	4

APPENDIX D: SUMMARY OF FLUX CALCULATIONS AND RESULTS

Battle Creek

Site	Area (ha)	Parameter	Year	Flow (hm3)	Model-Conc (ug/L)	Model-Mass (kg)	CV	Model-Conc (mg/L)	Model-Yield (kg/ha)	Precip (cm)	Runoff (cm)	RC
BA0022	2970	NO3	2000	5.33	432	2,307	0.049	0.432	0.78	78.3	18.0	0.23
BA0022	2970	NO3	2001	5.38	431	2,322	0.049	0.431	0.78	83.9	18.1	0.22
BA0022	2970	NO3	2002	8.76	419	3,670	0.049	0.419	1.24	112.1	29.5	0.26
BA0022	2970	NO3	2003	6.49	434	2,815	0.049	0.434	0.95	60.2	21.8	0.36
BA0022	2970	NO3	2004	8.30	412	3,422	0.049	0.412	1.15	77.1	28.0	0.36
BA0022	2970	TDP	1997	5.42	73	394	0.313	0.073	0.13	80.7	18.2	0.23
BA0022	2970	TDP	1998	3.72	86	320	0.194	0.086	0.11	96.9	12.5	0.13
BA0022	2970	TDP	1999	7.69	49	377	0.102	0.049	0.13	82.3	25.9	0.31
BA0022	2970	TDP	2000	5.33	45	239	0.045	0.045	0.08	78.3	18.0	0.23
BA0022	2970	TDP	2001	5.38	45	242	0.045	0.045	0.08	83.9	18.1	0.22
BA0022	2970	TDP	2002	8.76	46	403	0.045	0.046	0.14	112.1	29.5	0.26
BA0022	2970	TDP	2003	6.49	45	292	0.045	0.045	0.10	60.2	21.8	0.36
BA0022	2970	TDP	2004	8.30	46	382	0.045	0.046	0.13	77.1	28.0	0.36
BA0022	2970	TKN	2000	5.33	1,023	5,458	0.044	1.023	1.84	78.3	18.0	0.23
BA0022	2970	TKN	2001	5.38	1,010	5,437	0.044	1.010	1.83	83.9	18.1	0.22
BA0022	2970	TKN	2002	8.76	1,105	9,684	0.044	1.105	3.26	112.1	29.5	0.26
BA0022	2970	TKN	2003	6.49	1,010	6,547	0.044	1.010	2.20	60.2	21.8	0.36
BA0022	2970	TKN	2004	8.30	1,056	8,767	0.044	1.056	2.95	77.1	28.0	0.36
BA0022	2970	TP	1997	5.42	148	799	0.183	0.148	0.27	80.7	18.2	0.23
BA0022	2970	TP	1998	3.72	266	992	0.238	0.266	0.33	96.9	12.5	0.13
BA0022	2970	TP	1999	7.69	198	1,526	0.122	0.198	0.51	82.3	25.9	0.31
BA0022	2970	TP	2000	5.33	182	971	0.084	0.182	0.33	78.3	18.0	0.23
BA0022	2970	TP	2001	5.38	178	956	0.084	0.178	0.32	83.9	18.1	0.22
BA0022	2970	TP	2002	8.76	204	1,786	0.084	0.204	0.60	112.1	29.5	0.26
BA0022	2970	TP	2003	6.49	177	1,148	0.084	0.177	0.39	60.2	21.8	0.36
BA0022	2970	TP	2004	8.30	188	1,562	0.084	0.188	0.53	77.1	28.0	0.36
BA0022	2970	TSS	1997	5.42	50,689	274,516	0.328	50.689	92.43	80.7	18.2	0.23
BA0022	2970	TSS	1998	3.72	86,501	322,156	0.408	86.501	108.47	96.9	12.5	0.13
BA0022	2970	TSS	1999	7.69	70,874	544,943	0.311	70.874	183.48	82.3	25.9	0.31
BA0022	2970	TSS	2000	5.33	56,020	298,809	0.134	56.020	100.61	78.3	18.0	0.23
BA0022	2970	TSS	2001	5.38	49,411	265,882	0.134	49.411	89.52	83.9	18.1	0.22
BA0022	2970	TSS	2002	8.76	69,024	604,928	0.134	69.024	203.68	112.1	29.5	0.26
BA0022	2970	TSS	2003	6.49	55,307	358,669	0.134	55.307	120.76	60.2	21.8	0.36
BA0022	2970	TSS	2004	8.30	60,290	500,587	0.134	60.290	168.55	77.1	28.0	0.36

Bevens Creek – Lower

Site	Area (ha)	Parameter	Year	Flow (hm3)	Model-Conc (ug/L)	Model-Mass (kg)	CV	Model-Conc (mg/L)	Model-Yield (kg/ha)	Precip (cm)	Runoff (cm)	RC
BE0020	33750	NO3	1990	22.20	16,238	360,431	0.102	16.238	10.68	86.7	6.6	0.08
BE0020	33750	NO3	1991	52.30	17,797	930,728	0.102	17.797	27.58	90.2	15.5	0.17
BE0020	33750	NO3	1992	95.81	5,845	560,021	0.052	5.845	16.59	93.9	28.4	0.30
BE0020	33750	NO3	1993	176.93	5,768	1,020,563	0.052	5.768	30.24	88.7	52.4	0.59
BE0020	33750	NO3	1994	78.67	5,467	430,026	0.052	5.467	12.74	89.5	23.3	0.26
BE0020	33750	NO3	1995	72.32	5,586	404,030	0.052	5.586	11.97	79.6	21.4	0.27
BE0020	33750	NO3	1996	38.84	5,460	212,044	0.052	5.460	6.28	82.5	11.5	0.14
BE0020	33750	NO3	1997	108.05	7,726	834,763	0.065	7.726	24.73	70.5	32.0	0.45
BE0020	33750	NO3	1998	73.84	7,506	554,290	0.065	7.506	16.42	99.8	21.9	0.22
BE0020	33750	NO3	1999	52.38	6,803	356,315	0.065	6.803	10.56	88.0	15.5	0.18
BE0020	33750	NO3	2000	7.87	2,622	20,624	0.065	2.622	0.61	59.6	2.3	0.04
BE0020	33750	NO3	2001	71.84	11,528	828,153	0.060	11.528	24.54	70.0	21.3	0.30
BE0020	33750	NO3	2002	87.50	10,479	916,977	0.060	10.479	27.17	105.6	25.9	0.25
BE0020	33750	NO3	2003	33.48	8,142	272,594	0.060	8.142	8.08	49.0	9.9	0.20
BE0020	33750	NO3	2004	55.76	9,235	514,935	0.068	9.235	15.26	88.4	16.5	0.19
BE0020	33750	TDP	1990	22.20	573	12,726	0.078	0.573	0.38	86.7	6.6	0.08
BE0020	33750	TDP	1991	52.30	574	30,040	0.078	0.574	0.89	90.2	15.5	0.17
BE0020	33750	TDP	1992	95.81	324	31,081	0.040	0.324	0.92	93.9	28.4	0.30
BE0020	33750	TDP	1993	176.93	344	60,801	0.040	0.344	1.80	88.7	52.4	0.59
BE0020	33750	TDP	1994	78.67	291	22,927	0.040	0.291	0.68	89.5	23.3	0.26
BE0020	33750	TDP	1995	72.32	304	22,005	0.040	0.304	0.65	79.6	21.4	0.27
BE0020	33750	TDP	1996	38.84	305	11,863	0.040	0.305	0.35	82.5	11.5	0.14
BE0020	33750	TDP	1997	108.05	300	32,361	0.054	0.300	0.96	70.5	32.0	0.45
BE0020	33750	TDP	1998	73.84	290	21,381	0.054	0.290	0.63	99.8	21.9	0.22
BE0020	33750	TDP	1999	52.38	274	14,343	0.054	0.274	0.42	88.0	15.5	0.18
BE0020	33750	TDP	2000	7.87	221	1,737	0.054	0.221	0.05	59.6	2.3	0.04
BE0020	33750	TDP	2001	71.84	363	26,090	0.049	0.363	0.77	70.0	21.3	0.30
BE0020	33750	TDP	2002	87.50	343	30,033	0.049	0.343	0.89	105.6	25.9	0.25
BE0020	33750	TDP	2003	33.48	299	9,997	0.049	0.299	0.30	49.0	9.9	0.20
BE0020	33750	TDP	2004	55.76	329	18,326	0.056	0.329	0.54	88.4	16.5	0.19
BE0020	33750	TKN	2004	55.76	2,596	144,734	0.075	2.596	4.29	88.4	16.5	0.19
BE0020	33750	TP	1990	22.20	808	17,926	0.082	0.808	0.53	86.7	6.6	0.08
BE0020	33750	TP	1991	52.30	893	46,702	0.082	0.893	1.38	90.2	15.5	0.17
BE0020	33750	TP	1992	95.81	762	73,011	0.112	0.762	2.16	93.9	28.4	0.30
BE0020	33750	TP	1993	176.93	832	147,180	0.112	0.832	4.36	88.7	52.4	0.59
BE0020	33750	TP	1994	78.67	642	50,478	0.112	0.642	1.50	89.5	23.3	0.26

BE0020	33750	TP	1995	72.32	686	49,647	0.112	0.686	1.47	79.6	21.4	0.27
BE0020	33750	TP	1996	38.84	681	26,433	0.112	0.681	0.78	82.5	11.5	0.14
BE0020	33750	TP	1997	108.05	671	72,473	0.054	0.671	2.15	70.5	32.0	0.45
BE0020	33750	TP	1998	73.84	632	46,673	0.054	0.632	1.38	99.8	21.9	0.22
BE0020	33750	TP	1999	52.38	562	29,454	0.054	0.562	0.87	88.0	15.5	0.18
BE0020	33750	TP	2000	7.87	283	2,224	0.054	0.283	0.07	59.6	2.3	0.04
BE0020	33750	TP	2001	71.84	692	49,701	0.063	0.692	1.47	70.0	21.3	0.30
BE0020	33750	TP	2002	87.50	613	53,652	0.063	0.613	1.59	105.6	25.9	0.25
BE0020	33750	TP	2003	33.48	461	15,425	0.063	0.461	0.46	49.0	9.9	0.20
BE0020	33750	TP	2004	55.76	637	35,503	0.074	0.637	1.05	88.4	16.5	0.19
BE0020	33750	TSS	1990	22.20	173,665	3,854,907	0.146	173.665	114.22	86.7	6.6	0.08
BE0020	33750	TSS	1991	52.30	209,554	10,958,970	0.146	209.554	324.71	90.2	15.5	0.17
BE0020	33750	TSS	1992	95.81	248,278	23,787,020	0.149	248.278	704.80	93.9	28.4	0.30
BE0020	33750	TSS	1993	176.93	339,137	60,004,240	0.149	339.137	1,777.90	88.7	52.4	0.59
BE0020	33750	TSS	1994	78.67	190,851	15,013,370	0.149	190.851	444.84	89.5	23.3	0.26
BE0020	33750	TSS	1995	72.32	211,360	15,286,180	0.149	211.360	452.92	79.6	21.4	0.27
BE0020	33750	TSS	1996	38.84	196,504	7,631,723	0.149	196.504	226.13	82.5	11.5	0.14
BE0020	33750	TSS	1997	108.05	293,461	31,708,170	0.105	293.461	939.50	70.5	32.0	0.45
BE0020	33750	TSS	1998	73.84	264,627	19,541,210	0.105	264.627	579.00	99.8	21.9	0.22
BE0020	33750	TSS	1999	52.38	218,287	11,433,020	0.105	218.287	338.76	88.0	15.5	0.18
BE0020	33750	TSS	2000	7.87	21,137	166,237	0.105	21.137	4.93	59.6	2.3	0.04
BE0020	33750	TSS	2001	71.63	393,099	28,158,082	0.149	393.099	834.31	70.0	21.2	0.30
BE0020	33750	TSS	2002	87.50	339,282	29,687,871	0.149	339.282	879.64	105.6	25.9	0.25
BE0020	33750	TSS	2003	33.48	233,790	7,828,231	0.149	233.790	231.95	49.0	9.9	0.20
BE0020	33750	TSS	2004	55.76	335,121	18,685,325	0.149	335.121	553.64	88.4	16.5	0.19

Bevens Creek – Upper

Site	Area (ha)	Parameter	Year	Flow (hm3)	Model-Conc (ug/L)	Model-Mass (kg)	CV	Model-Conc (mg/L)	Model-Yield (kg/ha)	Precip (cm)	Runoff (cm)	RC
BE0050	23400	NO3	2002	47.87	7,985	382,222	0.076	7.985	16.33	105.6	20.5	0.19
BE0050	23400	NO3	2003	16.42	7,862	129,078	0.076	7.862	5.52	49.0	7.0	0.14
BE0050	23400	NO3	2004	34.53	7,878	272,019	0.076	7.878	11.62	88.4	14.8	0.17
BE0050	23400	TDP	2003	16.42	359	5,887	0.088	0.359	0.25	49.0	7.0	0.14
BE0050	23400	TDP	2004	34.53	342	11,821	0.088	0.342	0.51	88.4	14.8	0.17
BE0050	23400	TKN	2002	47.87	2,332	111,644	0.039	2.332	4.77	105.6	20.5	0.19
BE0050	23400	TKN	2003	16.42	2,225	36,538	0.039	2.225	1.56	49.0	7.0	0.14
BE0050	23400	TKN	2004	34.53	2,331	80,500	0.039	2.331	3.44	88.4	14.8	0.17
BE0050	23400	TP	2003	16.42	538	8,841	0.096	0.538	0.38	49.0	7.0	0.14
BE0050	23400	TP	2004	34.53	598	20,631	0.096	0.598	0.88	88.4	14.8	0.17
BE0050	23400	TSS	2003	16.42	215,902	3,544,892	0.146	215.902	151.49	49.0	7.0	0.14
BE0050	23400	TSS	2004	34.53	306,845	10,594,734	0.146	306.845	452.77	88.4	14.8	0.17

Bluff Creek

Site	Area (ha)	Parameter	Year	Flow (hm3)	Model-Conc (ug/L)	Model-Mass (kg)	CV	Model-Conc (mg/L)	Model-Yield (kg/ha)	Precip (cm)	Runoff (cm)	RC
BL0035	1470	NO3	1991	5.67	983	5,573	0.073	0.983	3.79	105.1	38.6	0.37
BL0035	1470	NO3	1992	6.02	919	5,527	0.073	0.919	3.76	77.2	40.9	0.53
BL0035	1470	NO3	1993	6.23	923	5,750	0.073	0.923	3.91	97.2	42.4	0.44
BL0035	1470	NO3	1994	6.12	917	5,607	0.073	0.917	3.81	83.7	41.6	0.50
BL0035	1470	NO3	1995	3.84	880	3,376	0.073	0.880	2.30	77.2	26.1	0.34
BL0035	1470	NO3	1996	2.84	878	2,496	0.073	0.878	1.70	63.6	19.3	0.30
BL0035	1470	NO3	1997	6.46	952	6,147	0.073	0.952	4.18	80.1	43.9	0.55
BL0035	1470	NO3	1998	6.34	951	6,023	0.073	0.951	4.10	81.2	43.1	0.53
BL0035	1470	NO3	1999	3.74	873	3,265	0.073	0.873	2.22	75.5	25.4	0.34
BL0035	1470	NO3	2000	1.95	835	1,625	0.073	0.835	1.11	73.7	13.2	0.18
BL0035	1470	NO3	2002	3.83	772	2,954	0.069	0.772	2.01	93.1	26.0	0.28
BL0035	1470	NO3	2003	2.54	730	1,855	0.069	0.730	1.26	59.4	17.3	0.29
BL0035	1470	NO3	2004	3.43	746	2,558	0.069	0.746	1.74	68.8	23.3	0.34
BL0035	1470	TDP	1991	5.67	161	912	0.075	0.161	0.62	105.1	38.6	0.37
BL0035	1470	TDP	1992	6.02	114	688	0.075	0.114	0.47	77.2	40.9	0.53
BL0035	1470	TDP	1993	6.23	115	714	0.075	0.115	0.49	97.2	42.4	0.44
BL0035	1470	TDP	1994	6.12	109	668	0.075	0.109	0.45	83.7	41.6	0.50
BL0035	1470	TDP	1995	3.84	91	349	0.075	0.091	0.24	77.2	26.1	0.34
BL0035	1470	TDP	1996	2.84	91	258	0.075	0.091	0.18	63.6	19.3	0.30
BL0035	1470	TDP	1997	6.46	136	881	0.075	0.136	0.60	80.1	43.9	0.55
BL0035	1470	TDP	1998	6.34	136	859	0.075	0.136	0.58	81.2	43.1	0.53
BL0035	1470	TDP	1999	3.74	86	323	0.075	0.086	0.22	75.5	25.4	0.34
BL0035	1470	TDP	2000	1.95	65	127	0.075	0.065	0.09	73.7	13.2	0.18
BL0035	1470	TDP	2002	3.83	164	628	0.116	0.164	0.43	93.1	26.0	0.28
BL0035	1470	TDP	2003	2.54	149	380	0.116	0.149	0.26	59.4	17.3	0.29
BL0035	1470	TDP	2004	3.43	166	569	0.116	0.166	0.39	68.8	23.3	0.34
BL0035	1470	TKN	2002	3.83	1,565	5,991	0.094	1.565	4.08	93.1	26.0	0.28
BL0035	1470	TKN	2003	2.54	1,461	3,712	0.094	1.461	2.53	59.4	17.3	0.29
BL0035	1470	TKN	2004	3.43	1,620	5,554	0.094	1.620	3.78	68.8	23.3	0.34
BL0035	1470	TP	1991	5.67	841	4,769	0.091	0.841	3.24	105.1	38.6	0.37
BL0035	1470	TP	1992	6.02	562	3,382	0.091	0.562	2.30	77.2	40.9	0.53
BL0035	1470	TP	1993	6.23	539	3,261	0.091	0.539	2.22	97.2	42.4	0.44
BL0035	1470	TP	1994	6.12	430	2,630	0.091	0.430	1.79	83.7	41.6	0.50
BL0035	1470	TP	1995	3.84	405	1,552	0.091	0.405	1.06	77.2	26.1	0.34
BL0035	1470	TP	1996	2.84	376	1,069	0.091	0.376	0.73	63.6	19.3	0.30
BL0035	1470	TP	1997	6.46	654	4,225	0.091	0.654	2.87	80.1	43.9	0.55

BL0035	1470	TP	1998	6.34	604	3,827	0.091	0.604	2.60	81.2	43.1	0.53
BL0035	1470	TP	1999	3.74	365	1,364	0.091	0.365	0.93	75.5	25.4	0.34
BL0035	1470	TP	2000	1.95	291	566	0.091	0.291	0.39	73.7	13.2	0.18
BL0035	1470	TP	2002	3.83	478	1,829	0.130	0.478	1.24	93.1	26.0	0.28
BL0035	1470	TP	2003	2.54	431	1,095	0.130	0.431	0.75	59.4	17.3	0.29
BL0035	1470	TP	2004	3.43	509	1,745	0.130	0.509	1.19	68.8	23.3	0.34
BL0035	1470	TSS	1991	5.67	593,901	3,367,081	0.114	593.901	2,290.53	105.1	38.6	0.37
BL0035	1470	TSS	1992	6.02	347,730	2,091,466	0.114	347.730	1,422.77	77.2	40.9	0.53
BL0035	1470	TSS	1993	6.23	295,994	1,844,718	0.114	295.994	1,254.91	97.2	42.4	0.44
BL0035	1470	TSS	1994	6.12	246,290	1,506,758	0.114	246.290	1,025.01	83.7	41.6	0.50
BL0035	1470	TSS	1995	3.84	221,614	849,855	0.114	221.614	578.13	77.2	26.1	0.34
BL0035	1470	TSS	1996	2.84	225,377	640,852	0.114	225.377	435.95	63.6	19.3	0.30
BL0035	1470	TSS	1997	6.46	433,951	2,802,833	0.114	433.951	1,906.69	80.1	43.9	0.55
BL0035	1470	TSS	1998	6.34	459,658	2,912,077	0.114	459.658	1,981.00	81.2	43.1	0.53
BL0035	1470	TSS	1999	3.74	169,142	632,557	0.114	169.142	430.31	75.5	25.4	0.34
BL0035	1470	TSS	2000	1.95	170,577	331,908	0.114	170.577	225.79	73.7	13.2	0.18
BL0035	1470	TSS	2002	3.83	342,160	1,310,131	0.213	342.160	891.25	93.1	26.0	0.28
BL0035	1470	TSS	2003	2.54	302,365	768,007	0.213	302.365	522.45	59.4	17.3	0.29
BL0035	1470	TSS	2004	3.43	386,210	1,323,926	0.213	386.210	900.63	68.8	23.3	0.34

Browns Creek

Site	Area (ha)	Parameter	Year	Flow (hm3)	Model-Conc (ug/L)	Model-Mass (kg)	CV	Model-Conc (mg/L)	Model-Yield (kg/ha)	Precip (cm)	Runoff (cm)	RC
BR0003	7410	NO3	2000	12.03	788	9,483	0.045	0.788	1.28	79.1	16.2	0.21
BR0003	7410	NO3	2001	13.98	697	9,750	0.039	0.697	1.32	88.1	18.9	0.21
BR0003	7410	NO3	2002	16.74	659	11,026	0.039	0.659	1.49	104.6	22.6	0.22
BR0003	7410	NO3	2003	10.29	816	8,395	0.039	0.816	1.13	73.4	13.9	0.19
BR0003	7410	NO3	2004	8.75	863	7,554	0.039	0.863	1.02	76.3	11.8	0.15
BR0003	7410	TDP	1998	10.21	55	557	0.067	0.055	0.08	86.0	13.8	0.16
BR0003	7410	TDP	1999	12.12	59	718	0.067	0.059	0.10	86.5	16.4	0.19
BR0003	7410	TDP	2000	12.03	60	722	0.067	0.060	0.10	79.1	16.2	0.21
BR0003	7410	TDP	2001	13.98	66	921	0.067	0.066	0.12	88.1	18.9	0.21
BR0003	7410	TDP	2002	16.77	66	1,110	0.067	0.066	0.15	104.6	22.6	0.22
BR0003	7410	TDP	2003	10.29	59	603	0.067	0.059	0.08	73.4	13.9	0.19
BR0003	7410	TDP	2004	8.75	60	526	0.087	0.060	0.07	76.3	11.8	0.15
BR0003	7410	TKN	2001	13.98	1,646	23,020	0.071	1.646	3.11	88.1	18.9	0.21
BR0003	7410	TKN	2002	16.74	1,827	30,588	0.071	1.827	4.13	104.6	22.6	0.22
BR0003	7410	TKN	2003	10.29	1,163	11,968	0.071	1.163	1.62	73.4	13.9	0.19
BR0003	7410	TKN	2004	8.75	943	8,248	0.071	0.943	1.11	76.3	11.8	0.15
BR0003	7410	TP	1998	10.21	187	1,904	0.081	0.187	0.26	86.0	13.8	0.16
BR0003	7410	TP	1999	12.12	208	2,523	0.081	0.208	0.34	86.5	16.4	0.19
BR0003	7410	TP	2000	12.03	231	2,779	0.081	0.231	0.38	79.1	16.2	0.21
BR0003	7410	TP	2001	13.98	244	3,413	0.081	0.244	0.46	88.1	18.9	0.21
BR0003	7410	TP	2002	16.77	245	4,113	0.081	0.245	0.56	104.6	22.6	0.22
BR0003	7410	TP	2003	10.29	197	2,032	0.081	0.197	0.27	73.4	13.9	0.19
BR0003	7410	TP	2004	8.75	167	1,460	0.094	0.167	0.20	76.3	11.8	0.15
BR0003	7410	TSS	1998	10.21	49,908	509,387	0.121	49.908	68.74	86.0	13.8	0.16
BR0003	7410	TSS	1999	12.12	84,072	1,019,051	0.121	84.072	137.52	86.5	16.4	0.19
BR0003	7410	TSS	2000	12.03	87,914	1,057,917	0.121	87.914	142.77	79.1	16.2	0.21
BR0003	7410	TSS	2001	13.98	120,852	1,689,994	0.108	120.852	228.07	88.1	18.9	0.21
BR0003	7410	TSS	2002	16.74	131,969	2,208,897	0.108	131.969	298.10	104.6	22.6	0.22
BR0003	7410	TSS	2003	10.29	73,041	751,449	0.108	73.041	101.41	73.4	13.9	0.19
BR0003	7410	TSS	2004	8.75	46,556	407,318	0.108	46.556	54.97	76.3	11.8	0.15

Bassett Creek

Site	Area (ha)	Parameter	Year	Flow (hm3)	Model-Conc (ug/L)	Model-Mass (kg)	CV	Model-Conc (mg/L)	Model-Yield (kg/ha)	Precip (cm)	Runoff (cm)	RC
BS0019	10370	NO3	2001	52.00	413	21,459	0.075	0.413	2.07	86.9	50.1	0.58
BS0019	10370	NO3	2002	51.72	422	21,827	0.075	0.422	2.10	97.2	49.9	0.51
BS0019	10370	NO3	2003	32.18	420	13,526	0.075	0.420	1.30	57.7	31.0	0.54
BS0019	10370	NO3	2004	27.62	353	9,760	0.054	0.353	0.94	69.6	26.6	0.38
BS0019	10370	TDP	2001	52.00	48	2,474	0.076	0.048	0.24	86.9	50.1	0.58
BS0019	10370	TDP	2002	51.72	48	2,461	0.076	0.048	0.24	97.2	49.9	0.51
BS0019	10370	TDP	2003	32.18	48	1,531	0.076	0.048	0.15	57.7	31.0	0.54
BS0019	10370	TDP	2004	27.62	44	1,210	0.167	0.044	0.12	69.6	26.6	0.38
BS0019	10370	TKN	2004	27.62	1,471	40,614	0.095	1.471	3.92	69.6	26.6	0.38
BS0019	10370	TP	2001	52.00	131	6,808	0.058	0.131	0.66	86.9	50.1	0.58
BS0019	10370	TP	2002	51.72	131	6,771	0.058	0.131	0.65	97.2	49.9	0.51
BS0019	10370	TP	2003	32.18	131	4,213	0.058	0.131	0.41	57.7	31.0	0.54
BS0019	10370	TP	2004	27.62	195	5,399	0.220	0.195	0.52	69.6	26.6	0.38
BS0019	10370	TSS	2001	52.00	33,457	1,621,550	0.112	33.457	156.37	86.9	50.1	0.58
BS0019	10370	TSS	2002	51.72	33,180	1,618,134	0.112	33.180	156.04	97.2	49.9	0.51
BS0019	10370	TSS	2003	32.18	30,201	971,902	0.112	30.201	93.72	57.7	31.0	0.54
BS0019	10370	TSS	2004	27.62	82,260	2,271,866	0.356	82.260	219.08	69.6	26.6	0.38

Carver Creek

Site	Area (ha)	Parameter	Year	Flow (hm3)	Model-Conc (ug/L)	Model-Mass (kg)	CV	Model-Conc (mg/L)	Model-Yield (kg/ha)	Precip (cm)	Runoff (cm)	RC
CA0017	21460	NO3	1989	7.03	2,242	15,759	0.066	2.242	0.73			
CA0017	21460	NO3	1990	14.60	2,760	40,298	0.066	2.760	1.88	84.4	6.8	0.08
CA0017	21460	NO3	1991	34.98	3,005	105,130	0.066	3.005	4.90	105.1	16.3	0.16
CA0017	21460	NO3	1992	33.10	1,589	52,594	0.068	1.589	2.45	77.2	15.4	0.20
CA0017	21460	NO3	1993	84.76	1,785	151,260	0.068	1.785	7.05	97.2	39.5	0.41
CA0017	21460	NO3	1994	38.57	1,502	57,923	0.068	1.502	2.70	83.7	18.0	0.21
CA0017	21460	NO3	1995	38.18	1,488	56,798	0.068	1.488	2.65	77.2	17.8	0.23
CA0017	21460	NO3	1996	28.48	1,521	43,323	0.068	1.521	2.02	63.6	13.3	0.21
CA0017	21460	NO3	1997	41.54	2,203	91,530	0.059	2.203	4.27	80.1	19.4	0.24
CA0017	21460	NO3	1998	34.74	2,198	76,358	0.059	2.198	3.56	81.2	16.2	0.20
CA0017	21460	NO3	1999	28.61	2,198	62,882	0.059	2.198	2.93	75.5	13.3	0.18
CA0017	21460	NO3	2000	5.64	2,205	12,444	0.059	2.205	0.58	73.7	2.6	0.04
CA0017	21460	NO3	2001	35.11	3,418	119,999	0.101	3.418	5.59	85.5	16.4	0.19
CA0017	21460	NO3	2002	47.08	2,996	141,038	0.101	2.996	6.57	93.1	21.9	0.24
CA0017	21460	TDP	1990	14.60	439	6,405	0.045	0.439	0.30	84.4	6.8	0.08
CA0017	21460	TDP	1991	34.98	474	16,578	0.045	0.474	0.77	105.1	16.3	0.16
CA0017	21460	TDP	1992	33.10	230	7,613	0.055	0.230	0.35	77.2	15.4	0.20
CA0017	21460	TDP	1993	84.76	282	23,938	0.055	0.282	1.12	97.2	39.5	0.41
CA0017	21460	TDP	1994	38.57	201	7,767	0.055	0.201	0.36	83.7	18.0	0.21
CA0017	21460	TDP	1995	38.18	200	7,640	0.055	0.200	0.36	77.2	17.8	0.23
CA0017	21460	TDP	1996	28.48	211	6,000	0.055	0.211	0.28	63.6	13.3	0.21
CA0017	21460	TDP	1997	41.54	203	8,430	0.064	0.203	0.39	80.1	19.4	0.24
CA0017	21460	TDP	1998	34.74	184	6,406	0.064	0.184	0.30	81.2	16.2	0.20
CA0017	21460	TDP	1999	28.61	188	5,374	0.064	0.188	0.25	75.5	13.3	0.18
CA0017	21460	TDP	2000	5.64	119	670	0.064	0.119	0.03	73.7	2.6	0.04
CA0017	21460	TDP	2001	35.11	256	8,971	0.076	0.256	0.42	85.5	16.4	0.19
CA0017	21460	TDP	2002	47.08	235	11,083	0.076	0.235	0.52	93.1	21.9	0.24
CA0017	21460	TP	1989	7.03	870	6,117	0.140	0.870	0.29			
CA0017	21460	TP	1990	14.60	847	12,371	0.140	0.847	0.58	84.4	6.8	0.08
CA0017	21460	TP	1991	34.98	695	24,307	0.140	0.695	1.13	105.1	16.3	0.16
CA0017	21460	TP	1992	33.10	870	28,796	0.246	0.870	1.34	77.2	15.4	0.20
CA0017	21460	TP	1993	84.76	970	82,221	0.246	0.970	3.83	97.2	39.5	0.41
CA0017	21460	TP	1994	38.57	1,010	38,957	0.246	1.010	1.82	83.7	18.0	0.21
CA0017	21460	TP	1995	38.18	915	34,917	0.246	0.915	1.63	77.2	17.8	0.23
CA0017	21460	TP	1996	28.48	876	24,958	0.246	0.876	1.16	63.6	13.3	0.21
CA0017	21460	TP	1997	41.54	905	37,579	0.259	0.905	1.75	80.1	19.4	0.24

CA0017	21460	TP	1998	34.74	722	25,096	0.259	0.722	1.17	81.2	16.2	0.20
CA0017	21460	TP	1999	28.61	746	21,333	0.259	0.746	0.99	75.5	13.3	0.18
CA0017	21460	TP	2000	5.64	299	1,689	0.259	0.299	0.08	73.7	2.6	0.04
CA0017	21460	TP	2001	35.11	659	23,144	0.188	0.659	1.08	85.5	16.4	0.19
CA0017	21460	TP	2002	47.08	584	27,513	0.188	0.584	1.28	93.1	21.9	0.24
CA0017	21460	TSS	1989	7.03	216,572	1,522,170	0.169	216.572	70.93			
CA0017	21460	TSS	1990	14.60	282,770	4,128,416	0.169	282.770	192.38	84.4	6.8	0.08
CA0017	21460	TSS	1991	34.98	323,007	11,299,150	0.169	323.007	526.52	105.1	16.3	0.16
CA0017	21460	TSS	1992	33.10	250,773	8,300,718	0.155	250.773	386.80	77.2	15.4	0.20
CA0017	21460	TSS	1993	84.76	293,505	24,876,500	0.155	293.505	1,159.20	97.2	39.5	0.41
CA0017	21460	TSS	1994	38.57	294,065	11,342,700	0.155	294.065	528.55	83.7	18.0	0.21
CA0017	21460	TSS	1995	38.18	261,218	9,973,024	0.155	261.218	464.73	77.2	17.8	0.23
CA0017	21460	TSS	1996	28.48	249,888	7,116,000	0.155	249.888	331.59	63.6	13.3	0.21
CA0017	21460	TSS	1997	41.54	323,984	13,459,270	0.165	323.984	627.18	80.1	19.4	0.24
CA0017	21460	TSS	1998	34.74	308,513	10,718,520	0.165	308.513	499.47	81.2	16.2	0.20
CA0017	21460	TSS	1999	28.61	317,473	9,084,258	0.165	317.473	423.31	75.5	13.3	0.18
CA0017	21460	TSS	2000	5.64	43,107	243,238	0.165	43.107	11.33	73.7	2.6	0.04
CA0017	21460	TSS	2001	35.11	306,501	10,760,030	0.299	306.501	501.40	85.5	16.4	0.19
CA0017	21460	TSS	2002	47.08	254,261	11,970,410	0.299	254.261	557.80	93.1	21.9	0.24

Carnelian Marine Outlet

Site	Area (ha)	Parameter	Year	Flow (hm3)	Model-Conc (ug/L)	Model-Mass (kg)	CV	Model-Conc (mg/L)	Model-Yield (kg/ha)	Precip (cm)	Runoff (cm)	RC
CM0030	7780	NO3	2001	5.03	164	826	0.292	0.164	0.11	88.1	6.5	0.07
CM0030	7780	NO3	2002	7.37	97	714	0.120	0.097	0.09	104.6	9.5	0.09
CM0030	7780	NO3	2003	5.99	110	660	0.070	0.110	0.08	73.4	7.7	0.10
CM0030	7780	NO3	2004	3.80	122	464	0.120	0.122	0.06	76.3	4.9	0.06
CM0030	7780	TDP	1996	9.74	10	96	0.100	0.010	0.01	81.5	12.5	0.15
CM0030	7780	TDP	1997	6.07	21	127	0.373	0.021	0.02	72.8	7.8	0.11
CM0030	7780	TDP	1998		11	45	0.127	0.011	0.01	86.0	0.0	0.00
CM0030	7780	TDP	2000	0.92	15	13	0.114	0.015	0.00	79.1	1.2	0.02
CM0030	7780	TDP	2001	5.03	10	50	0.050	0.010	0.01	88.1	6.5	0.07
CM0030	7780	TDP	2002	7.42	11	85	0.067	0.011	0.01	104.6	9.5	0.09
CM0030	7780	TDP	2003	5.99	12	73	0.114	0.012	0.01	73.4	7.7	0.10
CM0030	7780	TDP	2004	3.80	12	47	0.114	0.012	0.01	76.3	4.9	0.06
CM0030	7780	TKN	2002	7.37	425	3,134	0.030	0.425	0.40	104.6	9.5	0.09
CM0030	7780	TKN	2003	5.99	418	2,502	0.030	0.418	0.32	73.4	7.7	0.10
CM0030	7780	TKN	2004	3.80	420	1,596	0.030	0.420	0.21	76.3	4.9	0.06
CM0030	7780	TP	1996	9.74	16	153	0.144	0.016	0.02	81.5	12.5	0.15
CM0030	7780	TP	1997	6.07	28	170	0.233	0.028	0.02	72.8	7.8	0.11
CM0030	7780	TP	1998	4.21	22	94	0.287	0.022	0.01	86.0	5.4	0.06
CM0030	7780	TP	2000	0.92	23	21	0.088	0.023	0.00	79.1	1.2	0.02
CM0030	7780	TP	2001	5.03	23	114	0.088	0.023	0.01	88.1	6.5	0.07
CM0030	7780	TP	2002	7.37	23	167	0.088	0.023	0.02	104.6	9.5	0.09
CM0030	7780	TP	2003	5.99	23	135	0.088	0.023	0.02	73.4	7.7	0.10
CM0030	7780	TP	2004	3.80	23	86	0.088	0.023	0.01	76.3	4.9	0.06
CM0030	7780	TSS	1996	9.74	3,597	35,054	0.108	3.597	4.51	81.5	12.5	0.15
CM0030	7780	TSS	1997	6.07	3,316	20,115	0.335	3.316	2.59	72.8	7.8	0.11
CM0030	7780	TSS	1998	4.21	4,387	18,462	0.416	4.387	2.37	86.0	5.4	0.06
CM0030	7780	TSS	2000	0.92	2,302	2,125	0.110	2.302	0.27	79.1	1.2	0.02
CM0030	7780	TSS	2001	5.03	2,435	12,253	0.110	2.435	1.57	88.1	6.5	0.07
CM0030	7780	TSS	2002	7.42	2,532	18,776	0.106	2.532	2.41	104.6	9.5	0.09
CM0030	7780	TSS	2003	5.99	2,408	14,419	0.110	2.408	1.85	73.4	7.7	0.10
CM0030	7780	TSS	2004	3.80	2,403	9,131	0.110	2.403	1.17	76.3	4.9	0.06

Cannon River

Site	Area (ha)	Parameter	Year	Flow (hm3)	Model-Conc (ug/L)	Model-Mass (kg)	CV	Model-Conc (mg/L)	Model-Yield (kg/ha)	Precip (cm)	Runoff (cm)	RC
CN0119	347000	NO3	2000	705.58	4,930	3,478,177	0.034	4.930	10.02	80.2	20.3	0.25
CN0119	347000	NO3	2001	1079.45	5,612	6,058,051	0.034	5.612	17.46	72.8	31.1	0.43
CN0119	347000	NO3	2002	709.43	4,451	3,157,380	0.034	4.451	9.10	104.3	20.4	0.20
CN0119	347000	NO3	2003	477.90	4,376	2,091,290	0.034	4.376	6.03	48.8	13.8	0.28
CN0119	347000	NO3	2004	905.23	4,931	4,463,489	0.034	4.931	12.86	87.7	26.1	0.30
CN0119	347000	TDP	2000	705.58	157	111,100	0.062	0.157	0.32	80.2	20.3	0.25
CN0119	347000	TDP	2001	1079.00	163	175,812	0.058	0.163	0.51	72.8	31.1	0.43
CN0119	347000	TDP	2002	709.00	146	103,409	0.058	0.146	0.30	104.3	20.4	0.20
CN0119	347000	TDP	2003	478.00	140	66,702	0.058	0.140	0.19	48.8	13.8	0.28
CN0119	347000	TDP	2004	905.23	154	139,278	0.062	0.154	0.40	87.7	26.1	0.30
CN0119	347000	TKN	2000	705.58	1,326	935,701	0.058	1.326	2.70	80.2	20.3	0.25
CN0119	347000	TKN	2001	1079.45	1,463	1,579,512	0.058	1.463	4.55	72.8	31.1	0.43
CN0119	347000	TKN	2002	709.43	1,170	830,215	0.058	1.170	2.39	104.3	20.4	0.20
CN0119	347000	TKN	2003	477.90	1,044	498,827	0.058	1.044	1.44	48.8	13.8	0.28
CN0119	347000	TKN	2004	905.23	1,327	1,201,500	0.058	1.327	3.46	87.7	26.1	0.30
CN0119	347000	TP	2000	705.58	346	244,384	0.076	0.346	0.70	80.2	20.3	0.25
CN0119	347000	TP	2001	1079.45	380	409,801	0.076	0.380	1.18	72.8	31.1	0.43
CN0119	347000	TP	2002	709.43	298	211,672	0.076	0.298	0.61	104.3	20.4	0.20
CN0119	347000	TP	2003	477.90	274	131,012	0.076	0.274	0.38	48.8	13.8	0.28
CN0119	347000	TP	2004	905.23	339	306,700	0.076	0.339	0.88	87.7	26.1	0.30
CN0119	347000	TSS	2000	705.58	117,210	82,700,892	0.149	117.210	238.33	80.2	20.3	0.25
CN0119	347000	TSS	2001	1079.45	146,620	158,267,979	0.149	146.620	456.10	72.8	31.1	0.43
CN0119	347000	TSS	2002	709.43	86,199	61,152,261	0.149	86.199	176.23	104.3	20.4	0.20
CN0119	347000	TSS	2003	477.90	72,661	34,724,529	0.149	72.661	100.07	48.8	13.8	0.28
CN0119	347000	TSS	2004	905.23	115,151	104,237,909	0.149	115.151	300.40	87.7	26.1	0.30

Credit River

Site	Area (ha)	Parameter	Year	Flow (hm3)	Model-Conc (ug/L)	Model-Mass (kg)	CV	Model-Conc (mg/L)	Model-Yield (kg/ha)	Precip (cm)	Runoff (cm)	RC
CR0007	13300	NO3	1989	6.43	1,088	6,998	0.129	1.088	0.53			
CR0007	13300	NO3	1990	10.92	624	6,816	0.129	0.624	0.51			
CR0007	13300	NO3	1991	13.48	608	8,194	0.129	0.608	0.62			
CR0007	13300	NO3	1992	25.50	698	17,808	0.096	0.698	1.34			
CR0007	13300	NO3	1993	37.61	702	26,392	0.096	0.702	1.98			
CR0007	13300	NO3	1994	20.54	616	12,655	0.096	0.616	0.95			
CR0007	13300	NO3	1995	19.53	619	12,078	0.096	0.619	0.91			
CR0007	13300	NO3	1996	15.82	630	9,958	0.096	0.630	0.75			
CR0007	13300	NO3	1997	28.46	788	22,436	0.095	0.788	1.69			
CR0007	13300	NO3	1998	19.27	785	15,132	0.095	0.785	1.14			
CR0007	13300	NO3	1999	27.36	796	21,767	0.095	0.796	1.64			
CR0007	13300	TDP	1990	10.92	201	2,190	0.121	0.201	0.16			
CR0007	13300	TDP	1991	13.48	133	1,800	0.121	0.133	0.14			
CR0007	13300	TDP	1992	25.50	99	2,530	0.087	0.099	0.19			
CR0007	13300	TDP	1993	37.61	112	4,221	0.087	0.112	0.32			
CR0007	13300	TDP	1994	20.54	91	1,861	0.087	0.091	0.14			
CR0007	13300	TDP	1995	19.53	84	1,638	0.087	0.084	0.12			
CR0007	13300	TDP	1996	15.82	80	1,262	0.087	0.080	0.09			
CR0007	13300	TDP	1997	28.46	109	3,092	0.075	0.109	0.23			
CR0007	13300	TDP	1998	19.27	105	2,017	0.075	0.105	0.15			
CR0007	13300	TDP	1999	27.36	112	3,075	0.075	0.112	0.23			
CR0007	13300	TP	1989	6.43	478	3,077	0.112	0.478	0.23			
CR0007	13300	TP	1990	10.92	548	5,979	0.112	0.548	0.45			
CR0007	13300	TP	1991	13.48	570	7,690	0.112	0.570	0.58			
CR0007	13300	TP	1992	25.50	242	6,180	0.074	0.242	0.46			
CR0007	13300	TP	1993	37.61	279	10,490	0.074	0.279	0.79			
CR0007	13300	TP	1994	20.54	218	4,481	0.074	0.218	0.34			
CR0007	13300	TP	1995	19.53	200	3,897	0.074	0.200	0.29			
CR0007	13300	TP	1996	15.82	194	3,070	0.074	0.194	0.23			
CR0007	13300	TP	1997	28.46	296	8,416	0.088	0.296	0.63			
CR0007	13300	TP	1998	19.27	282	5,433	0.088	0.282	0.41			
CR0007	13300	TP	1999	27.36	302	8,267	0.088	0.302	0.62			
CR0007	13300	TSS	1989	6.43	158,717	1,021,256	0.182	158.717	76.79			
CR0007	13300	TSS	1990	10.92	195,706	2,136,555	0.182	195.706	160.64			
CR0007	13300	TSS	1991	13.48	205,321	2,768,154	0.182	205.321	208.13			
CR0007	13300	TSS	1992	25.50	72,649	1,852,560	0.113	72.649	139.29			

CR0007	13300	TSS	1993	37.61	87,912	3,306,264	0.113	87.912	248.59			
CR0007	13300	TSS	1994	20.54	46,866	962,757	0.113	46.866	72.39			
CR0007	13300	TSS	1995	19.53	47,712	931,606	0.113	47.712	70.05			
CR0007	13300	TSS	1996	15.82	48,660	769,691	0.113	48.660	57.87			
CR0007	13300	TSS	1997	28.46	102,512	2,917,671	0.140	102.512	219.37			
CR0007	13300	TSS	1998	19.27	96,777	1,865,121	0.140	96.777	140.23			
CR0007	13300	TSS	1999	27.36	101,893	2,787,829	0.140	101.893	209.61			
CR0009	13300	NO3	2001	20.18	1,331	26,858	0.122	1.331	2.02	85.4	15.2	0.18
CR0009	13300	NO3	2003	16.66	1,210	20,160	0.122	1.210	1.52	64.5	12.5	0.19
CR0009	13300	NO3	2003	16.68	1,027	17,120	0.092	1.027	1.29	64.5	12.5	0.19
CR0009	13300	NO3	2004	10.97	940	10,319	0.092	0.940	0.78	83.6	8.2	0.10
CR0009	13300	TDP	2001	20.18	115	2,316	0.104	0.115	0.17	85.4	15.2	0.18
CR0009	13300	TDP	2003	16.66	104	1,740	0.104	0.104	0.13	64.5	12.5	0.19
CR0009	13300	TDP	2003	16.68	107	1,792	0.143	0.107	0.13	64.5	12.5	0.19
CR0009	13300	TDP	2004	10.97	87	949	0.143	0.087	0.07	83.6	8.2	0.10
CR0009	13300	TKN	2003	16.68	1,383	23,068	0.077	1.383	1.73	64.5	12.5	0.19
CR0009	13300	TKN	2004	10.97	1,158	12,709	0.077	1.158	0.96	83.6	8.2	0.10
CR0009	13300	TP	2001	20.18	259	5,218	0.091	0.259	0.39	85.4	15.2	0.18
CR0009	13300	TP	2003	16.66	240	3,995	0.091	0.240	0.30	64.5	12.5	0.19
CR0009	13300	TP	2003	16.68	285	4,750	0.079	0.285	0.36	64.5	12.5	0.19
CR0009	13300	TP	2004	10.97	236	2,585	0.079	0.236	0.19	83.6	8.2	0.10
CR0009	13300	TSS	2001	20.18	103,840	2,095,434	0.190	103.840	157.55	85.4	15.2	0.18
CR0009	13300	TSS	2003	16.66	85,335	1,421,658	0.190	85.335	106.89	64.5	12.5	0.19
CR0009	13300	TSS	2003	16.68	120,828	2,015,168	0.386	120.828	151.52	64.5	12.5	0.19
CR0009	13300	TSS	2004	10.97	66,100	725,249	0.386	66.100	54.53	83.6	8.2	0.10

Crow River

Site	Area (ha)	Parameter	Year	Flow (hm3)	Model-Conc (ug/L)	Model-Mass (kg)	CV	Model-Conc (mg/L)	Model-Yield (kg/ha)	Precip (cm)	Runoff (cm)	RC
CW0231	679000	NO3	2000	213.40	2,499	533,217	0.074	2.499	0.79	49.5	3.1	0.06
CW0231	679000	NO3	2001	1123.60	2,730	3,067,751	0.064	2.730	4.52	68.6	16.5	0.24
CW0231	679000	NO3	2002	1595.09	1,524	2,430,971	0.064	1.524	3.58	116.3	23.5	0.20
CW0231	679000	NO3	2003	850.70	2,090	1,778,577	0.064	2.090	2.62	62.7	12.5	0.20
CW0231	679000	NO3	2004	713.63	2,316	1,653,005	0.074	2.316	2.43	75.6	10.5	0.14
CW0231	679000	TDP	2000	213.40	248	52,988	0.061	0.248	0.08	49.5	3.1	0.06
CW0231	679000	TDP	2001	1123.60	216	242,618	0.059	0.216	0.36	68.6	16.5	0.24
CW0231	679000	TDP	2002	1595.09	214	341,290	0.059	0.214	0.50	116.3	23.5	0.20
CW0231	679000	TDP	2003	850.70	233	198,118	0.059	0.233	0.29	62.7	12.5	0.20
CW0231	679000	TDP	2004	713.63	203	144,981	0.061	0.203	0.21	75.6	10.5	0.14
CW0231	679000	TKN	2000	213.40	1,537	327,953	0.030	1.537	0.48	49.5	3.1	0.06
CW0231	679000	TKN	2001	1123.62	1,552	1,743,300	0.030	1.552	2.57	68.6	16.5	0.24
CW0231	679000	TKN	2002	1595.09	1,473	2,350,068	0.030	1.473	3.46	116.3	23.5	0.20
CW0231	679000	TKN	2003	850.79	1,525	1,297,169	0.030	1.525	1.91	62.7	12.5	0.20
CW0231	679000	TKN	2004	713.63	1,454	1,037,762	0.030	1.454	1.53	75.6	10.5	0.14
CW0231	679000	TP	2000	213.40	359	76,558	0.047	0.359	0.11	49.5	3.1	0.06
CW0231	679000	TP	2001	1123.62	347	389,841	0.047	0.347	0.57	68.6	16.5	0.24
CW0231	679000	TP	2002	1595.09	314	500,891	0.047	0.314	0.74	116.3	23.5	0.20
CW0231	679000	TP	2003	850.79	341	290,239	0.047	0.341	0.43	62.7	12.5	0.20
CW0231	679000	TP	2004	713.63	320	228,612	0.047	0.320	0.34	75.6	10.5	0.14
CW0231	679000	TSS	2000	213.40	47,734	10,186,315	0.114	47.734	15.00	49.5	3.1	0.06
CW0231	679000	TSS	2001	1123.62	55,493	62,353,448	0.114	55.493	91.83	68.6	16.5	0.24
CW0231	679000	TSS	2002	1595.09	63,108	100,663,128	0.114	63.108	148.25	116.3	23.5	0.20
CW0231	679000	TSS	2003	850.79	61,064	51,952,414	0.114	61.064	76.51	62.7	12.5	0.20
CW0231	679000	TSS	2004	713.63	58,644	41,850,055	0.114	58.644	61.63	75.6	10.5	0.14

Eagle Creek

Site	Area (ha)	Parameter	Year	Flow (hm3)	Model-Conc (ug/L)	Model-Mass (kg)	CV	Model-Conc (mg/L)	Model-Yield (kg/ha)	Precip (cm)	Runoff (cm)	RC
EA0008	310	NO3	2000	6.99	243	1,697	0.102	0.243	5.47	64.2	225.4	3.51
EA0008	310	NO3	2004	7.80	244	1,901	0.102	0.244	6.13	83.6	251.6	3.01
EA0008	310	TDP	2000	6.99	30	210	0.271	0.030	0.68	64.2	225.4	3.51
EA0008	310	TDP	2001	8.78	18	129	0.093	0.018	0.42	85.4	283.1	3.31
EA0008	310	TDP	2002	9.65	19	179	0.093	0.019	0.58	105.9	311.2	2.94
EA0008	310	TDP	2003	7.00	17	122	0.093	0.017	0.39	64.5	225.8	3.50
EA0008	310	TDP	2004	7.80	30	232	0.271	0.030	0.75	83.6	251.6	3.01
EA0008	310	TKN	2003	7.00	334	2,335	0.191	0.334	7.53	64.5	225.8	3.50
EA0008	310	TKN	2004	7.80	325	2,534	0.191	0.325	8.18	83.6	251.6	3.01
EA0008	310	TP	2000	6.99	90	630	0.209	0.090	2.03	64.2	225.4	3.51
EA0008	310	TP	2001	8.78	53	462	0.096	0.053	1.49	85.4	283.1	3.31
EA0008	310	TP	2002	9.65	58	559	0.096	0.058	1.80	105.9	311.2	2.94
EA0008	310	TP	2003	6.99	47	327	0.096	0.047	1.06	64.5	225.5	3.50
EA0008	310	TP	2004	7.80	88	689	0.209	0.088	2.22	83.6	251.6	3.01
EA0008	310	TSS	2000	6.99	21,756	152,029	0.243	21.756	490.42	64.2	225.4	3.51
EA0008	310	TSS	2001	8.78	12,469	109,418	0.147	12.469	352.96	85.4	283.1	3.31
EA0008	310	TSS	2002	9.65	11,552	111,430	0.147	11.552	359.45	105.9	311.2	2.94
EA0008	310	TSS	2003	7.00	12,257	85,778	0.147	12.257	276.70	64.5	225.8	3.50
EA0008	310	TSS	2004	7.80	21,189	165,277	0.243	21.189	533.15	83.6	251.6	3.01

Elm Creek

Site	Area (ha)	Parameter	Year	Flow (hm3)	Model-Conc (ug/L)	Model-Mass (kg)	CV	Model-Conc (mg/L)	Model-Yield (kg/ha)	Precip (cm)	Runoff (cm)
EC0047	22140	NO3	1995	43.34	147	6,387	0.185	0.147	0.29	83.2	19.6
EC0047	22140	NO3	1996	37.02	136	5,049	0.185	0.136	0.23	75.7	16.7
EC0047	22140	NO3	1997	33.49	402	13,478	0.233	0.402	0.61	87.5	15.1
EC0047	22140	NO3	1998	21.58	459	9,915	0.233	0.459	0.45	80.4	9.7
EC0047	22140	NO3	1999	36.85	379	13,957	0.233	0.379	0.63	78.2	16.6
EC0047	22140	NO3	2000	10.10	473	4,778	0.233	0.473	0.22	90.4	4.6
EC0047	22140	NO3	2001	51.36	1,079	55,427	0.232	1.079	2.50	94.1	23.2
EC0047	22140	NO3	2002	86.19	624	53,792	0.198	0.624	2.43	106.1	38.9
EC0047	22140	NO3	2003	40.28	611	24,605	0.198	0.611	1.11	61.8	18.2
EC0047	22140	TDP	2001	53.16	151	8,003	0.173	0.151	0.36	94.1	24.0
EC0047	22140	TDP	2002	86.19	153	13,192	0.173	0.153	0.60	106.1	38.9
EC0047	22140	TDP	2003	40.30	151	6,067	0.173	0.151	0.27	61.8	18.2
EC0047	22140	TDP	2004	33.82	147	4,957	0.173	0.147	0.22	83.2	15.3
EC0047	22140	TKN	2001	53.16	1,222	64,936	0.110	1.222	2.93	94.1	24.0
EC0047	22140	TKN	2002	86.19	1,282	110,459	0.110	1.282	4.99	106.1	38.9
EC0047	22140	TKN	2003	40.30	1,276	51,424	0.110	1.276	2.32	61.8	18.2
EC0047	22140	TKN	2004	33.82	1,236	41,809	0.110	1.236	1.89	83.2	15.3
EC0047	22140	TP	1989	7.27	278	2,019	0.275	0.278	0.09		
EC0047	22140	TP	1990	22.19	304	6,738	0.275	0.304	0.30	83.9	10.0
EC0047	22140	TP	1991	62.48	326	20,372	0.275	0.326	0.92	123.8	28.2
EC0047	22140	TP	1992	34.71	151	5,254	0.089	0.151	0.24	90.7	15.7
EC0047	22140	TP	1993	66.37	130	8,661	0.089	0.130	0.39	93.9	30.0
EC0047	22140	TP	1994	37.11	145	5,395	0.089	0.145	0.24	75.8	16.8
EC0047	22140	TP	1995	43.34	143	6,212	0.089	0.143	0.28	83.2	19.6
EC0047	22140	TP	1996	37.02	138	5,096	0.089	0.138	0.23	75.7	16.7
EC0047	22140	TP	1997	33.49	298	9,971	0.128	0.298	0.45	87.5	15.1
EC0047	22140	TP	1998	21.58	298	6,426	0.128	0.298	0.29	80.4	9.7
EC0047	22140	TP	1999	36.85	298	10,972	0.128	0.298	0.50	78.2	16.6
EC0047	22140	TP	2000	10.10	298	3,009	0.128	0.298	0.14	90.4	4.6
EC0047	22140	TP	2001	53.16	213	11,346	0.106	0.213	0.51	94.1	24.0
EC0047	22140	TP	2001	51.36	1,082	55,572	0.232	1.082	2.51	94.1	23.2
EC0047	22140	TP	2002	86.19	221	19,036	0.106	0.221	0.86	106.1	38.9
EC0047	22140	TP	2002	86.19	241	20,776	0.171	0.241	0.94	106.1	38.9
EC0047	22140	TP	2003	40.30	217	8,754	0.106	0.217	0.40	61.8	18.2
EC0047	22140	TP	2003	40.28	237	9,547	0.171	0.237	0.43	61.8	18.2
EC0047	22140	TP	2004	33.82	219	7,418	0.106	0.219	0.34	83.2	15.3

EC0047	22140	TSS	1989	7.27	45,037	327,250	0.160	45.037	14.78		
EC0047	22140	TSS	1990	22.19	47,430	1,052,400	0.160	47.430	47.53	83.9	10.0
EC0047	22140	TSS	1991	62.48	48,345	3,020,780	0.160	48.345	136.44	123.8	28.2
EC0047	22140	TSS	1992	34.71	36,482	1,266,278	0.103	36.482	57.19	90.7	15.7
EC0047	22140	TSS	1993	66.37	35,602	2,362,875	0.103	35.602	106.72	93.9	30.0
EC0047	22140	TSS	1994	37.11	36,195	1,343,043	0.103	36.195	60.66	75.8	16.8
EC0047	22140	TSS	1995	43.34	36,175	1,567,906	0.103	36.175	70.82	83.2	19.6
EC0047	22140	TSS	1996	37.02	35,874	1,328,127	0.103	35.874	59.99	75.7	16.7
EC0047	22140	TSS	1997	33.49	26,921	901,480	0.078	26.921	40.72	87.5	15.1
EC0047	22140	TSS	1998	21.58	28,265	609,970	0.078	28.265	27.55	80.4	9.7
EC0047	22140	TSS	1999	36.85	26,038	959,380	0.078	26.038	43.33	78.2	16.6
EC0047	22140	TSS	2000	10.12	10,908	110,343	0.085	10.908	4.98	90.4	4.6
EC0047	22140	TSS	2000	10.10	30,618	309,381	0.078	30.618	13.97	90.4	4.6
EC0047	22140	TSS	2001	53.16	18,330	974,356	0.085	18.330	44.01	94.1	24.0
EC0047	22140	TSS	2001	51.36	33,747	1,733,323	0.039	33.747	78.29	94.1	23.2
EC0047	22140	TSS	2002	86.19	18,670	1,609,167	0.085	18.670	72.68	106.1	38.9
EC0047	22140	TSS	2002	86.19	39,534	3,407,376	0.345	39.534	153.90	106.1	38.9
EC0047	22140	TSS	2003	40.30	18,060	727,716	0.085	18.060	32.87	61.8	18.2
EC0047	22140	TSS	2003	40.28	39,536	1,592,698	0.345	39.536	71.94	61.8	18.2
EC0047	22140	TSS	2004	33.82	16,554	559,854	0.085	16.554	25.29	83.2	15.3

Fish Creek

Site	Area (ha)	Parameter	Year	Flow (hm3)	Model-Conc (ug/L)	Model-Mass (kg)	CV	Model-Conc (mg/L)	Model-Yield (kg/ha)	Precip (cm)	Runoff (cm)	RC
FC0002	1320	NO3	2001	3.39	826	2,799	0.284	0.826	2.12	83.9	25.7	0.31
FC0002	1320	NO3	2002	4.88	960	4,687	0.166	0.960	3.55	112.1	37.0	0.33
FC0002	1320	NO3	2003	3.39	891	3,016	0.093	0.891	2.28	60.2	25.7	0.43
FC0002	1320	NO3	2004	2.63	954	2,509	0.093	0.954	1.90	77.1	19.9	0.26
FC0002	1320	TDP	1996	2.22	61	136	0.279	0.061	0.10	77.5	16.8	0.22
FC0002	1320	TDP	1997	2.93	117	342	0.231	0.117	0.26	80.7	22.2	0.28
FC0002	1320	TDP	1999	3.92	98	383	0.312	0.098	0.29	82.3	29.7	0.36
FC0002	1320	TDP	2001	3.39	81	275	0.180	0.081	0.21	83.9	25.7	0.31
FC0002	1320	TDP	2002	4.88	96	469	0.147	0.096	0.36	112.1	37.0	0.33
FC0002	1320	TDP	2003	3.39	89	301	0.263	0.089	0.23	60.2	25.7	0.43
FC0002	1320	TDP	2004	2.63	107	283	0.116	0.107	0.21	77.1	19.9	0.26
FC0002	1320	TKN	2003	3.39	970	3,284	0.076	0.970	2.49	60.2	25.7	0.43
FC0002	1320	TKN	2004	2.63	966	2,542	0.076	0.966	1.93	77.1	19.9	0.26
FC0002	1320	TP	1996	2.22	148	328	0.172	0.148	0.25	77.5	16.8	0.22
FC0002	1320	TP	1997	2.93	277	811	0.237	0.277	0.61	80.7	22.2	0.28
FC0002	1320	TP	1999	3.92	231	907	0.335	0.231	0.69	82.3	29.7	0.36
FC0002	1320	TP	2001	3.39	141	480	0.193	0.141	0.36	83.9	25.7	0.31
FC0002	1320	TP	2002	4.88	175	854	0.113	0.175	0.65	112.1	37.0	0.33
FC0002	1320	TP	2003	3.39	212	719	0.111	0.212	0.54	60.2	25.7	0.43
FC0002	1320	TP	2004	2.63	211	555	0.111	0.211	0.42	77.1	19.9	0.26
FC0002	1320	TSS	1996	2.22	37,764	83,780	0.302	37.764	63.47	77.5	16.8	0.22
FC0002	1320	TSS	1997	2.93	125,240	366,452	0.194	125.240	277.61	80.7	22.2	0.28
FC0002	1320	TSS	1999	3.92	213,256	836,284	0.355	213.256	633.55	82.3	29.7	0.36
FC0002	1320	TSS	2001	3.39	17,317	58,707	0.355	17.317	44.47	83.9	25.7	0.31
FC0002	1320	TSS	2002	4.88	20,153	98,438	0.285	20.153	74.57	112.1	37.0	0.33
FC0002	1320	TSS	2003	3.39	46,566	157,672	0.195	46.566	119.45	60.2	25.7	0.43
FC0002	1320	TSS	2004	2.63	47,274	124,378	0.195	47.274	94.23	77.1	19.9	0.26

Minnehaha Creek

Site	Area (ha)	Parameter	Year	Flow (hm3)	Model-Conc (ug/L)	Model-Mass (kg)	CV	Model-Conc (mg/L)	Model-Yield (kg/ha)	Precip (cm)	Runoff (cm)	RC
MH0017	45730	NO3	2001	69.15	252	17,428	0.087	0.252	0.38	86.9	15.1	0.17
MH0017	45730	NO3	2002	111.76	245	27,414	0.087	0.245	0.60	97.2	24.4	0.25
MH0017	45730	NO3	2003	37.27	269	10,029	0.087	0.269	0.22	57.7	8.1	0.14
MH0017	45730	NO3	2004	47.82	294	14,074	0.110	0.294	0.31	69.6	10.5	0.15
MH0017	45730	TDP	2001	69.15	36	2,460	0.073	0.036	0.05	86.9	15.1	0.17
MH0017	45730	TDP	2002	111.76	36	4,059	0.073	0.036	0.09	97.2	24.4	0.25
MH0017	45730	TDP	2003	37.27	33	1,236	0.073	0.033	0.03	57.7	8.1	0.14
MH0017	45730	TDP	2004	47.82	39	1,878	0.113	0.039	0.04	69.6	10.5	0.15
MH0017	45730	TKN	2002	120.27	869	104,483	0.045	0.869	2.28	97.2	26.3	0.27
MH0017	45730	TKN	2003	37.27	1,167	43,482	0.045	1.167	0.95	57.7	8.1	0.14
MH0017	45730	TKN	2004	47.82	990	47,358	0.045	0.990	1.04	69.6	10.5	0.15
MH0017	45730	TP	2001	69.15	90	6,223	0.060	0.090	0.14	86.9	15.1	0.17
MH0017	45730	TP	2002	111.76	89	9,925	0.060	0.089	0.22	97.2	24.4	0.25
MH0017	45730	TP	2003	37.27	91	3,375	0.060	0.091	0.07	57.7	8.1	0.14
MH0017	45730	TP	2004	47.82	94	4,488	0.076	0.094	0.10	69.6	10.5	0.15
MH0017	45730	TSS	2001	69.15	13,902	961,271	0.093	13.902	21.02	86.9	15.1	0.17
MH0017	45730	TSS	2002	111.76	13,845	1,547,320	0.093	13.845	33.84	97.2	24.4	0.25
MH0017	45730	TSS	2003	37.27	14,103	525,554	0.093	14.103	11.49	57.7	8.1	0.14
MH0017	45730	TSS	2004	47.82	14,757	705,628	0.102	14.757	15.43	69.6	10.5	0.15

Nine Mile Creek

Site	Area (ha)	Parameter	Year	Flow (hm3)	Model-Conc (ug/L)	Model-Mass (kg)	CV	Model-Conc (mg/L)	Model-Yield (kg/ha)	Precip (cm)	Runoff (cm)	RC
NM0018	9730	NO3	1990	15.81	415	6,567	0.123	0.415	0.67	83.9	16.2	0.19
NM0018	9730	NO3	1991	19.95	383	7,634	0.123	0.383	0.78	93.2	20.5	0.22
NM0018	9730	NO3	1992	18.44	383	7,062	0.123	0.383	0.73	75.4	18.9	0.25
NM0018	9730	NO3	1993	22.79	364	8,299	0.123	0.364	0.85	81.8	23.4	0.29
NM0018	9730	NO3	1994	19.44	396	7,698	0.123	0.396	0.79	75.4	20.0	0.27
NM0018	9730	NO3	1995	17.86	414	7,396	0.123	0.414	0.76	65.2	18.4	0.28
NM0018	9730	NO3	1996	16.79	436	7,319	0.123	0.436	0.75	66.2	17.3	0.26
NM0018	9730	NO3	1997	45.90	338	15,514	0.082	0.338	1.59	87.4	47.2	0.54
NM0018	9730	NO3	1998	42.35	366	15,492	0.082	0.366	1.59	84.8	43.5	0.51
NM0018	9730	NO3	2000	25.60	397	10,151	0.082	0.397	1.04	77.4	26.3	0.34
NM0018	9730	NO3	2001	26.92	513	13,811	0.063	0.513	1.42	86.9	27.7	0.32
NM0018	9730	NO3	2002	38.20	491	18,762	0.063	0.491	1.93	97.2	39.3	0.40
NM0018	9730	NO3	2003	16.30	499	8,141	0.063	0.499	0.84	57.7	16.8	0.29
NM0018	9730	NO3	2004	16.54	563	9,310	0.097	0.563	0.96	69.6	17.0	0.24
NM0018	9730	TDP	1990	15.81	71	1,120	0.138	0.071	0.12	83.9	16.2	0.19
NM0018	9730	TDP	1991	19.95	66	1,322	0.138	0.066	0.14	93.2	20.5	0.22
NM0018	9730	TDP	1992	18.44	70	1,298	0.138	0.070	0.13	75.4	18.9	0.25
NM0018	9730	TDP	1993	22.79	68	1,548	0.138	0.068	0.16	81.8	23.4	0.29
NM0018	9730	TDP	1994	19.44	66	1,284	0.138	0.066	0.13	75.4	20.0	0.27
NM0018	9730	TDP	1995	17.86	67	1,191	0.138	0.067	0.12	65.2	18.4	0.28
NM0018	9730	TDP	1996	16.79	68	1,135	0.138	0.068	0.12	66.2	17.3	0.26
NM0018	9730	TDP	1997	45.90	43	1,987	0.059	0.043	0.20	87.4	47.2	0.54
NM0018	9730	TDP	1998	42.35	43	1,810	0.059	0.043	0.19	84.8	43.5	0.51
NM0018	9730	TDP	2000	25.60	41	1,042	0.059	0.041	0.11	77.4	26.3	0.34
NM0018	9730	TDP	2001	26.92	52	1,397	0.105	0.052	0.14	86.9	27.7	0.32
NM0018	9730	TDP	2002	38.20	51	1,964	0.105	0.051	0.20	97.2	39.3	0.40
NM0018	9730	TDP	2003	16.31	49	797	0.105	0.049	0.08	57.7	16.8	0.29
NM0018	9730	TDP	2004	16.54	49	817	0.105	0.049	0.08	69.6	17.0	0.24
NM0018	9730	TKN	2000	24.30	1,490	36,204	0.060	1.490	3.72	77.4	25.0	0.32
NM0018	9730	TKN	2001	26.92	1,574	42,388	0.060	1.574	4.36	86.9	27.7	0.32
NM0018	9730	TKN	2002	38.20	1,667	63,694	0.060	1.667	6.55	97.2	39.3	0.40
NM0018	9730	TKN	2003	16.31	1,552	25,302	0.060	1.552	2.60	57.7	16.8	0.29
NM0018	9730	TKN	2004	16.54	1,479	24,460	0.060	1.479	2.51	69.6	17.0	0.24
NM0018	9730	TP	1990	15.81	301	4,760	0.088	0.301	0.49	83.9	16.2	0.19
NM0018	9730	TP	1991	19.95	292	5,819	0.088	0.292	0.60	93.2	20.5	0.22

NM0018	9730	TP	1992	18.44	321	5,925	0.088	0.321	0.61	75.4	18.9	0.25
NM0018	9730	TP	1993	22.79	321	7,317	0.088	0.321	0.75	81.8	23.4	0.29
NM0018	9730	TP	1994	19.44	273	5,313	0.088	0.273	0.55	75.4	20.0	0.27
NM0018	9730	TP	1995	17.86	260	4,651	0.088	0.260	0.48	65.2	18.4	0.28
NM0018	9730	TP	1996	16.79	252	4,226	0.088	0.252	0.43	66.2	17.3	0.26
NM0018	9730	TP	1997	45.90	224	10,287	0.080	0.224	1.06	87.4	47.2	0.54
NM0018	9730	TP	1998	42.35	208	8,817	0.080	0.208	0.91	84.8	43.5	0.51
NM0018	9730	TP	2000	24.30	195	4,734	0.077	0.195	0.49	77.4	25.0	0.32
NM0018	9730	TP	2001	26.92	216	5,815	0.077	0.216	0.60	86.9	27.7	0.32
NM0018	9730	TP	2002	38.20	239	9,137	0.077	0.239	0.94	97.2	39.3	0.40
NM0018	9730	TP	2003	16.31	220	3,583	0.077	0.220	0.37	57.7	16.8	0.29
NM0018	9730	TP	2004	16.54	196	3,236	0.077	0.196	0.33	69.6	17.0	0.24
NM0018	9730	TSS	1990	15.81	207,399	3,278,230	0.186	207.399	336.92	83.9	16.2	0.19
NM0018	9730	TSS	1991	19.95	187,742	3,745,458	0.186	187.742	384.94	93.2	20.5	0.22
NM0018	9730	TSS	1992	18.44	230,774	4,254,449	0.186	230.774	437.25	75.4	18.9	0.25
NM0018	9730	TSS	1993	22.79	229,726	5,235,853	0.186	229.726	538.11	81.8	23.4	0.29
NM0018	9730	TSS	1994	19.44	156,693	3,045,480	0.186	156.693	313.00	75.4	20.0	0.27
NM0018	9730	TSS	1995	17.86	139,619	2,493,280	0.186	139.619	256.25	65.2	18.4	0.28
NM0018	9730	TSS	1996	16.79	128,437	2,155,804	0.186	128.437	221.56	66.2	17.3	0.26
NM0018	9730	TSS	1997	45.90	117,557	5,396,042	0.152	117.557	554.58	87.4	47.2	0.54
NM0018	9730	TSS	1998	42.35	101,036	4,278,932	0.152	101.036	439.77	84.8	43.5	0.51
NM0018	9730	TSS	2000	24.30	76,138	1,849,994	0.123	76.138	190.13	77.4	25.0	0.32
NM0018	9730	TSS	2001	26.92	94,236	2,537,208	0.123	94.236	260.76	86.9	27.7	0.32
NM0018	9730	TSS	2002	38.20	107,475	4,105,775	0.123	107.475	421.97	97.2	39.3	0.40
NM0018	9730	TSS	2003	16.31	93,775	1,529,286	0.123	93.775	157.17	57.7	16.8	0.29
NM0018	9730	TSS	2004	16.54	67,114	1,109,858	0.123	67.114	114.07	69.6	17.0	0.24

Rice Creek

Site	Area (ha)	Parameter	Year	Flow (hm3)	Model-Conc (ug/L)	Model-Mass (kg)	CV	Model-Conc (mg/L)	Model-Yield (kg/ha)	Precip (cm)	Runoff (cm)	RC
RC0037	47800	DOP	2001	84.97	24	2,046	0.101	0.024	0.04	88.0	17.8	0.20
RC0037	47800	DOP	2002	121.72	26	3,151	0.101	0.026	0.07	98.3	25.5	0.26
RC0037	47800	DOP	2003	75.54	28	2,088	0.101	0.028	0.04	53.4	15.8	0.30
RC0037	47800	DOP	2004	52.70	30	1,556	0.101	0.030	0.03	79.0	11.0	0.14
RC0037	47800	TKN	2001	84.97	1,602	136,153	0.054	1.602	2.85	88.0	17.8	0.20
RC0037	47800	TKN	2002	121.72	1,798	218,900	0.054	1.798	4.58	98.3	25.5	0.26
RC0037	47800	TKN	2003	75.54	1,663	125,605	0.054	1.663	2.63	53.4	15.8	0.30
RC0037	47800	TKN	2004	52.70	1,704	89,768	0.054	1.704	1.88	79.0	11.0	0.14
RC0037	47800	TP	1995	105.36	254	26,801	0.233	0.254	0.56	89.1	22.0	0.25
RC0037	47800	TP	1996	66.05	199	13,167	0.233	0.199	0.28	70.9	13.8	0.19
RC0037	47800	TP	1997	76.35	423	32,267	0.180	0.423	0.68	81.3	16.0	0.20
RC0037	47800	TP	1998	47.23	409	19,309	0.180	0.409	0.40	85.1	9.9	0.12
RC0037	47800	TP	1999	49.97	105	5,260	0.075	0.105	0.11	82.5	10.5	0.13
RC0037	47800	TP	2000	41.10	112	4,615	0.075	0.112	0.10	79.3	8.6	0.11
RC0037	47800	TP	2001	88.35	174	15,411	0.121	0.174	0.32	88.0	18.5	0.21
RC0037	47800	TP	2002	121.57	168	20,479	0.121	0.168	0.43	98.3	25.4	0.26
RC0037	47800	TP	2003	76.17	183	13,904	0.121	0.183	0.29	53.4	15.9	0.30
RC0037	47800	TP	2004	52.70	153	8,040	0.122	0.153	0.17	79.0	11.0	0.14
RC0037	47800	TSS	1995	105.36	70,004	7,375,743	0.124	70.004	154.30	89.1	22.0	0.25
RC0037	47800	TSS	1996	66.05	74,036	4,890,383	0.124	74.036	102.31	70.9	13.8	0.19
RC0037	47800	TSS	1997	76.35	260,305	19,873,460	0.280	260.305	415.76	81.3	16.0	0.20
RC0037	47800	TSS	1998	47.23	247,066	11,669,190	0.280	247.066	244.13	85.1	9.9	0.12
RC0037	47800	TSS	1999	49.97	23,364	1,167,426	0.106	23.364	24.42	82.5	10.5	0.13
RC0037	47800	TSS	2000	41.10	26,612	1,093,737	0.106	26.612	22.88	79.3	8.6	0.11
RC0037	47800	TSS	2001	84.97	36,185	3,074,565	0.181	36.185	64.32	88.0	17.8	0.20
RC0037	47800	TSS	2002	121.72	49,257	5,995,616	0.181	49.257	125.43	98.3	25.5	0.26
RC0037	47800	TSS	2003	75.54	40,253	3,040,706	0.181	40.253	63.61	53.4	15.8	0.30
RC0037	47800	TSS	2004	52.70	42,373	2,232,855	0.181	42.373	46.71	79.0	11.0	0.14

Riley Creek

Site	Area (ha)	Parameter	Year	Flow (hm3)	Model-Conc (ug/L)	Model-Mass (kg)	CV	Model-Conc (mg/L)	Model-Yield (kg/ha)	Precip (cm)	Runoff (cm)	RC
RI0013	2730	NO3	2001	4.61	694	3,197	0.075	0.694	1.17	85.5	16.9	0.20
RI0013	2730	NO3	2002	4.72	652	3,076	0.040	0.652	1.13	93.1	17.3	0.19
RI0013	2730	NO3	2003	2.82	884	2,493	0.040	0.884	0.91	60.1	10.3	0.17
RI0013	2730	NO3	2004	3.54	752	2,664	0.040	0.752	0.98	70.5	13.0	0.18
RI0013	2730	TDP	2001	4.61	64	294	0.123	0.064	0.11	85.5	16.9	0.20
RI0013	2730	TDP	2002	5.15	59	306	0.123	0.059	0.11	93.1	18.9	0.20
RI0013	2730	TDP	2003	2.82	37	106	0.123	0.037	0.04	60.1	10.3	0.17
RI0013	2730	TDP	2004	3.54	115	408	0.395	0.115	0.15	70.5	13.0	0.18
RI0013	2730	TKN	2000	1.37	842	1,157	0.125	0.842	0.42	59.5	5.0	0.08
RI0013	2730	TKN	2001	5.46	2,513	13,714	0.125	2.513	5.02	85.5	20.0	0.23
RI0013	2730	TKN	2002	4.72	2,194	10,347	0.125	2.194	3.79	93.1	17.3	0.19
RI0013	2730	TKN	2003	2.82	1,683	4,744	0.125	1.683	1.74	60.1	10.3	0.17
RI0013	2730	TKN	2004	3.55	2,229	7,902	0.125	2.229	2.89	70.5	13.0	0.18
RI0013	2730	TP	2000	1.37	219	301	0.173	0.219	0.11	59.5	5.0	0.08
RI0013	2730	TP	2001	5.46	718	3,920	0.173	0.718	1.44	85.5	20.0	0.23
RI0013	2730	TP	2002	4.72	621	2,928	0.173	0.621	1.07	93.1	17.3	0.19
RI0013	2730	TP	2003	2.82	468	1,320	0.173	0.468	0.48	60.1	10.3	0.17
RI0013	2730	TP	2004	3.55	634	2,249	0.173	0.634	0.82	70.5	13.0	0.18
RI0013	2730	TSS	2000	1.37	145,466	199,871	0.186	145.466	73.21	59.5	5.0	0.08
RI0013	2730	TSS	2001	5.46	652,790	3,562,276	0.186	652.790	1,304.86	85.5	20.0	0.23
RI0013	2730	TSS	2002	4.72	546,371	2,576,686	0.186	546.371	943.84	93.1	17.3	0.19
RI0013	2730	TSS	2003	2.82	391,902	1,104,771	0.186	391.902	404.68	60.1	10.3	0.17
RI0013	2730	TSS	2004	3.55	570,245	2,021,517	0.186	570.245	740.48	70.5	13.0	0.18

Rum River

Site	Area (ha)	Parameter	Year	Flow (hm3)	Model-Conc (ug/L)	Model-Mass (kg)	CV	Model-Conc (mg/L)	Model-Yield (kg/ha)	Precip (cm)	Runoff (cm)	RC
RUM0007	402000	NO3	2001	983.29	525	516,068	0.197	0.525	1.28	93.1	24.5	0.26
RUM0007	402000	NO3	2001	983.29	567	557,507	0.123	0.567	1.39	93.1	24.5	0.26
RUM0007	402000	NO3	2002	1260.11	515	648,570	0.066	0.515	1.61	112.3	31.3	0.28
RUM0007	402000	NO3	2002	1260.11	538	678,013	0.123	0.538	1.69	112.3	31.3	0.28
RUM0007	402000	NO3	2003	968.55	404	391,363	0.183	0.404	0.97	73.1	24.1	0.33
RUM0007	402000	NO3	2003	969.10	540	523,383	0.123	0.540	1.30	73.1	24.1	0.33
RUM0007	402000	NO3	2004	703.77	501	352,470	0.123	0.501	0.88	89.7	17.5	0.20
RUM0007	402000	TDP	1997	796.71	59	46,973	0.071	0.059	0.12	71.3	19.8	0.28
RUM0007	402000	TDP	1999	639.66	62	39,379	0.140	0.062	0.10	86.2	15.9	0.18
RUM0007	402000	TDP	2000	428.41	93	39,999	0.184	0.093	0.10	68.4	10.7	0.16
RUM0007	402000	TDP	2001	983.29	66	64,796	0.162	0.066	0.16	93.1	24.5	0.26
RUM0007	402000	TDP	2001	983.29	63	61,466	0.064	0.063	0.15	93.1	24.5	0.26
RUM0007	402000	TDP	2002	1260.11	55	69,601	0.112	0.055	0.17	112.3	31.3	0.28
RUM0007	402000	TDP	2002	1260.11	64	80,848	0.064	0.064	0.20	112.3	31.3	0.28
RUM0007	402000	TDP	2003	968.55	48	46,728	0.227	0.048	0.12	73.1	24.1	0.33
RUM0007	402000	TDP	2003	969.10	60	57,943	0.064	0.060	0.14	73.1	24.1	0.33
RUM0007	402000	TDP	2004	703.77	53	37,011	0.064	0.053	0.09	89.7	17.5	0.20
RUM0007	402000	TKN	2001	983.29	988	971,700	0.044	0.988	2.42	93.1	24.5	0.26
RUM0007	402000	TKN	2002	1260.11	1,092	1,376,074	0.044	1.092	3.42	112.3	31.3	0.28
RUM0007	402000	TKN	2003	969.10	1,031	999,378	0.044	1.031	2.49	73.1	24.1	0.33
RUM0007	402000	TKN	2004	703.77	939	660,490	0.044	0.939	1.64	89.7	17.5	0.20
RUM0007	402000	TP	1997	796.71	115	91,994	0.105	0.115	0.23	71.3	19.8	0.28
RUM0007	402000	TP	1999	639.66	158	101,351	0.281	0.158	0.25	86.2	15.9	0.18
RUM0007	402000	TP	2000	428.41	150	64,062	0.339	0.150	0.16	68.4	10.7	0.16
RUM0007	402000	TP	2001	983.29	154	151,648	0.131	0.154	0.38	93.1	24.5	0.26
RUM0007	402000	TP	2001	983.29	141	138,802	0.057	0.141	0.35	93.1	24.5	0.26
RUM0007	402000	TP	2002	1260.11	136	171,202	0.068	0.136	0.43	112.3	31.3	0.28
RUM0007	402000	TP	2002	1260.11	153	193,363	0.057	0.153	0.48	112.3	31.3	0.28
RUM0007	402000	TP	2003	967.47	207	200,130	0.178	0.207	0.50	73.1	24.1	0.33
RUM0007	402000	TP	2003	969.10	142	137,748	0.057	0.142	0.34	73.1	24.1	0.33
RUM0007	402000	TP	2004	703.77	124	87,000	0.057	0.124	0.22	89.7	17.5	0.20
RUM0007	402000	TSS	1997	796.71	19,125	15,237,080	0.288	19.125	37.90	71.3	19.8	0.28
RUM0007	402000	TSS	1999	639.66	39,751	25,426,710	0.097	39.751	63.25	86.2	15.9	0.18
RUM0007	402000	TSS	2000	428.41	8,483	3,634,275	0.182	8.483	9.04	68.4	10.7	0.16
RUM0007	402000	TSS	2001	983.29	27,598	27,137,230	0.221	27.598	67.51	93.1	24.5	0.26
RUM0007	402000	TSS	2001	983.29	24,754	24,339,992	0.104	24.754	60.55	93.1	24.5	0.26

RUM0007	402000	TSS	2002	1260.11	25,740	32,435,410	0.106	25.740	80.69	112.3	31.3	0.28
RUM0007	402000	TSS	2002	1260.11	26,900	33,896,625	0.104	26.900	84.32	112.3	31.3	0.28
RUM0007	402000	TSS	2003	968.55	23,059	22,334,160	0.152	23.059	55.56	73.1	24.1	0.33
RUM0007	402000	TSS	2003	969.10	24,514	23,756,358	0.104	24.514	59.10	73.1	24.1	0.33
RUM0007	402000	TSS	2004	703.77	20,680	14,554,096	0.104	20.680	36.20	89.7	17.5	0.20

Sand Creek

Site	Area (ha)	Parameter	Year	Flow (hm3)	Model-Conc (ug/L)	Model-Mass (kg)	CV	Model-Conc (mg/L)	Model-Yield (kg/ha)	Precip (cm)	Runoff (cm)	RC
SA0082	60390	NO3	1990	134.93	6,597	890,100	0.080	6.597	14.74	86.7	22.3	0.26
SA0082	60390	NO3	1991	83.49	6,188	516,626	0.080	6.188	8.55	90.2	13.8	0.15
SA0082	60390	NO3	1992	216.13	5,596	1,209,390	0.080	5.596	20.03	93.9	35.8	0.38
SA0082	60390	NO3	1993	261.13	2,907	759,005	0.046	2.907	12.57	88.7	43.2	0.49
SA0082	60390	NO3	1994	122.82	2,723	334,426	0.046	2.723	5.54	89.5	20.3	0.23
SA0082	60390	NO3	1995	119.09	2,745	326,907	0.046	2.745	5.41	79.6	19.7	0.25
SA0082	60390	NO3	1996	102.30	2,738	280,108	0.046	2.738	4.64	82.5	16.9	0.21
SA0082	60390	NO3	1997	177.33	3,070	544,392	0.055	3.070	9.01	70.5	29.4	0.42
SA0082	60390	NO3	1998	184.25	3,945	726,861	0.055	3.945	12.04	99.8	30.5	0.31
SA0082	60390	NO3	1999	107.76	3,837	413,495	0.055	3.837	6.85	88.0	17.8	0.20
SA0082	60390	NO3	2000	57.62	3,985	229,572	0.055	3.985	3.80	59.6	9.5	0.16
SA0082	60390	NO3	2001	130.96	6,023	788,841	0.070	6.023	13.06	70.0	21.7	0.31
SA0082	60390	NO3	2002	140.92	5,251	740,021	0.070	5.251	12.25	105.6	23.3	0.22
SA0082	60390	NO3	2003	69.39	4,874	338,237	0.070	4.874	5.60	49.0	11.5	0.23
SA0082	60390	NO3	2004	80.01	4,474	357,989	0.074	4.474	5.93	88.4	13.2	0.15
SA0082	60390	TDP	1990	134.93	326	44,024	0.088	0.326	0.73	86.7	22.3	0.26
SA0082	60390	TDP	1991	83.49	334	27,885	0.088	0.334	0.46	90.2	13.8	0.15
SA0082	60390	TDP	1992	216.13	341	73,625	0.088	0.341	1.22	93.9	35.8	0.38
SA0082	60390	TDP	1993	261.13	212	55,474	0.044	0.212	0.92	88.7	43.2	0.49
SA0082	60390	TDP	1994	122.82	191	23,493	0.044	0.191	0.39	89.5	20.3	0.23
SA0082	60390	TDP	1995	119.09	191	22,711	0.044	0.191	0.38	79.6	19.7	0.25
SA0082	60390	TDP	1996	102.30	191	19,565	0.044	0.191	0.32	82.5	16.9	0.21
SA0082	60390	TDP	1997	177.45	214	38,043	0.049	0.214	0.63	70.5	29.4	0.42
SA0082	60390	TDP	1998	184.28	223	41,064	0.049	0.223	0.68	99.8	30.5	0.31
SA0082	60390	TDP	1999	107.76	203	21,837	0.049	0.203	0.36	88.0	17.8	0.20
SA0082	60390	TDP	2000	57.62	197	11,326	0.049	0.197	0.19	59.6	9.5	0.16
SA0082	60390	TDP	2001	130.96	230	30,166	0.051	0.230	0.50	70.0	21.7	0.31
SA0082	60390	TDP	2002	140.92	211	29,690	0.051	0.211	0.49	105.6	23.3	0.22
SA0082	60390	TDP	2003	69.39	202	14,037	0.051	0.202	0.23	49.0	11.5	0.23
SA0082	60390	TDP	2004	80.01	186	14,843	0.076	0.186	0.25	88.4	13.2	0.15
SA0082	60390	TKN	2003	69.40	3,056	212,068	0.078	3.056	3.51	49.0	11.5	0.23
SA0082	60390	TKN	2004	80.01	3,005	240,464	0.078	3.005	3.98	88.4	13.2	0.15
SA0082	60390	TP	1990	134.93	781	105,336	0.168	0.781	1.74	86.7	22.3	0.26
SA0082	60390	TP	1991	83.49	751	62,667	0.168	0.751	1.04	90.2	13.8	0.15
SA0082	60390	TP	1992	216.40	781	169,062	0.168	0.781	2.80	93.9	35.8	0.38
SA0082	60390	TP	1993	261.13	652	170,369	0.090	0.652	2.82	88.7	43.2	0.49

SA0082	60390	TP	1994	122.82	574	70,560	0.090	0.574	1.17	89.5	20.3	0.23
SA0082	60390	TP	1995	119.09	576	68,649	0.090	0.576	1.14	79.6	19.7	0.25
SA0082	60390	TP	1996	102.30	577	58,993	0.090	0.577	0.98	82.5	16.9	0.21
SA0082	60390	TP	1997	177.45	641	113,689	0.059	0.641	1.88	70.5	29.4	0.42
SA0082	60390	TP	1998	184.28	720	132,751	0.059	0.720	2.20	99.8	30.5	0.31
SA0082	60390	TP	1999	107.76	561	60,466	0.059	0.561	1.00	88.0	17.8	0.20
SA0082	60390	TP	2000	57.62	531	30,598	0.059	0.531	0.51	59.6	9.5	0.16
SA0082	60390	TP	2001	130.96	581	76,077	0.074	0.581	1.26	70.0	21.7	0.31
SA0082	60390	TP	2002	140.92	522	73,500	0.074	0.522	1.22	105.6	23.3	0.22
SA0082	60390	TP	2003	69.39	487	33,760	0.074	0.487	0.56	49.0	11.5	0.23
SA0082	60390	TP	2004	80.01	610	48,779	0.092	0.610	0.81	88.4	13.2	0.15
SA0082	60390	TSS	1990	134.93	227,173	30,651,740	0.146	227.173	507.56	86.7	22.3	0.26
SA0082	60390	TSS	1991	83.49	227,384	18,983,820	0.146	227.384	314.35	90.2	13.8	0.15
SA0082	60390	TSS	1992	216.13	309,912	66,979,840	0.146	309.912	1,109.12	93.9	35.8	0.38
SA0082	60390	TSS	1993	261.13	388,123	101,350,200	0.107	388.123	1,678.26	88.7	43.2	0.49
SA0082	60390	TSS	1994	122.82	282,334	34,677,290	0.107	282.334	574.22	89.5	20.3	0.23
SA0082	60390	TSS	1995	119.09	289,202	34,442,180	0.107	289.202	570.33	79.6	19.7	0.25
SA0082	60390	TSS	1996	102.30	289,157	29,581,740	0.107	289.157	489.85	82.5	16.9	0.21
SA0082	60390	TSS	1997	177.45	325,468	57,752,780	0.109	325.468	956.33	70.5	29.4	0.42
SA0082	60390	TSS	1998	184.28	406,818	74,968,930	0.109	406.818	1,241.41	99.8	30.5	0.31
SA0082	60390	TSS	1999	107.76	238,898	25,744,070	0.109	238.898	426.30	88.0	17.8	0.20
SA0082	60390	TSS	2000	57.62	193,405	11,143,140	0.109	193.405	184.52	59.6	9.5	0.16
SA0082	60390	TSS	2001	130.96	499,287	65,387,140	0.267	499.287	1,082.75	70.0	21.7	0.31
SA0082	60390	TSS	2002	140.92	371,165	52,305,310	0.267	371.165	866.13	105.6	23.3	0.22
SA0082	60390	TSS	2003	69.40	617,287	42,836,659	0.242	617.287	709.33	49.0	11.5	0.23
SA0082	60390	TSS	2004	80.01	639,365	51,156,209	0.242	639.365	847.10	88.4	13.2	0.15

Scott County Ditch 10

Site	Area (ha)	Parameter	Year	Flow (hm3)	Model-Conc (ug/L)	Model-Mass (kg)	CV	Model-Conc (mg/L)	Model-Yield (kg/ha)	Precip (cm)	Runoff (cm)	RC
SD0003	4270	NO3	2003	3.07	12,261	37,653	0.076	12.261	8.82	49.0	7.2	0.15
SD0003	4270	NO3	2004	6.07	15,895	96,469	0.076	15.895	22.59	88.4	14.2	0.16
SD0003	4270	TDP	2003	3.07	248	763	0.223	0.248	0.18	49.0	7.2	0.15
SD0003	4270	TDP	2004	6.07	243	1,472	0.223	0.243	0.34	88.4	14.2	0.16
SD0003	4270	TKN	2003	3.07	1,984	6,094	0.062	1.984	1.43	49.0	7.2	0.15
SD0003	4270	TKN	2004	6.07	2,249	13,647	0.062	2.249	3.20	88.4	14.2	0.16
SD0003	4270	TP	2003	3.07	302	927	0.159	0.302	0.22	49.0	7.2	0.15
SD0003	4270	TP	2004	6.07	367	2,227	0.159	0.367	0.52	88.4	14.2	0.16
SD0003	4270	TSS	2003	3.07	50,966	156,517	0.270	50.966	36.66	49.0	7.2	0.15
SD0003	4270	TSS	2004	6.07	90,200	547,422	0.270	90.200	128.20	88.4	14.2	0.16

Silver Creek

Site	Area (ha)	Parameter	Year	Flow (hm3)	Model-Conc (ug/L)	Model-Mass (kg)	CV	Model-Conc (mg/L)	Model-Yield (kg/ha)	Precip (cm)	Runoff (cm)	RC
SI0001	1930	NO3	2001	0.78	181	140	0.320	0.181	0.07	88.1	4.0	0.05
SI0001	1930	NO3	2002	3.03	304	920	0.132	0.304	0.48	104.6	15.7	0.15
SI0001	1930	NO3	2003	1.54	577	887	0.060	0.577	0.46	73.4	8.0	0.11
SI0001	1930	NO3	2004	1.10	708	778	0.088	0.708	0.40	76.3	5.7	0.07
SI0001	1930	TDP	2000	0.20	25	5	0.163	0.025	0.00	79.1	1.0	0.01
SI0001	1930	TDP	2001	0.78	18	14	0.123	0.018	0.01	88.1	4.0	0.05
SI0001	1930	TDP	2002	3.03	31	94	0.092	0.031	0.05	104.6	15.7	0.15
SI0001	1930	TDP	2003	1.53	23	36	0.106	0.023	0.02	73.4	7.9	0.11
SI0001	1930	TDP	2004	1.10	23	25	0.106	0.023	0.01	76.3	5.7	0.07
SI0001	1930	TKN	2003	1.53	563	862	0.094	0.563	0.45	73.4	7.9	0.11
SI0001	1930	TKN	2004	1.10	441	484	0.094	0.441	0.25	76.3	5.7	0.07
SI0001	1930	TP	2000	0.20	63	13	0.196	0.063	0.01	79.1	1.0	0.01
SI0001	1930	TP	2001	0.78	64	50	0.127	0.064	0.03	88.1	4.0	0.05
SI0001	1930	TP	2002	3.03	95	287	0.090	0.095	0.15	104.6	15.7	0.15
SI0001	1930	TP	2003	1.53	86	131	0.104	0.086	0.07	73.4	7.9	0.11
SI0001	1930	TP	2004	1.10	64	71	0.104	0.064	0.04	76.3	5.7	0.07
SI0001	1930	TSS	2000	0.20	29,762	5,906	0.427	29.762	3.06	79.1	1.0	0.01
SI0001	1930	TSS	2001	0.78	13,861	10,753	0.143	13.861	5.57	88.1	4.0	0.05
SI0001	1930	TSS	2002	3.03	41,814	126,539	0.225	41.814	65.56	104.6	15.7	0.15
SI0001	1930	TSS	2003	1.53	38,008	58,228	0.193	38.008	30.17	73.4	7.9	0.11
SI0001	1930	TSS	2004	1.10	23,039	25,320	0.193	23.039	13.12	76.3	5.7	0.07

South Fork Crow River

Site	Area (ha)	Parameter	Year	Flow (hm3)	Model-Conc (ug/L)	Model-Mass (kg)	CV	Model-Conc (mg/L)	Model-Yield (kg/ha)	Precip (cm)	Runoff (cm)	RC
CWS0203	294000	NO3	2001	567.09	4,929	2,795,015	0.080	4.929	9.51	80.6	19.3	0.24
CWS0203	294000	NO3	2002	544.59	4,594	2,501,743	0.039	4.594	8.51	103.9	18.5	0.18
CWS0203	294000	NO3	2003	357.12	5,402	1,929,316	0.090	5.402	6.56	63.1	12.1	0.19
CWS0203	294000	NO3	2004	395.13	5,479	2,165,025	0.090	5.479	7.36	98.5	13.4	0.14
CWS0203	294000	TDP	2002	544.59	272	148,080	0.054	0.272	0.50	103.9	18.5	0.18
CWS0203	294000	TDP	2003	357.12	284	101,376	0.077	0.284	0.34	63.1	12.1	0.19
CWS0203	294000	TDP	2004	395.13	291	115,039	0.077	0.291	0.39	98.5	13.4	0.14
CWS0203	294000	TKN	2002	544.59	1,775	966,649	0.030	1.775	3.29	103.9	18.5	0.18
CWS0203	294000	TKN	2003	357.12	1,851	661,151	0.030	1.851	2.25	63.1	12.1	0.19
CWS0203	294000	TKN	2004	395.13	1,767	698,093	0.030	1.767	2.37	98.5	13.4	0.14
CWS0203	294000	TP	2001	567.09	362	205,408	0.081	0.362	0.70	80.6	19.3	0.24
CWS0203	294000	TP	2002	544.59	388	211,422	0.036	0.388	0.72	103.9	18.5	0.18
CWS0203	294000	TP	2003	357.12	407	145,387	0.054	0.407	0.49	63.1	12.1	0.19
CWS0203	294000	TP	2004	395.13	410	162,143	0.054	0.410	0.55	98.5	13.4	0.14
CWS0203	294000	TSS	2001	567.09	22,299	12,645,500	0.093	22.299	43.01	80.6	19.3	0.24
CWS0203	294000	TSS	2002	544.59	56,155	30,581,606	0.099	56.155	104.02	103.9	18.5	0.18
CWS0203	294000	TSS	2003	357.12	57,313	20,467,504	0.099	57.313	69.62	63.1	12.1	0.19
CWS0203	294000	TSS	2004	395.13	54,274	21,445,618	0.099	54.274	72.94	98.5	13.4	0.14

Valley Creek

Site	Area (ha)	Parameter	Year	Flow (hm3)	Model-Conc (ug/L)	Model-Mass (kg)	CV	Model-Conc (mg/L)	Model-Yield (kg/ha)	Precip (cm)	Runoff (cm)	RC
VA0010	3410	NO3	1999	14.09	3,990	56,235	0.014	3.990	16.49	86.5	41.3	0.48
VA0010	3410	NO3	2000	15.41	3,987	61,456	0.014	3.987	18.02	79.1	45.2	0.57
VA0010	3410	NO3	2001	17.42	3,992	69,556	0.014	3.992	20.40	88.1	51.1	0.58
VA0010	3410	NO3	2002	18.82	3,987	75,044	0.014	3.987	22.01	104.6	55.2	0.53
VA0010	3410	NO3	2003	18.56	3,982	73,904	0.014	3.982	21.67	73.4	54.4	0.74
VA0010	3410	NO3	2004	15.09	4,480	67,608	0.019	4.480	19.83	76.3	44.3	0.58
VA0010	3410	TDP	1999	14.09	26	362	0.078	0.026	0.11	86.5	41.3	0.48
VA0010	3410	TDP	2000	15.41	25	382	0.078	0.025	0.11	79.1	45.2	0.57
VA0010	3410	TDP	2001	17.42	23	407	0.078	0.023	0.12	88.1	51.1	0.58
VA0010	3410	TDP	2002	18.82	24	454	0.078	0.024	0.13	104.6	55.2	0.53
VA0010	3410	TDP	2003	18.56	25	460	0.078	0.025	0.13	73.4	54.4	0.74
VA0010	3410	TDP	2004	15.09	28	428	0.650	0.028	0.13	76.3	44.3	0.58
VA0010	3410	TKN	2003	18.61	415	7,716	0.092	0.415	2.26	73.4	54.6	0.74
VA0010	3410	TKN	2004	15.09	265	3,997	0.092	0.265	1.17	76.3	44.3	0.58
VA0010	3410	TP	1999	14.09	90	1,265	0.142	0.090	0.37	86.5	41.3	0.48
VA0010	3410	TP	2000	15.41	71	1,102	0.142	0.071	0.32	79.1	45.2	0.57
VA0010	3410	TP	2001	17.42	63	1,093	0.142	0.063	0.32	88.1	51.1	0.58
VA0010	3410	TP	2002	18.82	65	1,230	0.142	0.065	0.36	104.6	55.2	0.53
VA0010	3410	TP	2003	18.56	66	1,222	0.142	0.066	0.36	73.4	54.4	0.74
VA0010	3410	TP	2004	15.09	53	799	0.417	0.053	0.23	76.3	44.3	0.58
VA0010	3410	TSS	1999	14.09	12,092	170,406	0.115	12.092	49.97	86.5	41.3	0.48
VA0010	3410	TSS	2000	15.41	14,360	221,356	0.115	14.360	64.91	79.1	45.2	0.57
VA0010	3410	TSS	2001	17.42	11,875	206,886	0.115	11.875	60.67	88.1	51.1	0.58
VA0010	3410	TSS	2002	18.82	14,573	274,307	0.115	14.573	80.44	104.6	55.2	0.53
VA0010	3410	TSS	2003	18.56	16,882	313,297	0.115	16.882	91.88	73.4	54.4	0.74
VA0010	3410	TSS	2004	15.09	11,365	171,516	0.320	11.365	50.30	76.3	44.3	0.58

Vermillion River

Site	Area (ha)	Parameter	Year	Flow (hm3)	Model-Conc (ug/L)	Model-Mass (kg)	CV	Model-Conc (mg/L)	Model-Yield (kg/ha)	Precip (cm)	Runoff (cm)	RC
VR0020	69940	NO3	1998	185.27	3,807	705,283	0.113	3.807	10.08	95.6	26.5	0.28
VR0020	69940	NO3	1999	129.72	3,856	500,219	0.113	3.856	7.15	75.8	18.5	0.24
VR0020	69940	NO3	2000	77.24	5,377	415,370	0.047	5.377	5.94	77.1	11.0	0.14
VR0020	69940	NO3	2001	120.95	5,265	636,726	0.047	5.265	9.10	79.3	17.3	0.22
VR0020	69940	NO3	2002	253.06	4,560	1,154,018	0.036	4.560	16.50	106.9	36.2	0.34
VR0020	69940	NO3	2003	170.42	5,608	955,711	0.036	5.608	13.66	66.6	24.4	0.37
VR0020	69940	NO3	2004	154.57	5,767	891,416	0.036	5.767	12.75	83.7	22.1	0.26
VR0020	69940	TDP	1995	100.13	382	38,277	0.190	0.382	0.55	75.7	14.3	0.19
VR0020	69940	TDP	1996	81.08	399	32,343	0.190	0.399	0.46	68.8	11.6	0.17
VR0020	69940	TDP	1997	154.23	266	41,091	0.123	0.266	0.59	93.1	22.1	0.24
VR0020	69940	TDP	1998	185.27	245	45,315	0.123	0.245	0.65	95.6	26.5	0.28
VR0020	69940	TDP	1999	129.72	248	32,161	0.123	0.248	0.46	75.8	18.5	0.24
VR0020	69940	TDP	2000	77.24	627	48,433	0.063	0.627	0.69	77.1	11.0	0.14
VR0020	69940	TDP	2001	120.95	528	63,830	0.063	0.528	0.91	79.3	17.3	0.22
VR0020	69940	TDP	2002	253.06	413	104,442	0.039	0.413	1.49	106.9	36.2	0.34
VR0020	69940	TDP	2003	170.42	505	86,139	0.039	0.505	1.23	66.6	24.4	0.37
VR0020	69940	TDP	2004	154.57	518	80,127	0.039	0.518	1.15	83.7	22.1	0.26
VR0020	69940	TKN	2002	253.06	1,216	307,777	0.101	1.216	4.40	106.9	36.2	0.34
VR0020	69940	TKN	2003	170.42	1,144	194,880	0.101	1.144	2.79	66.6	24.4	0.37
VR0020	69940	TKN	2004	154.57	1,147	177,321	0.101	1.147	2.54	83.7	22.1	0.26
VR0020	69940	TP	1995	100.13	634	63,515	0.094	0.634	0.91	75.7	14.3	0.19
VR0020	69940	TP	1996	81.08	721	58,467	0.094	0.721	0.84	68.8	11.6	0.17
VR0020	69940	TP	1997	154.23	358	55,232	0.059	0.358	0.79	93.1	22.1	0.24
VR0020	69940	TP	1998	185.27	356	66,006	0.059	0.356	0.94	95.6	26.5	0.28
VR0020	69940	TP	1999	129.72	362	47,005	0.059	0.362	0.67	75.8	18.5	0.24
VR0020	69940	TP	2000	77.24	749	57,822	0.094	0.749	0.83	77.1	11.0	0.14
VR0020	69940	TP	2001	120.95	686	82,989	0.094	0.686	1.19	79.3	17.3	0.22
VR0020	69940	TP	2002	253.06	559	141,358	0.040	0.559	2.02	106.9	36.2	0.34
VR0020	69940	TP	2003	170.42	630	107,340	0.040	0.630	1.53	66.6	24.4	0.37
VR0020	69940	TP	2004	154.57	641	99,071	0.040	0.641	1.42	83.7	22.1	0.26
VR0020	69940	TSS	1995	100.13	84,927	8,503,455	0.141	84.927	121.58	75.7	14.3	0.19
VR0020	69940	TSS	1996	81.08	84,927	6,886,175	0.141	84.927	98.46	68.8	11.6	0.17
VR0020	69940	TSS	1997	154.23	35,944	5,543,653	0.197	35.944	79.26	93.1	22.1	0.24
VR0020	69940	TSS	1998	185.27	41,031	7,601,592	0.197	41.031	108.69	95.6	26.5	0.28
VR0020	69940	TSS	1999	129.72	39,605	5,137,521	0.197	39.605	73.46	75.8	18.5	0.24
VR0020	69940	TSS	2000	77.24	33,055	2,553,286	0.141	33.055	36.51	77.1	11.0	0.14

VR0020	69940	TSS	2001	120.95	34,964	4,228,688	0.141	34.964	60.46	79.3	17.3	0.22
VR0020	69940	TSS	2002	253.06	28,542	7,222,873	0.141	28.542	103.27	106.9	36.2	0.34
VR0020	69940	TSS	2003	170.22	35,416	6,028,647	0.141	35.416	86.20	66.6	24.3	0.37
VR0020	69940	TSS	2004	154.57	37,395	5,780,183	0.172	37.395	82.64	83.7	22.1	0.26

Willow Creek

Site	Area (ha)	Parameter	Year	Flow (hm3)	Model-Conc (ug/L)	Model-Mass (kg)	CV	Model-Conc (mg/L)	Model-Yield (kg/ha)	Precip (cm)	Runoff (cm)	RC
WI0010	2120	NO3	2001	6.05	376	2,273	0.087	0.376	1.07	85.4	28.6	0.33
WI0010	2120	NO3	2002	7.37	319	2,347	0.067	0.319	1.11	105.9	34.7	0.33
WI0010	2120	NO3	2003	3.18	338	1,073	0.067	0.338	0.51	64.5	15.0	0.23
WI0010	2120	NO3	2004	3.40	336	1,142	0.067	0.336	0.54	83.6	16.0	0.19
WI0010	2120	TDP	2001	6.05	44	267	0.079	0.044	0.13	85.4	28.6	0.33
WI0010	2120	TDP	2002	7.37	45	335	0.079	0.045	0.16	105.9	34.7	0.33
WI0010	2120	TDP	2003	3.18	42	134	0.079	0.042	0.06	64.5	15.0	0.23
WI0010	2120	TDP	2004	3.40	58	197	0.177	0.058	0.09	83.6	16.0	0.19
WI0010	2120	TKN	2003	3.18	1,442	4,579	0.267	1.442	2.16	64.5	15.0	0.23
WI0010	2120	TKN	2004	3.40	1,608	5,464	0.267	1.608	2.58	83.6	16.0	0.19
WI0010	2120	TP	2001	6.05	140	850	0.105	0.140	0.40	85.4	28.6	0.33
WI0010	2120	TP	2002	7.37	153	1,125	0.105	0.153	0.53	105.9	34.7	0.33
WI0010	2120	TP	2003	3.18	137	437	0.105	0.137	0.21	64.5	15.0	0.23
WI0010	2120	TP	2004	3.40	119	404	0.125	0.119	0.19	83.6	16.0	0.19
WI0010	2120	TSS	2001	6.05	56,602	342,611	0.172	56.602	161.61	85.4	28.6	0.33
WI0010	2120	TSS	2002	7.37	64,909	478,099	0.172	64.909	225.52	105.9	34.7	0.33
WI0010	2120	TSS	2003	3.18	56,598	155,229	0.172	56.598	73.22	64.5	15.0	0.23
WI0010	2120	TSS	2004	3.40	83,248	282,961	0.215	83.248	133.47	83.6	16.0	0.19

West Raven Creek

Site	Area (ha)	Parameter	Year	Flow (hm3)	Model-Conc (ug/L)	Model-Mass (kg)	CV	Model-Conc (mg/L)	Model-Yield (kg/ha)	Precip (cm)	Runoff (cm)	RC
WR0047	3850	NO3	2004	4.22	11,393	48,103	0.105	11.393	12.49	88.4	11.0	0.12
WR0047	3850	TDP	2003	2.85	320	914	0.102	0.320	0.24	49.0	7.4	0.15
WR0047	3850	TDP	2004	4.22	317	1,338	0.102	0.317	0.35	88.4	11.0	0.12
WR0047	3850	TKN	2004	4.22	2,426	10,242	0.117	2.426	2.66	88.4	11.0	0.12
WR0047	3850	TP	2004	4.22	604	2,549	0.151	0.604	0.66	88.4	11.0	0.12
WR0047	3850	TSS	2004	4.22	237,083	1,000,966	0.377	237.083	259.99	88.4	11.0	0.12