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Annual Monitoring Report 2007



MWMO Watershed Bulletin 2009-1



Annual Monitoring Report 2007

Primary Author

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Acknowledgements

The Mississippi Watershed Management Organization (MWMO) thanks the following groups for their cooperation and assistance with MWMO monitoring activities: City of Minneapolis' Department of Public Works and Department of Emergency Preparedness, City of Saint Anthony Village Public Works Department, and the Minnesota Department of Transportation. The MWMO also acknowledges the Minnesota Pollution Control Agency and the Hennepin County Sheriff's Office for their assistance with the Interstate 35W bridge collapse monitoring activities.



Suggested Citation

Mississippi Watershed Management Organization. 2009. *Annual Monitoring Report 2007*. MWMO Watershed Bulletin 2009-1. 49 p.

Front Cover

Looking south toward the Mississippi River Gorge from the University of Minnesota East Bank Campus, Minneapolis. *Photograph by B. Jastram, Mississippi Watershed Management Organization.*

Data Disclaimer

The MWMO does not support interpretation of the data other than what is presented in this report. The MWMO will not use site data for decision making until sufficient data exists to draw scientific conclusions: generally this requires three to five years of flow-weighted records for a sampling location.

Five or more years of flow-weighted monitoring are needed to establish a water quality baseline for stormwater discharges entering the Mississippi River, to determine pollutant loads entering the Mississippi River, and to evaluate the effects of MWMO projects and programs on water quality.

Annual Monitoring Report 2007

Abstract

In 2007, the Mississippi Watershed Management Organization (MWMO) continued monitoring the Mississippi River, Loring Pond, and stormwater outfalls to the Mississippi River. The MWMO conducted emergency water quality monitoring following the collapse of the Interstate 35W bridge in August 2007 and continued through the demolition and removal of the bridge from the river.

Under section 303(d) of the Federal Clean Water Act, the 12-mile reach of the Mississippi River in the MWMO is listed on the 303(d) Total Maximum Daily Load (TMDL) list as impaired for fecal coliform. Fecal coliform concentrations exceeded Minnesota water quality standards during the months of August, September, and October in 2007. *E. coli* concentrations also exceeded water quality standards proposed by the Minnesota Pollution Control Agency (MPCA) during the same months. Long-term monitoring of the river and stormwater

outfalls to the river is necessary to evaluate bacteria inputs from within the watershed compared to inputs from upstream sources. In Loring Pond, fecal coliform concentrations exceeded Minnesota water quality standards July through October, 2007. *E. coli* concentrations also exceeded proposed water quality standards in Loring Pond during the same months. Loring Pond is not listed on the 303(d) TMDL list due to a lack of data. Data are submitted to the MPCA on an annual basis and included in assessments conducted biannually to add waterbodies to the 303(d) TMDL list.

Stormwater monitoring was expanded in 2007 to include an additional stormwater monitoring site on the jurisdictional boundary of Saint Anthony Village and Minneapolis, allowing the MWMO to measure the quantity and quality of water leaving Saint Anthony Village.



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Annual Monitoring Report 2007final_rev20120926

Annual Monitoring Report 2007

Table of Contents

Executive Summary.....	1
Introduction	3
Background	3
Methodology.....	5
Sample Collection, Handling, and Preservation	5
Mississippi River and Loring Pond	5
Stormwater	6
Interstate 35W Bridge Collapse	6
Sampling Quality Control	6
Laboratory Analyses.....	7
Parameters Information	7
Data Analysis.....	7
Cold Climate Considerations.....	7
Precipitation	7
Mississippi River	9
Water Level.....	9
Monitoring Results	10
Fecal Coliform.....	10
<i>E. coli</i>	11
Dissolved Oxygen, pH, Transparency, and Specific Conductivity	12
Loring Pond.....	12
Water Level.....	12
Monitoring Results	13
Fecal coliform.....	13
<i>E. coli</i>	13
Dissolved Oxygen, pH, Transparency, and Specific Conductivity	13
Stormwater	16
Site Description	16
Water Level.....	17
Monitoring Results.....	17
Special Studies.....	20
Monitoring Results	20
Work Plan	21
Assessment of 2007.....	21
2008 Work Plan	21
Future Recommendations	21

References	21
Appendix A – Watershed Maps	23
Appendix B – Laboratory Methods and Certification	25
Appendix C – Unit Conversions	27
Appendix D – Mississippi River Data	28
Appendix E – Stormwater Drainage Systems Major Land Uses	32
Appendix F – Stormwater Monitoring Results	33
Appendix G – I-35W Bridge Collapse Monitoring Results	47

List of Figures

Figure 1. Diagram of sample collection method.	5
Figure 2. Precipitation for six locations along the Mississippi River.	8
Figure 3. Precipitation for two locations in the MWMO watershed.	9
Figure 4. Mississippi River stage based on a 100-foot benchmark.	10
Figure 5. Fecal coliform monthly geomeans for the Mississippi River monitoring sites.	11
Figure 6. <i>E. coli</i> monthly geomeans for the Mississippi River monitoring sites.	12
Figure 7. Loring Pond stage data based on a 100-foot benchmark.	13
Figure 8. Fecal coliform monthly geomeans for Loring Pond.	14
Figure 9. Fecal coliform and <i>E. coli</i> concentrations for Loring Pond.	15
Figure 10. <i>E. coli</i> monthly geomeans for Loring Pond.	15
Figure 11. Dissolved oxygen in mg/L, pH, transparency in cm, and specific conductivity in μ S for Loring Pond.	16
Figure 12. Water level for 1NE.	148
Figure 13. Water level for 6UMN.	18
Figure 14. Water level for 10SA.	19
Figure 15. Discharge for 1NE.	19
Figure 16. Discharge for 10SA.	20
Figure A.1. MWMO watershed boundary and monitoring sites.	23
Figure A.2. I-35W bridge collapse monitoring sites, Minneapolis, Minnesota.	24

List of Tables

Table 1. Water use classifications for waterbodies in the MWMO.....	4
Table 2. Pollutants in Impaired Waters.	4
Table 3. Sites that exceeded the monthly fecal coliform geomean for the Mississippi River.....	11
Table B.1. Laboratory methods and certification for each analyte... ..	25
Table C.1. Unit conversions.	27
Table E.1. Stormwater drainage systems' major land uses.....	32
Table F.1. Monitoring results for 1NE outfall.	33
Table F.2. Monitoring results for 2NNBC outfall.	35
Table F.3. Monitoring results for 4PP outfall.....	37
Table F.4. Monitoring results for 6UMN outfall.	39
Table F.5. Monitoring results for 7LSTU outfall.....	43
Table F.6. Monitoring results for 10SA stormwater pipe.....	45
Table G.1. I-35W bridge collapse monitoring results.....	47

Executive Summary

This report details the results of the Mississippi Watershed Management Organization's (MWMO) 2007 monitoring season. MWMO staff will complete an annual monitoring report summarizing the year's results and outlining the next year's work plan each year. The report is available on the MWMO website at www.mwmo.org.

The MWMO monitors water quality in the watershed's stormwater drainage system, the Mississippi River, and Loring Pond. Within these systems, major factors influencing water quality include the amount of precipitation, timing of precipitation events, and land use practices in the watershed. Long-term monitoring of stormwater outfalls is necessary to characterize the impact of various land use practices on surface water runoff within the MWMO and, ultimately, the Mississippi River. Water quality in the Mississippi River is also influenced by precipitation and land use practices in the entire Mississippi River basin upstream of the MWMO. Long-term monitoring of the river will aid the understanding of upstream weather patterns and land use impacts on the MWMO watershed.

The 2007 monitoring season included collection of water quality samples from six locations in the Mississippi River, one in Loring Pond, and five stormwater outfalls to the Mississippi River. One stormwater pipe, located at the jurisdictional boundary of Saint Anthony Village and Minneapolis, was installed as an automated monitoring site.

The MWMO had a total of three automated stormwater monitoring sites in 2007. A fourth automated site installation was started inside the Interstate 35W (I-35W) stormwater pipe, but the I-

35W bridge collapse prevented completion of the installation.

The 12-mile reach of the Mississippi River in the MWMO is listed on the Federal Clean Water Act Section 303(d) Total Maximum Daily Load (TMDL) list as impaired for fecal coliform. Fecal coliform concentrations continued to exceed Minnesota water quality standards in 2007 during the months of August, September, and October. *E. coli* concentrations also exceeded proposed water quality standards during the same months. Long-term monitoring of the river and stormwater outfalls to the river is necessary to compare fecal coliform inputs from within the watershed to those inputs from upstream sources.

Fecal coliform concentrations in Loring Pond exceeded Minnesota water quality standards during July through October of 2007. *E. coli* concentrations also exceeded proposed water quality standards during the same months. Loring Pond is not listed on the 303(d) TMDL list due to a lack of data. Data submitted to the MPCA on an annual basis are included in assessments conducted biannually to add waterbodies to the 303(d) TMDL list.

The MWMO continued monitoring stormwater in 2007. There are no water quality standards for stormwater so, rather than comparing to standards, stormwater drainage results are presented in subsequent sections. The MWMO will continue to monitor stormwater drainage systems to develop a record of baseline data to characterize stormwater quality within the watershed.

The I-35W bridge collapse was the largest potential environmental emergency the MWMO has

experienced within its watershed boundaries. The MWMO conducted all water quality monitoring in the Mississippi River following the bridge collapse. While the MWMO had not responded to environmental emergencies in the past, this instance required staff attention. As all other public agencies were focused on human safety, rescue, and air quality concerns, it quickly became apparent that the MWMO could fill the need to monitor the Mississippi River water quality. The MWMO worked in cooperation with the City of Minneapolis, the Hennepin County Sheriff's Office, and the Minnesota Pollution Control Agency to collect and interpret data. Prior data were not available to establish baseline conditions before the collapse, so samples were collected both upstream and downstream of the bridge collapse site.

The MWMO and the MPCA concluded that the upstream and downstream samples compared well. With the exception of one oil and grease sample collected on August 4, the water quality results did not exceed state water quality standards during the recovery and debris removal phases. To be better prepared for future emergencies, the MWMO also contracted with the United States Geological Survey (USGS) to sample both water quality and river bottom sediment quality to establish baseline information for the Mississippi River. The sampling was conducted in the spring of 2008.

Introduction

This report details the results of the Mississippi Watershed Management Organization's (MWMO) 2007 monitoring season. MWMO staff will complete an annual monitoring report summarizing the year's results and outlining the next year's work plan each year. The report is available on the MWMO website at www.mwmo.org.

The MWMO established the monitoring program to provide a scientific basis for identifying and evaluating water quality and quantity issues. This is necessary to implement solutions to improve water quality and reestablish natural water regimes in the watershed. The objectives of the program are as follows:

- Monitor biological, chemical, and physical parameters of water resources in the watershed
- Monitor water quality within the watershed
 - Develop a record of baseline data to characterize water quality and identify pollutants that exceed water quality standards
 - Assess pollutants listed on the 303(d) Total Maximum Daily Load list
- Assess the volume and rate of water movement in the watershed
- Develop and agree upon a standardized set of parameters and sample collection, data analysis, and reporting standards with organizations in the watershed
- Develop partnerships and collaborate with other organizations and agencies, both inside and outside the watershed boundaries, to improve water quality in the Mississippi River
- Assess land use impact on water quality

The 2007 monitoring season included collection of water quality samples from six locations in the Mississippi River, one in Loring Pond, and six stormwater sites. Refer to Figure A.1 in Appendix A for the monitoring locations. Descriptions of the sampling sites can be found in the MWMO 2005

Annual Monitoring Report, available at www.mwmo.org.

Additionally, the MWMO monitored water quality in the Mississippi River following the I-35W bridge collapse.

Background

The MWMO was established in 1985 by a joint powers agreement among member organizations. (The MWMO watershed boundaries are shown in Figure A.1 in Appendix A.) The MWMO is a unique organization, as it includes a reach of the Mississippi River. Other local watershed districts and organizations include land and water resources up to the river's shore, but not extending into the river itself. The reach of the Mississippi River included in the MWMO extends from 53rd Avenue in north Minneapolis downstream to Lock and Dam 1 (Ford Dam) in south Minneapolis. Another unique feature of the MWMO is that its boundaries include only one lake, Loring Pond.

Minnesota regulations require that the MWMO protect water quality in the watershed. Minnesota Rules Chapter 7050 requires that all water bodies comply with state water quality standards. Furthermore, section 303(d) of the Federal Water Pollution Control Act (commonly known as the Clean Water Act) requires states to develop TMDLs for waters with impaired uses. Impaired waters are those waters that exceed water quality standards for their classified use. Some typical classifications include drinking water and aquatic life and recreation (swimming and fishing). According to Minnesota Rules Chapter 7050, the reach of the Mississippi River within the MWMO watershed is divided into two sections for classification. Table 1 highlights the most restrictive classifications.

Table 1. Water use classifications for waterbodies in the MWMO

Waterbody	Water Use Classification
Mississippi River: MWMO upstream boundary to Upper Saint Anthony Falls	1C, 2Bd Domestic consumption (drinking water)
Mississippi River: Upper Saint Anthony Falls to Lock & Dam 1 (Ford Dam)	2B Aquatic life and recreation
Loring Pond	2B Aquatic life and recreation

Table 2. Pollutants in impaired waters

Impaired Mississippi River Reach	Pollutant
MWMO upstream boundary to Upper Saint Anthony Falls	Fecal coliform, Mercury in fish tissue, Polychlorinated biphenyls (PCBs) in fish tissue
Upper Saint Anthony Falls to Lower Saint Anthony Falls	Mercury in fish tissue, PCBs in fish tissue
Lower Saint Anthony Falls to Lock & Dam 1 (Ford Dam)	Fecal coliform, Mercury in fish tissue

The MWMO reach of the Mississippi River is listed on Minnesota's 303(d) TMDL list. The Minnesota Pollution Control Agency divided the reach of the Mississippi River flowing through the MWMO into three sections. Table 2 lists the impaired reaches of the river and the corresponding pollutants of concern. The Minnesota Pollution Control Agency has written a statewide TMDL for mercury (MPCA, 2007).

Mercury and polychlorinated biphenyls (PCBs) are listed on the 303(d) TMDL list for aquatic consumption advisories; therefore, this report will address fecal coliform only.

Protecting water quality in the Mississippi River is a complicated task. The reach of the Mississippi River

flowing through the MWMO is densely urbanized. Commercial, industrial, residential, park lands, and downtown Minneapolis land uses contribute to the volume and quality of the water entering the river through the stormwater drainage system. The MWMO monitors stormwater outfalls to determine the contributions of surface runoff in the watershed to water quality in the river.

That being said, the entire Mississippi River basin upstream of the MWMO watershed contributes to water quality in the MWMO's reach of the river.

The upper Mississippi River is a large, dynamic river system that includes runoff from forested areas near the source at Lake Itasca, agricultural runoff from the central region of Minnesota, and the urbanized

areas of Saint Cloud and the north Twin Cities Metro area. As precipitation produces surface runoff, precipitation differences throughout the upper Mississippi River basin can affect water flow and water quality in the MWMO's reach of the Mississippi River.

Thus, if large amounts of rainfall have washed pollutants from the land upstream into the river, it is possible that flows could increase and water quality could decline, even though it has not rained in the watershed. In cooperation with other watershed organizations and districts, the MWMO plans to investigate upstream impacts on water quality to discern the effect precipitation in other portions of the state has on water quality in the MWMO's reach of the Mississippi River.

Further complicating the investigation of water volume and quality in the river are the inputs of groundwater, and the recharge to groundwater from the river. Groundwater may carry pollutants from upstream in the Mississippi River basin to the MWMO reach of the river. Pollutants may also leach from the river into the groundwater system. It is quite difficult to track potential groundwater inputs from an area as large as the Mississippi River basin to the MWMO reach of the river. The MWMO has long-term plans to coordinate with organizations and agencies in the upper portion of the basin to improve water quality in the Mississippi River.

Methodology

In 2007, the MWMO examined water quality from the Mississippi River, Loring Pond, and stormwater collected from stormwater pipes at the point of discharge to the river and at the boundary of the cities of Saint Anthony Village and Minneapolis. Mississippi River and Loring Pond samples were collected between April and October, while

stormwater samples were collected between March and October. Snowmelt samples were also collected at the stormwater sampling sites.

Sample Collection, Handling, and Preservation *Mississippi River and Loring Pond*

Grab samples were collected from six locations in the Mississippi River and one location in Loring Pond. Samples were collected in lab-sterilized, 250-ml plastic bottles. Collection occurred away from shore, in approximately three feet of water. For the river, samples were taken in positive flow (no back eddies or stagnant water) and upstream of the monitoring technician to prevent contamination by the disturbed river bottom. To collect samples, the monitoring technician plunged an opened, inverted bottle to one foot below the water surface, turned it upward to fill, and brought it out of the water (Figure 1). The technician then poured some of the sample out to provide headspace for the laboratory.

Samples were labeled, stored on ice in a cooler, and delivered to the laboratory by the monitoring technician after the final sample was collected. Analyses conducted on these samples did not require preservation.

Samples were collected weekly for base flow and up to three times per month during storm events.

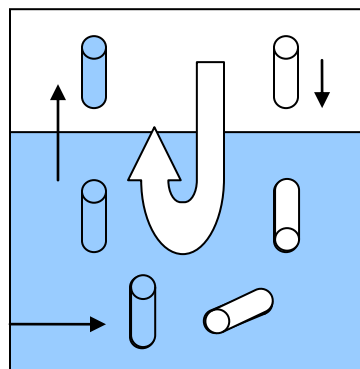


Figure 1. Diagram of sample collection method

Stormwater

Grab samples were collected from six stormwater sites in the MWMO watershed. Samples were collected in laboratory cleansed (non-sterile) two-gallon plastic bottles. Samples were collected with a one-gallon plastic bottle mounted on the end of a telescoping pole. The container was rinsed one time with the water to be sampled before the sample was collected. After collection, the sample was transferred to the two-gallon bottle. The bottle was capped after it was filled, with headspace included.

An ISCO 6712 automatic sampler (Teledyne Isco, Inc., Lincoln, NE) was used at the 1NE, 6UMN, and 10SA sites. 10SA is located at the boundary Saint Anthony Village and Minneapolis. The samplers housed twenty-four one-liter plastic bottles for sample collection. Velocity, water level, and flow data were collected with an ISCO 750 area velocity meter (Teledyne Isco, Inc., Lincoln, NE) attached to the automatic sampler. When the meter detected water level above baseflow, it triggered the sampler to begin sampling.

Once triggered, the sampler rinsed the sample tubing twice before drawing the sample into the containers. Samples were collected on a flow-paced basis at 1NE and 10SA and on a time-paced basis at 6UMN. The bottles were rinsed three times with deionized (DI) water free of pollutants between storm events. Once collected, the bottles were composited as one sample into a two-gallon plastic bottle by the monitoring technician. Automated precipitation gauges were used at 1NE and 10SA to gather precipitation data in the watershed.

Samples were labeled and placed in a cooler for transport to the laboratory by the monitoring technician. Samples were dropped off at the laboratory after collection of the last sample.

Laboratory personnel split the sample and preserved it as needed for the various analyses.

Stormwater samples were collected for a maximum of three storm events per month and twice per month during baseflow, if baseflow conditions were present.

Interstate 35W Bridge Collapse

The I-35W bridge collapsed on August 1, 2007.

The MWMO collected water quality samples on August 2, 3, 4, and 6 to investigate any immediate pollutant concerns. MWMO staff continued to collect weekly samples throughout the human recovery and bridge demolition phases.

Since prior data were not available to establish baseline conditions before the bridge collapse, samples were collected both upstream and downstream of the collapse site. Because the Coast Guard closed the river to boat traffic, samples were collected from both banks of the river by wading in a safe distance from shore. The downstream sampling locations changed as staff was able to obtain safe river access closer to the collapse site. Following completion of the human recovery stage, personnel from the Hennepin County Sheriff's Office used their boat to take MWMO staff into the middle of the river to collect samples. Minneapolis Emergency Preparedness staff provided boat travel to the middle of the river at the upstream sampling locations. Refer to Figure A.2 in Appendix A for the monitoring locations. Samples were submitted to the Metropolitan Council Environmental Services Laboratory for analysis.

Sampling Quality Control

The MWMO staff followed the quality control protocol outlined in the MWMO Ambient Surface Water Monitoring Quality Assurance Project Plan. Blank samples of DI water were submitted to

laboratories periodically to verify that sample containers were clean and samples were not contaminated during travel. Duplicate samples were submitted periodically to verify that sampling and laboratory procedures did not jeopardize the data.

Laboratory Analyses

The MWMO used two laboratories for analyses. Bacteria samples were analyzed at the Minneapolis Department of Health Laboratory. All other samples were analyzed at the Metropolitan Council Environmental Services Laboratory. Refer to Table B.1 in Appendix B for a list of sample parameters the laboratories analyzed, the analysis methods, and information regarding certification. Standard unit conversions are available in Appendix C.

Each laboratory followed strict protocol for quality assurance and quality control. Information regarding laboratory protocol is available from MWMO staff.

Parameters Information

The MWMO has conducted extensive research regarding the parameters of concern. Parameter information includes definitions, sources, impacts to various organisms, and water quality standards, as well as others. Refer to the MWMO 2006 Annual Monitoring Report for the comprehensive list of parameters information.

Data Analysis

The following data cleaning techniques were used to ensure quality data:

- Duplicates were omitted from analysis
- Suspect data were flagged and verified with the laboratory
- For values greater than the maximum detection level, the maximum detection level + 1 was used for analysis
- Values less than the minimum detection level were changed to half the minimum detection level for analysis

- For approximate values that were less than the minimum detection level, the approximate value was used for analysis
- Statistical regression techniques were used to interpolate automated flow data missing due to equipment malfunctions

For the Mississippi River and Loring Pond, grab sample data were compared to the Minnesota water quality standards for their most restricted water use classification. Water quality standards do not exist for stormwater. Data were therefore not compared to standards, but are presented in subsequent sections.

Cold Climate Considerations

Minnesota is considered a cold climate state, requiring special consideration in runoff management. MWMO staff takes this into consideration when writing the annual work plan for the program. The Minnesota Stormwater Manual (Minnesota Stormwater Steering Committee, 2008) outlines the cold climate considerations in Chapter 9.

Precipitation

Precipitation controls surface runoff and is arguably the greatest factor controlling surface water quality. As stated in Background, water quality in the MWMO reach of the Mississippi River is affected by precipitation in the entire Mississippi River basin upstream of the MWMO, including tributary watersheds to the river.

Figure 2 shows precipitation for six locations along the Mississippi River: two in the watershed (Lower Saint Anthony Falls and Lock & Dam 1) and four between Saint Cloud and the MWMO northern boundary. Precipitation for the watershed only is shown in Figure 3. The MWMO acknowledges a link between precipitation and the water quality data

shown in the following sections. However, the MWMO does not support quantitative analysis of this relationship because the precipitation data are

not representative of the entire Mississippi River basin contributing to the MWMO watershed.

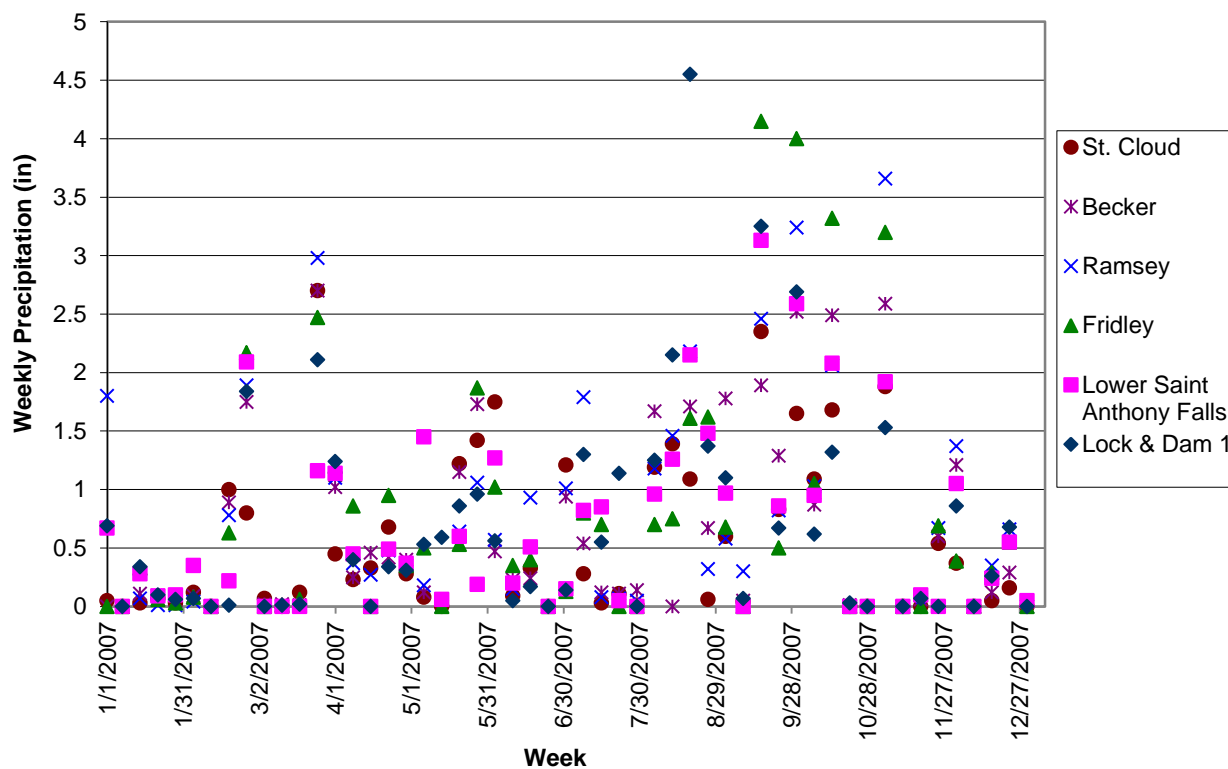


Figure 2. Precipitation for six locations along the Mississippi River

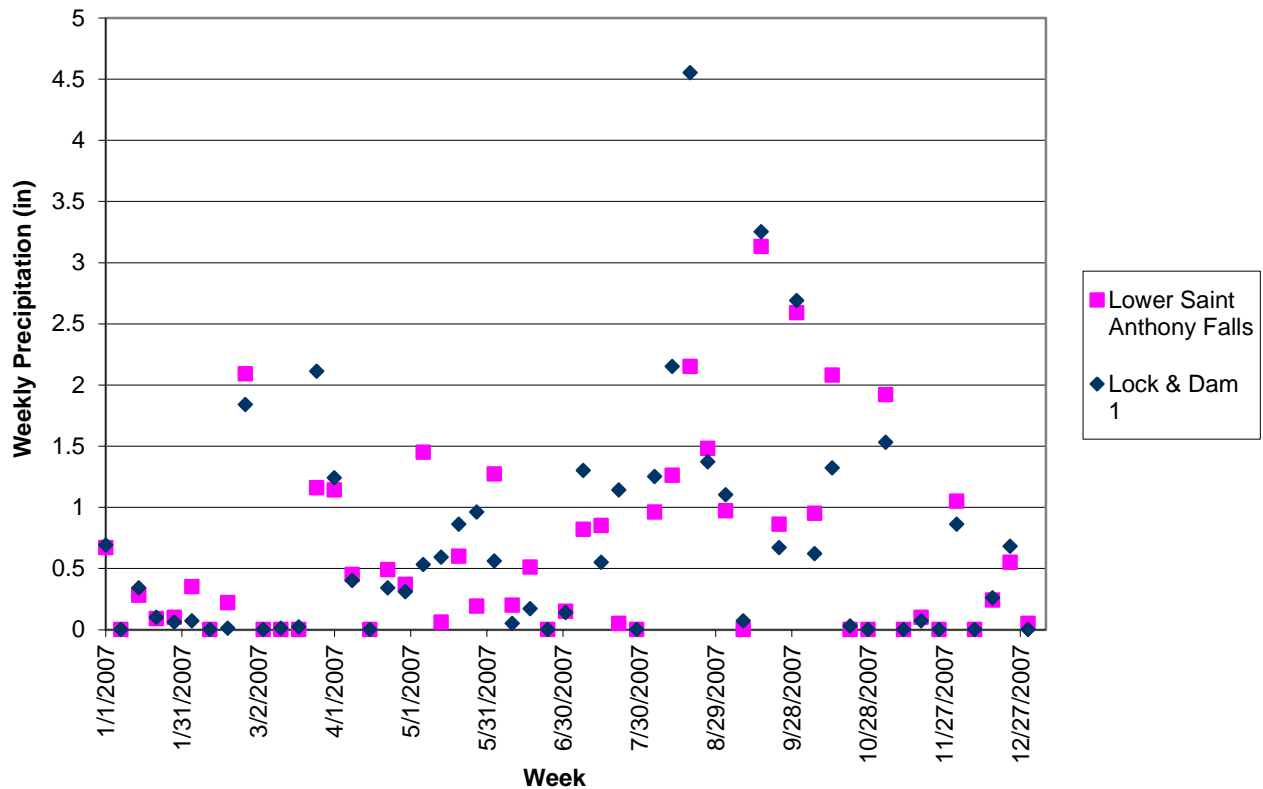


Figure 3. Precipitation for two locations in the MWMO watershed

Mississippi River

The MWMO monitors six locations in the Mississippi River. Refer to the 2005 Annual Monitoring Report (MWMO, 2006) for site-specific details and information regarding site selection.

Water Level

Water level data (typically referred to as stage data) show the rise and fall of the river in response to precipitation. These data are complicated by the dams at Saint Anthony Falls and Lock and Dam 1.

Since the river pools behind the dams, control activities at the dams create changes in river stage

even in the absence of precipitation. Stage data for the six MWMO monitoring locations on the Mississippi River are shown in Figure 4. Stage values are based upon a selected benchmark of 100 feet. Thus, data are comparable among dates for a single location but not comparable between locations.

Time periods with missing data are the result of low water levels that caused the staff gauges to be located in dry riverbed. The water level in Pool 1, upstream of Lock and Dam 1, was lowered to facilitate recovery and demolition activities related to the I-35W bridge collapse. This resulted in dry staff gauges at sites 4, 5, and 6.1.

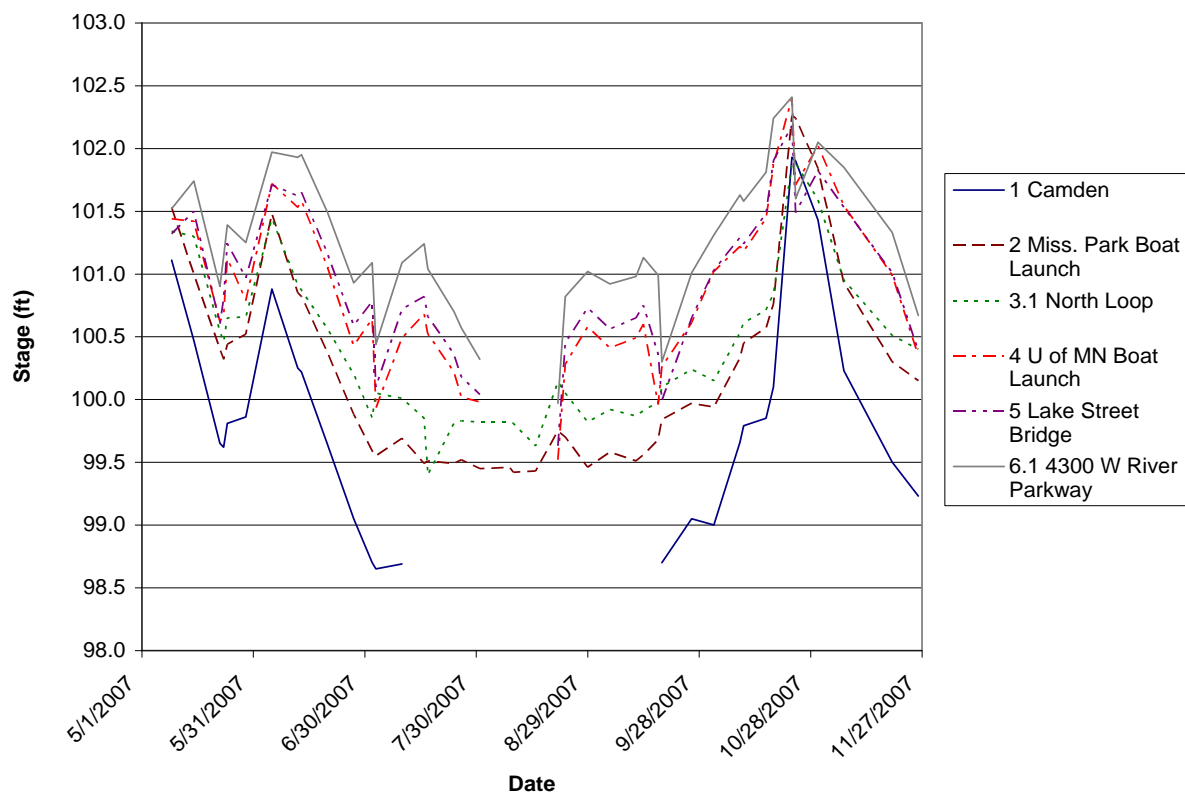


Figure 4. Mississippi River stage based on a 100-foot benchmark

Monitoring Results

Fecal Coliform

As noted under Background, the MWMO reach of the Mississippi River is listed as an impaired water for fecal coliform pollution. The MPCA fecal coliform standard for 2Bd and 2B waters is 200 colony forming units (CFU)/100 mL of water. This standard is a monthly geomean of at least five grab samples taken each month. The geomean is equal to the n th root of the product of the n terms:

$$\text{Geomean}_y = \sqrt[n]{y_1 y_2 y_3 \dots y_n}$$

The 2007 monitoring season results show that Mississippi River sites 2 and 5 exceeded the standard in August, while sites 1 and 2 exceeded the standard in September. With the exception of site 6.1, all of the sites exceeded the standard in October (Figure 5). For June data, sites 1 and 2 fecal coliform

geomeans are based on four data points rather than five or more.

The MPCA fecal coliform standard also states that fecal coliform cannot exceed 2,000 CFU/100 mL in more than 10% of the samples taken in one month. Site 2 exceeded this standard in October. Table 3 presents a summary of fecal coliform exceedances. The fecal coliform concentrations for each sample collected are shown in Appendix D.

Two additional factors should be considered when evaluating these results. First, these results are based on a maximum of eight samples collected per month. Had more samples been collected, the data may have exhibited different results. Second, two unique features of the MWMO watershed are the Upper and Lower Saint Anthony Falls. The Mississippi River water mixes as it flows over the falls, likely affecting water quality.

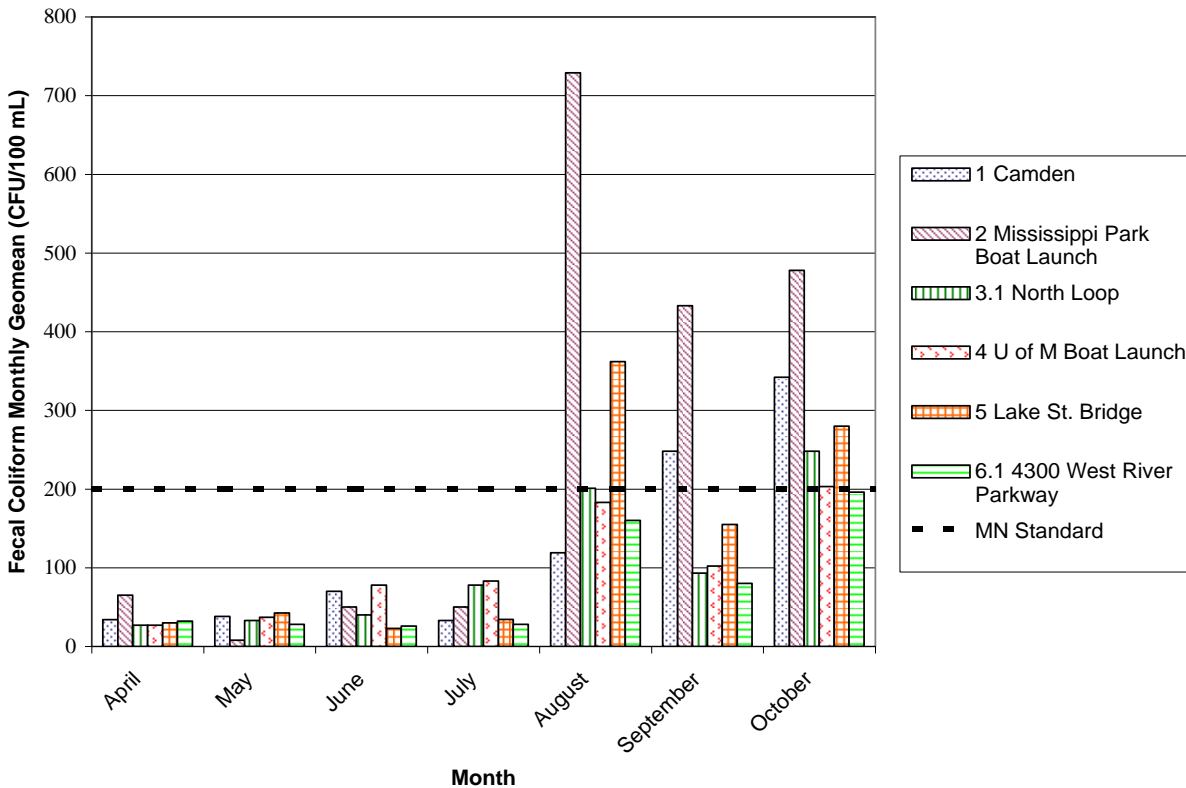


Figure 5. Fecal coliform monthly geomeans for the Mississippi River monitoring sites

Table 3. Sites that exceeded the monthly fecal coliform geomean for the Mississippi River

Month	Sites that exceed monthly geomean	Sites that exceed 2,000 CFU/100 mL in > 10% of samples	Sites that do not exceed the standards
April	None	None	All
May	None	None	All
June	None	None	All
July	None	None	All
August	2, 5	None	1, 3.1, 4, 6.1
September	1, 2	None	3.1, 4, 5, 6.1
October	1, 2, 3.1, 4, 5	2	6.1

E. coli

In 2008, the MPCA changed the bacteria water quality standard from fecal coliform to *E. coli* for bacteria monitoring in Minnesota. The proposed standard for *E. coli* in 2B and 2Bd waters is 126 CFU/100 mL for a monthly geomean of at least five

samples. In anticipation of this changeover, the MWMO monitored *E. coli* concentrations to develop a historical record of *E. coli* in the Mississippi River. Sites 2, 4 and 5 exceeded the *E. coli* standard in August, while sites 1 and 2 exceeded the proposed standard in September. All of the sites

exceeded the standard in October (Figure 6). The *E.*

coli concentrations are shown in Appendix D.

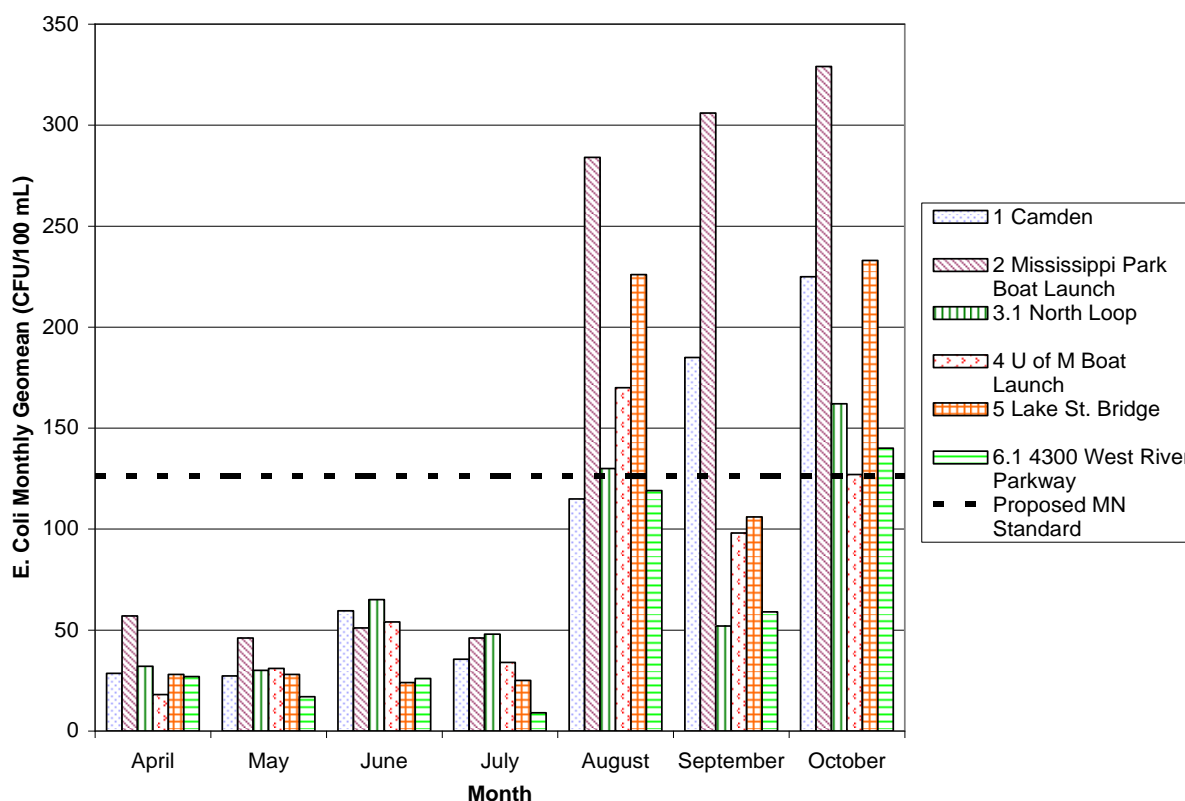


Figure 6. *E. coli* monthly geomeans for the Mississippi River monitoring sites

As these results are highly dependent on precipitation, both in the watershed and upstream, results may differ drastically from year to year. The MWMO does not support interpretation or assumptions based solely on one year of data. The MWMO will continue to collect data on the Mississippi River to provide baseline data for development of TMDLs in the watershed.

Dissolved Oxygen, pH, Transparency, and Specific Conductivity

The MWMO monitored dissolved oxygen, pH, transparency, and specific conductivity on a weekly basis throughout the 2007 sampling season. These parameters are basic measures that indicate the health of a waterbody, as they contribute to survival of fish and other aquatic organisms and plants. Refer to Appendix D for the monitoring data.

Loring Pond

Loring Pond is the only lake in the MWMO watershed. It is not listed on the impaired waters list. Refer to the 2005 Annual Monitoring Report (MWMO, 2006) for an overview and history of Loring Pond. Refer to Figure A.1 in Appendix A for the location of Loring Pond.

Water Level

The MWMO monitored stage in Loring Pond with the MPRB staff gauge installed on the large pond outlet. Water level fluctuations throughout the 2007 sampling season are shown in Figure 7. Water levels less than 106.6 ft before June 12 were due to a planned drawdown of water level to discourage cattail growth in the smaller of the two ponds. Water levels were based upon a selected benchmark of 100 feet.

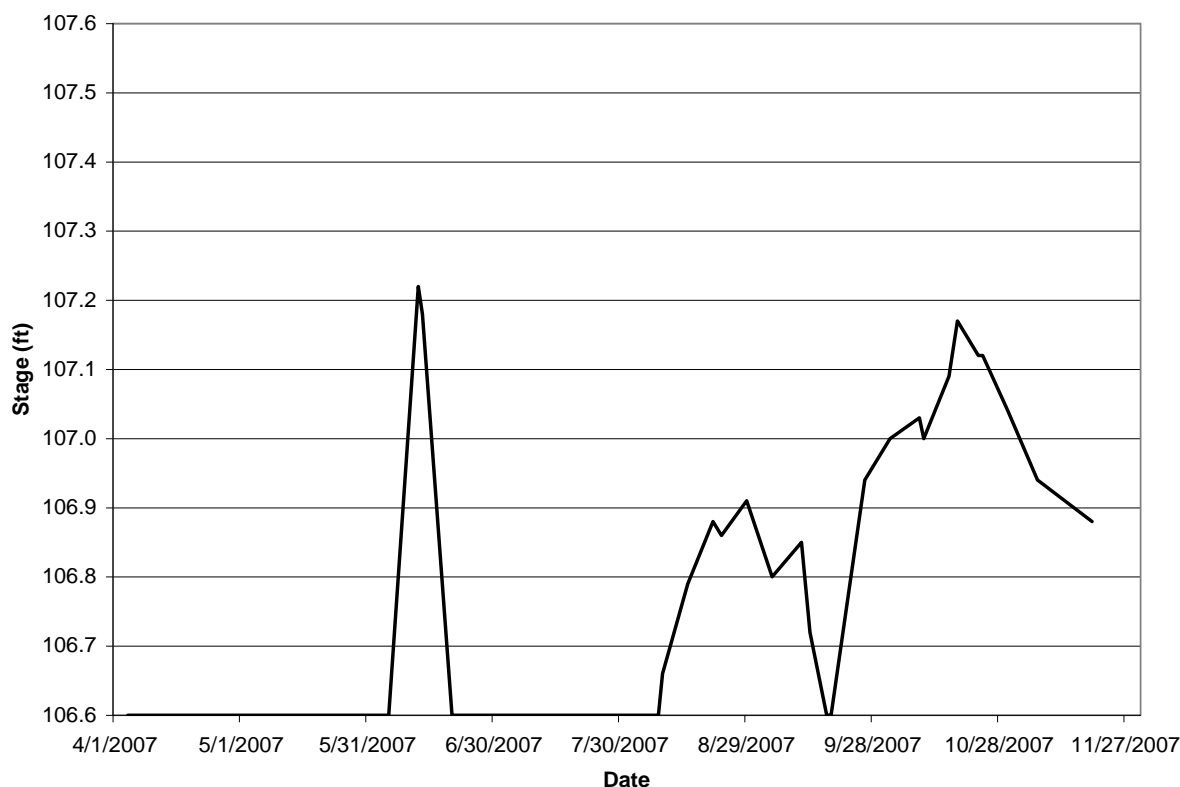


Figure 7. Loring Pond stage data based on a 100-foot benchmark

Monitoring Results

Fecal coliform

Loring Pond is classified for 2B water use; therefore, the same water quality standards apply as for the Mississippi River monitoring sites. Loring Pond exceeded the fecal coliform standard from July through October (Figures 8 and 9). The fecal coliform count for August 29 was 16,000 CFU/100 mL. This value was omitted from analysis to improve the scale of the figures, but fecal coliform still exceeded the standard following omission of this data point. As the fecal coliform results are highly dependent on precipitation, results may differ drastically from year to year.

In addition, fecal coliform results may have been impacted by the pond drawdown conducted in April and May. The MPCA lists waterbodies as impaired when two exceedances occur in a three-year period

(MPCA, 2003). The MWMO notified the MPCA that Loring Pond exceeded the fecal coliform standard in both 2006 and 2007.

E. Coli

Loring Pond exceeded the proposed MPCA standard from July through October (Figure 10). The *E. coli* count for September 11 was 15,000 CFU/100 mL. This value was omitted from analysis to improve the scale of the figures, but *E. coli* still exceeded the proposed standard following omission of this data point.

Dissolved Oxygen, pH, Transparency, and Specific Conductivity

Due to the closed nature of a lake system, their dissolved oxygen, pH, and specific conductivity will often differ greatly from rivers. While rivers are always receiving “new” water from upstream, lakes

contain the same water throughout the sampling season. Precipitation, stormwater, and occasional pumping of water from the recharge well are the

major water inputs to Loring Pond. Figure 11 exhibits the dissolved oxygen, pH, transparency, and specific conductivity data for Loring Pond.

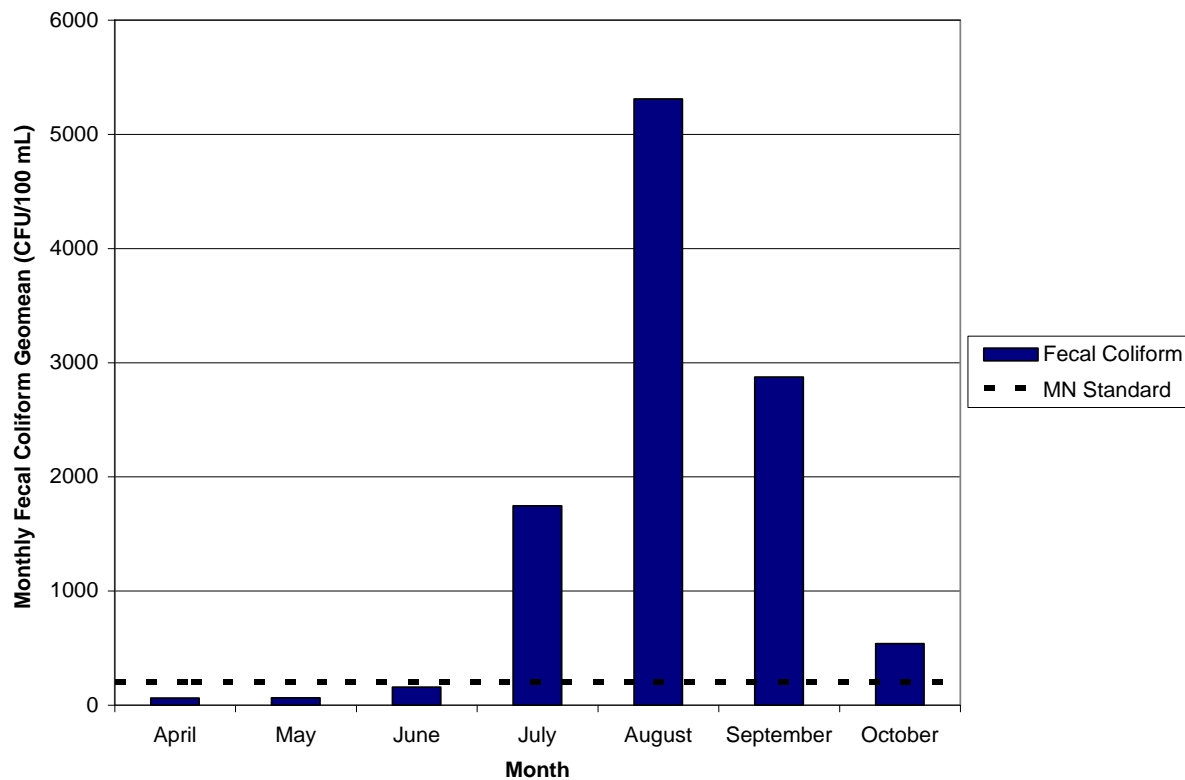


Figure 8. Fecal coliform monthly geomeans for Loring Pond

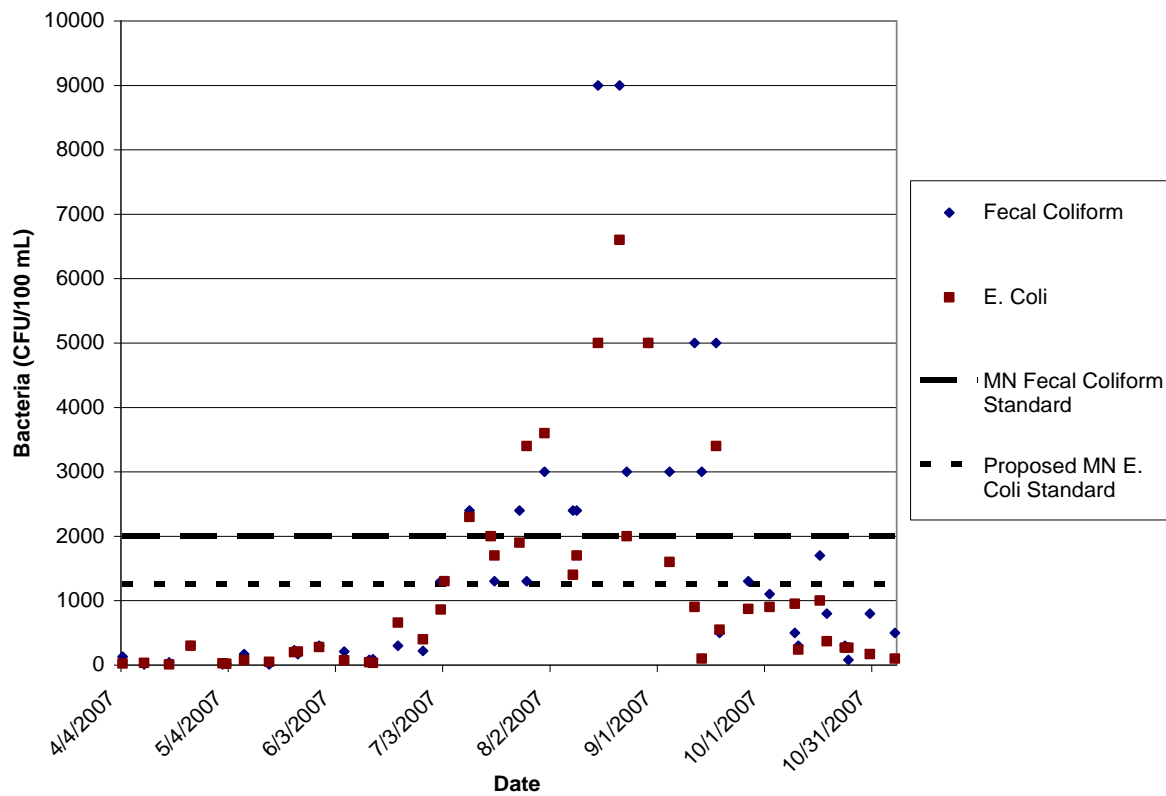


Figure 9. Fecal coliform and *E. coli* concentrations for Loring Pond

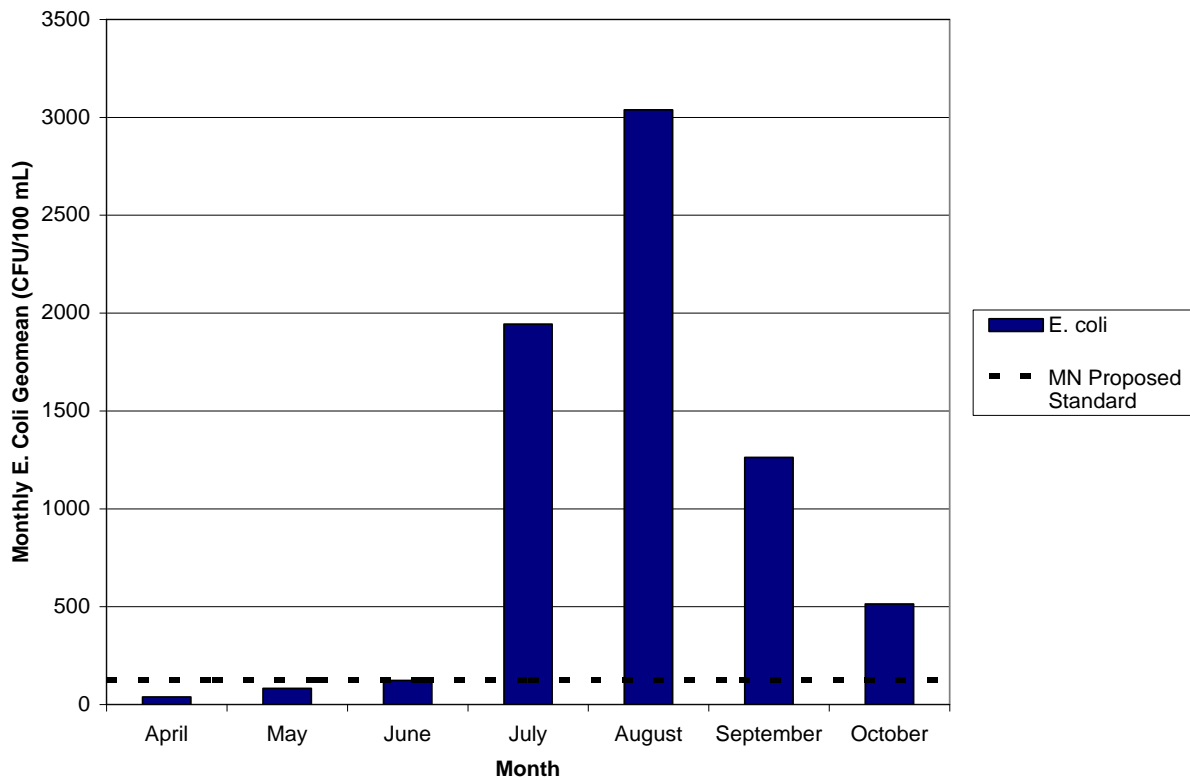


Figure 10. *E. coli* monthly geomeans for Loring Pond

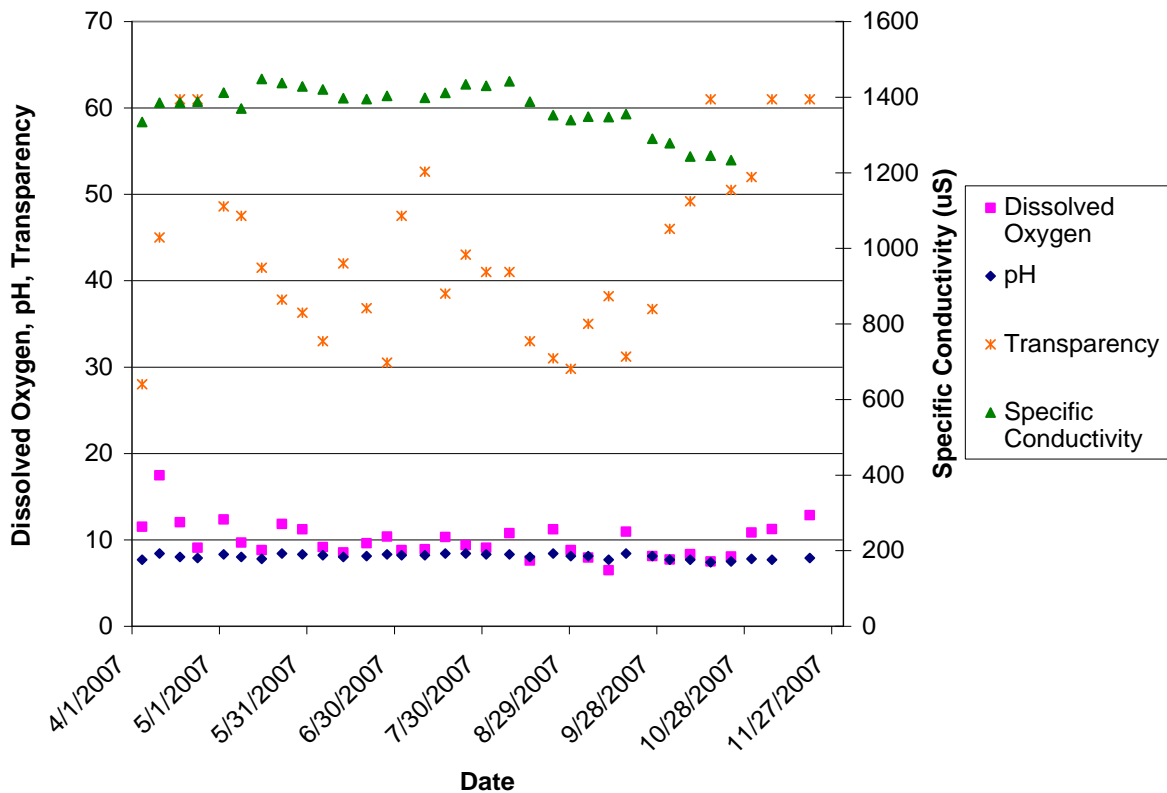


Figure 11. Dissolved oxygen in mg/L, pH, transparency in cm and specific conductivity in µS for Loring Pond

Stormwater

The MWMO monitored five stormwater outfalls into the Mississippi River and one stormwater pipe at the jurisdictional boundary of the City of Saint Anthony and the City of Minneapolis. The monitored outfalls were chosen because they are the most extensive drainage systems within the watershed, and they are accessible. Refer to Figure A.1 in Appendix A for the outfall locations. Refer to the 2005 Annual Monitoring Report (MWMO, 2006) for site descriptions for the five stormwater outfalls. Water quality data for each stormwater outfall are provided in this section.

A stormwater drainage system refers to the area that drains to one stormwater outfall. Land uses in the stormwater drainage systems affect water quality.

The amount of impervious surfaces and potential pollutants differs between land uses such as industrial and residential. A future objective of the monitoring program is to investigate the impacts of specific land uses on water quality. Refer to Table E.1 in Appendix E for land uses in the stormwater drainage system.

Site Description

10SA (Saint Anthony Village): 10SA differs from the other MWMO stormwater monitoring sites as it is located near the top of a stormwater drainage system rather than at the bottom near the outfall to the Mississippi River. The MWMO chose to monitor this location to investigate the quantity and quality of stormwater from the southern portion of Saint Anthony Village (594 acres) as it enters

Minneapolis. The concrete stormwater pipe is 54 inches in diameter with continuous base flow.

Water Level

Water level in a stormwater pipe is very different from water levels in the Mississippi River and Loring Pond. Stormwater pipes respond quickly to rainfall. Water levels may rise many feet within a few minutes, depending on the size and intensity of the storm event. Some stormwater pipes only contain water during precipitation events, while others have baseflow throughout the year. Stormwater monitoring sites 1NE, 4PP, 6UMN, and 10SA have baseflow throughout the year. Water levels (stage) for each stormwater outfall are listed in Tables F.1 – F.6 in Appendix F. Water level data collected with the automated equipment are presented in Figures 12-14.

It should be noted that, as the Mississippi River water level rises above the base of the stormwater outfalls, river tailwater may affect the water level in the stormwater pipes.

Monitoring Results

Since the MPCA does not have water quality criteria for stormwater drainage systems, data are not compared with standards. The MWMO monitors stormwater to characterize surface runoff in the watershed and determine land contributions to water quality in the Mississippi River. Samples are collected for bacteria, nutrients, sediment, inorganic, organic, and metals analyses. The MWMO will not draw conclusions or make assumptions based on this data until 3-5 years of accurate flow-weighted composite data are available. The data are presented in Tables F.1 – F.6 in Appendix F. Data were not available for the 4PP outfall after July 26 due to the collapse of the I-35W bridge on August 1.

Discharge data collected with the automated equipment are presented in Figures 15 and 16.

Discharge data for 6UMN were not available due to the shape of the tunnel. The MWMO is working on measuring cross-sections in the pipe to determine discharge.

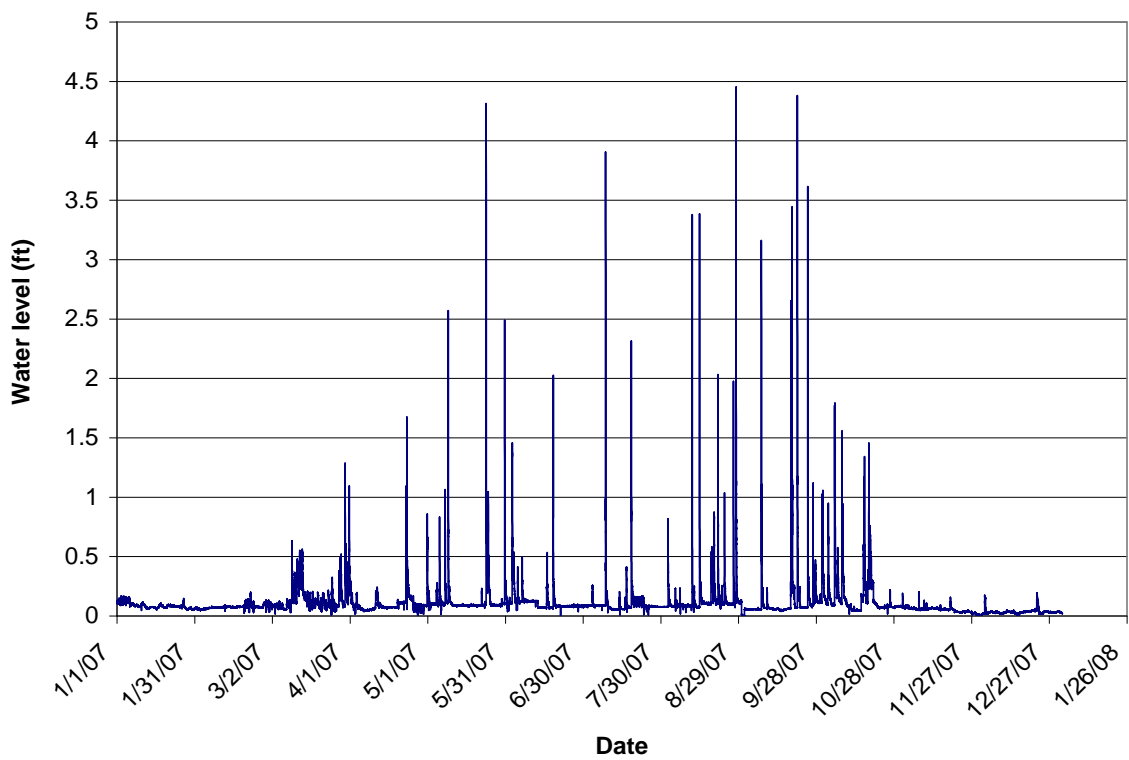


Figure 12. Water level for 1NE

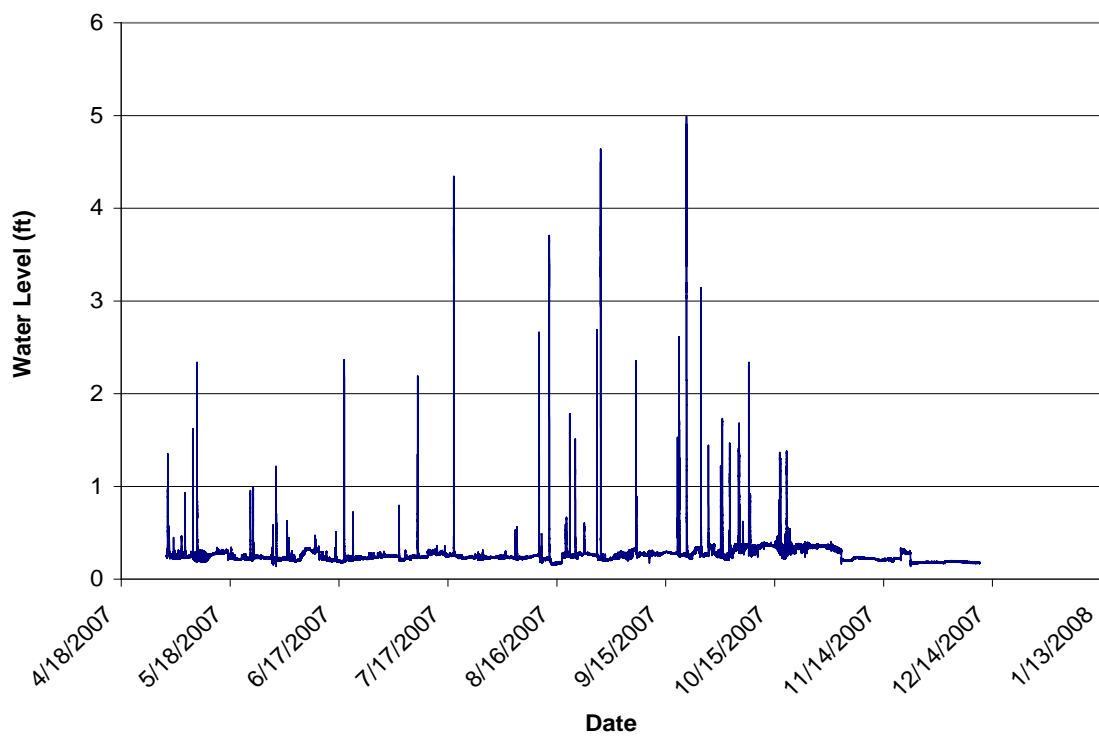


Figure 13. Water level for 6UMN

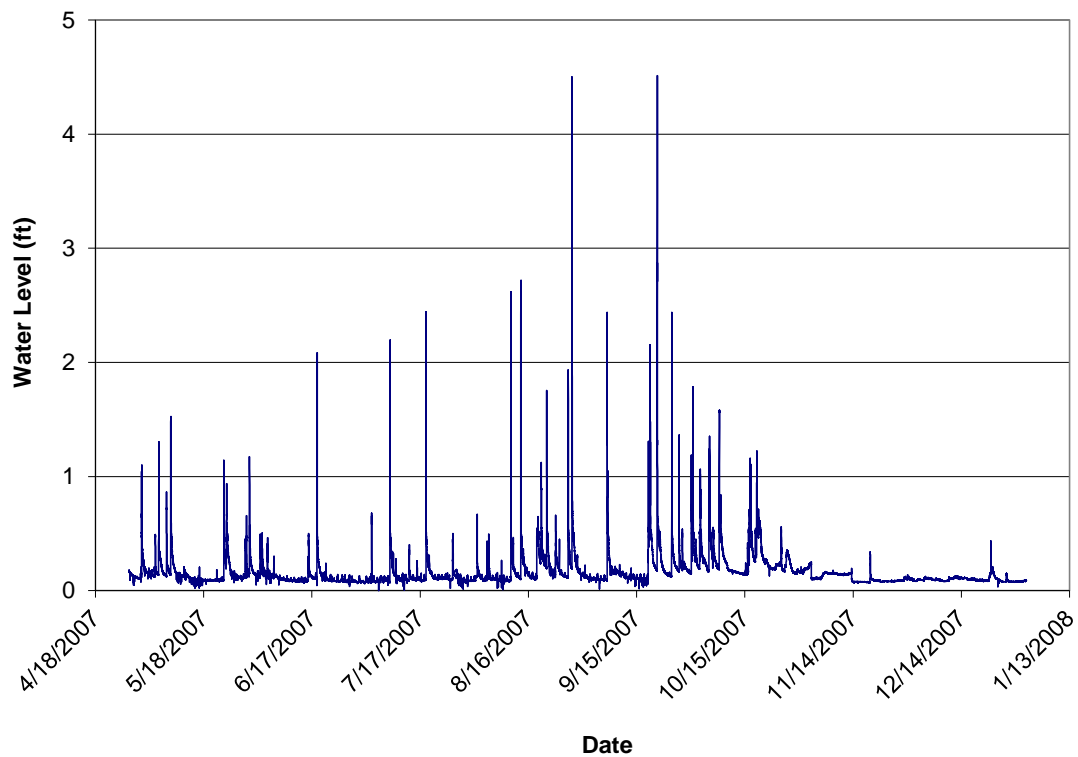


Figure 14. Water level for 10SA

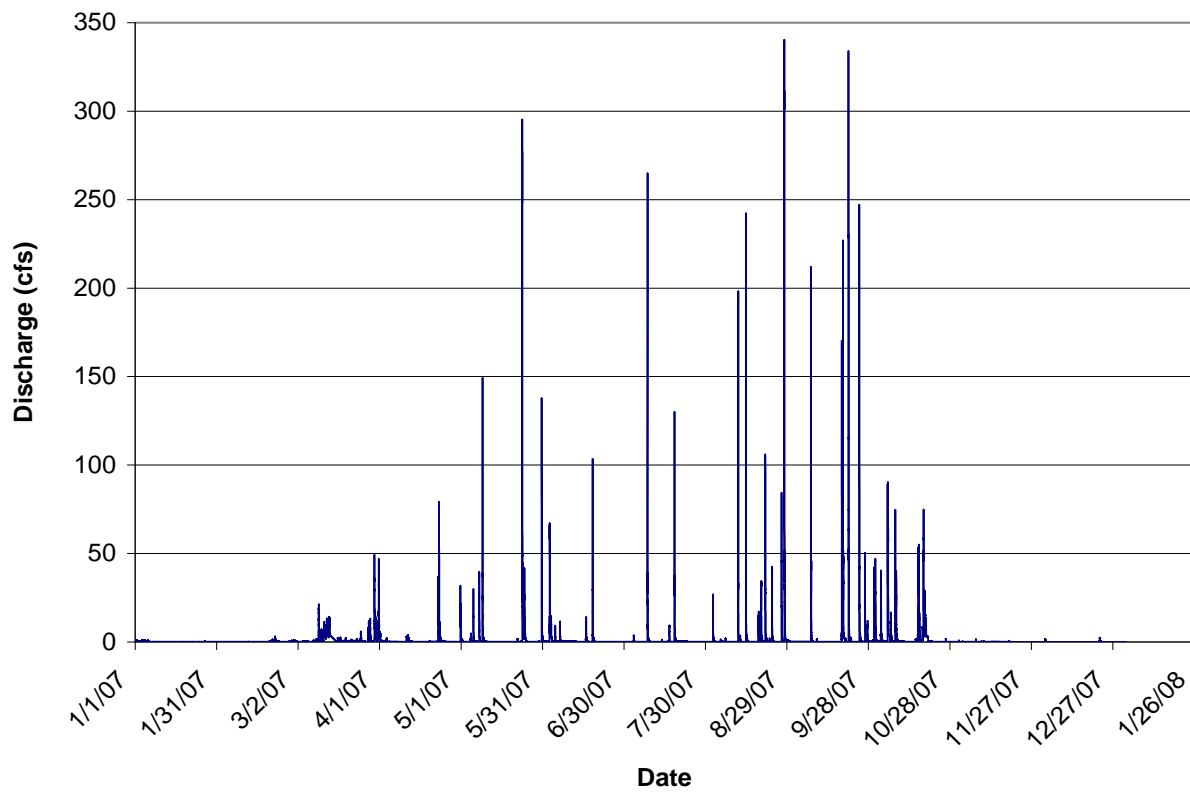


Figure 15. Discharge for 1NE

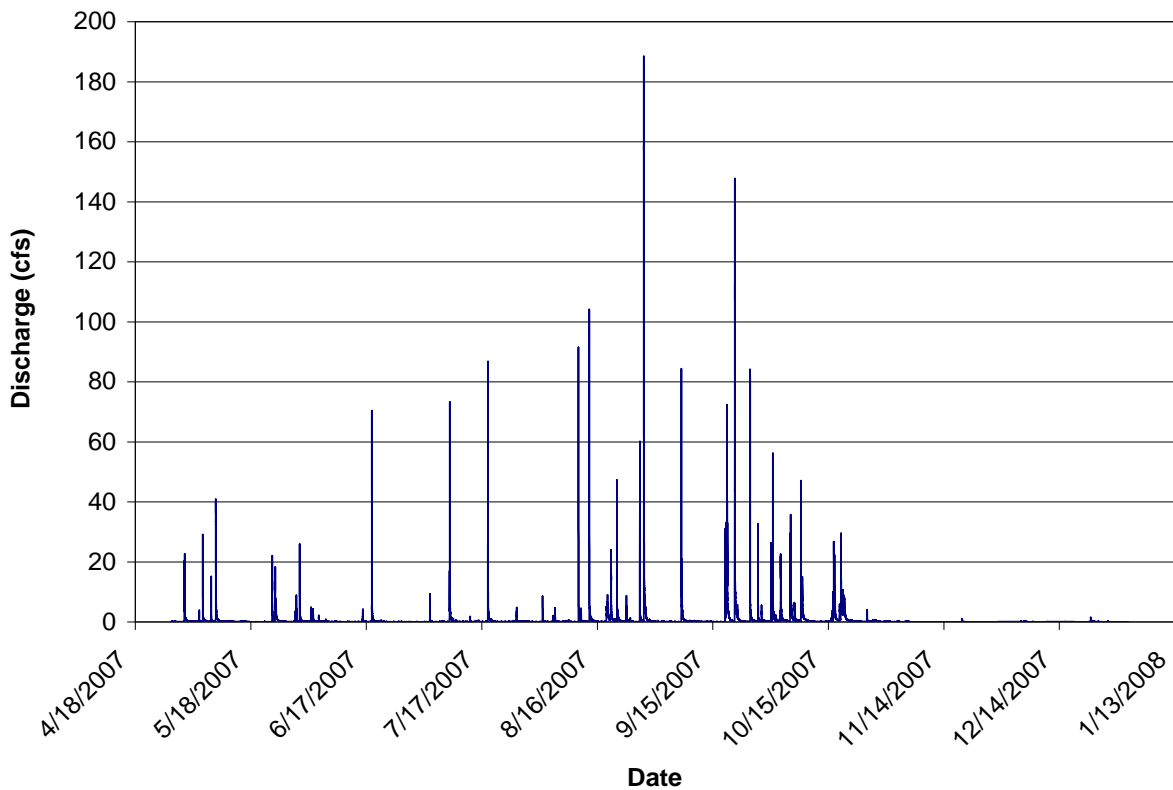


Figure 16. Discharge for 10SA

Special Studies

The MWMO conducted water quality sampling in the Mississippi River following the I-35W bridge collapse on August 1, 2007. Pollutants of concern included:

- Petroleum products released from vehicles in the water
- PCBs contained in transformers or adsorbed to sediment that may have been suspended during the collapse
- Mercury in light fixtures
- Lead from paint on the bridge trusses
- Metals such as zinc, chromium, cadmium, and nickel

Monitoring methods and locations are described in the Methodology Sample Collection, Handling, and Preservation section.

Monitoring Results

The MWMO and the MPCA concluded that the upstream and downstream samples compared well. With the exception of one oil and grease sample collected on August 4, the water quality results did not exceed state water quality standards during the recovery and debris removal phases. The water quality results are detailed in Table G.1 in Appendix G. The volatile organic carbon (VOC) results are not included in this report because they were all below the minimum detection level.

Work Plan

Assessment of 2007

The MWMO completed all but two of its monitoring objectives for 2007. Staff installed automated monitoring equipment in the 4PP and 10SA stormwater pipes, and new equipment was installed at 6UMN. The 4PP site did not operate because one week after installation the I-35W bridge collapsed only 30 feet from the site. Equipment will be reinstalled in 2008, following completion of construction activities. Staff were hired at Saint Anthony Falls Laboratory to design a real-time monitoring network for the stormwater sampling sites.

Objectives that were not met included sampling at Kasota Ponds and installation of automated monitoring equipment at 2NNBC. Kasota Ponds sampling was postponed due to additional workload for the bridge collapse sampling. An assessment of the 2NNBC sites showed that installation will be difficult as the bottom of the sandstone stormwater pipe has eroded and the depth of water ranges from four to ten feet deep. Staff plans to install the 2NNBC site following development of an installation plan.

2008 Work Plan

The MWMO will continue to monitor all the sites listed in this report. Goals for 2008 include:

- Install automated sampling equipment at 7LSTU stormwater outfall
- Monitor water quality in Kasota Ponds
- Install real-time stormwater monitoring network
- Conduct data cleaning and analysis for 2008 monitoring data
- Submit all Mississippi River and Loring Pond data to EPA's STORET database
- Coordinate with the MPCA to begin work on the Upper Mississippi River Bacteria TMDL
- Continue to develop partnerships to improve water quality in the watershed

Future Recommendations

The MWMO must gain knowledge of the contribution of fecal coliform to the Mississippi River from within the MWMO boundaries relative to the remainder of the upper Mississippi River watershed for development of TMDLs for the current impairment. The MWMO must also gain knowledge of the inputs of phosphorus and turbidity to the river from the MWMO watershed relative to the rest of the Upper Mississippi River Basin for the Lake Pepin TMDL.

References

- Minneapolis Public Works Department. 2005. Stormwater Management Program and Annual Report. City of Minneapolis and Minneapolis Park & Recreation Board, Minneapolis, MN, 206 p.
- Minnesota Pollution Control Agency. 2007. Guidance Manual for Assessing the Quality of Minnesota Surface Waters for the Determination of Impairment. Minnesota Pollution Control Agency, Saint Paul, MN, September 2007, 146 p. available at www.pca.state.mn.us/publications/wq-iw1-04.pdf (accessed 12/2008).
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- Minnesota Stormwater Steering Committee. 2008. The Minnesota Stormwater Manual – Version 2. Minnesota Pollution Control Agency, Saint Paul, MN, 883 p. available at www.pca.state.mn.us/water/stormwater/stormwater-manual.html (accessed 12/2008).

Mississippi Watershed Management Organization.
2006. Annual Monitoring Report 2005. 54 p.
available at www.mwmo.org/docs.html
(accessed 04/2009).

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Figure A.2. I-35W bridge collapse monitoring sites, Minneapolis, Minnesota

Appendix B – Laboratory Methods and Certification

Table B.1. Laboratory methods and certification for each analyte

Analyte	Lab	Method	Certified
Total Metals (Copper, Nickel, Lead, Zinc, Cadmium, Chromium, Mercury)	Metropolitan Council	EPA 200.8 with ATP (Mercury) EPA 245.7	Yes
Total Soluble Metals	Metropolitan Council	EPA 200.8 with ATP (Mercury) EPA 245.7	Yes
Total Chemical Oxygen Demand	Metropolitan Council	EPA 410.4	Yes
Carbonaceous Biological Oxygen Demand (CBOD) 5-Day	Metropolitan Council	Standard Methods 5210B 18th Edition	Yes
Total 5-day BOD	Metropolitan Council	Standard Methods 5210B 18th Edition	No*
Total Organic Carbon	Metropolitan Council	EPA 415.1 wet oxidation, auto sampler, settled sample, NDIR detection	NA
Total & Volatile Suspended Solids	Metropolitan Council	EPA 160.2 ATP	Yes
Total Dissolved Solids	Metropolitan Council	Standard Methods 2540C 18th Edition	No
Total Alkalinity	Metropolitan Council	EPA 310.2	Yes
Total Hardness	Metropolitan Council	Standard Methods 314B 15th Edition	NA
Total Chlorides	Metropolitan Council	EPA 325.2	No
Total Sulfates	Metropolitan Council	Standard Methods 425C 15th Edition	No
Fluoride	Minneapolis Department of Health	Standard Methods 20th Edition 4500-F ⁻ D. SPADNS Method, Ref SM 20th ed. P 4-82	No

Table B.1 continued. Laboratory methods and certification for each analyte

Analyte	Lab	Method	Certified
Total Phosphorus plus Total Kjeldahl Nitrogen	Metropolitan Council	EPA 351.2 & 365.4 ATP	Yes
Dissolved Phosphorus	Metropolitan Council	EPA 351.2 & 365.4 ATP	Yes
Orthophosphorus	Metropolitan Council	EPA 365.2	Yes
Total Ammonia Nitrogen	Metropolitan Council	EPA 350.1	Yes
Nitrate & Nitrite Nitrogen	Metropolitan Council	EPA 353.1 Chloroform preservation	Yes
Total Volatile Organic Compounds	Metropolitan Council	EPA 624/625	Yes
Oil and Grease	Metropolitan Council	Soxhlet extraction using Freon, dry at 130C and weigh Standard Methods 503C 15th Ed.	NA
Fecal Coliform	Minneapolis Department of Health	Standard Methods 20 th Edition 9221E fecal coliform test using EC medium. SM 20th ed. P 9-54	Yes
<i>E. coli</i>	Minneapolis Department of Health	EPA method 1603	Yes

*No = Indicates that the lab follows standard certification test methods but has not sought certification from the Minnesota Department of Health.

NA = The Minnesota Department of Health does not have certification for the analyte.

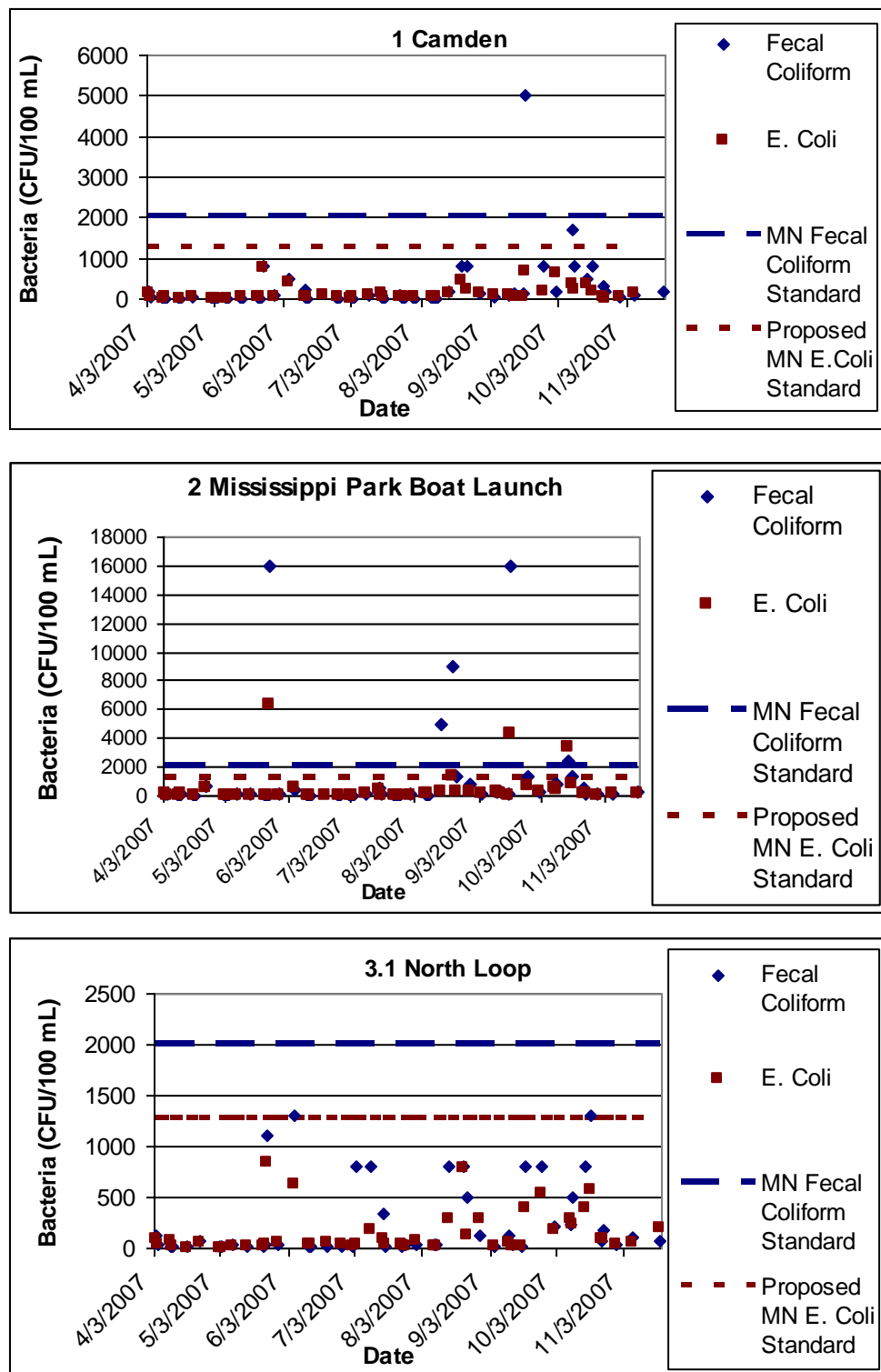
Appendix C – Unit Conversions

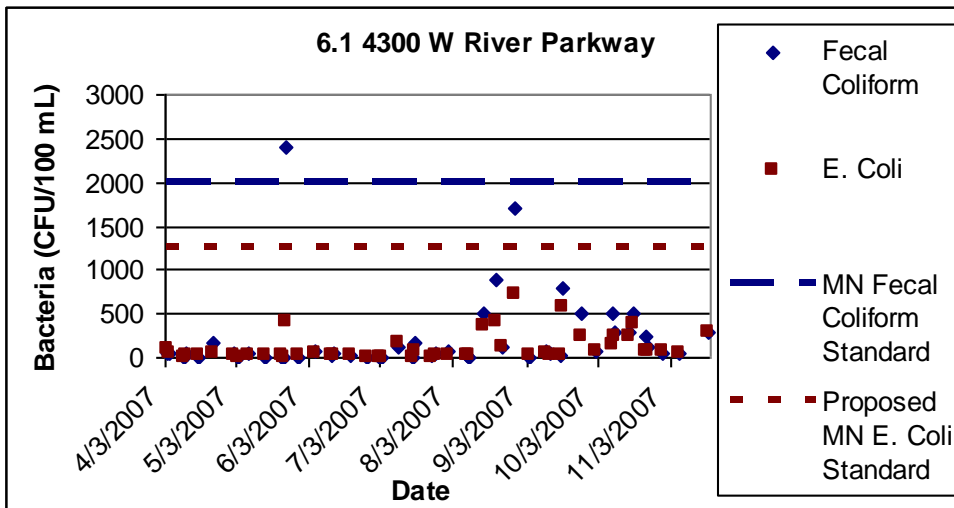
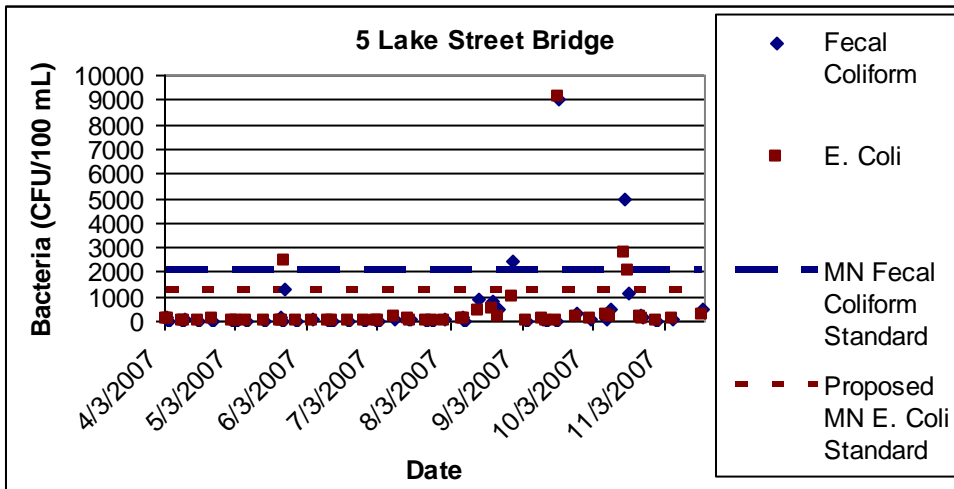
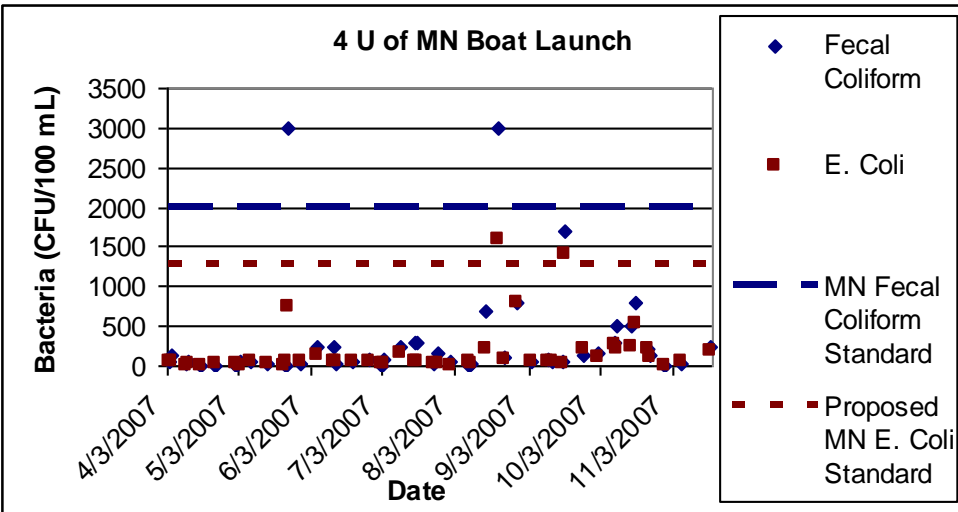
Table C.1. Unit conversions

Unit	Unit Conversion
1 L	1,000 mL
1 gallon	3.78 L
1 g	1,000 mg
1 mg	1,000 µg
1 mg/L	1 ppm
1 µg/L	1 ppb
1 m	100 cm
1 in	2.54 cm
1 ft	12 in

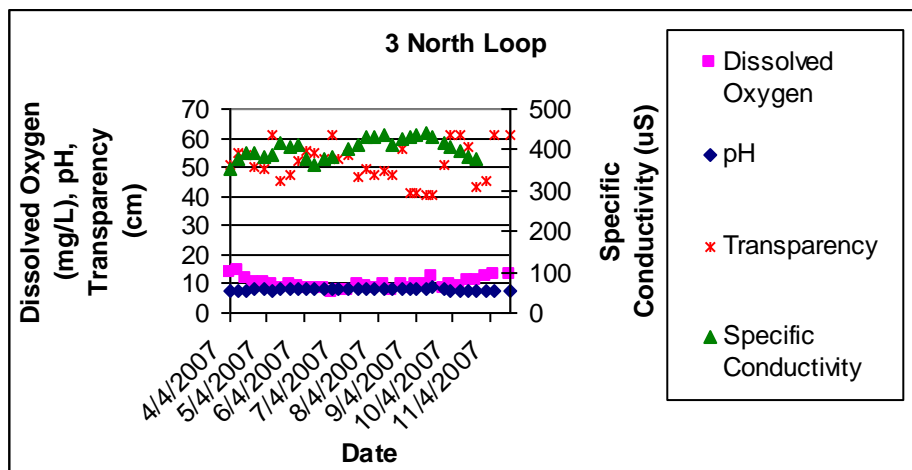
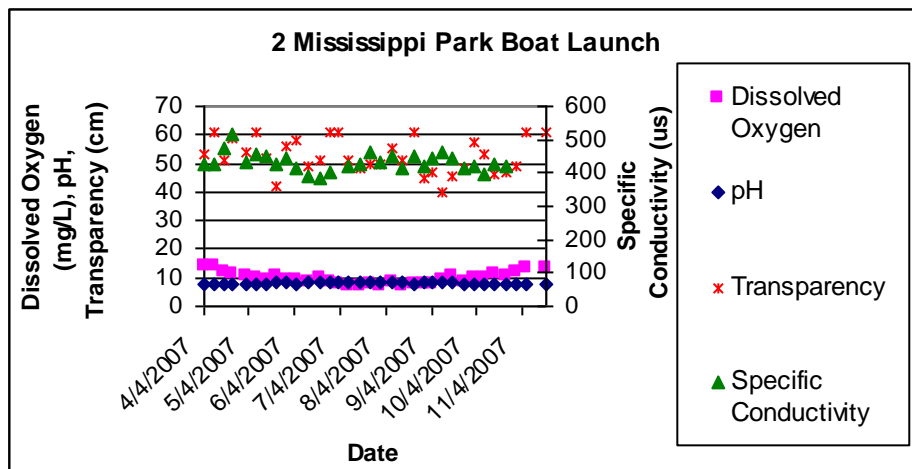
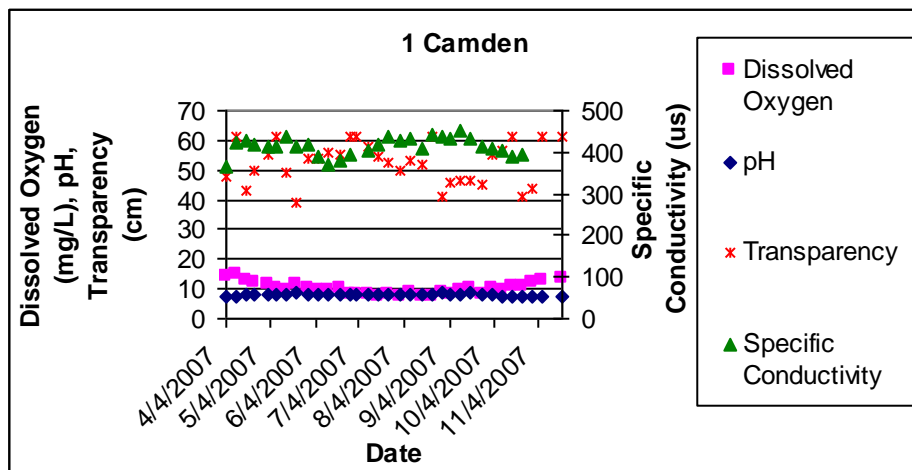
Appendix D – Mississippi River Data

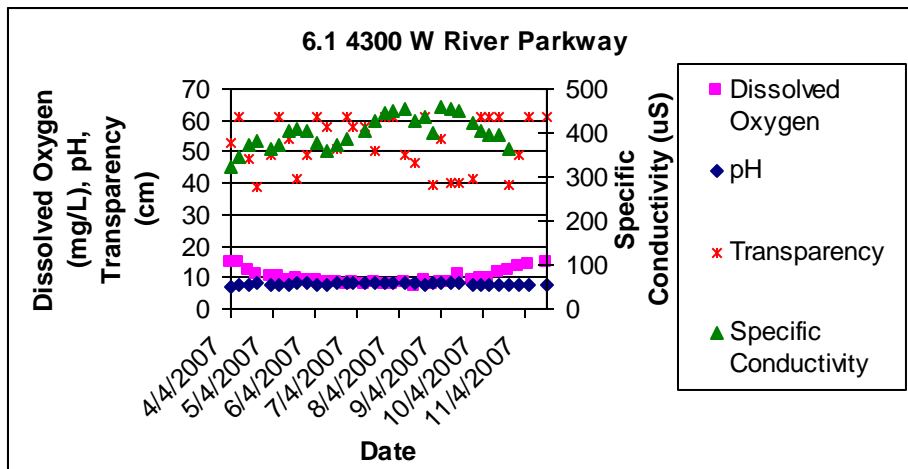
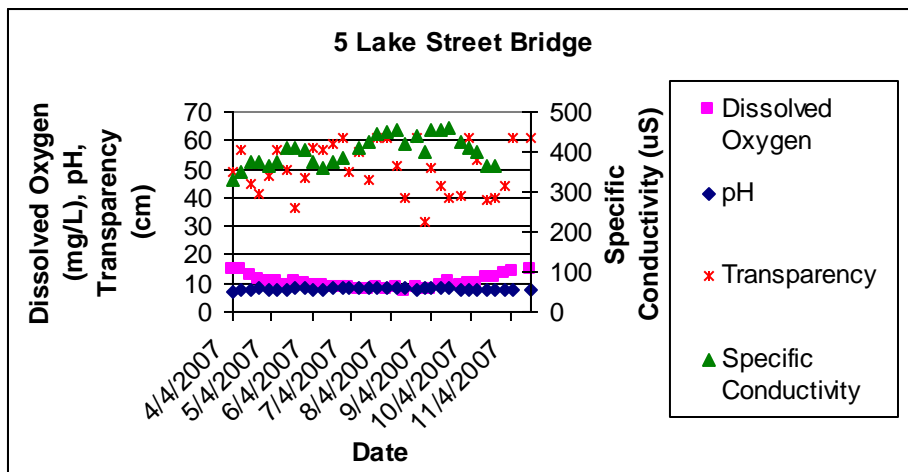
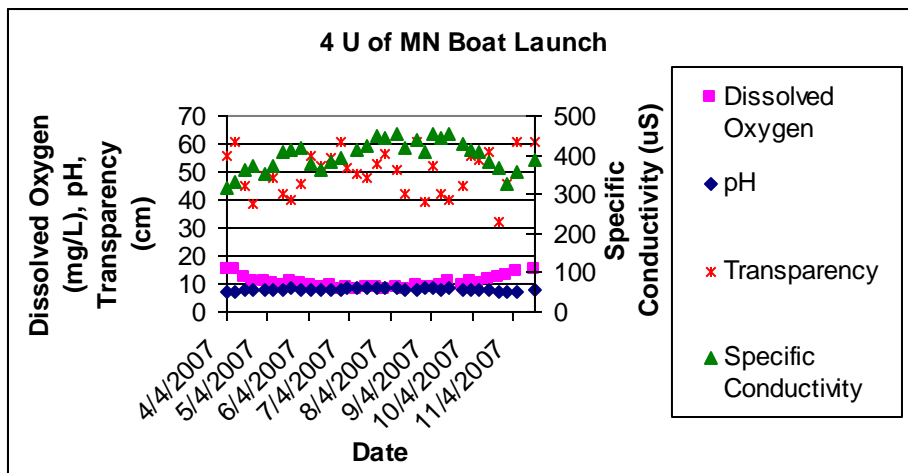
Mississippi River fecal coliform and *E. coli* concentrations





Mississippi River dissolved oxygen (mg/L), pH, transparency (cm), and specific conductivity (μS) monitoring results





Appendix E – Stormwater drainage systems' major land uses

Table E.1. Stormwater drainage systems' major land uses

Stormwater Drainage System	Major Land Uses
1NE Excel Power Plant	Residential, Industrial
2NNBC Old Bassetts Creek	Residential, Commercial
4PP 35W Bridge	Residential, Heavy Industry
6UMN U of M Coal Storage Facility	Residential, Commercial
7LSTU Franklin Bridge	Residential, Industrial, Commercial
10SA Saint Anthony Village	Residential, Industrial, Commercial

Appendix F – Stormwater Monitoring Results

Table F.1. Monitoring results for 1NE outfall

Date	Sample Time	Air Temp (F)	Water Temp (F)	Dissolved Oxygen (mg/L)	Conductivity (uS)	Specific Conductivity (uS)	pH	Transparency (cm)	Salinity (ppt)	Fecal Coliform (counts/100 mL)	E. coli (counts/100 mL)	Fluoride (mg/L)	Volatile Suspended Solids (mg/L)	Total Suspended Solids (mg/L)	Total Dissolved Solids (mg/L)	Sulfate (mg/L)	Dissolved Phosphorus (mg/L)	Total Phosphorus (mg/L)	Ortho Phosphate (mg/L)	Total Kjeldahl Nitrogen (mg/L)	Ammonia Nitrogen (mg/L)	Nitrite N (mg/L)	Nitrate N (mg/L)
2/20/2007	12:35	37	45.0	11.00	1630.0	2472.0	6.5	14.5	1.3				16	28	1420	114	0.096	0.242	0.097	4.8	0.8	0.08	1.17
3/9/2007	11:39	39	42.1	11.55	4202.0	6680.0	7.6	4.0	3.6				42	96	3560	31.8	0.07	0.37	0.059	6.4	0.61	0.14	1.15
3/9/2007	13:02	38	45.3	9.46	3163.0	4756.0	7.0	3.6	2.5						763	16.7	0.076	0.314		12	0.5	0.15	0.74
3/12/2007	13:55	40	40.1	12.99	310.4	510.0	7.0	6.2	0.2														
3/12/2007	15:02	46	43.9	12.30	260.7	402.1	6.7	12.0	0.2						222	7.44	0.233		0.186		0.54	0.04	0.52
3/13/2007	10:58	47	45.1	11.32	187.0	282.9	6.6	20.0	0.1						151	5.12	0.236		0.2		0.48	0.03	0.35
3/27/2007	10:58	55.4	52.5	10.60	713.0	964.0	6.9	61.0	0.5						690	104	0.066		0.049		0.54	0.06	1.03
3/27/2007	17:18	55	52.9	8.53	421.3	566.0	6.8	6.8	0.3						298	16.2	0.143				0.33	0.06	0.82
3/30/2007	2:16	48	46.8	11.23	134.2	197.5	6.7	6.5	0.1						122	7.55	0.068		0.059		0.16	0.015	0.32
4/3/2007	12:35	39.2	44.6							800	310	0.41											
4/11/2007	11:45	34	41.0							5000	2240	0.05											
4/19/2007	10:20	44	48.2		908.0		7.8	61.0	0.6				32	78		120	0.05	0.098	0.01	1.7	0.06	0.015	4.68
4/22/2007	14:16	70	64.8	7.02	645.0	742.0	7.5	7.4	0.4						398	14	0.051	0.592	0.053	4.9	0.55	0.09	0.67
4/30/2007	19:08	62	57.7	8.52	479.0	603.0	7.1	13.5	0.3						168	11.6	0.177	0.822	0.036	5.4	1.14	0.08	0.88
5/3/2007	11:40	67	60.8							3000	1100	0.43											
5/14/2007	13:15	84	64.9	8.89	1180.0	1353.0	7.9	61.0	0.7						590	149	0.05	0.013	0.007	1.5	0.1	0.015	1.69
5/23/2007	12:20	70	53.6							1400	3000	0.44											
5/23/2007	13:44	70	49.6	5.92	102.7	144.8	7.0	1.2	0.1							7.6	0.022	0.855	0.006	5.2	0.02	0.015	0.09
5/24/2007	12:40	54	60.8							16001	16000	0.05											
5/30/2007	17:15	72	72.3	5.08	186.7	196.4	7.1	12.0	0.1							7.84	0.05	0.379		2.1	0.06	0.015	0.18
6/2/2007	14:47	74	72.0	6.92	208.3	220.0	8.0	14.0	0.1							8.48	0.055	0.334		2.5	0.39	0.04	0.37
6/13/2007	11:35	79	53.6							16001	10000	0.51											
6/18/2007	10:36		69.3	4.91	153	166.6	7.2	19.6	0.1							7.04	0.082	0.451		2.7	0.24	0.07	0.38
6/19/2007	9:59	64	59.4	9.59	838	1030	7.4	61.0	0.5							91.7	0.017	0.076		1.8	0.1	0.04	0.91
6/29/2007	10:31	65	58.5	9.66			7.8	44.5	0.7							149	0.249	0.419	0.25	7.3	3.91	0.08	1.55
7/3/2007	12:15	77	55.4							1700	1100	0.42											
7/8/2007	14:57	81	75.6	3.16	198	201.2	6.7	6.5	0.1							14.1	0.027	0.723	0.0025	4.3	0.04	0.015	0.025
7/12/2007	9:00	64	61.3	8.65	1092	1310	7.8	61.0	0.7						860	142	0.05	0.027	0.012	1.4	0.15	0.015	1.69
7/16/2007	10:20	73	66.2							3000	7400												
7/18/2007	14:21	72	74.7	3.14	146.3	149.9	7.3	10.0	0.1						106	7.86	0.011	0.446	0.0025	4.1	0.08	0.15	0.56
7/25/2007	11:53	97	67.3	8.47	1154	1288	7.9	61.0	0.6							139	0.017	0.032	0.018	1.9	0.25	0.015	1.9
7/26/2007	11:40	86	69.4							500	450	0.49											
8/1/2007	19:33	79	76.1	4.44	441.6	445.7		19.5	0.2							15.7	0.115	0.7		5.2		0.015	0.025
8/9/2007	11:30	79	68.5							3000	2200	0.5											
8/11/2007	2:34	88	76.1	3.28	132.8	134	6.5	15.0	0.1						79								
8/13/2007	22:09	74	74.7	6.08	75.9	77.8	6.7	12.0	0						46	4.31	0.034	0.277	0.016	1.2	0.01	0.015	0.34
8/16/2007	12:38	81	61.2	9.73	1092	1314	7.9	61.0	0.7				1	2	820	150	0.033	0.044	0.024	1.7	0.36	0.015	1.17
8/18/2007	9:47	66	64.4	7.39	138.4	159.7	7.2	19.6	0.1				10	45	112	4.19	0.078	0.185		1.3	0.13	0.05	0.31
8/21/2007	2:03	70	70.3	7.2	115.8	124.7	7.2	7.0	0.1						71	8.2	0.04	0.266		2.1	0.32	0.04	0.44
8/21/2007	12:25	70	66.2							9000	14000	0.05											
8/23/2007	13:22	75	74.7	6.86	140.4	144	7.3	13.0	0.1						74	7.62	0.067	0.289		1.6	0.22	0.08	0.55
8/27/2007	1:06	72	71.6	7.26	108.2	114.8	7	17.0	0.2				68	214	58	6.93	0.064	0.338	0.053	1.7	0.22	0.015	0.54
8/28/2007	1:41	82	74.3	7.32	56.5	58.2	7.5	6.0	0				78	358	39	3.05	0.053	0.421	0.058	2.1	0.43	0.04	0.31
8/31/2007	11:35	72	65.3	8.65	1114	1271	7.8	37.2	0.6				5	8	834	128	0.032	0.071	0.032	2.9	0.63	0.015	1.24
9/6/2007	19:51	63	72.5	5.79	99.2	104.2	7	9.6	0.1				52	198	76	6.75	0.085	0.458	0.067	2.7	0.01	0.03	0.56
9/13/2007	10:51	57	59.0							2400	920	0.51											
9/14/2007	10:55	49	53.2	10.16	1011	1353	7.9	61.0	0.7				1	2	844	135	0.037	0.049	0.031	2	0.53	0.015	1.36
9/14/2007	11:00	49	53.2	10.16	1011	1353	7.9	61.0	0.7				1	2	836	136	0.036	0.039	0.029	2.6	0.51	0.015	1.36
9/18/2007	12:35	69	69.8							16001	13000	0.05											
9/18/2007	5:23	64	70.0	6.3	97.1	104.8	7.6	11.0	0.1							19.9	0.058	0.319		1.6	0.16	0.015	0.26
9/20/2007	16:56	75	68.9	7.79	58.2	63.6	7.5	6.2	0							4.04	0.063	0.512	0.0025	2.6	0.45	0.03	0.3
9/24/2007	16:51	56	68.2	6.82	77.3	85.3	7.3	6.3	0							5.88	0.052	0.409	0.041	2.7	0.01	0.03	0.38
9/26/2007	18:23	54	59.5	7.53	97.8	120	7.4	16.5	0.1							7.22	0.043	0.287	0.033	2.1	0.22	0.015	1.21
10/2/2007	14:49	50	59.5	8.66	136.9	168.3	7	15.8	0.1							9.59	0.106	0.248		1.2	0.03	0.015	0.2
10/5/2007	1:49	75	67.1	8.65	118	131.8	7.2	12.0	0.1							8.08	0.072	0.32	0.06	1.4	0.03	0.015	0.36
10/10/2007	12:27	54	55.4							170	150	0.37											
10/11/2007	11:45	48	58.8	9.75	784	972	7.4	61.0	0.5				1	2	632	89.1	0.079	0.099	0.08	1.6	0.11	0.015	2.22
10/16/2007	15:53	73	57.6	9.43	133.1	167.9	7.2	11.4	0.1						118	11	0.086	0.276	0.082	0.83	0.01	0.015	0.34
10/17/2007	23:19	55	56.7	8.44			7	15.7	0.1						101	9.89	0.103	0.279	0.098	0.8	0.01	0.04	0.24
10/18/2007	11:45	63	57.2							16001	5900	0.1											
10/24/2007	11:55	45	53.6							5000	5500	0.47											
10/26/2007	10:55	55	55.0	9.67	1054	1373	7.7	61.0	0.7				1	2	878	139	0.02	0.041	0.021	2.1	0.33	0.03	2.42

All duplicates are omitted from analysis
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Blue font indicates the value was below the minimum detection limit and 1/2 the MDL was used as the value for analysis
Maroon font equals approximate value. Value used for analysis was the approximate value

Table F.1 continued. Monitoring results for 1NE outfall

Date	Sample Time	Alkalinity (mg/L CaCO3)	Chloride ion (mg/L)	Hardness (mg/L CaCO3)	COD (mg/L)	Total Organic Carbon (mg/L)	Carbonaceous Biological Oxygen Demand 5-day (mg/L)	Total Biological Oxygen Demand 5-day (mg/L)	Soluble Copper (mg/L)	Total Copper (mg/L)	Soluble Nickel (mg/L)	Total Nickel (mg/L)	Soluble Lead (mg/L)	Total Lead (mg/L)	Soluble Zinc (mg/L)	Total Zinc (mg/L)	Soluble Cadmium (mg/L)	Total Cadmium (mg/L)	Soluble Chromium (mg/L)	Total Chromium (mg/L)	Mercury (ug/L)	Oil and Grease (mg/L)
2/20/2007	12:35	283	578	448	61	8.3	7.4	13	0.007	0.0143	0.008	0.0097	0.0002	0.0063	0.0163	0.047	0.00002	0.00002	0.0013	0.0032		69
3/9/2007	11:39	81	2027	150	162	12.2	9	13	0.0112	0.031	0.0037	0.0091	0.0004	0.034	0.0256	0.131	0.00002	0.00002	0.0065	0.0145		7
3/9/2007	13:02	51	1343	126	246	11.6	15		0.0099	0.051	0.0032	0.0175	0.0008	0.086	0.029	0.232	0.00002	0.00002	0.0043	0.0246		17
3/12/2007	13:55		107																			
3/12/2007	15:02	28	81	54	65	11	1.3	2.6														6
3/13/2007	10:58	39	47	44	59	13.5	2.7	4.7	0.0042		0.0014		0.0005		0.0159		0.00002		0.0019			0.5
3/27/2007	10:58	260	127	400	19	4.7	1.4	1.9														0.5
3/27/2007	17:18	66	90	74	161	11.5	6.9															3
3/30/2007	2:16	27	35	44	145	3.8	4.3	7.6														10
4/3/2007	12:35																					
4/11/2007	11:45																					
4/19/2007	10:20	347	116	510	20	3.7	0.5	1.3														0.5
4/22/2007	14:16	53	175	66	166	13.1	16	21														14
4/30/2007	19:08	51	42	54	278	32.2	39	53														5
5/3/2007	11:40																					
5/14/2007	13:15	323	148	510	16	2.9	0.5	0.5	0.0018	0.002	0.0099	0.0101	0.000035	0.00008	0.0065	0.0068	0.00002	0.00002	0.0005	0.0005		0.5
5/23/2007	12:20																					
5/23/2007	13:44	38	15	50	175	8.8	18	28	0.0056	0.039	0.0023	0.0125	0.001	0.064	0.0077	0.216	0.00002	0.0007	0.0012	0.0137	0.075	9
5/24/2007	12:40																					
5/30/2007	17:15	46	25	52	99	8.8	6.9															0.5
6/2/2007	14:47	45	26	62	99			5.8														0.5
6/13/2007	11:35																					
6/18/2007	10:36	46	18	44	105	9.4	6.1															3
6/19/2007	9:59	251	121	240	20	5	1.4															
6/29/2007	10:31	375	140	554	28	3.9	5.6	8.9														3
7/3/2007	12:15																					
7/8/2007	14:57	70	20	84	228	23.4	48	65														7
7/12/2007	9:00	323	137	498	17	3.6	0.5	0.5														4
7/16/2007	10:20																					
7/18/2007	14:21	27	16	42	115	14.3	7.7	16														5
7/25/2007	11:53	326	128	268	37	2.9	1.1	1.4														0.5
7/26/2007	11:40																					
8/1/2007	19:33	83	25	98	229	34.6	45															
8/9/2007	11:30																					
8/11/2007	2:34	50	9	46	140																	6
8/13/2007	22:09	22	5	32	91	6.2	6.5	10.4														13
8/16/2007	12:38	313	137	558	15	3.9	0.5	0.5														3
8/18/2007	9:47	48	13	50	50	17.4			0.0047		0.0022		0.0003		0.0141		0.00025		0.0037			2
8/21/2007	2:03	34	8	44	64	5.9	1.5															0.5
8/21/2007	12:25																					
8/23/2007	13:22	41	10	48	52	7.1	2.5															0.5
8/27/2007	1:06	29	8	38	86	8.5	6.1	7.8														4
8/28/2007	1:41	20	2	26	81	5.4	3.7	5														0.5
8/31/2007	11:35	331	130	490	22	3.5	1.1	0.5														9
9/6/2007	19:51	23	7	36	96	7.9	5.3	6.6														7
9/13/2007	10:51																					
9/14/2007	10:55	337	150	550	16	2.6	0.5	0.5														0.5
9/14/2007	11:00	341	144	554	13	2.6	0.5	0.5														0.5
9/18/2007	12:35																					
9/18/2007	5:23	27	7	38	73	7.5	0.5															
9/20/2007	16:56	19	4	32	97	3.7	3.8	4.8														6
9/24/2007	16:51	22	5	38	83	5.6	3.6	5.5														0.5
9/26/2007	18:23	84	27	120	94	10.3		13														
10/2/2007	14:49	41	13	60	67	10.5	5.3		0.0114		0.0036		0.009		0.056		0.00025		0.004			2
10/5/2007	1:49	41	9	50	70	7.1	6.3	11														0.5
10/10/2007	12:27																					
10/11/2007	11:45	278	93	256	12	5.3	0.5															4
10/16/2007	15:53	42	9	64	59	7.6	4.5	6.3														6
10/17/2007	23:19	38	7	56	44	7.1	3.3	4.5														0.5
10/18/2007	11:45																					
10/24/2007	11:55																					
10/26/2007	10:55	379	142	544	8	3.9	0.5	1.3														0.5

All duplicates are omitted from analysis

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Blue font indicates the value was below the minimum detection limit and 1/2 the MDL was used as the value for analysis

Maroon font equals approximate value. Value used for analysis was the approximate value

Table F.2. Monitoring results for 2NNBC outfall

				Dissolved		Specific								Volatile	Total	Total		Dissolved	Total		Total			
Date	Sample	Air Temp	Water	Oxygen	Conductivity	Conductivity	pH	Transparency	Salinity	Fecal Coliform	E. coli	Fluoride	Stage (ft)	Solids (mg/L)	Suspended	Dissolved	Sulfate	Phosphorus	Phosphorus	Ortho	Kjeldahl	Ammonia	Nitrite N	Nitrate N
	Time	(F)	Temp (F)	(mg/L)	(uS)	(uS)		(cm)	(ppt)	(counts/100 mL)	(counts/100 mL)	(mg/L)			(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)
2/20/2007	No Sample*	41											1.32											
3/9/2007	11:10	40	47.12	8.07	3683.0	5390.0	7.4	28.00	2.9				1.31	6	14	2560	59.3	0.309	0.349	0.205	3.6	0.49	0.12	3.41
3/12/2007	13:20	39	40.1	12.23	555.0	913.0	7.1	11.00	0.4				1.30											
3/13/2007	13:30	46	40.64	11.87	342.5	557.0	7.2	10.40	0.3				1.54			301	14.4	0.218		0.183		0.25	0.04	0.57
3/30/2007	12:50	46	45.5	11.43	123.9	186.0	6.7	12.00	0.1				3.75	17	66	93	6.81	0.196		0.044	1.2	0.14	0.015	0.38
4/3/2007	11:35	42.8	48.2							110	180	0.62	4.04											
4/11/2007	No Sample	34											3.50											
4/19/2007	No Sample	49											2.78											
5/3/2007	No Sample	64											2.89											
5/14/2007	12:35	86	70.7	3.22	813.0	871.0	7.5	61.00	0.4				2.42			880	80.8	0.232	0.276	0.18	1.6	0.23	0.07	1.22
5/23/2007	11:22	70	75.2							16001	7000	1.12	1.86											
5/24/2007	12:22	50	60.8							9000	11000	0.05	2.05											
5/24/2007	14:20	55	62.06	7.84	247.0	293.4	7.0	14.20	0.1				2.05			165	18	0.107	0.204	0.068	1.2	0.15	0.05	0.68
6/13/2007	No Sample	75											2.27											
6/19/2007	11:35	73	73.04	4.00	703.0	735.0	7.2	61.00	0.4				1.95				47.7	0.103	0.226		1.4	0.23	0.03	0.69
6/29/2007	No Sample	74											1.43											
7/3/2007	11:30	79	78.8							9000	4600	1.04	1.43											
7/12/2007	9:30	64	72.5	6.42	944.0	990.0	7.4	61.00	0.5				1.14	1	3	685	88.2	0.219	0.259	0.176	1.3	0.36	0.015	1.37
7/16/2007	9:55	73	75.2							1700	4700		1.28											
7/25/2007	12:30	90	79.52	5.61	941.0	916.0	7.4	61.00	0.4				1.25	1	1	552	68.1	0.14	0.181	0.124	1.2	0.23	0.015	0.34
7/26/2007	11:13	90	80.78							300	270	0.45	1.53											
8/9/2007	11:07	79	80.06							1300	420	0.79	1.20											
8/16/2007	12:05	72	80.6	6.33	992.0	957.0	7.6	61.00	0.5				1.02	0.5	1	593	85.5	0.186	0.223	0.164	0.82	0.17	0.015	0.72
8/20/2007	No Sample	66											1.26											
8/21/2007	12:10	71	73.4							16001	6400	0.44	1.53											
8/31/2007	11:10	74	80.96	5.74	1020	979	7.4	61.00	0.5				1.40	0.5	1	628	80.5	0.256	0.333	0.242	0.98	0.28	0.015	1.05
9/13/2007	10:09	61	70.7							170	64	1.19	1.30											
9/18/2007	11:51	68	71.6							16001	8600	0.15	1.65											
9/18/2007	14:20	70	71.06	7.12	191	203.9	7.1	9	0.1				1.50	8	33	117	11.7	0.077	0.15	0.07	0.74	0.08	0.015	0.29
9/27/2007	10:02	60	67.46	6.93	524	583	6.3	61.00	0.3				1.68			345	44.5	0.158	0.257	0.153	1.2	0.18	0.04	0.7
10/5/2007	12:15	68	66.56	7.77	233.4	262.5	7	19.3	0.1				1.93			171	15	0.134	0.287	0.133	0.96	0.05	0.04	0.38
10/10/2007	No Sample	48											2.00											
10/11/2007	No Sample	48											1.90											
10/18/2007	11:03	59	59							5000	5100	0.19	2.25											
10/24/2007	No Sample	46											3.25											
10/26/2007	No Sample	50											3.25											

All duplicates are omitted from analysis

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Maroon font equals approximate value. Value used for analysis was the approximate value

*A sample was not collected because there was not positive flow coming out of the pipe

Table F.2 continued. Monitoring results for 2NNBC outfall

Date	Sample Time	Alkalinity (mg/L CaCO3)	Chloride ion (mg/L)	Hardness (mg/L CaCO3)	COD (mg/L)	Total Organic Carbon (mg/L)	Carbonaceous Biological Oxygen Demand 5-day (mg/L)	Total Biological Oxygen Demand 5-day (mg/L)	Soluble Copper (mg/L)	Total Copper (mg/L)	Soluble Nickel (mg/L)	Total Nickel (mg/L)	Soluble Lead (mg/L)	Total Lead (mg/L)	Soluble Zinc (mg/L)	Total Zinc (mg/L)	Soluble Cadmium (mg/L)	Total Cadmium (mg/L)	Soluble Chromium (mg/L)	Total Chromium (mg/L)	Mercury (ug/L)	Oil and Grease (mg/L)
2/20/2007	No Sample*																					
3/9/2007	11:10	98	1321	226	73	9.6	5.6	6.9	0.0084	0.0127	0.0039	0.0048	0.0009	0.0055	0.059	0.087	0.00002	0.00002	0.003	0.0046		4
3/12/2007	13:20		225																			
3/13/2007	13:30	42	117	62	72	10.7	4.4	6.2														2
3/30/2007	12:50	25	33	40	53	4.9	3.5	5.5														10
4/3/2007	11:35																					
4/11/2007	No Sample																					
4/19/2007	No Sample																					
5/3/2007	No Sample																					
5/14/2007	12:35	269	84	392	29	7.2	1.5	1.6	0.0016	0.0035	0.0049	0.0053	0.0019	0.004	0.0071	0.0206	0.00002	0.00002	0.001	0.0015		2
5/23/2007	11:22																					
5/24/2007	12:22																					
5/24/2007	14:20	60	33	82	38	7.8	3.4	5		0.0098		0.0034		0.01		0.052		0.00005		0.0029	0.012	3
6/13/2007	No Sample																					
6/19/2007	11:35	211	71	286	35	7.6	2.3															0.5
6/29/2007	No Sample																					
7/3/2007	11:30																					
7/12/2007	9:30	267	95	396	27	6.7	0.5	1.1	0.0027		0.0047		0.0007		0.0059		0.00002		0.0006			2
7/16/2007	9:55																					
7/25/2007	12:30	275	85	382	12	3.4	0.5	0.5														0.5
7/26/2007	11:13																					
8/9/2007	11:07																					
8/16/2007	12:05	250	89	420	17	5.1	0.5	0.5														0.5
8/20/2007	No Sample																					
8/21/2007	12:10																					
8/31/2007	11:10	252	95	388	18	5.3	0.5	0.5														0.5
9/13/2007	10:09																					
9/18/2007	11:51																					
9/18/2007	14:20	56	18	68	37	5.4	2.9	4.3														0.5
9/27/2007	10:02	166	49	222	23	7.9	1.9	2.6														0.5
10/5/2007	12:15	86	17	122	36	6.6	2.2	3.8														4
10/10/2007	No Sample																					
10/11/2007	No Sample																					
10/18/2007	11:03																					
10/24/2007	No Sample																					
10/26/2007	No Sample																					

All duplicates are omitted from analysis

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*A sample was not collected because there was not positive flow coming out of the pipe

Table F.3. Monitoring results for 4PP outfall

Date	Sample Time	Air Temp (F)	Water Temp (F)	Dissolved Oxygen (mg/L)	Conductivity (uS)	Specific Conductivity (uS)	pH	Transparency (cm)	Salinity (ppt)	Fecal Coliform (counts/100 mL)	E. coli (counts/100 mL)	Fluoride (mg/L)	Stage (ft)	Sample Type	Volatile Suspended Solids (mg/L)	Total Suspended solids (mg/L)	Total Dissolved Solids (mg/L)	Sulfate (mg/L)	Dissolved Phosphorus (mg/L)	Total Phosphorus (mg/L)	Ortho Phosphate (mg/L)	Total Kjeldahl Nitrogen (mg/L)	Ammonia Nitrogen (mg/L)	Nitrite N (mg/L)	Nitrate N (mg/L)
2/20/2007	14:45	42	48.74	9.42	2529.0	3615.0	6.7	20.00	1.9				0.38	LIQ	12	25	2200	82	0.092	0.17	0.059	5.1	0.59	0.09	1.36
3/9/2007	10:27	36	46.94	9.54	3118.0	4577.0	7.3	25.00	2.5				0.36	LIQ	5	11	2590	76.2	0.034	0.089	0.031	3.3	0.37	0.11	1.43
3/12/2007	12:55	47	41.54	12.20	654.0	1049.0	6.9	10.00	0.5				0.89	LIQ											
3/13/2007	13:00	46	42.62	11.80	428.5	675.0	7.0	9.40	0.3				0.91	LIQ			343	20.3	0.208		0.174		0.42	0.04	0.5
3/30/2007	12:30	43	45.68	12.13	65.5	98.1	6.5	15.00	0				1.21	LIQ	27	81	52	5.81	0.039	0.256	0.037	0.59	0.24	0.015	0.29
4/19/2007	15:15	52	51.8	10.28	822.0	1121.0	7.7	61.00	0.6				0.33	LIQ	4	9		87.6	0.865	0.997	0.133	2.9	0.2	0.04	1.48
5/3/2007	10:50	55	51.8							130	13	0.31	0.27												
5/14/2007	12:09	90	53.06	9.65	964.0	1293.0	7.7	61.00	0.6				0.27	LIQ			758	94.2	0.022	0.081	0.021	1.9	0.04	0.015	0.89
5/23/2007	10:55	70	53.6							500	220	0.32	0.27												
5/24/2007	11:55	55	59							16000	13000	0.05	1.09												
5/24/2007	14:53	52	59.18	9.06	201.5	248.7	7.1	23.20	0.1				0.77	LIQ				13.7	0.059	0.164	0.048	0.88	0.12	0.05	0.48
6/13/2007	10:52	81	55.4							10	17	0.24	0.27												
6/19/2007	12:15	79	56.48	9.33	884.0	1130.0	7.6	61.00	0.6				0.28	LIQ	2	4		76.5	0.026	0.085		1.6	0.11	0.03	0.81
6/29/2007	10:30	70	54.5	10.26			7.7	61.00	0.7				0.27	LIQ	0.5	0.5	797	96.4	0.029	0.043	0.026	2.1	0.08	0.015	1.3
7/3/2007	11:10	79	66.2							9000	1500	0.3	0.27												
7/12/2007	9:55	72	71.6	10.25	1046.0	1356.0	7.8	61.00	0.7				0.27	LIQ	0.5	1	867	87.8	0.038	0.039	0.029	2.7	0.09	0.015	1.25
7/16/2007	9:22	70	60.8							5000	1800		0.33												
7/25/2007	12:59	91	57.38	9.48	1073.0	1354.0	7.4	61.00	0.7	5000	3200	0.43	0.27	LIQ	1	1	781	86.8	0.021	0.041	0.024	1.8	0.05	0.015	1.08
7/26/2007	10:53	93	56.3							5000	3200	0.23	0.27												

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Table F.3 continued. Monitoring results for 4PP outfall

Date	Sample Time	Alkalinity (mg/L CaCO3)	Chloride ion (mg/L)	Hardness (mg/L CaCO3)	COD (mg/L)	Carbonaceous			Soluble Copper (mg/L)	Total Copper (mg/L)	Soluble Nickel (mg/L)	Total Nickel (mg/L)	Soluble Lead (mg/L)	Total Lead (mg/L)	Soluble Zinc (mg/L)	Total Zinc (mg/L)	Soluble Cadmium (mg/L)	Total Cadmium (mg/L)	Soluble Chromium (mg/L)	Total Chromium (mg/L)	Mercury (ug/L)	Oil and Grease (mg/L)
						Total Organic Carbon (mg/L)	Biological Oxygen Demand 5-day (mg/L)	Total Biological Oxygen Demand 5-day (mg/L)														
2/20/2007	14:45	236	1000	450	75	12.5	14	16	0.0122	0.0199	0.0064	0.0093	0.0002	0.0074	0.02	0.047	0.00002	0.00002	0.0012	0.0029	1	1
3/9/2007	10:27	198	1289	382	61	7.4	7	8.6	0.0111	0.0175	0.0054	0.0059	0.0003	0.0044	0.038	0.063	0.00002	0.00002	0.0021	0.0033	2	2
3/12/2007	12:55		217																			
3/13/2007	13:00	77	129	108	82	7.6	5.7	7.5														5
3/30/2007	12:30	26	12	34	56	2.6	2	3.9														7
4/19/2007	15:15	217	169	396	29	6.9	0.5	0.5														0.5
5/3/2007	10:50																					
5/14/2007	12:09	268	196	474	16	2.4	1.1	1.3	0.0017	0.0022	0.0064	0.0064	0.000035	0.0003	0.004	0.0093	0.00002	0.00002	0.0005	0.0008		10
5/23/2007	10:55																					
5/24/2007	11:55																					
5/24/2007	14:53	48	33	78	36	7.9	4.5	6.6	0.0083	0.0131	0.0021	0.0024	0.0007	0.0066	0.0168	0.047	0.00002	0.00002	0.0027	0.0039	0.012	9
6/13/2007	10:52																					
6/19/2007	12:15	245	161	362	11	2.7	0.5															0.5
6/29/2007	10:30	296	212	486	18	1.8	0.5	0.5														0.5
7/3/2007	11:10																					
7/12/2007	9:55	290	200	494	11	2.1	0.5	0.5														0.5
7/16/2007	9:22																					
7/25/2007	12:59	289	200	492	12	2.2	0.5	0.5														0.5
7/26/2007	10:53																					

All duplicates are omitted from analysis
Red font indicates suspect data
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Blue font indicates the value was below the minimum detection limit and 1/2 the MDL was used as the value for analysis
Maroon font equals approximate value. Value used for analysis was the approximate value

Table F.4. Monitoring results for 6UMN outfall

Date	Sample Time	Air Temp (F)	Water Temp (F)	Dissolved Oxygen (mg/L)	Conductivity (uS)	Specific Conductivity (uS)	pH	Transparency (cm)	Salinity (ppt)	Fecal Coliform (counts/100 mL)	E. coli (counts/100 mL)	Fluoride (mg/L)	Volatile Suspended Solids (mg/L)	Total Suspended Solids (mg/L)	Total Dissolved Solids (mg/L)	Sulfate (mg/L)	Dissolved Phosphorus (mg/L)	Total Phosphorus (mg/L)	Ortho Phosphate (mg/L)	Total Kjeldahl Nitrogen (mg/L)	Ammonia Nitrogen (mg/L)	Nitrite N (mg/L)	Nitrate N (mg/L)
2/20/2007	15:20	42	48.02	10.62	2429.0	3506.0	8.9	5.5	1.8				33	200	1960	65.1	0.18	0.493	0.107	15	0.75	0.1	3.7
3/9/2007	09:39	36	49.46	10.39	1676.0	2371.0	7.5	55.0	1.2				8	24	1310	77.6	0.005	0.075	0.013	2.3	0.07	0.03	5.31
3/12/2007	11:55	39	43.52	11.96	979	1519	6.9	5.0	0.8														
3/13/2007	12:30	47	45.68	11.79	745.0	1118.0	7.5	4.5	0.6						615	29.3	0.136		0.115		0.22	0.05	1.65
4/30/2007	20:50	64	58.82	9.10	272.8	338.3	6.9		0.2						199	21.4	0.051	0.233	0.034	2.4	0.93	0.08	2.11
5/3/2007	10:25	55	57.2							60	1	0.4											
5/14/2007	11:29	80	64.04	8.63	1050.0	1219.0	7.9	61.0	0.6						861	99.4	0.005	0.242	0.007	1.4	0.01	0.015	4.84
5/23/2007	10:35	70	60.8							140	35	0.32											
5/23/2007	14:41	73	50.72	3.57	759.0	1054.0	7.2	15.0	0.5						452	39.9	0.138	1.21		5.8	0.04	0.015	0.025
5/23/2007	15:11	73	50	0.46	266.8	374.3	7.0	6.0	0.2						182	18	0.029	0.38		2.9	0.09	0.37	0.62
5/23/2007	15:41	73	50	0.83	194.7	272.8	6.9	10.3	0.1						170	16.6	0.041	0.577		3.3	0.14	0.31	0.3
5/24/2007	11:23	54	58.1							5000	43000	0.05											
5/30/2007	17:25	70	67.28	3.55	807.0	900.0	7.3		0.4						268	22.1	0.005	0.924		6.1	0.01	0.14	0.15
5/30/2007	17:55	70	66.74	1.82	159.1	178.7	7.3	11.0	0.1						96	7.22	0.005	0.222		1.4	0.06	0.04	0.39
5/30/2007	22:25	70	66.38	7.38	555	625.0	7.5	61.0	0.3						383	36.3	0.005	0.052		0.81	0.02	0.04	2.05
6/2/2007	16:26	73	65.3	1.24	459.0	524.0	6.9	18.0	0.3							21.3	0.105	0.198		1.3	0.18		
6/2/2007	18:26	73	64.4	4.03	376.6	434.7	7.0	23.0	0.2							31.5	0.041	0.078		0.92	0.12	0.06	2.03
6/2/2007	19:56	73	64.4	6.28	403.8	465.9	7.3	49.0	0.2							29.3	0.064	0.352		2.2	0.19	0.14	1.01
6/13/2007	10:31	73	62.6							20	15	0.44											
6/18/2007	11:04	74	68.72	2.01	510.0	559.0	7.4		0.3							13.6	0.023	0.589		3	0.24	0.07	0.66
6/18/2007	11:34	74	68.54	3.53	132.0	145.0	7.6		0.1							5.21	0.048	0.408		2.4	0.18	0.03	0.3
6/19/2007	12:12	74	63.14	9.21	1164	1365	8	61.0	0.7							102	0.005	0.005		1.5	0.01	0.015	6.28
6/29/2007	08:45	64	60.62	9.17			7.9	61.0	0.7							98.4	0.022	0.035	0.016	1.7	0.03	0.015	4.44
7/3/2007	10:45	73	66.2							16000	200	0.37											
7/3/2007	13:44	80	68.54	1.66	536	590	7.8	10.2	0.3							37	0.081	1.89		9.1	0.35	0.015	0.025
7/8/2007	15:08	75	73.04	0.26	481	503	6.7	4.5	0.2							13.1	0.04	0.261	0.022	2.3	0.07	0.015	0.72
7/8/2007	16:38	75	72.86	3.87	217.6	227.5	6.8	30.5	0.1							26.9	0.017	0.832	0.0025	4.2	0.04	0.015	0.05
7/12/2007	10:25	66	61.34	9.08	1025	1230	8	61.0	0.6							98.1		~0.021		2.2	0.05	0.015	7.01
7/12/2007	10:25	66	61.34	9.08	1025	1230	8	61.0	0.6								0.005		0.009				
7/16/2007	08:58	66	69.08							2400	1900												
7/18/2007	14:39	75	71.6	0.37	687	728	7	9.4	0.4						154	13	0.005	7	0.0025	7.2	0.05	0.2	0.07
7/18/2007	15:09	75	72.14	5.4	87.3	92	7.3	13.3	0.0						55	5.64	0.026	2.19	0.025	1.2	0.39	0.05	0.7
7/18/2007	15:39	75	71.96	6.72	89.8	94.9	7.3		0.0							6.62	0.112	1.99	0.026	1.4	0.32	0.04	0.79
7/25/2007	10:35	81	58.82	7.86	1062	1315	7.8	61.0	0.7				7	6	794	87.8	0.005	0.119	0.0025	3.6	0.01	0.04	4.78
7/26/2007	10:30	82	68							2200	1	0.39											
8/13/2007	22:15	73	71.6	6.14	552	585	7.4	35.0	0.3							6.5	0.178			1.2	0.81		0.015
8/13/2007	22:45	73	71.78	7.11	78.3	83	7.6	14.0	0.0							4.4	0.197			0.94	0.38		0.015
8/13/2007	23:15	73	71.24	7.18	81.7	87	7.1	19.0	0.0							8.1	0.137			0.82	0.39		0.015
8/16/2007	10:45	68	63.68	8.88	1044	1216	7.9	61.0	0.6				1	6	831	93.6	0.014	0.021	0.009	1.2	0.01	0.015	6.24
8/18/2007	09:03	62	63.32	0.46	898	1050	7.4	19.5	0.5							16					0.025		0.015
8/18/2007	11:33	62	63.14	5.74	237.3	271.8	7.4	47.0	0.1							10.1					1.17		0.04
8/18/2007	14:33	62	63.14	7.31	304	356.2	7.2	61.0	0.2							8.6	0.052			0.72	1.77		0.015
8/21/2007	02:23	70	67.64	3.95	370.2	411.4	7.1	17.4	0.2							4.2	0.276			1.7	0.83		0.04
8/21/2007	02:53	70	67.28	3.79	124.7	139.1	7	16.4	0.1							2.5	0.145			0.94	0.47		0.015
8/21/2007	03:23	70	67.1	6.06	112.4	125.7	6.9	15.8	0.1							3.3	0.113			0.74	0.67		0.015
8/21/2007	11:33	68	64.76							9000	9000	0.31											

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Table F.4 continued. Monitoring results for 6UMN outfall

Date	Sample Time	Air Temp (F)	Water Temp (F)	Dissolved Oxygen (mg/L)	Conductivity (uS)	Specific Conductivity (uS)	pH	Transparency (cm)	Salinity (ppt)	Fecal Coliform (counts/100 mL)	E. coli (counts/100 mL)	Fluoride (mg/L)	Volatile Suspended Solids (mg/L)	Total Suspended Solids (mg/L)	Total Dissolved Solids (mg/L)	Sulfate (mg/L)	Dissolved Phosphorus (mg/L)	Total Phosphorus (mg/L)	Ortho Phosphate (mg/L)	Total Kjeldahl Nitrogen (mg/L)	Ammonia Nitrogen (mg/L)	Nitrite N (mg/L)	Nitrate N (mg/L)
8/23/2007	14:03	73	68	4.59	785	868	7.7	20.6	0.4							10.7					1.83		0.15
8/23/2007	14:33	73	67.46	3.68	327.3	364	7.7	20.8	0.2							8.1	0.143			0.94	1.03		0.07
8/23/2007	18:03	73	66.74	7.07	598	670	7.6	33.3	0.3							6	0.048			0.81	3.29		0.03
8/27/2007	01:08	70	66.74	5.77	249.2	279.4	7.6	17.8	0.1							7.9	0.411			2.1	0.45		0.03
8/27/2007	01:38	70	67.1	7.08	77.8	86.8	7.7	10.2	0.0							6.8	0.185			1.2	0.47		0.015
8/27/2007	02:38	70	66.74	7.35	153.2	171.9	7.4	14.4	0.1							6.7	0.139			0.77	1.02		0.04
8/28/2007	01:58	73	69.8	6	438.1	376.6	7.1	13.4	0.2							6.8	0.334	7.2		3	0.7		0.04
8/28/2007	02:28	73	70.16	7.81	60.3	65	7.7	10.3	0.0							3.8	0.25	3.5		1.2	0.23		0.03
8/28/2007	03:28	73	69.8	7.33	109.4	118.4	7.3	12.3	0.1							4.7	0.136	3.5		0.74	0.52		0.03
8/31/2007	10:35	72	62.6	8.6	961	1135	8	61.0	0.6							2		0.5				0.5	
9/13/2007	09:30	61	59.9							1700	1600												
9/14/2007	09:40	46	57.02	8.96	1054	1339	7.8	61.0	0.7				1	4	877	87.9	0.005	0.015	0.0025	2	0.01	0.015	4.95
9/18/2007	11:15	68	66.2							16000	7200	0.17											
9/18/2007	05:32	64	66.56	1.78	841	946	7.7	14.8	0.5							7.12	0.05	0.368		2.5	0.11	0.06	0.54
9/18/2007	06:01	64	66.56	2.45	150.1	168.9	7.3	17.7	0.1							13.8	0.038	0.28		2.3	0.09	0.015	0.23
9/18/2007	07:31	64	66.2	5.29	178.2	201.2	7.1	48.7	0.1							13	0.048	0.099		0.72	0.025	0.05	0.85
9/20/2007	17:05	75	67.64	6.23	559	620	7.3	20.0	0.3							8.92	0.112	0.372	0.105	1.1	0.24	0.05	0.78
9/20/2007	17:35	75	67.28	8.08	109.1	121.6	7.6	7.8	0.1							13.4	0.005	0.4	0.0025	2.9	0.39	0.05	0.8
9/20/2007	20:05	75	67.1	6.9	145	162	7.1	5.9	0.1							3.65	0.055	0.322	0.053	1.2	0.51	0.015	0.28
9/24/2007	16:57	61	69.08	6.41	132.2	144.2	8.5	15.5	0.1							6.27	0.039	0.328	0.025	2.1	0.14	0.015	0.2
9/24/2007	17:27	61	69.44	7.01	67.2	73.1	7.9	12.5	0.0							4.79	0.047	0.149	0.037	0.82	0.15	0.015	0.25
9/24/2007	19:27	61	68.9	7.43	230.3	252.1	7.4	28.5	0.1							16.4	0.059	0.072	0.051	0.54	0.11	0.03	1.26
9/26/2007	18:47	56	61.34	7.3	728	873	7.5	28.5	0.4							16.9	0.011	0.206	0.0025	2.8	0.6	0.04	0.77
9/26/2007	19:16	56	61.34	8.07	105.3	126.3	7	23.0	0.1							8.81	0.011	0.105	0.0025	1.4	0.54	0.015	0.59
9/26/2007	20:46	56	61.16	8.48	271.6	326.8	6.9	30.6	0.2							26.4	0.02	0.047	0.016	0.97	0.35	0.04	2.13
10/2/2007	11:11	48	61.52	5.08	745	892	7.2	21.8	0.4						374	41.3	0.037	0.316		3	0.04	0.16	0.025
10/2/2007	11:41	48	61.52	6.18	453.9	543	7.2	15.4	0.3						346	34.6	0.014	0.09		1.4	0.02	0.04	1.54
10/2/2007	12:41	48	61.52	6.68	279.9	334.8	7.2	11.8	0.2						214	21	0.045	0.124		1.2	0.01	0.015	1
10/5/2007	01:58	77	65.48	7.98	440.9	502	7.3	13.8	0.2							31.2	0.017	0.171	0.0025	1.5	0.03	0.04	1.22
10/5/2007	02:28	77	64.94	7.77	123.5	141.8	7.4	19.3	0.1							6.56	0.026	0.146	0.013	0.74	0.08	0.015	0.38
10/5/2007	02:58	77	64.58	8.41	121.7	140	7.2	23.2	0.1							10.7	0.024	0.072	0.011	0.62	0.05	0.015	0.82
10/10/2007	10:57	50	55.4							10	10	0.41											
10/11/2007	13:45	57	57.2	9.1	1039	1314	7.7	61.0	0.7				3	4	959	105	0.032	0.037	0.007	3.1	0.01	0.06	5.48
10/16/2007	05:24	55	56.48	6.59	463	592	7.1	22.6	0.3						246	24.1	0.005	0.307	0.013	1.7	0.01	0.03	1.51
10/16/2007	06:09	55	56.12	6.59	168.9	217.1	7	12.8	0.1						273	28.3	0.029	0.084	0.027	0.55	0.01	0.04	2.15
10/16/2007	09:09	55	56.12	8.53	322	413.9	7.1	19.0	0.2						114	9.56	0.014	0.218	0.01	0.79	0.07	0.015	0.58
10/18/2007	10:35	15	59							9000	2100	0.11											
10/18/2007	06:08	54	57.56	7.56	290	365.4	7.2	25.5	0.2						234	23.2	0.005	0.056	0.007	0.73	0.01	0.03	1.17
10/18/2007	07:38	54	57.56	8.25	88.2	111.1	6.9	17.0	0.1						73	4.63	0.025	0.117	0.033	0.57	0.01	0.015	0.31
10/18/2007	08:23	54	57.38	8.73	81.3	102.6	6.9	19.7	0.1						76	4.49	0.037	0.099	0.041	0.48	0.02	0.015	0.22
10/24/2007	10:56	48	55.4							20	18	0.35											
10/26/2007	09:55	45	55.04	9.18	1035	1351	7.7	8.7	0.7				3	43	828	101	0.005	0.031	0.0025	1.8	0.01	0.015	4.88

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Table F.4 continued. Monitoring results for 6UMN outfall

Date	Sample Time	Alkalinity (mg/L CaCO3)	Chloride ion (mg/L)	Hardness (mg/L CaCO3)	COD (mg/L)	Total Organic Carbon (mg/L)	Carbonaceous Biological Oxygen Demand 5-day (mg/L)	Total Biological Oxygen Demand 5-day (mg/L)	Soluble Copper (mg/L)	Total Copper (mg/L)	Soluble Nickel (mg/L)	Total Nickel (mg/L)	Soluble Lead (mg/L)	Total Lead (mg/L)	Soluble Zinc (mg/L)	Total Zinc (mg/L)	Soluble Cadmium (mg/L)	Total Cadmium (mg/L)	Soluble Chromium (mg/L)	Total Chromium (mg/L)	Oil and Grease (mg/L)
2/20/2007	15:20	234	951	344	129	15.6	17	21	0.0101	0.0239	0.0084	0.0148	0.0003	0.0295	0.0114	0.086	0.00002	0.00002	0.0037	0.0135	0.5
3/9/2007	09:39	309	522	508	26	3.9	1.6	2.1	0.0044	0.0053	0.0085	0.0089	0.000035	0.0014	0.0185	0.022	0.00002	0.00002	0.0029	0.0053	3
3/12/2007	11:55		363																		
3/13/2007	12:30	114	248	192	106	10.8	6.2	7.1													5
4/30/2007	20:50	80	39	112	73	6.7	6.2	10													3
5/3/2007	10:25																				
5/14/2007	11:29	296	166	506	14	2.5	0.5	0.5	0.002	0.0022	0.0095	0.0096	0.000035	0.000035	0.0025	0.006	0.00002	0.00002	0.0025	0.0042	0.5
5/23/2007	10:35																				
5/23/2007	14:41		97		264																
5/23/2007	15:11		33		142																
5/23/2007	15:41		36		180																
5/24/2007	11:23																				
5/30/2007	17:25	126	48	154	566	8.4															
5/30/2007	17:55		14			6.3															
5/30/2007	22:25	136	86	234	25	6.7															
6/2/2007	16:26	93	44	134	46	10.6															
6/2/2007	18:26	121	64	188	33	8.1															
6/2/2007	19:56	107	71	174	238	16.9															
6/13/2007	10:31																				
6/18/2007	11:04	71	30	94	155	8.7															
6/18/2007	11:34	28	11	30	104	3.6															
6/19/2007	12:12	310	178	540	8	2.2															
6/29/2007	08:45	306	174	468	32	3	8.9	8.9													0.5
7/3/2007	10:45																				
7/3/2007	13:44	146	73	214	408	32.4															
7/8/2007	15:08	55	18	74	84	12.5															
7/8/2007	16:38	132	47	184	240	24.1															
7/12/2007	10:25	312	176	406	16		0.5	0.5													0.5
7/12/2007	10:25					3.5															
7/16/2007	08:58																				
7/18/2007	14:39	70	19	88	270	26.1															
7/18/2007	15:09	21	6	28	58	5.4															
7/18/2007	15:39	26	8	36	43	7															
7/25/2007	10:35	321	150	454	15	2.8	3.7	4.2													38
7/26/2007	10:30																				
8/13/2007	22:15	49	12.7	90	0.16	0.014	25														
8/13/2007	22:45	21	3.91	26	0.28	0.056	6														0.048
8/13/2007	23:15	23	5.08	30	0.29	0.048	7														
8/16/2007	10:45	297	166	542	20	2.7	0.5	0.5													2
8/18/2007	09:03	179	46.1	280	0.02	0.019	78														
8/18/2007	11:33	72	13.6	104	0.01	0.031	25														
8/18/2007	14:33	89	19.9	140	0.01	0.016	44														
8/21/2007	02:23	79	21.1	120	0.04	0.021	33														
8/21/2007	02:53	22	5.45	30	0.24	0.024															
8/21/2007	03:23	42	7.43	44	0.27	0.041															
8/21/2007	11:33																				

All duplicates are omitted from analysis
Red font indicates suspect data
Green font indicates value was greater than the maximum detetion limit. MDL+1 was the value used for analysis
Blue font indicates the value was below the minimum detection limit and 1/2 the MDL was used as the value for analysis
Maroon font equals approximate value. Value used for analysis was the approximate value

Table F.4 continued. Monitoring results for 6UMN outfall

Date	Sample Time	Alkalinity (mg/L CaCO3)	Chloride ion (mg/L)	Hardness (mg/L CaCO3)	COD (mg/L)	Total Organic Carbon (mg/L)	Carbonaceous	Total Biological	Soluble Copper (mg/L)	Total Copper (mg/L)	Soluble Nickel (mg/L)	Total Nickel (mg/L)	Soluble Lead (mg/L)	Total Lead (mg/L)	Soluble Zinc (mg/L)	Total Zinc (mg/L)	Soluble Cadmium (mg/L)	Total Cadmium (mg/L)	Soluble Chromium (mg/L)	Total Chromium (mg/L)	Oil and Grease (mg/L)
							Biological Oxygen Demand 5-day (mg/L)														
8/23/2007	14:03	172	44.4	264	0.05	0.011															
8/23/2007	14:33	68	17.3	100	0.05	0.021															
8/23/2007	18:03	173	1.15	258	0.02	0.005															
8/27/2007	01:08	31	9.24	42	0.43	0.077															
8/27/2007	01:38	25	4.89	26	0.3	0.044															
8/27/2007	02:38	40	10.9	60	0.2	0.08															
8/28/2007	01:58	42	48.6	48	0.74	0.019															
8/28/2007	02:28	23	7.8	20	0.38	0.042															0.043
8/28/2007	03:28	31	5.37	40	0.42	0.054															0.06
8/31/2007	10:35	298	84	416				742													
9/13/2007	09:30																				
9/14/2007	09:40	304	168	530	16	2.5	2.2	2.1													0.5
9/18/2007	11:15																				
9/18/2007	05:32	59	29	100	121	10.5															
9/18/2007	06:01	31	12	42	61	9.8															
9/18/2007	07:31	45	19	78	36	7.6															
9/20/2007	17:05	31	16	62	60	4.6															
9/20/2007	17:35	47	24	84	100	4.6															
9/20/2007	20:05	19	4	34	145	3.3															
9/24/2007	16:57	20	7	46	145	8.7															
9/24/2007	17:27	14	4	28	54	3.8															
9/24/2007	19:27	56	29	100	25	5															
9/26/2007	18:47	58	27	86	84	9.9															
9/26/2007	19:16	22	10	38	48	9.2				0.0093		0.0032		0.0072		0.058		0.00025		0.0032	
9/26/2007	20:46	71	38	130	27	8															
10/2/2007	11:11	138	70	200	155	21.9			0.0086		0.0082		0.003		0.082		0.00025		0.0016		
10/2/2007	11:41	121	70	200	52	7.8			0.0061		0.004		0.0019		0.037		0.00025		0.0024		
10/2/2007	12:41	72	36	120	51	7.3			0.0053		0.0038		0.0004		0.025		0.00025		0.0029		
10/5/2007	01:58	137	56	200	60	7.6															
10/5/2007	02:28	25	8	36	54	5.6															
10/5/2007	02:58	40	13	56	34	4.9															
10/10/2007	10:57																				
10/11/2007	13:45	358	171	596	64	19.9	9														4
10/16/2007	05:24	91	47	150	104	5.1															
10/16/2007	06:09	102	53	172	34	5.8															
10/16/2007	09:09	46	12	64	76	4.9															
10/18/2007	10:35																				
10/18/2007	06:08	99	43	152	29	3.5															
10/18/2007	07:38	24	5	48	37	2.6															
10/18/2007	08:23	23	9	40	23	2															
10/24/2007	10:56																				
10/26/2007	09:55	331	151	288	10	3.4	1.7	2.1													2

All duplicates are omitted from analysis
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Blue font indicates the value was below the minimum detection limit and 1/2 the MDL was used as the value for analysis
Maroon font equals approximate value. Value used for analysis was the approximate value

Table F.5. Monitoring results for 7LSTU outfall

Date	Sample Time	Air Temp (F)	Water Temp (F)	Dissolved Oxygen (mg/L)	Conductivity (uS)	Specific Conductivity (uS)	pH	Transparency (cm)	Salinity (ppt)	Stage (ft)	Fecal Coliform (counts/100 mL)	E. coli (counts/100 mL)	Fluoride (mg/L)	Volatile Suspended Solids (mg/L)	Total Suspended Solids (mg/L)	Total Dissolved Solids (mg/L)	Sulfate (mg/L)	Dissolved Phosphorus (mg/L)	Total Phosphorus (mg/L)	Ortho Phosphate (mg/L)	Total Kjeldahl Nitrogen (mg/L)	Ammonia Nitrogen (mg/L)	Nitrite N (mg/L)	Nitrate N (mg/L)
2/20/2007	No Sample*	42								0.72														
3/9/2007	No Sample	37								0.72														
3/12/2007	11:20	40	38.12	13.60	542.0	923.0	6.8	2.0	0.5	0.62				64	308	589	14	0.182	0.308	0.161	4.9	0.42	0.12	0.64
3/13/2007	11:30	47	36.14	14.50	479.0	847.0	6.4	4.5	0.4	0.66						474	14.7	0.194	0.503	0.15	3.8	0.64	0.05	0.57
3/14/2007	11:45	40	35.06	14.70	401.8	718.0	6.5	24.8	0.3	0.66				5	10	382								
3/27/2007	No Sample	54.5								2.11														
3/28/2007	12:11	43	49.28	11.16	456.0	647.0	6.8	5.5	0.3	2.55						374	23.8	0.083		0.019		0.35	0.07	1.02
3/30/2007	11:30	41	46.76	12.04	313.4	461.4	6.8	4.0	0.2	2.65						258	12.7	0.034	0.386	0.026	1.6	0.13	0.04	0.46
4/3/2007	No Sample	37.4								3.26														
4/11/2007	No Sample	35								2.43														
4/19/2007	No Sample	49								1.45														
5/3/2007	No Sample	57								1.53														
5/14/2007	No Sample	86								1.54														
5/23/2007	No Sample	70								0.68														
5/24/2007	10:35	59	59							1.10	16001	44000	0.05											
5/24/2007	15:32	52	60.26	9.55	379.6	461.3	7.5	6.0	0.2	0.95							15.9	0.052	0.263	0.051	1.7	0.13	0.05	0.32
6/13/2007	No Sample	81								1.55														
6/19/2007	No Sample	80								1.20														
6/29/2007	No Sample	68								0.73														
7/3/2007	9:56	79	68								16000	4400	0.51											
7/12/2007	No Sample	72								0.55														
7/16/2007	No Sample	68								0.60														
7/25/2007	No Sample	91								0.10														
7/26/2007	9:55	87	68.9							0.01	20	1	0.71											
8/9/2007	10:25	82	67.82								16000	3600	0.39											
8/16/2007	9:55	72	68.18	8.14	732	808	7.8	61.0	0.4					9	10	535	35.4	0.035	0.137	0.014	2.4	0.14	0.09	0.89
8/20/2007	10:05	62	65.3	8.82	453	518	7.6	33.3	0.3					4	13	310	20.5	0.019	0.088	0.018	1	0.08	0.05	0.49
8/21/2007	10:50	70	66.2								2400	7000	0.17											
8/31/2007	No Sample	76								0.14														
9/13/2007	No Sample	62								0.6														
9/14/2007	No Sample	45								0.06														
9/18/2007	10:33	72	68								16001	10000	0.37											
9/18/2007	15:10	72	67.46	8.7	447.9	497.9	7.5	8.0	0.2	0.35				19	107	297	19.1	0.026	0.204	0.008	1.3	0.04	0.015	0.21
9/27/2007	10:45	54	66.2	9.65	399.1	450.9	7.7	5.0	0.2	0.97						341	26.6	0.034	0.324	0.034	1.5	0.11	0.05	0.58
10/5/2007	11:25	67	64.94	9.38	199.4	228.8	7.5	5.5	0.1	1.15				40	237	194	11	0.04	0.421	0.031	0.95	0.01	0.07	0.37
10/10/2007	No Sample	49								1.1														
10/11/2007	No Sample	48								0.99														
10/18/2007	10:05	59	57.2							1.8	9000	5900	0.1											
10/19/2007	9:59	52	56.3		354.3	454.2	7.3	8.2	0.2	1.7				12	52	281	14.4	0.026	0.173	0.031	0.79	0.07	0.04	0.43
10/24/2007	No Sample	48								0.56														
10/26/2007	No Sample	43								0.6														

All duplicates are omitted from analysis

Red font indicates suspect data

Green font indicates value was greater than the maximum detetion limit. MDL+1 was the value used for analysis

Blue font indicates the value was below the minimum detection limit and 1/2 the MDL was used as the value for analysis

Maroon font equals approximate value. Value used for analysis was the approximate value

*A sample was not collected because there was not positive flow coming out of the pipe

Table F.5 continued. Monitoring results for 7LSTU outfall

Date	Sample Time	Alkalinity (mg/L_CaCO3)	Chloride ion (mg/L)	Hardness (mg/L_CaCO3)	COD (mg/L)	Total Organic Carbon (mg/L)	Carbonaceous Biological Oxygen Demand 5-day (mg/L)	Total Biological Oxygen Demand 5-day (mg/L)	Soluble Copper (mg/L)	Total Copper (mg/L)	Soluble Nickel (mg/L)	Total Nickel (mg/L)	Soluble Lead (mg/L)	Total Lead (mg/L)	Soluble Zinc (mg/L)	Total Zinc (mg/L)	Soluble Cadmium (mg/L)	Total Cadmium (mg/L)	Soluble Chromium (mg/L)	Total Chromium (mg/L)	Mercury (ug/L)	Oil and Grease (mg/L)
2/20/2007	No Sample*																					
3/9/2007	No Sample																					
3/12/2007	11:20	61	228	104	205	12.4	13		0.0107	0.045	0.0023	0.017	0.0011	0.149	0.0132	0.364	0.00002	0.001	0.0027	0.0175	0.104	8
3/13/2007	11:30	91	186	124	101	20.7	7		0.0063		0.0022		0.0006		0.0124		0.00002		0.0021			7
3/14/2007	11:45																					
3/27/2007	No Sample																					
3/28/2007	12:11	94	105	142	109	12.9	6.3	11														5
3/30/2007	11:30	67	90	104	94	6	4.1	6.8														9
4/3/2007	No Sample																					
4/11/2007	No Sample																					
4/19/2007	No Sample																					
5/3/2007	No Sample																					
5/14/2007	No Sample																					
5/23/2007	No Sample																					
5/24/2007	10:35																					
5/24/2007	15:32	98	74	138	71	7.7	4	7.4	0.0045	0.013	0.0022	0.0056	0.0004	0.0183	0.0048	0.107	0.00002	0.00002		0.0053	0.012	5
6/13/2007	No Sample																					
6/19/2007	No Sample																					
6/29/2007	No Sample																					
7/3/2007	9:56																					
7/12/2007	No Sample																					
7/16/2007	No Sample																					
7/25/2007	No Sample																					
7/26/2007	9:55																					
8/9/2007	10:25																					
8/16/2007	9:55	219	93	294	62	18.6	9	9														4
8/20/2007	10:05	129	64	174	32	6.7	2.1	3.2	0.0034	0.0052	0.003	0.0038	0.0001	0.0037	0.0096	0.029	0.00025	0.00025		0.0019		0.5
8/21/2007	10:50																					
8/31/2007	No Sample																					
9/13/2007	No Sample																					
9/14/2007	No Sample																					
9/18/2007	10:33																					
9/18/2007	15:10	99	78	164	56	6	3.9	5.9														3
9/27/2007	10:45	139	72	194	60	10.3	2.7	4.2		0.0151		0.0084		0.036		0.082		0.00025		0.0053		3
10/5/2007	11:25	85	36	86	121	8.4	2.3	4.6		0.03		0.0126		0.08		0.182		0.00025		0.0124		3
10/10/2007	No Sample																					
10/11/2007	No Sample																					
10/18/2007	10:05																					
10/19/2007	9:59	99	63	134	51	6.7	2.7	3.7														5
10/24/2007	No Sample																					
10/26/2007	No Sample																					

All duplicates are omitted from analysis
Red font indicates suspect data
Green font indicates value was greater than the maximum detetion limit. MDL+1 was the value used for analysis
Blue font indicates the value was below the minimum detection limit and 1/2 the MDL was used as the value for analysis
Maroon font equals approximate value. Value used for analysis was the approximate value
*A sample was not collected because there was not positive flow coming out of the pipe

Table F.6. Monitoring results for 10SA stormwater pipe

Date	Sample Time	Air Temp (F)	Water Temp (F)	Dissolved Oxygen (mg/L)	Conductivity (uS)	Specific Conductivity (uS)	pH	Transparency (cm)	Salinity (ppt)	Fecal Coliform (counts/100 mL)	E. coli (counts/100 mL)	Fluoride (mg/L)	Volatile Suspended Solids (mg/L)	Total Suspended Solids (mg/L)	Total Dissolved Solids (mg/L)	Sulfate (mg/L)	Dissolved Phosphorus (mg/L)	Total Phosphorus (mg/L)	Ortho Phosphate (mg/L)	Total Kjeldahl Nitrogen (mg/L)	Ammonia Nitrogen (mg/L)	Nitrite N (mg/L)	Nitrate N (mg/L)
2/20/2007	13:55	39	40.82	11.63	3894	6320	6.8	7	3.4				28	92	3410	37.5	0.411	0.658	0.275	7.1	1.03	0.17	0.88
3/9/2007	12:20	47	37.58	12.82	1781	3065	7.7	8	3.1				57	184	1610	23.2	0.114	0.63	0.094	7.5	0.61	0.09	0.93
3/12/2007	15:25	55	40.10	12.38	253.1	415.5	7.2	13.8	0.2														
3/13/2007	14:25	46	41.36	12.29	157.1	252.9	7.1	16.3	0.1						136	5.96	0.243		0.173		0.42	0.015	0.36
3/19/2007	13:00	34	39.20	12.52	341	570	6.9	22.2	0.3														
3/27/2007	12:45	59	44.60	11.97	621	945	7.3	61	0.5						653	36.2	0.15		0.135		0.03	0.03	0.94
3/28/2007	14:20	43	46.58	12.46	158.6	234	6.8		0.1						129	8.65	0.087		0.083		0.49	0.015	0.45
3/30/2007	10:45	45	45.32	11.78	196.4	296.3	7	20	0.1				8	36	165	10.5	0.066	0.167	0.064	1.1	0.2	0.015	0.47
4/3/2007	12:57	39.2	41.90							16001	4001	0.05											
4/11/2007	12:15	32	37.40							300	530	0.05											
4/19/2007	14:45	52	47.30	11.69	699	1020	7.8	61	0.5				2	2		42.6	0.167	0.223	0.166	2.8	0.08	0.05	1.26
5/3/2007	12:32	56	63.50							10	23	0.65											
5/14/2007	13:48	86	66.56	8.74	870	978	8.1	61	0.5						596	38.6	0.084	0.103	0.087	1.8	0.03	0.04	1.17
5/23/2007	12:45	73	60.80							20	2												
5/23/2007	13:39	70	61.88	6.19	231.3	275.2	6.6	7.7	0.1				50	256		10.4	0.027	0.433	0.013	2.8	0.27	0.16	0.48
5/29/2007	13:00	74	72.86	6.86	302.3	316	7	17	0.2							5.77	0.024	0.237		1.5	0.08	0.04	0.23
6/2/2007	15:47	58	63.86	7.94	251.8	292.4	6.9	32	0.1							7.68	0.12	0.189		1.3	0.32	0.07	0.58
6/13/2007	12:20	79	68.00							2200	350	0.79											
6/18/2007	10:03	66	71.78	6.24	171.4	181.6	7.1	21.3	0.1							5.14	0.043	0.503		2.2	0.19	0.06	0.31
6/19/2007	8:48	66	66.92	8.31	309.7	347	7.2	61	0.2							7.92	0.056	0.274		1.2	0.12	0.06	0.36
6/29/2007	11:45	80	65.12	8.84			8.2	26.6	0.5							34.6	0.332		0.214	1.1	0.04	0.015	0.82
7/3/2007	11:53	84	73.40							80	21	0.78											
7/3/2007	13:16	75	72.68	7.13	616	646	10.5		0.3							26.8	0.124	1.09		7.2	1.2	0.09	2
7/8/2007	14:51	81	75.02	6.32	143.3	146.4	7.1	10.5	0.1							9.14	0.056	0.419	0.048	1.8	0.17	0.015	0.34
7/12/2007	8:30	64	65.66	8.73	474	539	7.9	61	0.3							14.9	0.178	0.238	0.162	0.81	0.17	0.015	0.4
7/16/2007	6:48	64	67.82							16001	100000												
7/18/2007	14:21	72	73.58	6.47	123.6	128.4	7.2	8.8	0.1						98	5.72	0.083	0.321	0.025	4	0.33	0.07	0.91
7/25/2007	9:17	87	64.40	8.86	534	617	8	61	0.3				1	23	395	19.7	0.207		0.179	0.52	0.02	0.015	0.47
7/26/2007	8:55	86	69.26							5000	3200												
8/9/2007	9:05	73	72.14							230	62	1.01											
8/11/2007	2:36	88	80.78	5.68	178	171	7	25	0.1						87								
8/13/2007	22:09	77																					
8/16/2007	13:15	75	71.60	8.52	418.8	444	8.2	50	0.2				2	3	262	4.38	0.06	0.625		2.4	0.25	0.015	0.47
8/18/2007	8:52	66	63.50	8	134.3	156.7	7.4	29	0.1							4.43	0.058	0.176	0.053	0.8	0.08	0.04	0.25
8/19/2007	10:16	66	63.32	8.13	104.3	122.2	7.4	25	0.1							3.73	0.037	0.149		0.99	0.05	0.015	0.35
8/21/2007	2:04	82	72.32	7.43	142.8	150.3	7.1	19.3	0.1						69	5.53	0.053	0.152		1.2	0.3	0.04	0.42
8/21/2007	9:25	70	67.10							9000	8000	0.05											
8/23/2007	13:30	70	67.10	7.99	233.7	261	7.3	61	0.1						96	5.15	0.054	0.153		0.93	0.14	0.06	0.51
8/27/2007	1:06	71	75.02	7.49	117.5	120.1	7.3	10.5	0.1				68	334	84	5.13	0.05	0.347	0.055	1.6	0.21	0.03	0.41
8/28/2007	1:42	79	78.80	7.8	56.7	58	7.5	6.4	0				43	401	43	2.4	0.064	0.364	0.062	1.3	0.39	0.05	0.26
8/31/2007	13:35	81	73.40	7.65	581	605	8.2	61	0.3							20	0.125	0.139		0.47	0.02	0.015	1.01
9/6/2007	19:51	66	75.74	6.6	94.7	96	7	9.1	0				33	234	66	4.28	0.076	0.309	0.064	1.3	0.05	0.015	0.32
9/13/2007	10:31	61							0	500	390	0.7											
9/14/2007	11:35	55	60.98	9.53	469	565	8	61	0.3				1	3	331	17.5	0.167		0.142	0.6	0.01	0.015	0.42
9/18/2007	12:13	68	69.80								5900	0.08											
9/18/2007	5:26	57	61.88	8.15	87.7	104.4	7.5	16	0.1						77	5.57	0.041	0.219		1.3	0.12	0.04	0.21
9/20/2007	16:54	80	70.52	8.26	60.8	65.3	8.2	6.8	0							3.08	0.064	0.413	0.066	2.3	0.56	0.04	0.29
9/24/2007	16:52	59	66.74	7.57	96.2	107.8	7.5	13.7	0.1							6.2	0.05	0.218	0.04	1.1	0.09	0.015	0.34
9/26/2007	18:22	57	57.56	9.31	248.2	312.9	7.2	53	0.2							7.53	0.062	0.202	0.056	1.8	0.58	0.015	0.41
10/2/2007	11:04	53	58.28	9.68	147.2	183.6	7.2	12	0.1							8.69	0.087	0.218		1	0.06	0.015	0.34
10/5/2007	1:39	77	68.18	8.98	123.7	136.3	7	12.5	0.1							6.34	0.086	0.263	0.078	1.3	0.27	0.04	0.39
10/10/2007	11:59	54	51.8							9000	4600	0.47											
10/11/2007	13:10	54	59.54	9.63	642	788	7.8	15.3	0.4				1	1	475	36.6	0.147		0.105	1.3	0.1	0.05	1.74
10/16/2007	0:47	68	57.38	9.98	130.9	165.3	7	21	0.1						100	7.3	0.078	0.18	0.076	0.81	0.06	0.015	0.025
10/17/2007	21:49	55	55.76	9.63			7	23.5	0.1						115	6.56	0.074	0.162	0.069	0.93	0.05	0.015	0.34
10/18/2007	11:24	63	57.2							1700	2900	0.17											
10/24/2007	12:44	48	59							1300	1000	0.31											
10/26/2007	11:37	61	55.22	9.97	487	633	7.8	18.8	0.3				19	58	370	27.4	0.115	0.505	0.123	2.2	0.01	0.03	1.1

All duplicates are omitted from analysis
Red font indicates suspect data
Green font indicates value was greater than the maximum detetion limit. MDL+1 was the value used for analysis
Blue font indicates the value was below the minimum detection limit and 1/2 the MDL was used as the value for analysis
Maroon font equals approximate value. Value used for analysis was the approximate value

Table F.6 continued. Monitoring results for 10SA stormwater pipe

Date	Sample Time	Alkalinity (mg/L CaCO3)	Chloride ion (mg/L)	Hardness (mg/L CaCO3)	COD (mg/L)	Total Organic Carbon (mg/L)	Carbonaceous Biological Oxygen Demand 5-day (mg/L)	Total Biological Oxygen Demand 5-day (mg/L)	Soluble Copper (mg/L)	Total Copper (mg/L)	Soluble Nickel (mg/L)	Total Nickel (mg/L)	Soluble Lead (mg/L)	Total Lead (mg/L)	Soluble Zinc (mg/L)	Total Zinc (mg/L)	Soluble Cadmium (mg/L)	Total Cadmium (mg/L)	Soluble Chromium (mg/L)	Total Chromium (mg/L)	Mercury (ug/L)	Oil and Grease (mg/L)
2/20/2007	13:55	120	1812	236	106	17.4	16	19	0.0168	0.027	0.0049	0.0091	0.0002	0.012	0.0106	0.065	0.00002	0.00002	0.0024	0.0076		0.5
3/9/2007	12:20	40	885	88	186	12.1	10	15	0.0094	0.032	0.0027	0.01	0.0002	0.0235	0.021	0.149	0.00002	0.00002	0.0078	0.0211		13
3/12/2007	15:25		88																			2
3/13/2007	14:25	31	44	38	46	11.3	1.1	1.5														
3/19/2007	13:00		102																			
3/27/2007	12:45	179	221	238	33	5.3	2.1	3.3														0.5
3/28/2007	14:20	31	44	45	127	7.3	5.5	9.7														9
3/30/2007	10:45	39	59	64	36	4.6	1.6	2.9														0.5
4/3/2007	12:57																					
4/11/2007	12:15																					
4/19/2007	14:45	259	139	346	16	5.3	3.3	3.1														0.5
5/3/2007	12:32																					
5/14/2007	13:48	224	134	308	24	5.9	1.2	1.4	0.005	0.0053	0.005	0.005	3.5E-05	0.0001	0.0041	0.0083	0.00002	0.00002	0.001	0.0009		0.5
5/23/2007	12:45																					
5/23/2007	13:39	57	36	78	125	13.4	11	18	0.0081	0.0236	0.0029	0.0076	0.0003	0.0154	0.0088	0.089	0.00002	0.00009	0.0023	0.0082	0.029	4
5/29/2007	13:00	46	25	56	66	7.4	3.7															0.5
6/2/2007	15:47	59	41	72	54		1.9															0.5
6/13/2007	12:20																					
6/18/2007	10:03	52	20	54	124	7.8	3.9															7
6/19/2007	8:48	90	41	104	38	8.8	3.9															0.5
6/29/2007	11:45	342	97	420	26	4.2	0.5	0.5														52
7/3/2007	11:53																					
7/3/2007	13:16	130	68	200	390	39																4
7/8/2007	14:51	45	12	52	82	11.1	5.4	9.2														5
7/12/2007	8:30	190	51	224	26	7.7	2	1.9														
7/16/2007	6:48																					
7/18/2007	14:21	39	10	56	95	12	5.8	8.4														7
7/25/2007	9:17	259	41	284	13	3.4	0.5	0.5														0.5
7/26/2007	8:55																					
8/9/2007	9:05																					
8/11/2007	2:36		12		86																	3
8/13/2007	22:09	32	8	38	132	9.7																
8/16/2007	13:15	143	43	160	32	6.2	1.3	1.6														0.5
8/18/2007	8:52	58	13	48	44	7.8			0.0049	0.0086	0.0016	0.0031	0.0001	0.0022	0.0062	0.024	0.00025	0.00025	0.0029	0.0033		0.5
8/19/2007	10:16	32	11	36	49	4.8	1.5		0.0031		0.0014		0.0001		0.0045		0.00025		0.003			0.5
8/21/2007	2:04	46	12	44	36	5.6	1.4															0.5
8/21/2007	9:25																					
8/23/2007	13:30	43	14	48	38	7	1.8															0.5
8/27/2007	1:06	33	9	44	78	7.6	4.8	5.9														3
8/28/2007	1:42	20	3	34	69	5	3.3	4.6														3
8/31/2007	13:35	178	61	228	15	4.2																
9/6/2007	19:51	26	7	38	62	7.1	3	4.4														4
9/13/2007	10:31																					
9/14/2007	11:35	215	35	252	14	4.9	1.1	1.5														0.5
9/18/2007	12:13																					
9/18/2007	5:26	29	6	46	55	7.4	0.5															0.5
9/20/2007	16:54	21	5	28	69	3.9	3.2	4.5														13
9/24/2007	16:52	29	10	40	170	4.7	1.7	3.6														0.5
9/26/2007	18:22	29	13	42	75	9.6	4.8	6.1														4
10/2/2007	11:04	36	17	62	53	6	2.6		0.009		0.0038		0.0055		0.03		0.00025		0.0048			0.5
10/5/2007	1:39	39	11	46	46	5.6	3.1	5.3	0.0073		0.0037		0.0059		0.03		0.00025		0.0041			0.5
10/10/2007	11:59																					
10/11/2007	13:10	249	83	298	10	5.8	0.5															11
10/16/2007	0:47	41	14	54	37	5	2.5	4.4														2
10/17/2007	21:49	46	14	56	27	3.9	2	2.9														6
10/18/2007	11:24																					
10/24/2007	12:44																					
10/26/2007	11:37	223	41	264	38	6	4.4	7.6														0.5

All duplicates are omitted from analysis
Red font indicates suspect data
Green font indicates value was greater than the maximum detetion limit. MDL+1 was the value used for analysis
Blue font indicates the value was below the minimum detection limit and 1/2 the MDL was used as the value for analysis
Maroon font equals approximate value. Value used for analysis was the approximate value

Appendix G – I-35W Bridge Collapse Monitoring Results

Table G.1. I-35W bridge collapse monitoring results

Sample Location	Date Time	Temperature (Celcius)	Dissolved Oxygen (mg/L)	Conductivity (uS)	Specific Conductivity (uS/cm)	Transparency (cm)	pH	Salinity	Oil and Grease (mg/L)	Soluble Cadmium (mg/L)	Total Cadmium (mg/L)	Soluble Chromium (mg/L)	Total Chromium (mg/L)	Soluble Copper (mg/L)	Total Copper (mg/L)	Soluble Lead (mg/L)	Total Lead (mg/L)	Soluble Nickel (mg/L)	Total Nickel (mg/L)	Soluble Zinc (mg/L)	Total Zinc (mg/L)	Mercury (ug/L)
SP-01	8/2/07 12:50	30.2	7.13	NA	NA	49.6	8.4	NA	<1	<.0005	<.0005	0.0006	<.0005	0.0011	0.0016	<.0001	0.0007	0.0021	0.0023	0.0027	0.005	NA
SP-01	8/3/07 13:15	30.3	8.20	473.0	429.7	58.0	8.4	0.2	<1	<.0005	<.0005	0.0009	<.0005	0.0013	0.0014	<.0001	0.0005	0.0025	0.0023	0.0037	0.006	NA
SP-01	8/6/07 11:55	26.6	9.27	446.2	433.3	49.0	8.4	0.2	<1	<.0005	<.0005	<.0005	<.0005	0.0023	0.0015	<.0001	0.0003	0.0023	0.0024	0.0039	0.006	<0.012
SP-01	8/15/07 15:25	27.2	7.29	428.1	410.9	43.0	8.2	0.2	<1	<.0005	<.0005	<.0005	<.0005	0.0009	0.0015	<.0001	0.0007	0.0021	0.0022	0.0029	0.005	NA
SPMS-01*	8/24/07 12:35	23.4	10.54	418.8	431.6	>60	8.2	0.2	NA	<.0005	<.0005	<.0005	<.0005	0.0012	0.0013	<.0001	0.0003	0.0022	0.0021	0.0036	0.005	<0.024
SPMS-01	8/31/07 8:35	23.8	10.71	423.8	443.4	41.0	8.4	0.2	NA	<.0005	NA	0.0007	NA	0.001	NA	0.0005	NA	0.002	NA	0.0039	NA	<0.024
SPMS-01	9/5/07 8:55	27.3	8.45	461.4	442.0	36.8	8.4	0.2	NA	<.0005	<.0005	0.0008	0.0008	0.001	0.0016	<.0001	0.0008	0.0025	0.0025	0.0041	0.005	<0.024
SPMS-01	9/12/07 10:00	19.3	9.42	401.2	450.0	23.5	8.3	0.2	NA	<.0005	<.0005	0.0012	0.0008	0.001	0.0014	<.0001	0.0007	0.0024	0.0025	0.0036	0.004	NA
SPMS-01	9/19/07 10:25	20.7	8.64	351.2	382.8	42	8.3	0.2	<1	<.0005	<.0005	0.001	0.001	0.0014	0.0022	<.0001	0.0011	0.002	0.0023	0.0054	0.008	NA
SPMS-01	9/26/07 10:50	19.9	8.57	374.2	414.4	>60	8	0.2	3	<.0005	<.0005	<.0005	<.0005	0.001	0.0014	<.0001	0.0006	0.002	0.0023	0.0026	0.004	NA
SPMS-01	10/3/07 13:10	17.9	10.05	345.6	399.9	NA	8.1	0.2	<1	<.0005	<.0005	<.0005	<.0005	0.001	0.0012	<.0001	0.0004	0.002	0.0021	0.0082	NA	NA
SP-02	8/2/07 13:14	29.5	6.98	463.6	426.7	46.0	8.4	0.2	<1	<.0005	<.0005	0.0006	<.0005	0.0013	0.0015	<.0001	0.0004	0.0021	0.0022	0.0027	0.004	NA
SP-02	8/3/07 13:41	29.8	7.40	469.0	429.6	49.0	8.4	0.2	<1	<.0005	<.0005	0.0008	<.0005	0.0012	0.0014	<.0001	0.001	0.0027	0.0023	0.004	0.005	<0.012
SP-02	8/6/07 12:25	26.3	8.70	444.4	433.9	55.5	8.5	0.2	<1	<.0005	<.0005	<.0005	<.0005	0.0015	0.0014	<.0001	0.0002	0.0024	0.0025	0.006	0.005	<0.012
SP-02	8/15/07 15:50	27.2	7.84	426.2	409.3	43.0	8.4	0.2	3	<.0005	<.0005	<.0005	<.0005	0.001	0.0013	<.0001	0.0004	0.0021	0.0021	0.0028	0.004	NA
SPMS-02	8/24/07 12:30	23.1	10.65	418.1	433.7	52.8	8.2	0.2	NA	<.0005	<.0005	0.0006	0.0006	0.0014	0.0014	<.0001	0.0003	0.0022	0.0022	0.0036	0.005	<0.024
SPMS-02	8/31/07 8:30	23.6	10.32	432.4	444.1	36.0	8.3	0.2	NA	<.0005	<.0005	0.0005	0.0005	0.001	0.0014	<.0001	0.0007	0.0021	0.0022	0.0038	0.009	<0.024
SPMS-02	9/5/07 8:50	27.1	8.18	459.2	441.4	39.3	8.4	0.2	NA	<.0005	<.0005	0.0008	0.0007	0.001	0.0016	<.0001	0.0008	0.0022	0.0024	0.0019	0.004	<0.024
SPMS-02	9/12/07 9:55	19.2	9.38	400.4	450.3	38.0	8.2	0.2	NA	<.0005	<.0005	0.0012	0.0007	0.0009	0.0011	<.0001	0.0006	0.0024	0.0024	0.0033	0.003	NA
SPMS-02	9/19/07 10:20	20.7	8.59	356.5	388.7	38.8	8.2	0.2	<1	<.0005	<.0005	0.0011	0.0011	0.0014	0.002	0.0001	0.001	0.0021	0.0024	0.023	0.007	NA
SPMS-02	9/26/07 10:45	19.8	8.38	373.1	414.1	>60	8	0.2	<1	<.0005	<.0005	<.0005	<.0005	0.0011	0.0013	<.0001	0.0005	0.0022	0.0023	0.0034	0.004	NA
SPMS-02	10/3/07 13:06	18.0	10.18	344.3	397.6	>60	7.9	0.2	<1	<.0005	<.0005	NA	<.0005	NA	0.0012	<.0001	0.0004	NA	0.0021	NA	0.003	NA
SP-03	8/2/07 11:55	28.9	7.98	477.2	444.5	49.6	8.4	0.2	<1	<.0005	<.0005	<.0005	<.0005	0.0015	0.0015	0.0001	0.0008	0.0021	0.0023	0.0031	0.004	NA
SP-05**	8/3/07 12:35	29.0	8.68	NA	NA	51.0	8.3	NA	<1	<.0005	<.0005	0.0007	0.0005	0.0012	0.0016	<.0001	0.0009	0.0023	0.0025	0.0035	0.006	0.043
SP-03	8/4/07 12:30	27.6	7.59	471.7	449.2	51.0	8.2	0.2	82	<.0005	<.0005	<.0005	<.0005	0.0011	0.0014	<.0001	0.0006	0.0022	0.0023	0.0022	0.005	<0.012
SP-03 (Dup)	8/4/07 12:36	27.6	7.59	471.7	449.2	51.0	8.2	0.2	<1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SP-03	8/6/07 11:10	24.8	8.67	453.0	455.2	49.0	8.2	0.2	<1	<.0005	<.0005	0.0005	<.0005	0.0011	0.0014	<.0001	0.0005	0.0024	0.0025	0.0044	0.006	<0.012
SP-03	8/15/07 15:00	26.8	8.12	430.5	415.9	43.0	8.1	0.2	2	<.0005	<.0005	<.0005	<.0005	0.0014	0.0016	0.0001	0.001	0.0022	0.0022	0.0039	0.005	NA
SPMS-S4_1	8/24/07 11:40	22.4	9.76	422.4	444.1	54.2	8.0	0.2	NA	<.0005	<.0005	0.0005	0.0007	0.0012	0.0016	<.0001	0.001	0.0022	0.0023	0.0047	0.006	<0.024
SPMS-S4_1	8/31/07 12:50	23.6	9.32	443.7	456.1	39.9	8.4	0.2	NA	<.0005	<.0005	0.0005	<.0005	0.001	0.0014	<.0001	0.0009	0.0021	0.0022	0.0028	0.005	<0.024
SPMS-S4_1	9/5/07 10:40	27.0	8.51	466.4	449.5	36.4	8.3	0.2	NA	<.0005	<.0005	0.0008	0.0008	0.001	0.0015	<.0001	0.001	0.0024	0.0026	0.0029	0.004	<0.024
SPMS-S4_1 (Dup)	9/5/07 10:47	27.0	8.51	466.4	449.5	36.4	8.3	0.2	NA	<.0005	<.0005	0.0009	0.0009	0.0009	0.0015	<.0001	0.001	0.0024	0.0026	0.0021	0.004	<0.060
SPMS-S4_1	9/12/07 12:25	20.2	10.45	410.5	452.1	43.0	8.3	0.2	NA	<.0005	<.0005	0.0015	0.0009	0.0011	0.0012	<.0001	0.0007	0.0026	0.0026	0.004	0.004	NA
SPMS-S4_1	9/19/07 11:45	20.4	9.54	338.4	371	34.3	8.4	0.2	4	<.0005	<.0005	0.0013	0.0013	0.0017	0.0025	<.0001	0.0017	0.002	0.0023	0.0064	0.01	NA
SPMS-S4_1	9/26/07 12:25	20.0	9.28	381.4	421.3	49.2	8.0	0.2	8	<.0005	<.0005	<.0005	0.0005	0.0012	0.0016	<.0001	0.0008	0.0021	0.0024	0.0029	0.004	NA
SPMS-S4_1	10/3/07 11:59	17.9	10.75	352	406.9	45.9	7.9	0.2	<1	<.0005	<.0005	<.0005	0.0005	0.0012	0.0015	<.0001	0.0011	0.0021	0.0022	NA	0.005	NA
SP-04***	8/2/07 11:30	28.9	7.71	487.5	453.5	44.6	8.3	0.2	<1	<.0005	<.0005	<.0005	<.0005	0.0026	0.0021	0.0002	0.0016	0.0022	0.0023	0.0042	0.006	NA
SP-04	8/3/07 11:37	28.9	7.28	487.4	453.9	50.0	8.1	0.2	<1	<.0005	<.0005	0.0006	0.0006	0.0014	0.0019	<.0001	0.0013	0.0025	0.0027	0.0042	0.006	0.016
SP-04 (Dup)	8/3/07 11:38	28.9	7.28	487.4	453.9	50.0	8.1	0.2	<1	<.0005	<.0005	0.0008	0.0006	0.0013	0.0017	<.0001	0.0012	0.0027	0.0027	0.0046	0.006	0.014
SP-04	8/4/07 11:40	27.7	7.17	468.5	445.2	55.0	8.2	0.2	<1	<.0005	<.0005	0.0006	<.0005	0.0014	0.0013	<.0001	0.0007	0.0024	0.0023	0.004	0.004	<0.012
SP-06	8/6/07 10:00	24.7	8.66	446.7	449.0	53.0	8.2	0.2	<1	<.0005	<.0005	<.0005	<.0005	0.001	0.0015	<.0001	0.0007	0.0022	0.0031	0.0054	0.032	<0.012
SP-06 (Dup)	8/6/07 10:01	24.7	8.66	446.7	449.0	53.0	8.2	0.2	<1	<.0005	<.0005	<.0005	<.0005	0.0012	0.0015	<.0001	0.0008	0.0023	0.0026	0.0039	0.007	<0.012
SP-06	8/15/07 14:15	26.9	8.47	436.8	421.4	42.0	8.1	0.2	<1	<.0005	<.0005	<.0005	0.0005	0.0012	0.0016	<.0001	0.001	0.0022	0.0022	0.0075	0.005	NA
SP-06	8/16/07 11:00	25.9	8.37	442.4	435.1	37.5	8.3	0.2	<1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SP-06	8/20/07 11:45	21.7	8.67	408.4	435.6	49.0	7.9	0.2	<1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SPMS-N4_1	8/24/07 11:50	22.7	9.65	422.0	441.4	51.4	8.1	0.2	<1	<.0005	<.0005	0.0006	0.0007	0.0016	0.0017	<.0001	0.001	0.0022	0.0023	0.0041	0.008	<0.060
SPMS-N4_1	8/31/07 12:55	24.2	10.20	449.1	455.9	39.2	8.5	0.2	NA	<.0005	<.0005	0.0005	<.0005	0.0012	0.0013	<.0001	0.0008	0.0021	0.0022	0.0041	0.005	<0.024
SPMS-N4_1	9/5/07 10:45	26.9	8.39	465.6	449.2	33.0	8.4	0.2	NA	<.0005	<.0005	0.0009	0.0008	0.001	0.0015	<.0001	0.001	0.0025	0.0026	0.0028	0.008	<0.024
SPMS-N4_1	9/12/07 12:28	20.2	10.54	410.7	452.1	39.2	8.4	0.2	NA	<.0005	<.0005	0.0014	0.001	0.001	0.0012	<.0001	0.0006	0.0027	0.0027	0.0054	0.004	NA
SPMS-N4_1	9/19/07 11:50	20.4	9.72	335.6	368.3	38.6	8.2	0.2	<1	<.0005	<.0005	0.0013	0.0013	0.0017	0.0026	<.0001	0.002	0.0021	0.0024	0.0064	0.01	NA
SPMS-N4_1	9/26/07 12:35	20.1	9.74	382.5	421.7	51.6	8.2	0.2	<1	<.0005	<.0005	<.0005	0.0005	0.0011	0.0014	<.0001	0.0008	0.0023	0.0025	0.0033	0.004	NA
SPMS-N4_1	10/3/07 11:5																					

Table G.1 continued. I-35W bridge collapse monitoring results

Sample Location	Date Time	Total PCBs (ug/L)	Total Suspended Solids (mg/L)	Volatile Suspended Solids (mg/L)	Total Dissolved Solids (mg/L)	COD (mg/L)	CBOD 5-day (mg/L)	BOD 5-day (mg/L)	Chloride (mg/L)	Sulfate (mg/L)	Alkalinity (mg/L as CaCO3)	Hardness (mg/L as CaCO3)	Total Organic Carbon (mg/L)	Ortho Phosphate (mg/L)	Dissolved Phosphorus (mg/L)	Total Phosphorus (mg/L)
SP-01	8/2/07 12:50	NA	15	~8	261	35	2.5	3.6	18	18.3	167	186	7.9	~0.008	<0.010	0.076
SP-01	8/3/07 13:15	<0.2	9	~5	272	29	3.1	4.1	21	19.2	163	182	7.6	~0.009	NA	0.067
SP-01	8/6/07 11:55	<0.2	11	7	273	33	2.3	3.4	20	19.6	165	192	6.9	0.016	NA	0.07
SP-01	8/15/07 15:25	<0.2	17	~7	256	32	1.9	2.6	24	18.6	145	178	6.6	0.014	~0.016	0.119
SPMS-01*	8/24/07 12:35	NA	10	7	247	NA	NA	NA	NA	NA	NA	184	NA	NA	NA	NA
SPMS-01	8/31/07 8:35	NA	16	~9	260	NA	NA	NA	NA	NA	NA	186	NA	NA	NA	NA
SPMS-01	9/5/07 8:55	NA	22	~10	255	NA	NA	NA	NA	NA	NA	188	NA	NA	NA	NA
SPMS-01	9/12/07 10:00	NA	19	9	272	NA	NA	NA	NA	NA	NA	196	NA	NA	NA	NA
SPMS-01	9/19/07 10:25	NA	19	7	224	NA	NA	NA	NA	NA	NA	162	NA	NA	NA	NA
SPMS-01	9/26/07 10:50	NA	15	6	244	NA	NA	NA	NA	NA	NA	178	NA	NA	NA	NA
SPMS-01	10/3/07 13:10	NA	10	4	253	NA	NA	NA	NA	NA	NA	186	NA	NA	NA	NA
SP-02	8/2/07 13:14	NA	~9	~6	263	35	2.6	2.2	19	18.5	168	186	7.9	<0.005	~0.013	0.069
SP-02	8/3/07 13:41	<0.2	8	~5	267	30	2.9	4.1	21	20.1	164	182	7.6	~0.006	NA	0.062
SP-02	8/6/07 12:25	NA	7	~5	278	29	2.1	3	20	36.1	168	192	7.3	0.014	NA	0.075
SP-02	8/15/07 15:50	<0.2	13	~7	262	30	1.7	2.5	25	18.2	140	172	7	0.012	~0.012	0.081
SPMS-02	8/24/07 12:30	NA	10	6	249	NA	NA	NA	NA	NA	NA	186	NA	NA	NA	NA
SPMS-02	8/31/07 8:30	NA	17	~8	275	NA	NA	NA	NA	NA	NA	196	NA	NA	NA	NA
SPMS-02	9/5/07 8:50	NA	22	~10	264	NA	NA	NA	NA	NA	NA	188	NA	NA	NA	NA
SPMS-02	9/12/07 9:55	NA	18	9	276	NA	NA	NA	NA	NA	NA	198	NA	NA	NA	NA
SPMS-02	9/19/07 10:20	NA	20	7	224	NA	NA	NA	NA	NA	NA	164	NA	NA	NA	NA
SPMS-02	9/26/07 10:45	NA	15	6	244	NA	NA	NA	NA	NA	NA	180	NA	NA	NA	NA
SPMS-02	10/3/07 13:06	NA	14	5	256	NA	NA	NA	NA	NA	NA	176	NA	NA	NA	NA
SP-03	8/2/07 11:55	NA	~11	~6	269	34	3.1	3.9	21	19.6	167	192	8	0.011	<0.010	0.072
SP-05**	8/3/07 12:35	<0.2	9	~5	274	31	2.5	3.6	22	20.3	170	198	7.6	0.011	NA	0.078
SP-03	8/4/07 12:30	<0.2	11	~5	287	60	1.3	2.1	22	20	166	192	7.2	0.015	NA	0.066
SP-03 (Dup)	8/4/07 12:36	<0.2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SP-03	8/6/07 11:10	<0.2	13	6	282	28	1.7	2.6	23	20.4	171	200	7.1	0.021	NA	0.08
SP-03	8/15/07 15:00	<0.2	17	~8	268	28	1.6	2.6	27	19.6	143	170	6.6	<0.005	~0.045	0.094
SPMS-S4_1	8/24/07 11:40	NA	13	6	252	NA	NA	NA	NA	NA	NA	186	NA	NA	NA	NA
SPMS-S4_1	8/31/07 12:50	NA	16	~9	274	NA	NA	NA	NA	NA	NA	194	NA	NA	NA	NA
SPMS-S4_1	9/5/07 10:40	NA	22	~10	273	NA	NA	NA	NA	NA	NA	194	NA	NA	NA	NA
SPMS-S4_1 (Dup)	9/5/07 10:47	NA	22	~10	250	NA	NA	NA	NA	NA	NA	190	NA	NA	NA	NA
SPMS-S4_1	9/12/07 12:25	NA	16	9	259	NA	NA	NA	NA	NA	NA	192	NA	NA	NA	NA
SPMS-S4_1	9/19/07 11:45	NA	19	7	222	NA	NA	NA	NA	NA	NA	158	NA	NA	NA	NA
SPMS-S4_1	9/26/07 12:25	NA	18	7	247	NA	NA	NA	NA	NA	NA	186	NA	NA	NA	NA
SPMS-S4_1	10/3/07 11:59	NA	17	5	255	NA	NA	NA	NA	NA	NA	178	NA	NA	NA	NA
SP-04***	8/2/07 11:30	NA	15	~8	274	32	2.4	3.1	23	20.2	164	192	7.9	0.01	<0.010	0.076
SP-04	8/3/07 11:37	<0.2	16	~6	286	32	2.3	3.4	24	20.7	173	202	7.6	0.012	NA	0.081
SP-04 (Dup)	8/3/07 11:38	<0.2	14	~6	291	30	2.3	3.4	24	20.3	174	190	7.7	0.011	NA	0.072
SP-04	8/4/07 11:40	NA	10	~4	277	64	1.2	2.1	22	20.4	171	190	6.9	0.014	NA	0.069
SP-06	8/6/07 10:00	<0.2	14	~8	282	39	2.1	3.1	22	20	171	190	7.1	0.017	NA	0.095
SP-06 (Dup)	8/6/07 10:01	NA	16	9	287	28	2	2.9	22	28.3	167	194	7.1	0.016	NA	0.11
SP-06	8/15/07 14:15	<0.2	16	~8	267	28	1.9	3	28	19.8	142	170	6.6	0.013	~0.015	0.089
SP-06	8/16/07 11:00	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SP-06	8/20/07 11:45	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SPMS-N4_1	8/24/07 11:50	NA	14	6	253	NA	NA	NA	26	NA	NA	186	NA	NA	NA	NA
SPMS-N4_1	8/31/07 12:55	NA	17	~9	269	NA	NA	NA	NA	NA	NA	190	NA	NA	NA	0.078
SPMS-N4_1	9/5/07 10:45	NA	21	~10	283	NA	NA	NA	NA	NA	NA	192	NA	NA	NA	NA
SPMS-N4_1	9/12/07 12:28	NA	16	9	267	NA	NA	NA	NA	NA	NA	202	NA	NA	NA	NA
SPMS-N4_1	9/19/07 11:50	NA	17	6	211	NA	NA	NA	NA	NA	NA	156	NA	NA	NA	NA
SPMS-N4_1	9/26/07 12:35	NA	19	7	247	NA	NA	NA	NA	NA	NA	186	NA	NA	NA	NA
SPMS-N4_1	10/3/07 11:55	NA	16	6	246	NA	NA	NA	NA	NA	NA	180	NA	NA	NA	0.092

NA = Not Analyzed

~ indicates an approximate value

*SPMS-01 and SPMS-02 are taken mid-river at the SP-01 and SP-02 locations, respectively. SPMS-S4_1 and SPMS-N4_1 are taken mid-river just downstream of the Washington Avenue bridge

**SP-05 is an alternate location (further downstream) for SP-03 because we were not allowed access to SP-03.

***SP-04 and SP-06 are east bank, downstream samples. SP-06 is the preferred site but it was difficult to gain access due to security.

Table G.1 continued. I-35W bridge collapse monitoring results

Sample Location	Date Time	Ammonia Nitrogen (mg/L)	Nitrate N (mg/L)	Nitrite N (mg/L)	Dissolved Kjeldahl Nitrogen (mg/L)	Total Kjeldahl Nitrogen (mg/L)	E. Coli (mpn/100 ml)	Fecal Coliform (mpn/100 mL)
SP-01	8/2/07 12:50	~0.02	<0.05	<0.03	0.63	0.86	150	300
SP-01	8/3/07 13:15	~0.03	<0.05	<0.03	NA	0.79	43	NA
SP-01	8/6/07 11:55	<0.02	<0.05	<0.03	NA	0.94	60	170
SP-01	8/15/07 15:25	<0.02	<0.05	<0.03	NA	1.1	NA	NA
SPMS-01*	8/24/07 12:35	NA	NA	NA	NA	NA	NA	NA
SPMS-01	8/31/07 8:35	NA	NA	NA	NA	NA	NA	NA
SPMS-01	9/5/07 8:55	NA	NA	NA	NA	NA	NA	NA
SPMS-01	9/12/07 10:00	NA	NA	NA	NA	NA	NA	NA
SPMS-01	9/19/07 10:25	NA	NA	NA	NA	NA	NA	NA
SPMS-01	9/26/07 10:50	NA	NA	NA	NA	NA	NA	NA
SPMS-01	10/3/07 13:10	NA	NA	NA	NA	NA	NA	NA
SP-02	8/2/07 13:14	~0.02	<0.05	<0.03	0.72	0.82	230	800
SP-02	8/3/07 13:41	~0.03	<0.05	<0.03	NA	0.75	82	NA
SP-02	8/6/07 12:25	~0.02	<0.05	<0.03	NA	0.92	78	230
SP-02	8/15/07 15:50	<0.02	<0.05	<0.03	NA	0.94	NA	NA
SPMS-02	8/24/07 12:30	NA	NA	NA	NA	NA	NA	NA
SPMS-02	8/31/07 8:30	NA	NA	NA	NA	NA	NA	NA
SPMS-02	9/5/07 8:50	NA	NA	NA	NA	NA	NA	NA
SPMS-02	9/12/07 9:55	NA	NA	NA	NA	NA	NA	NA
SPMS-02	9/19/07 10:20	NA	NA	NA	NA	NA	NA	NA
SPMS-02	9/26/07 10:45	NA	NA	NA	NA	NA	NA	NA
SPMS-02	10/3/07 13:06	NA	NA	NA	NA	NA	NA	NA
SP-03	8/2/07 11:55	<0.02	<0.05	<0.03	0.83	0.93	190	270
SP-05**	8/3/07 12:35	~0.02	<0.05	<0.03	NA	0.75	47	NA
SP-03	8/4/07 12:30	~0.05	<0.05	<0.03	NA	0.73	36	NA
SP-03 (Dup)	8/4/07 12:36	NA	NA	NA	NA	NA	NA	NA
SP-03	8/6/07 11:10	~0.04	0.06	<0.03	NA	0.79	110	230
SP-03	8/15/07 15:00	<0.02	<0.05	<0.03	NA	1	NA	NA
SPMS-S4_1	8/24/07 11:40	NA	NA	NA	NA	NA	NA	NA
SPMS-S4_1	8/31/07 12:50	NA	NA	NA	NA	NA	NA	NA
SPMS-S4_1	9/5/07 10:40	NA	NA	NA	NA	NA	NA	NA
SPMS-S4_1 (Dup)	9/5/07 10:47	NA	NA	NA	NA	NA	NA	NA
SPMS-S4_1	9/12/07 12:25	NA	NA	NA	NA	NA	NA	NA
SPMS-S4_1	9/19/07 11:45	NA	NA	NA	NA	NA	NA	NA
SPMS-S4_1	9/26/07 12:25	NA	NA	NA	NA	NA	NA	NA
SPMS-S4_1	10/3/07 11:59	NA	NA	NA	NA	NA	NA	NA
SP-04***	8/2/07 11:30	~0.02	<0.05	<0.03	0.74	0.83	290	300
SP-04	8/3/07 11:37	~0.05	<0.05	<0.03	NA	0.85	43	NA
SP-04 (Dup)	8/3/07 11:38	~0.04	<0.05	<0.03	NA	0.82	46	NA
SP-04	8/4/07 11:40	~0.04	<0.05	<0.03	NA	0.72	27	NA
SP-06	8/6/07 10:00	~0.02	<0.05	<0.03	NA	1.1	150	300
SP-06 (Dup)	8/6/07 10:01	<0.02	<0.05	<0.03	NA	1.5	130	230
SP-06	8/15/07 14:15	<0.02	0.07	<0.03	NA	0.86	NA	NA
SP-06	8/16/07 11:00	NA	NA	NA	NA	NA	NA	NA
SP-06	8/20/07 11:45	NA	NA	NA	NA	NA	NA	NA
SPMS-N4_1	8/24/07 11:50	NA	NA	NA	NA	NA	NA	NA
SPMS-N4_1	8/31/07 12:55	NA	NA	NA	NA	0.87	NA	NA
SPMS-N4_1	9/5/07 10:45	NA	NA	NA	NA	NA	NA	NA
SPMS-N4_1	9/12/07 12:28	NA	NA	NA	NA	NA	NA	NA
SPMS-N4_1	9/19/07 11:50	NA	NA	NA	NA	NA	NA	NA
SPMS-N4_1	9/26/07 12:35	NA	NA	NA	NA	NA	NA	NA
SPMS-N4_1	10/3/07 11:55	NA	NA	NA	NA	0.99	NA	NA

NA = Not Analyzed
~ indicates an approximate value
*SPMS-01 and SPMS-02 are taken mid-river at the SP-01 and SP-02 locations, respectively. SPMS-S4_1 and SPMS-N4_1 are taken mid-river just downstream of the Washington Avenue bridge.
**SP-05 is an alternate location (further downstream) for SP-03 because we were not allowed access to SP-03.
***SP-04 and SP-06 are east bank, downstream samples. SP-06 is the preferred site but it was difficult to gain access due to security.