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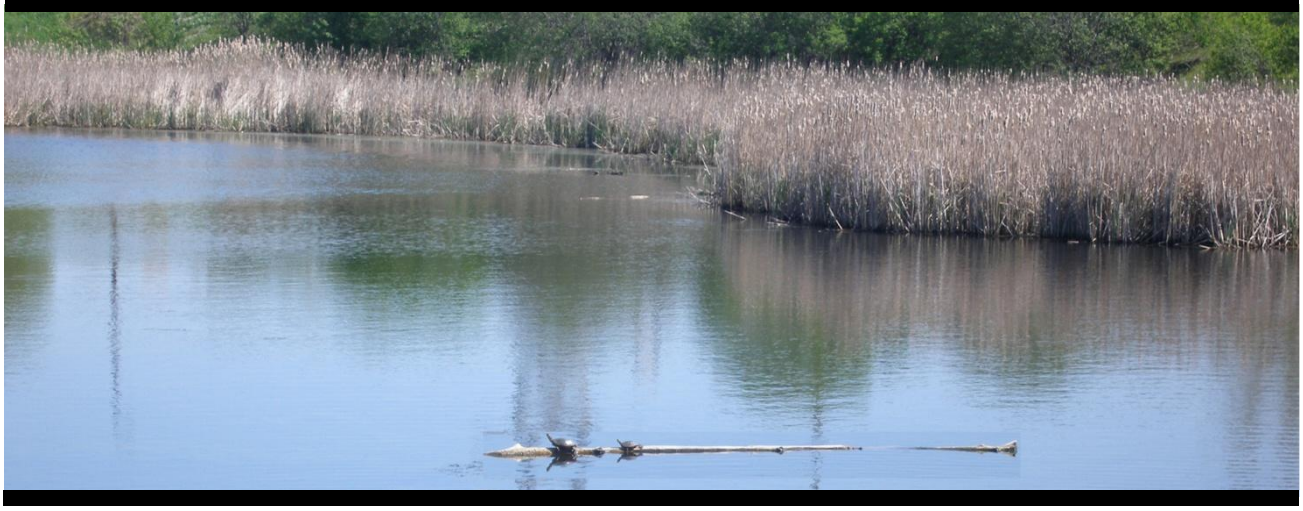
MISSISSIPPI WATERSHED MANAGEMENT ORGANIZATION

Annual Monitoring Report 2008



MWMO Watershed Bulletin: 2010-1

Annual Monitoring Report 2008

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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.

■ ■ ■

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Front Cover:
Kasota Ponds, a wetland in Saint Paul. In 2008, the MWMO began monitoring water quality in Kasota Ponds. *Photographs by B. Jastram (top) and A. Bruwelheide (bottom), 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.

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MISSISSIPPI WATERSHED MANAGEMENT ORGANIZATION

Annual Monitoring Report 2008

MWMO Watershed Bulletin: 2010-1

Abstract

In 2008, The Mississippi Watershed Management Organization (MWMO) continued monitoring in the Mississippi River, Loring Pond, and stormwater outfalls to the Mississippi River. In addition, monitoring locations were added in the Kasota Ponds wetlands. 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. The Minnesota Pollution Control Agency has moved from a fecal coliform standard to an *E. coli* standard, therefore all fecal coliform impairments are now evaluated with *E. coli* data. *E. coli* concentrations exceeded Minnesota water quality standards during the months of June, September, and October in 2008. 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, *E. coli* concentrations exceeded Minnesota water quality standards June through September in 2008. 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.

The MWMO continued monitoring stormwater in 2008. There are no water quality standards for stormwater so, rather than comparing to standards, stormwater drainage results are presented in the report.The MPCA wetlands' water quality criteria indicate that wetland water quality should maintain background. Background water quality has not yet been determined for MWMO wetlands.

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Executive Summary

This report details the results of the Mississippi Watershed Management Organization's (MWMO) 2008 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, Loring Pond, and Kasota Ponds (wetlands). 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 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 2008 monitoring season included collection of water quality samples from six locations in the Mississippi River, one in Loring Pond, five stormwater outfalls to the Mississippi River, one stormwater pipe at the jurisdictional boundary of Saint Anthony Village and Minneapolis, and seven locations in the three wetlands known as Kasota Ponds. The MWMO had a total of four automated stormwater monitoring sites in 2008.

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. The Minnesota Pollution Control Agency has moved from a fecal coliform standard to an *E. coli* standard, therefore all fecal coliform impairments are now evaluated with *E. coli* data. *E. coli* concentrations exceeded Minnesota water quality standards in 2008 during the months of June, September, and October. Long-term monitoring of the river and stormwater outfalls to the river is necessary to evaluate *E. coli* inputs from within the watershed compared to those inputs from upstream sources.

E. coli concentrations in Loring Pond exceeded Minnesota water quality standards from June through September of 2008. 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.

The MWMO continued monitoring stormwater in 2008. Water quality standards do not exist for stormwater, therefore data were not compared to standards but 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 MWMO began monitoring wetlands in 2008. The MWMO monitors three wetlands: Kasota Pond North, Kasota Pond East (Mallard Marsh), and Kasota Pond West. The Kasota Ponds drainage area is urbanized with industrial and commercial land uses. The Kasota Ponds are located near the intersection of Highway 280 and Kasota Avenue. Samples are collected for nutrients, sediment, inorganics, and metals analyses. The MPCA water quality criteria indicate that wetland water quality should maintain background. Background water quality has not yet been determined for MWMO wetlands.

Introduction

This report details the results of the Mississippi Watershed Management Organization's (MWMO) 2008 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 and implementing solutions to improve water quality and reestablish natural water regimes in the watershed. The objectives of the program are to:

- 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/or agencies, both inside and outside the watershed boundaries, to improve water quality in the Mississippi River
- Assess land use impacts on water quality

The 2008 monitoring season included collection of water quality samples from six locations in the Mississippi River, one in Loring Pond, six stormwater sites, and seven wetland sites in the Kasota Ponds. (Refer to Figures A.1 and A.2. in Appendix A for the monitoring locations.) Descriptions of the sampling sites are found in the MWMO 2005 Annual Monitoring Report (2006) and Annual Monitoring Report 2007 (2009) at **www.mwmo.org**.

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 in that 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 waterbodies 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 with commercial, industrial, residential, park lands, and downtown Minneapolis land uses contributing 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 from 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's 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's 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 2008, the MWMO examined water quality from four types of locations: rivers, lakes, stormwater, and wetlands. River and lake samples were collected in the Mississippi River and Loring Pond. Stormwater outfall samples were 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. Wetland samples were collected from the Kasota Ponds in St. Paul. Mississippi River and Loring Pond samples were collected between April and October, while stormwater samples were collected between March and October. Wetland samples were collected between March and November. 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 250mL plastic bottles. Collection occurred away from shore, in approximately three feet of water. For the river water collection, 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 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.

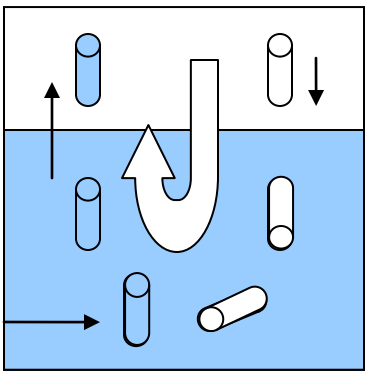

Figure 1. Diagram of sample collection method

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.

Dissolved oxygen, conductivity, salinity, and temperature were collected using a YSI 85 meter (YSI Inc., Yellow Springs, OH). The meter probe was placed in the water approximately one foot below the surface. Data were recorded when the values stabilized. Data for pH were collected using an ISFET pH meter (Hach Company, Loveland, CO). These data were collected by placing the pH meter in the surface of the water.

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

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 either a one gallon plastic bottle or the two gallon sample bottle mounted on the end of a telescoping pole. When the one gallon bottle was used, it 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. When possible, samples were collected directly into the two gallon plastic bottle with the automatic sampler. The sample 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. The same automatic sampler was also installed at 7LSTU in August. 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) that 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. Samples at 6UMN were collected on a time-paced basis until October 14 and then on a flow-paced basis for the remainder of the year. 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.

Stormwater 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.

Dissolved oxygen, conductivity, salinity, temperature, and pH were collected using the same equipment listed in the previous section. However,

the data were collected in the two gallon bottle rather than directly in the stormwater drainage system.

Stormwater samples were collected for a maximum of three precipitation events per month. If baseflow conditions were present, samples were collected twice per month during baseflow.

The MWMO contracted with the University of Minnesota Saint Anthony Falls Laboratory (SAFL) staff to design and implement a real-time monitoring network at the stormwater sites. The network was designed to provide instantaneous data about stormwater level, velocity and flow, and precipitation, as well as automated sample collection. The data was available instantly from any computer, allowing MWMO staff to respond more quickly to sample collection and equipment failures. The network used radios to link six automatic water samplers to the internet, enabling the MWMO staff to view stormwater data, automated sample collection, and rainfall from the office. Radios were located at two additional locations—the SAFL roof and the Moos Tower roof on the University of Minnesota's East Bank campus—to provide line-of-sight communication between all of the monitoring sites. Refer to Figure A.3 in Appendix A for the real-time monitoring network.

Equipment for the real-time monitoring network included the area velocity meters and automatic samplers described previously, dataloggers, antennas, and radios to send data to a central location. All data was stored at SAFL. As previously described, the area velocity meters provided stormwater level and velocity readings to the automatic samplers. The automatic samplers stored these readings and calculated the volume of water that flowed past the sensors.

MWMO staff installed a CR800 Measurement and Control Datalogger (Campbell Scientific, Inc., Logan, UT) at each stormwater monitoring location. The datalogger retrieved data from the automatic sampler. Data were then transmitted via RF450 Spread Spectrum Radios (Campbell Scientific, Inc., Logan, UT) and Yagi or Omnidirectional antennas (Campbell Scientific, Inc., Logan, UT) to an NL100 Network Link Interface (Campbell Scientific, Inc., Logan, UT). The NL100 allowed communication between the dataloggers and a network-linked computer in order to store the logged data in a useable data file. Vista Data Vision software (Vista Engineering, Reykjavik, Iceland) displayed the data on webpages in graphical and tabular form so it could be viewed in real time.

Kasota Ponds

Grab samples were collected from seven locations in the Kasota Ponds wetlands. Samples were collected in lab-sterilized 250mL plastic bottles. Collection occurred away from shore in approximately three feet of water. Samples were collected in laboratory cleansed (non-sterile) two gallon plastic bottles. To collect samples, the monitoring technician plunged an opened, inverted bottle one foot below the water surface, turned it upward to fill, and brought it out of the water. The technician then poured some of the sample out to provide headspace for the laboratory.

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.

Dissolved oxygen, conductivity, salinity, temperature, and pH were collected using the same methodology as stormwater samples.

Kasota Ponds samples were collected one time each month, March through November.

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.

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 (2007) 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 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 determines surface runoff and is arguably the greatest factor controlling surface water quality. As stated in Background, water quality in the MWMO's 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 and 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.

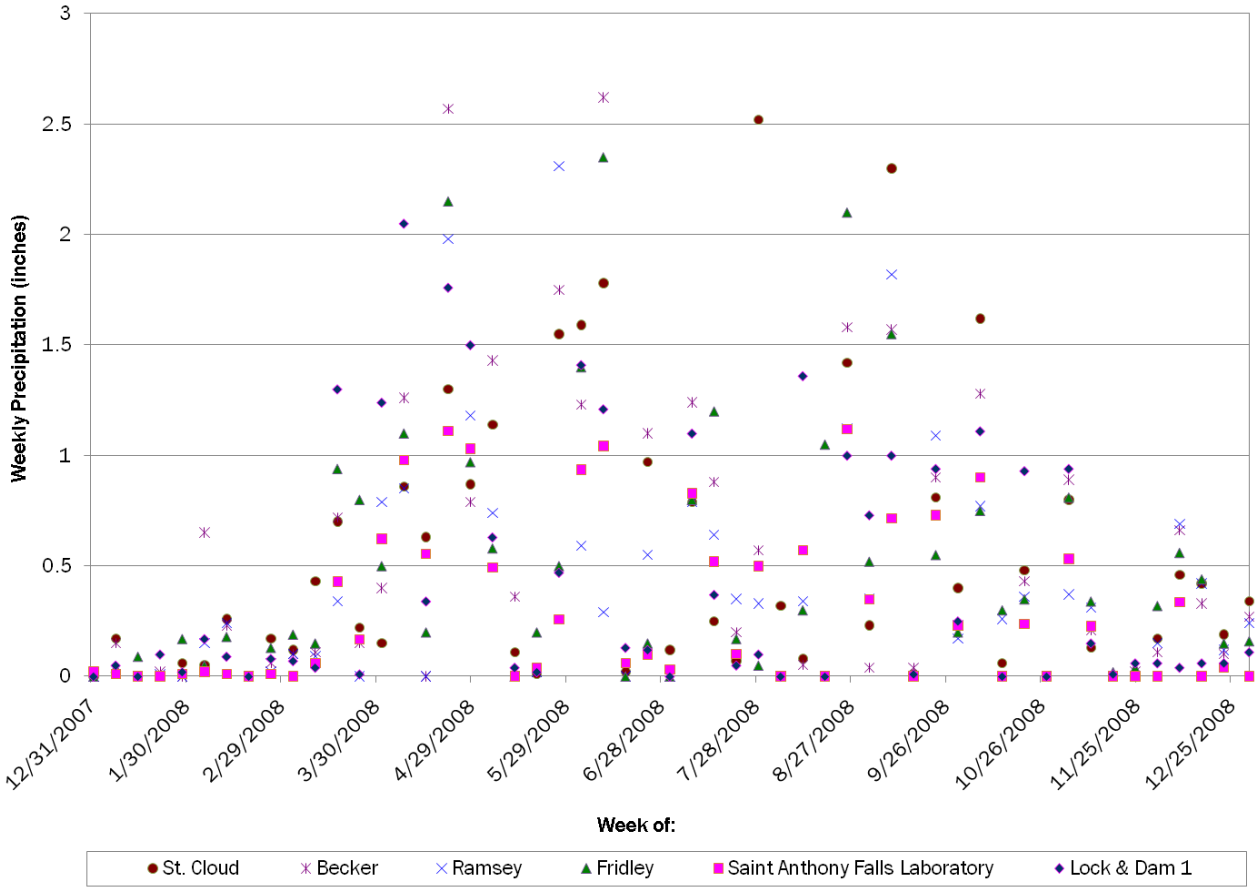

Figure 2. Precipitation for six locations along the Mississippi River

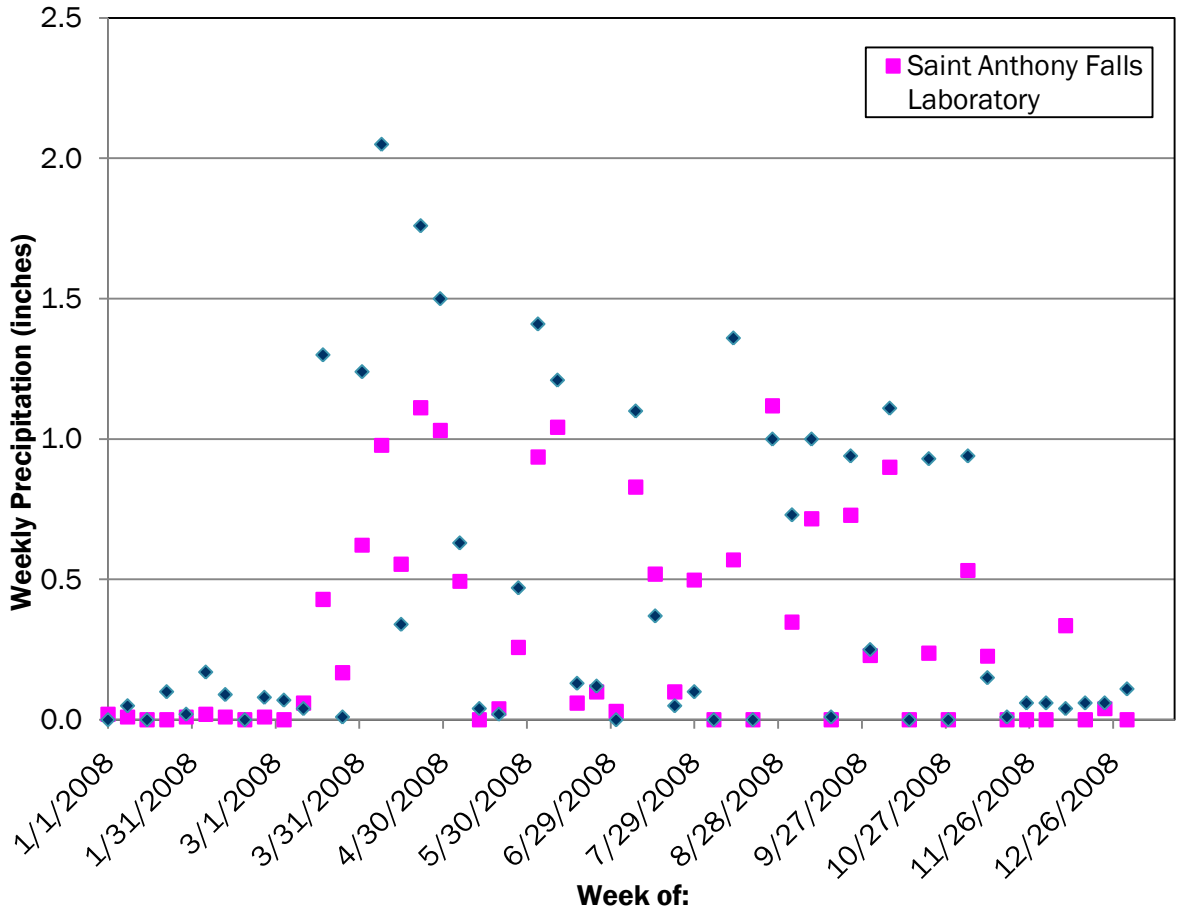

Figure 3. Precipitation for two locations in the MWMO watershed

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 Elevation

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.

The river pools behind the dams, therefore control activities at the dam cause changes in river elevation even in the absence of precipitation. River elevations for the six MWMO monitoring locations on the Mississippi River are shown in Figures 4 and 5.

The MWMO previously reported water levels as stage data recorded from a staff gauge that was installed and removed from the river each year. This prevented comparison of data between years. In 2009, the MWMO contracted with Bonestroo, Inc. (Bonestroo) to establish MWMO benchmarks at each monitoring site and survey them into benchmarks established by the Minnesota Department of Transportation. Bonestroo also surveyed the new MWMO benchmarks into the old benchmarks so stage data from previous years could be transformed into water elevations. All water elevations were obtained using North American Vertical Datum, 1988 (NAVD88).

Time periods with missing data are the result of either high water levels (the staff gauges were submerged underwater) or low water levels (the staff gauges were located in the dry riverbed).

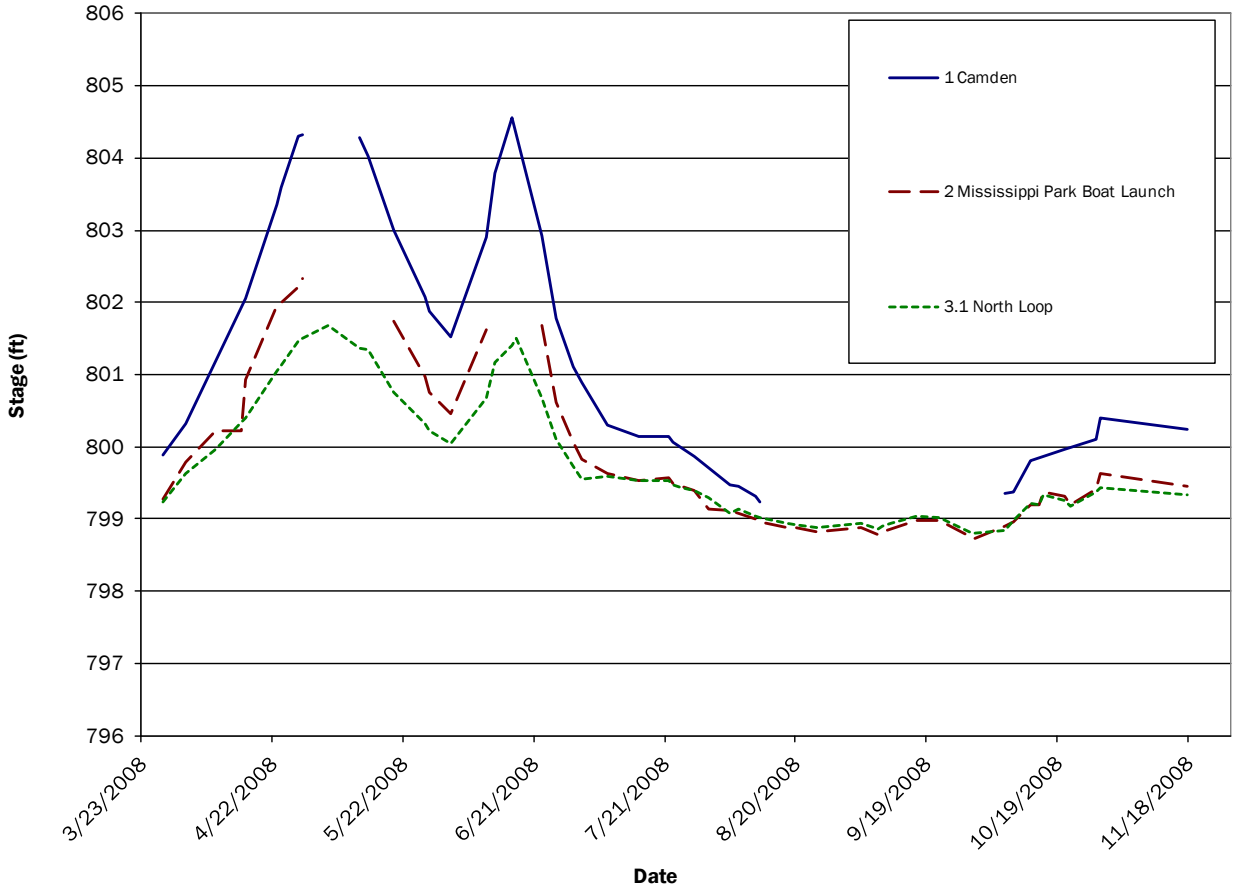

Figure 4. Mississippi River water level upstream of Saint Anthony Falls

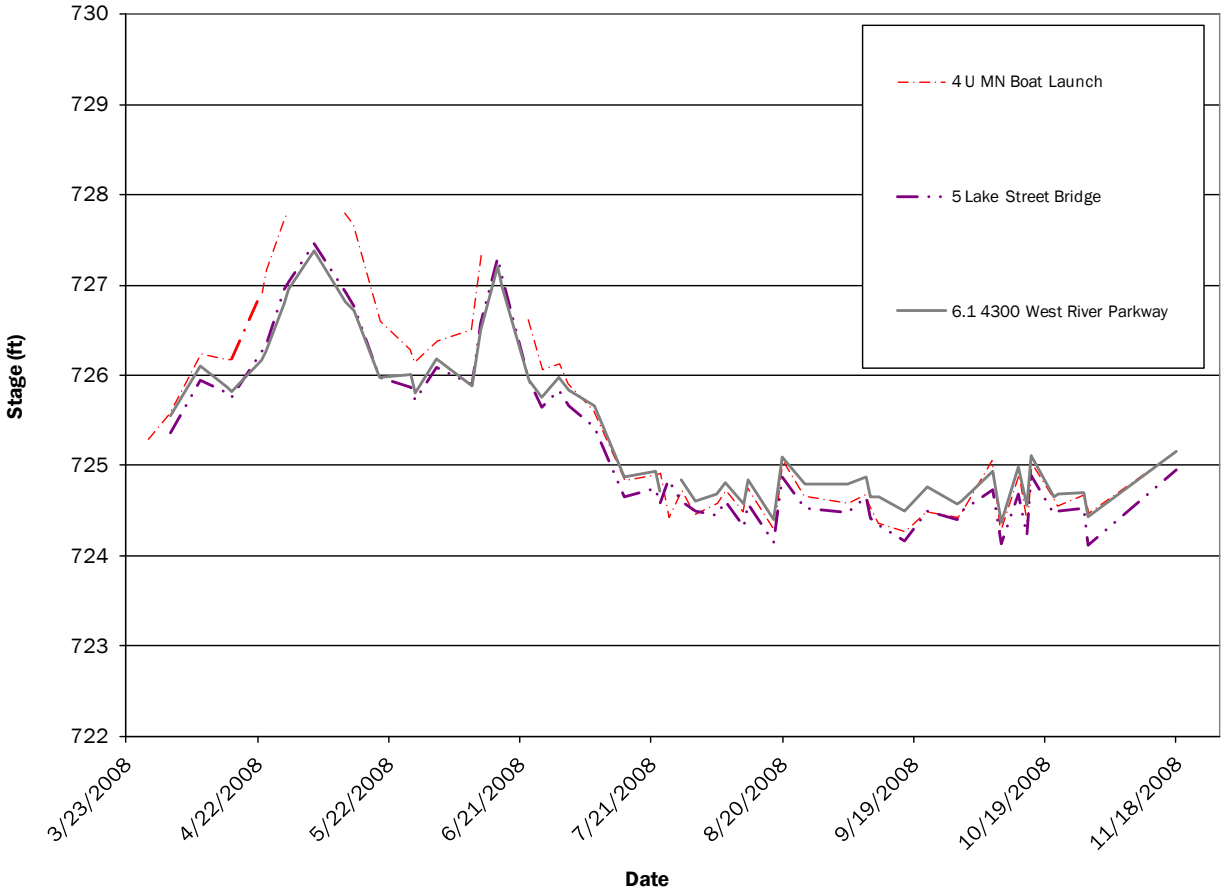

Figure 5. Mississippi River water level downstream of Saint Anthony Falls

Monitoring Results

E. coli

As noted under Background, the MWMO's reach of the Mississippi River is listed as an impaired water for fecal coliform pollution. In 2008, the MPCA changed the bacteria water quality standard from fecal coliform to *E. coli* for bacteria monitoring in Minnesota. The standard for *E. coli* in 2B and 2Bd waters is 126 CFU/100mL for a monthly geomean of at least five samples. The geomean is equal to the nth root of the product of the n terms:

$$Geomean_{\bar{y}} = \sqrt[n]{y_1 y_2 y_3 \ldots y_n}$$

Sites 2 and 5 exceeded the *E. coli* standard in September and October (Figure 6). The *E. coli* concentrations are shown in Appendix D.

The MPCA *E. coli* standard also states that *E. coli* cannot exceed 1260 CFU/100mL in more than 10% of the samples taken in one month. Sites 2, 4, 5, and 6.1 exceeded this standard in various months. Table 3 presents a summary of *E. coli* exceedances. The *E. coli* concentrations for each sample collected are shown in Appendix C.

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.

Two additional factors should be considered when evaluating these results. First, these results are based on a maximum of nine 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.

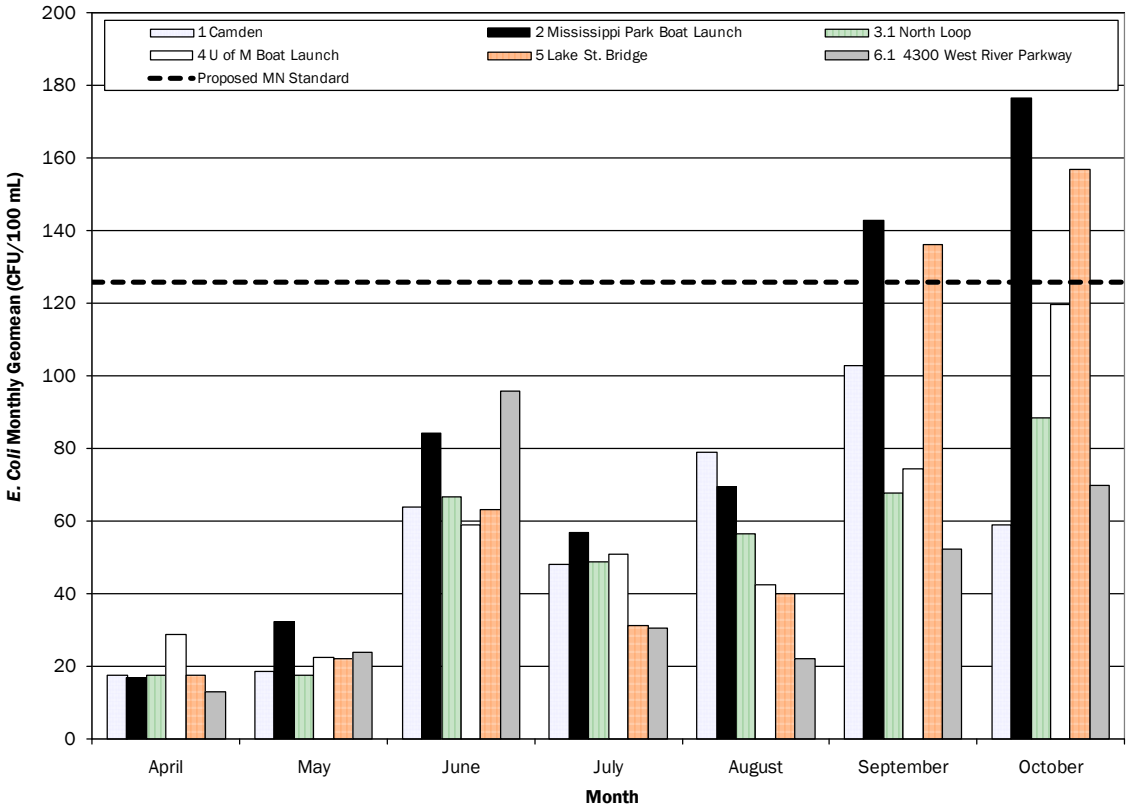

Figure 6. E. coli monthly geomeans for the Mississippi River monitoring sites

Table 3. Sites that exceeded the monthly *e. coli* geomean for the Mississippi River

Month	Sites that exceed monthly geomean	Sites that exceed 1260 CFU/100 mL in > 10% of samples	Sites that do not exceed the standards
April	None	None	All
May	None	None	All
June	None	6.1	1, 2, 3.1, 4, 5
July	None	None	All
August	None	5	1, 2, 3.1, 4, 6.1
September	2, 5	5	1, 3.1, 4, 6.1
October	2, 5	2, 4, 5	1, 3.1, 6.1

Dissolved Oxygen, pH, Transparency, and Specific Conductivity

The MWMO monitored dissolved oxygen, pH, transparency, and specific conductivity on a weekly basis throughout the 2008 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 C 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 2008 sampling season are shown in Figure 7. Water levels were based upon a selected benchmark of 100 feet.

Monitoring Results

E. coli

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 MPCA standard June through September (Figure 8). The *E. coli* results are highly dependent on precipitation, therefore results may differ drastically from year to year.

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 9 exhibits the dissolved oxygen, pH, transparency, and specific conductivity data for Loring Pond.

Stormwater

The MWMO monitored five stormwater outfalls into the Mississippi River and one stormwater pipe at the jurisdictional boundary of Saint Anthony Village and Minneapolis. The monitored outfalls were chosen because they are the most extensive drainage systems within the watershed, and because they are accessible. Refer to Figure A.1 in Appendix A for the outfall locations. Refer to the 2005 Annual Monitoring Report (MWMO, 2006) and the Annual Monitoring Report 2007 (MWMO, 2009) for site descriptions for the stormwater monitoring sites. 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 industrial and residential land uses. A future objective of the monitoring program is to investigate the impact of specific land uses on water quality. Refer to the Annual Monitoring Report 2007 (MWMO, 2009) for land uses in the watershed.

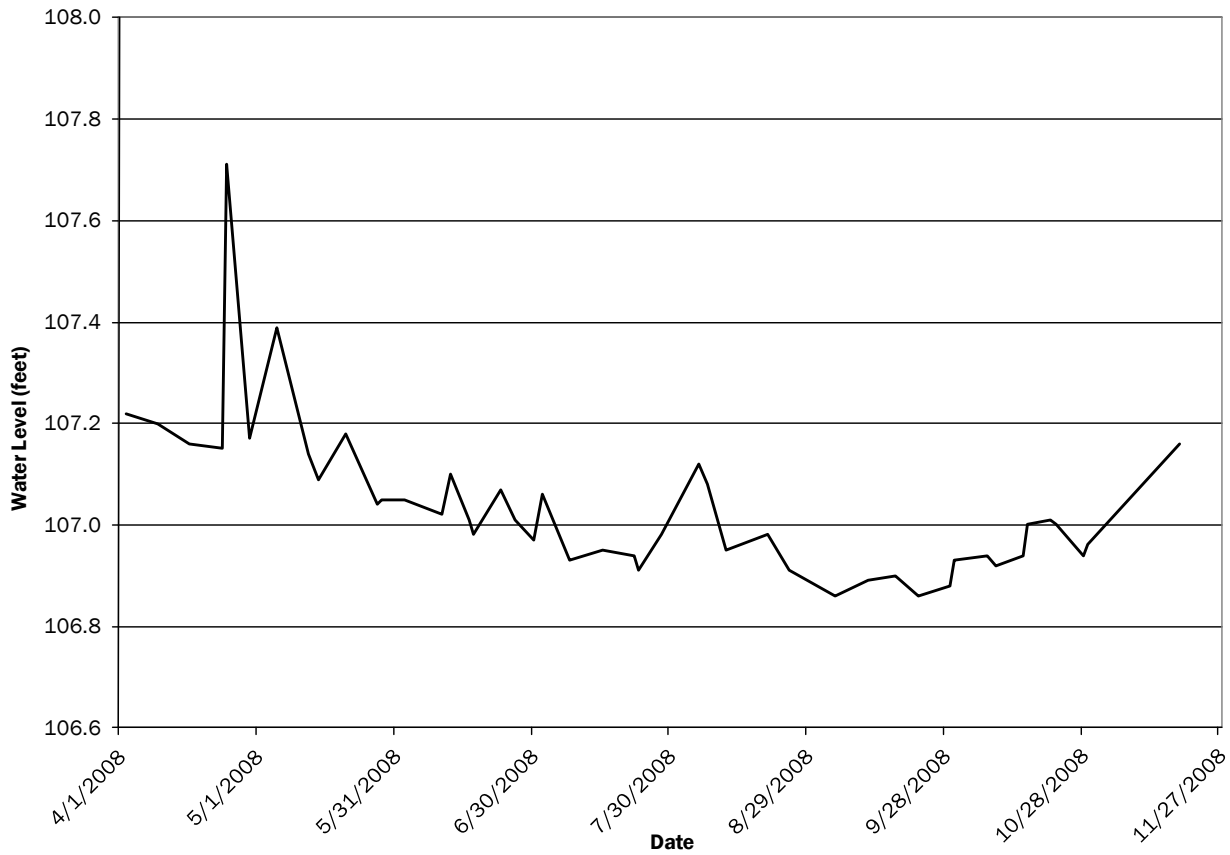

Figure 7. Loring Pond water level data based on a 100-foot benchmark

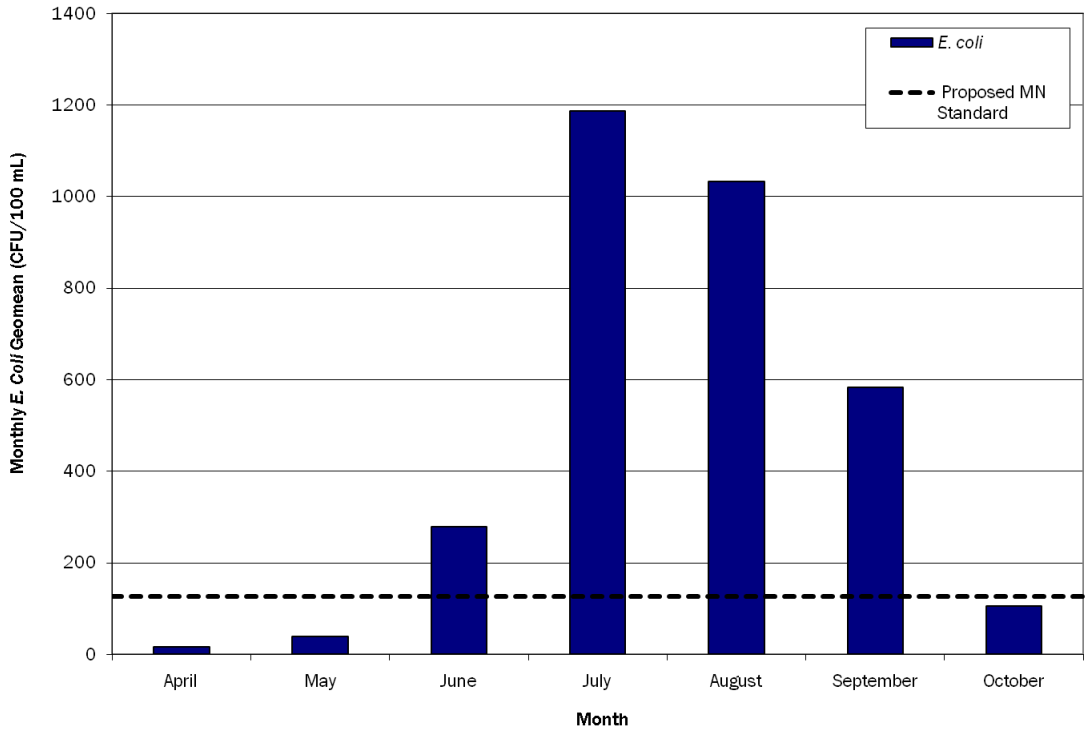

Figure 8. E. coli monthly geomeans for Loring Pond

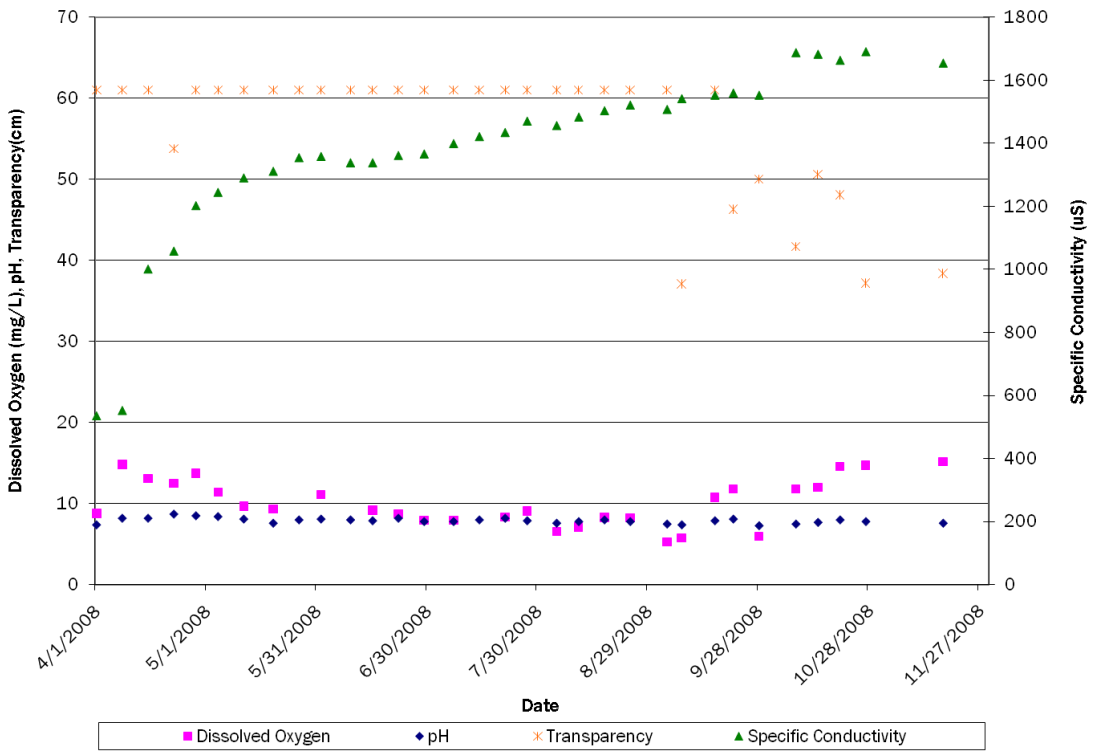

Figure 9. Dissolved oxygen, pH, transparency, and specific conductivity for Loring Pond

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, so 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 D.1 – D.6 in Appendix D. Water level data collected with the automated equipment are presented in Figures 10 –12. Automated data for 7LSTU are not included, as the data were not accurate due to Mississippi River tailwater in the stormwater tunnel.

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

The MPCA does not have water quality criteria for stormwater drainage systems, therefore 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 D.1 – D.6 in Appendix D.

Discharge data collected with the automated equipment are presented in Figures 13 – 15.

Discharge data for 7LSTU were not available due to Mississippi River tailwater in the stormwater tunnel. Discharge for 10SA is not shown after September because the equipment that measures velocity malfunctioned and new equipment was not installed until 2009.

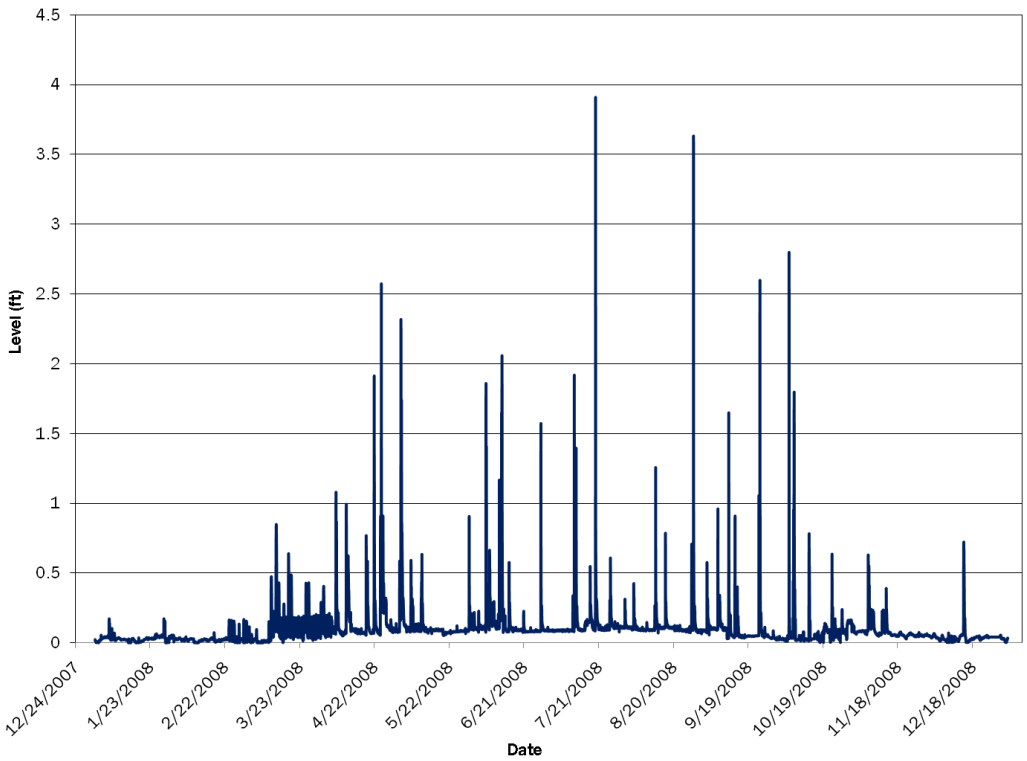

Figure 10. Water level for 1NE

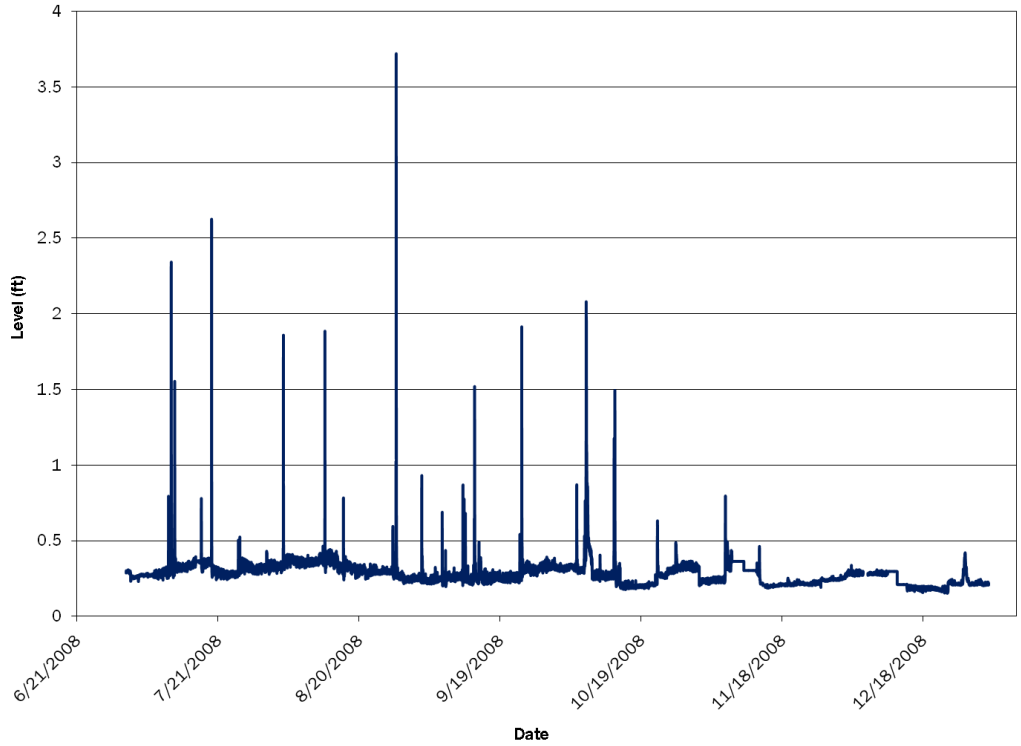

Figure 11. Water level for 6UMN

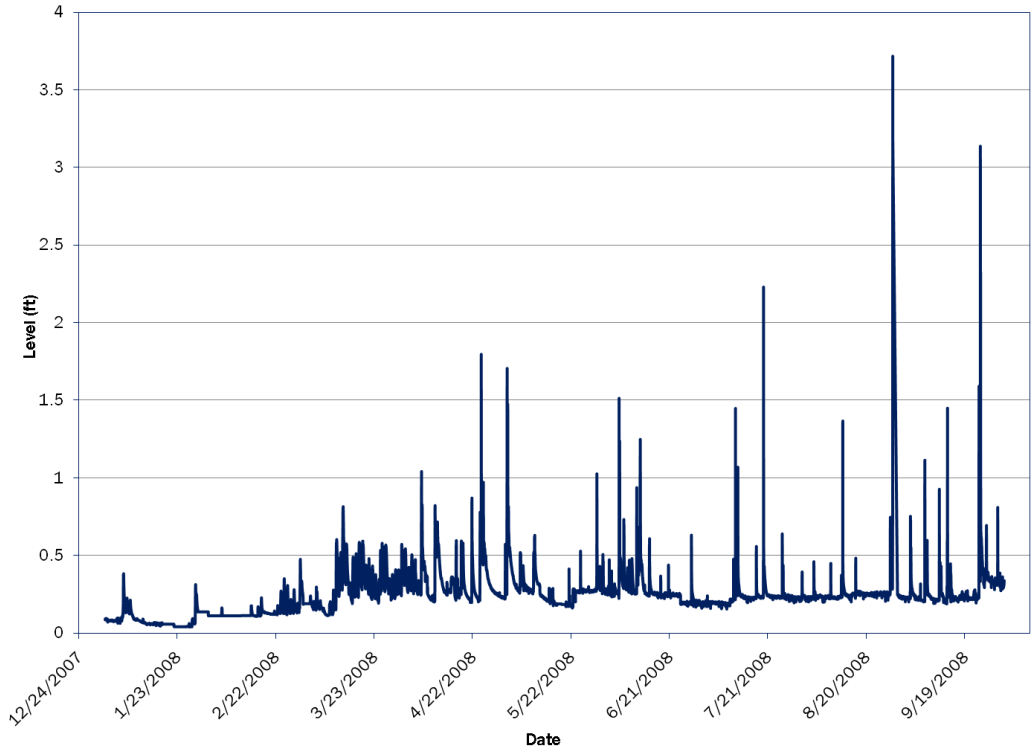

Figure 12. Water level for 10SA

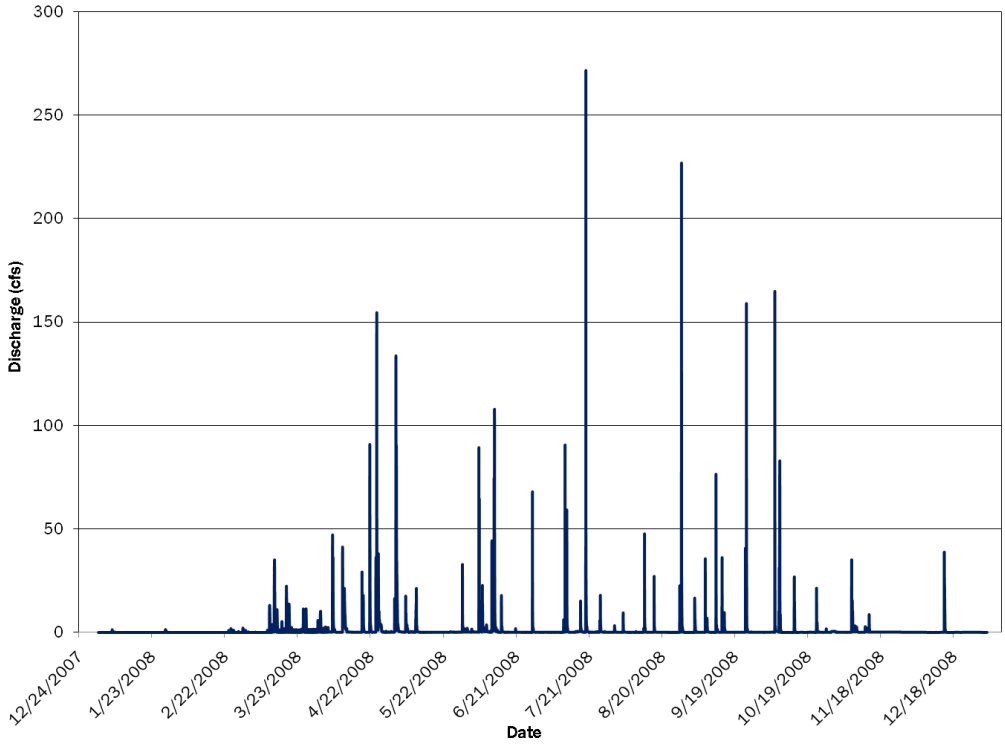

Figure 13. Discharge for 1NE

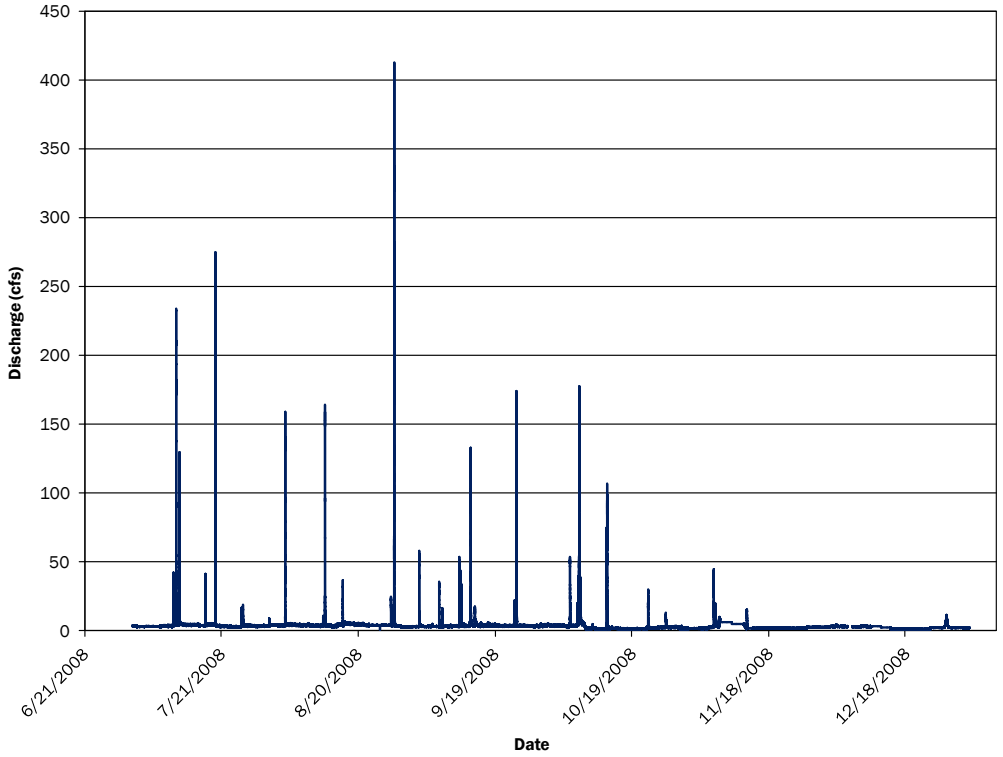

Figure 14. Discharge for 6UMN

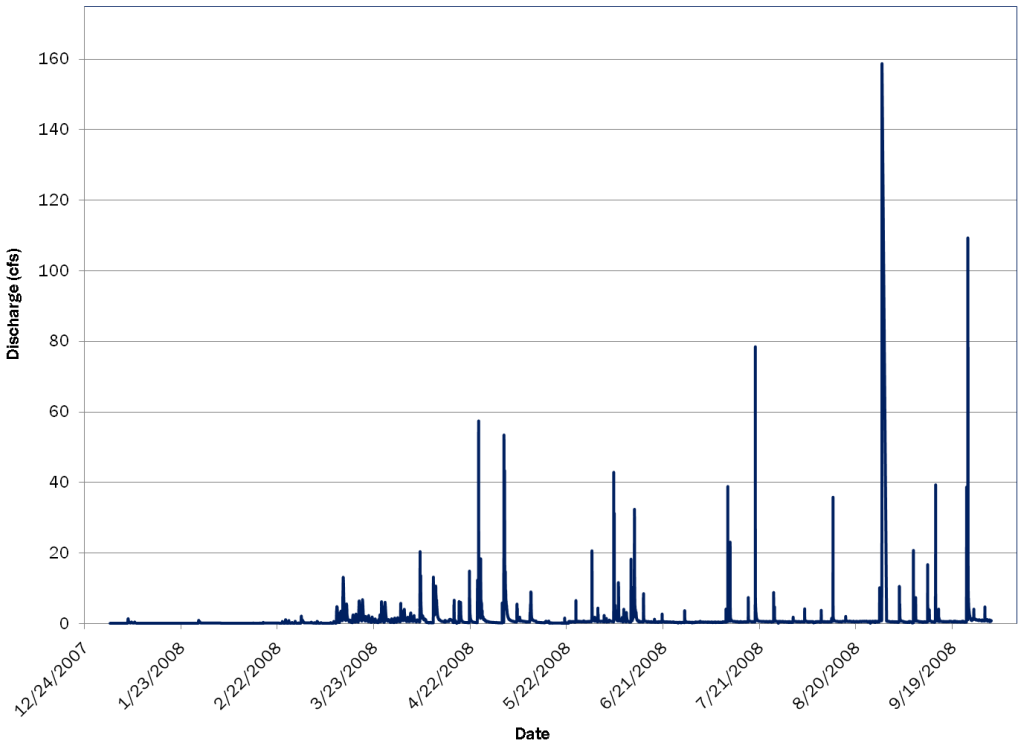

Figure 15. Discharge for 10SA

Kasota Ponds

The MWMO monitors three ponds, Kasota Pond North, Kasota Pond East (Mallard Marsh), and Kasota Pond West. Three monitoring sites are located in Kasota Pond East while Kasota Pond North and Kasota Pond West have two monitoring sites each. The Kasota Ponds drainage area is urbanized with industrial and commercial land uses. The Kasota Ponds are located near the intersection of Highway 280 and Kasota Avenue. Site descriptions for each site are provided in this section.

Site Description

KPN (Kasota Pond North): KPN is the northernmost pond. It is located west of Highway 280 and south of the intersection of North Hunting Valley Road and West Doswell Avenue. The two sites located in this pond are KPNW and KPNS. KPNW is located on the southwest side of the pond. KPNS is located on the southern side of the pond near the railroad tracks. (See Figure A.2. in Appendix A for the wetland sampling locations.) The area surrounding the pond is heavily vegetated with nonnative species such as buckthorn and burdock. KPN is dense with cattails and aquatic plants during the summer months. The bottom of the pond contains organic matter, silt, and clay.

KPE (Kasota Pond East): KPE is the largest of the ponds. It is also known as Mallard Marsh. It is located southwest of the intersection of Highway 280 and Kasota Avenue. The three sites monitored in KPE are KPEN, KPEW, and KPEE. KPEN is located near the middle of the north side of the pond. KPEW is located near the middle of the west side of the pond, nearest to the railroad tracks. KPEE is located near the middle of the east side of the pond. There is a grassy buffer area surrounding most of the pond. Railroad tracks run alongside the west side of the pond, with approximately three feet of riprap between the tracks and the pond. Turtles and ducks are frequently observed in KPE. This wetland is dense with cattails and aquatic plants during the summer months. The bottom of the pond contains organic matter, silt, and clay.

KPW (Kasota Pond West): KPW is located just west of KPE. The two sites monitored at this pond are KPWN and KPWE. KPWN is located on the northeast side of the pond near an outfall pipe. KPWE is located on the southeast side of the pond, also near an outfall pipe. KPW receives runoff from the parking lot of Brock White and the railyard. Dense algal blooms are observed in KPW during the summer months while other types of aquatic vegetation are seldom present in this pond. The pond has a sandy bottom.

Monitoring Results

The MWMO monitors Kasota Ponds to characterize water quality in its wetlands. Samples are collected for nutrients, sediment, inorganic, and metals analyses. The MPCA water quality criteria indicate that wetland water quality should maintain background. Background water quality has not yet been determined for MWMO wetlands. The data are presented in Tables E.1 – E.7 in Appendix E.

Work Plan

Assessment of 2008

The MWMO completed all of its monitoring objectives for 2008. Staff installed automated monitoring equipment in the 7LSTU stormwater pipe, but Mississippi River tailwater in the pipe has made it difficult to analyze the data. MWMO staff will look into other equipment options to collect useable data at the site.

MWMO staff began monitoring three of the Kasota Ponds wetlands at seven sampling sites. MWMO staff, in cooperation with SAFL staff, installed real-time monitoring equipment at three of the MWMO stormwater monitoring locations. It was determined that a repeater station at high elevation would be needed to provide the necessary line of sight between antennas to transfer data to the SAFL. After several months of looking for cost-effective options, it was determined that Moos Tower on the University of Minnesota East Bank campus would provide the needed elevation. Because it took a few more months to get permission to locate an antenna, radio, and datalogger on the Moos Tower roof, MWMO staff were only to complete installation of real-time equipment at four of the monitoring locations: 1NE, 4PP, 6UMN, and 10SA. The remaining two sites will be completed in 2009.

Additional work completed by the MWMO included submitting all of the MWMO's Mississippi River and Loring Pond data to the MPCA's data storage and retrieval (STORET) database. This will allow all of the data to be used in analyses for the Upper Mississippi River Bacteria TMDL project.

2009 Work Plan

The MWMO will continue to monitor all the sites listed in this report. Goals for 2009 include:

- Install automated sampling equipment at 4PP and 2NNBC stormwater outfalls
- Complete installation of the real-time stormwater monitoring network
- Conduct data cleaning for 2009 monitoring data
- Share MWMO data through the MPCA STORET database and the Annual Monitoring Report
- Continue working with the MPCA on the Upper Mississippi River Bacteria TMDL
- Coordinate with the City of Minneapolis to assist with their illicit discharge monitoring program

Future Recommendations

Future needs of the MWMO include: (1) knowledge of the contribution of *E. coli* 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 and (2) development of big river monitoring methodology to collect accurate, representative data from the Mississippi River in a dense, urban watershed with over 70 outfalls and two streams discharging to the river.

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Appendix A – Watershed Maps

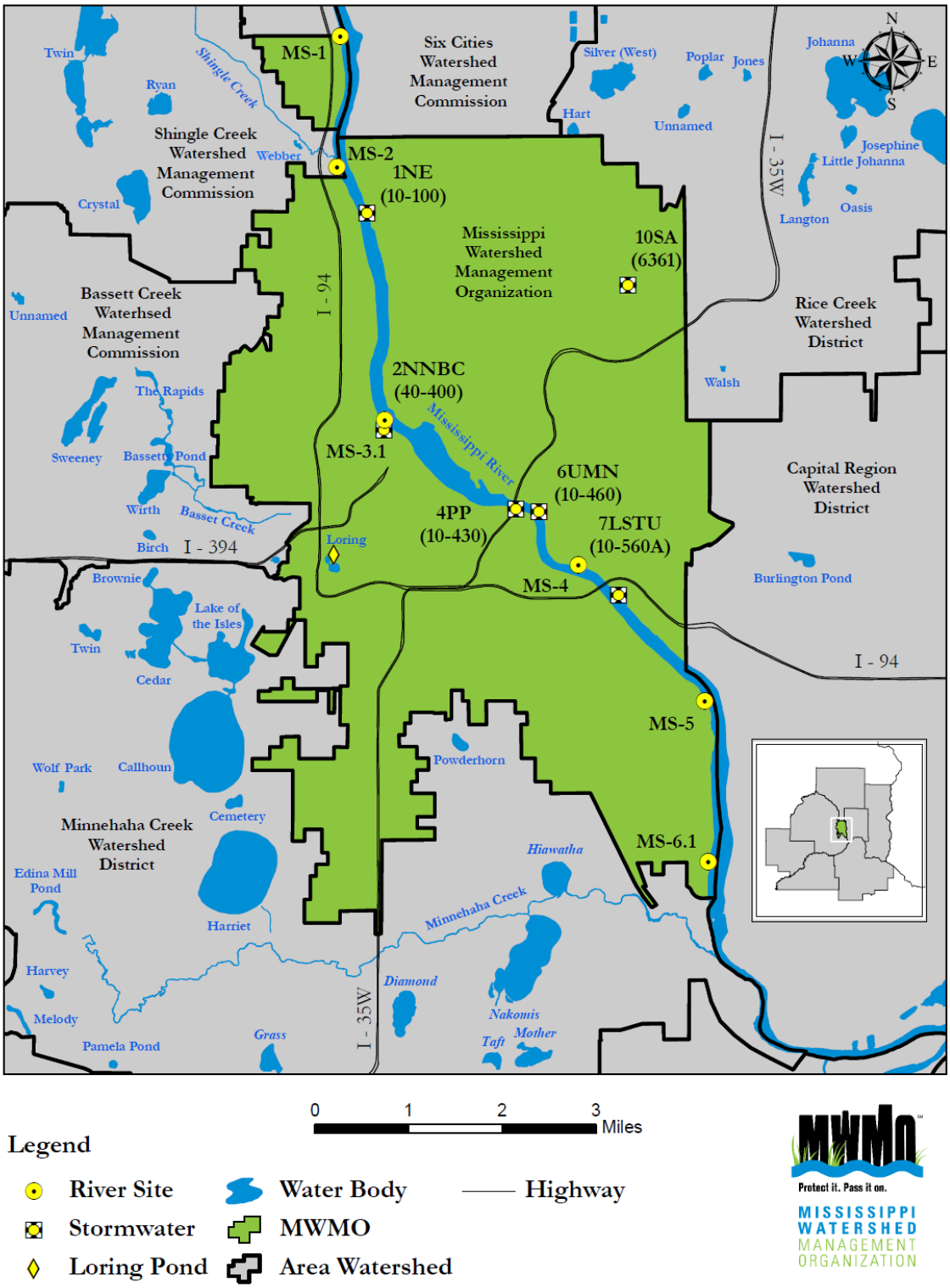

Figure A.1. MWMO watershed boundary and monitoring sites

Figure A.2. Kasota Ponds monitoring sites

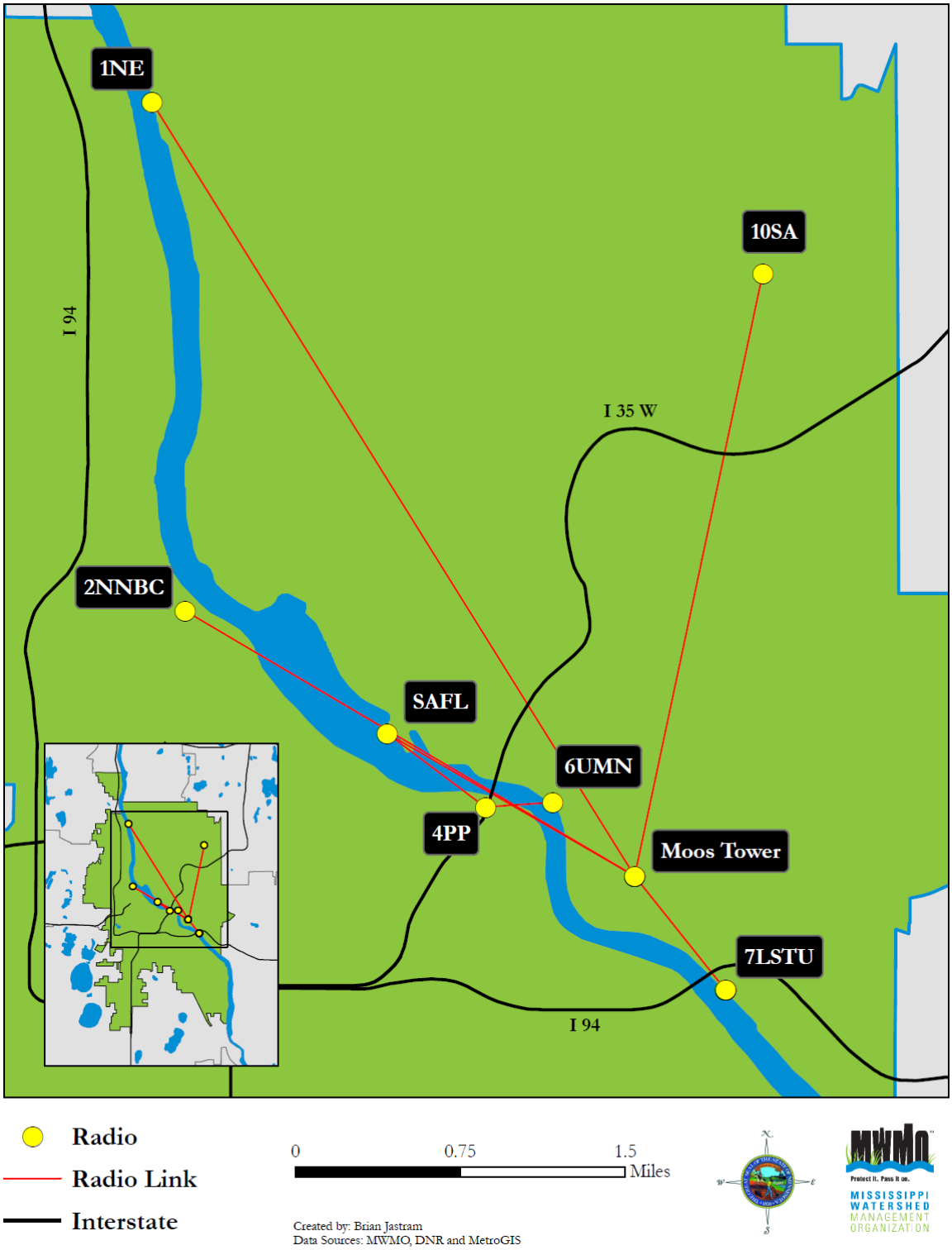

Figure A.3. Real-time monitoring network

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

*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.

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

Analyte	Lab	Method	Certified
Fluoride	Minneapolis Department of Health	Standard Methods 20th Edition 4500-F^- D. SPADNS Method, Ref SM 20th ed.P 4-82	No
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
E. coli	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 – *E. coli* Data

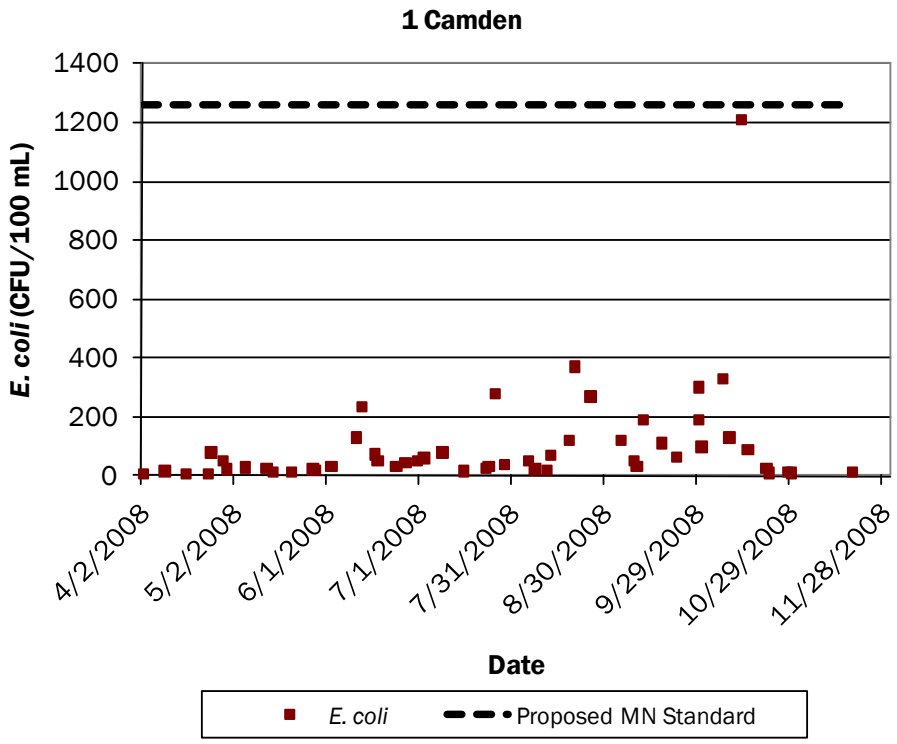

Figure C.1. *E. coli* data for Mississippi River Site 1

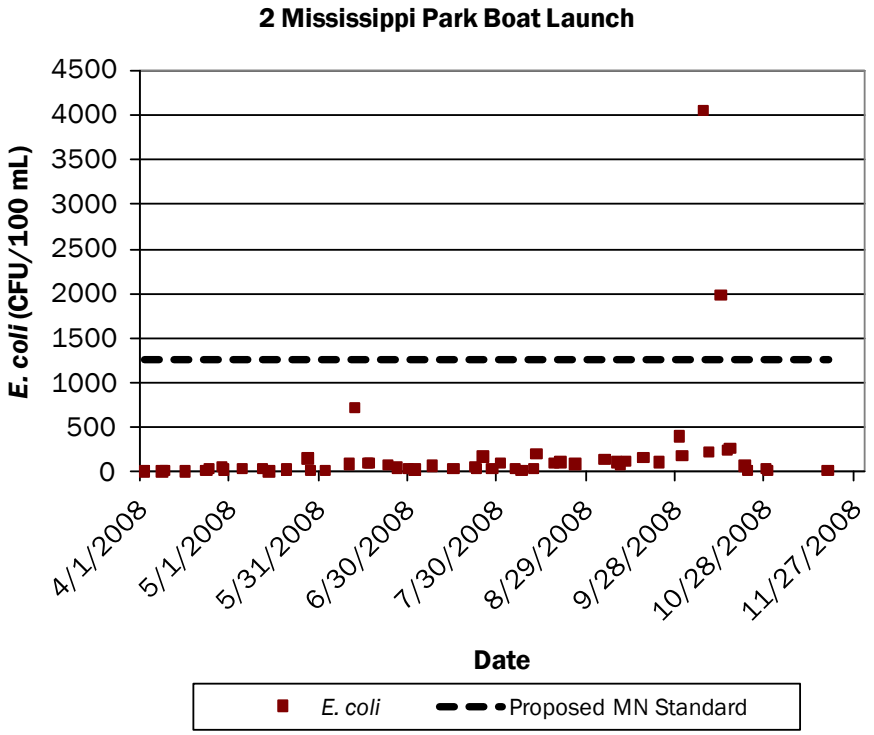

Figure C.2. *E. coli* data for Mississippi River Site 2

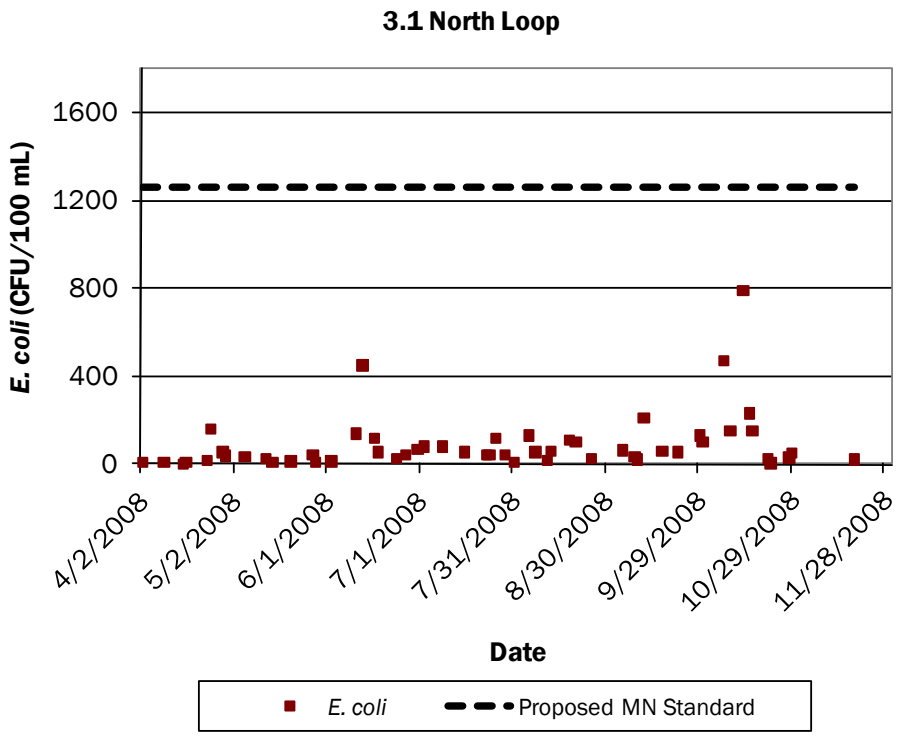

Figure C.3. *E. coli* data for Mississippi River Site 3.1

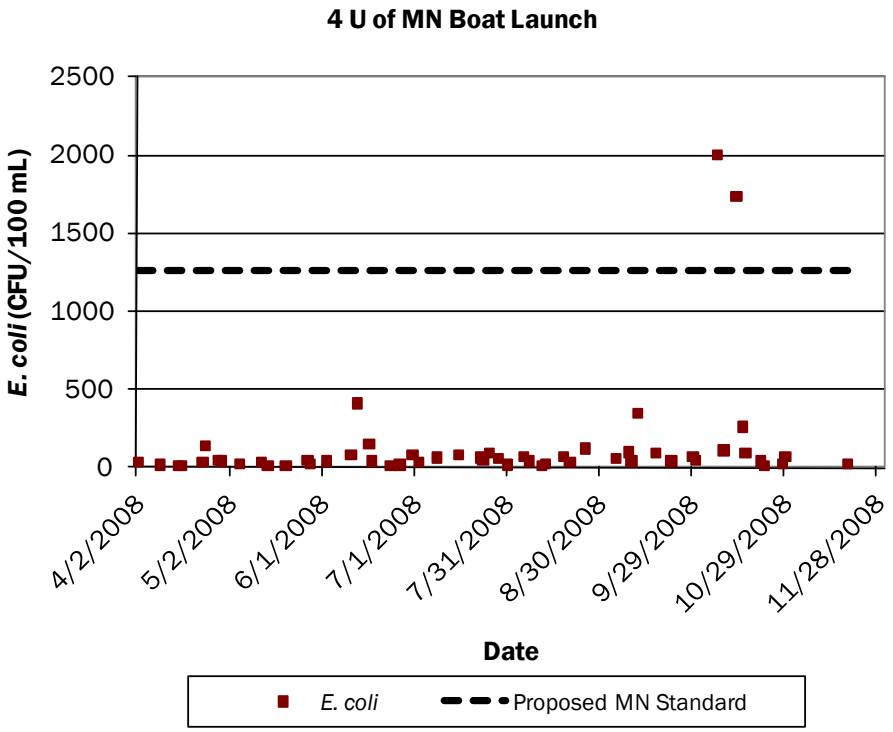

Figure C.4. *E. coli* data for Mississippi River Site 4

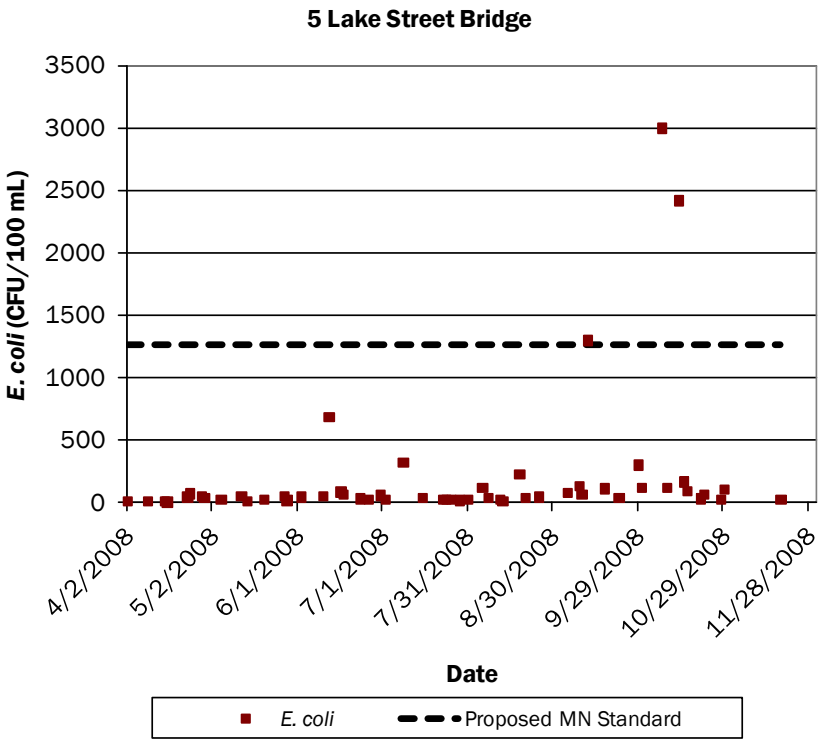

Figure C.5. *E. coli* data for Mississippi River Site 5

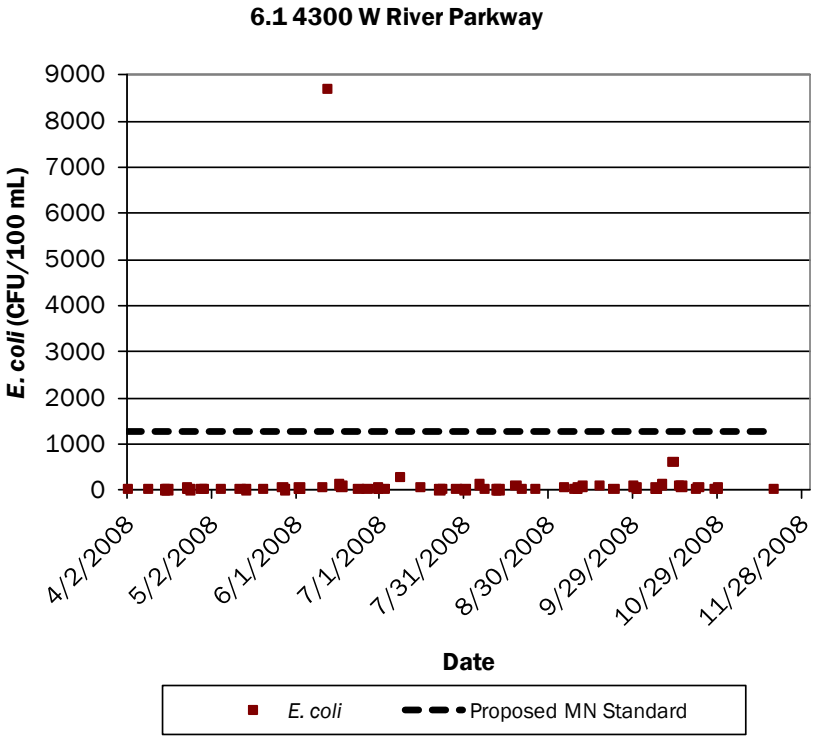

Figure C.6. *E. coli* data for Mississippi River Site 6.1

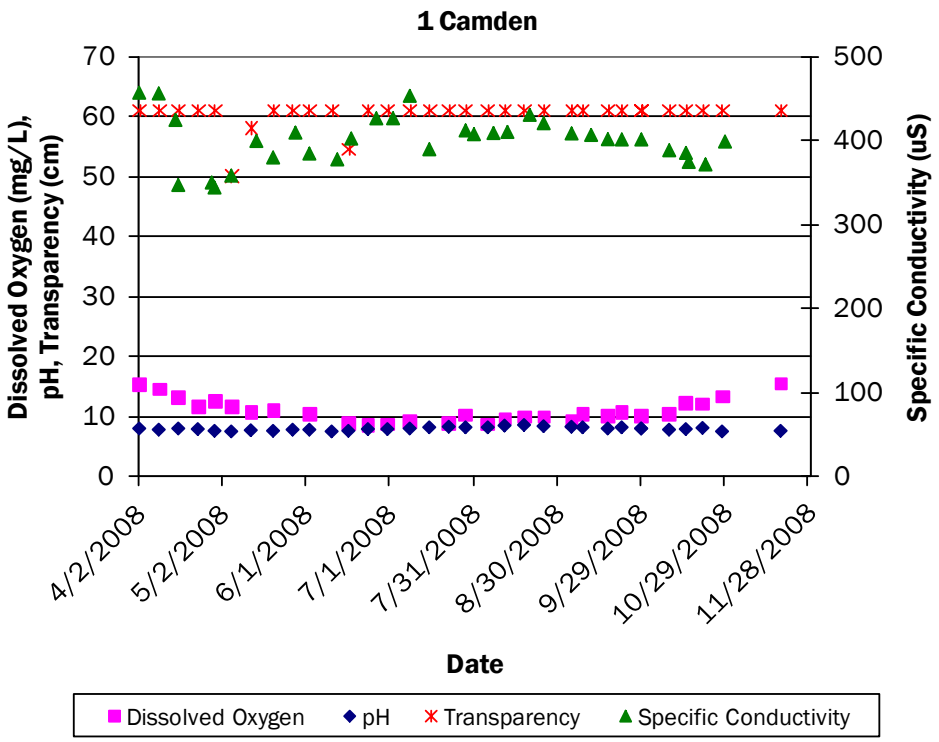

Figure C.7. Dissolved oxygen, pH, transparency, and specific conductivity for Mississippi River Site 1

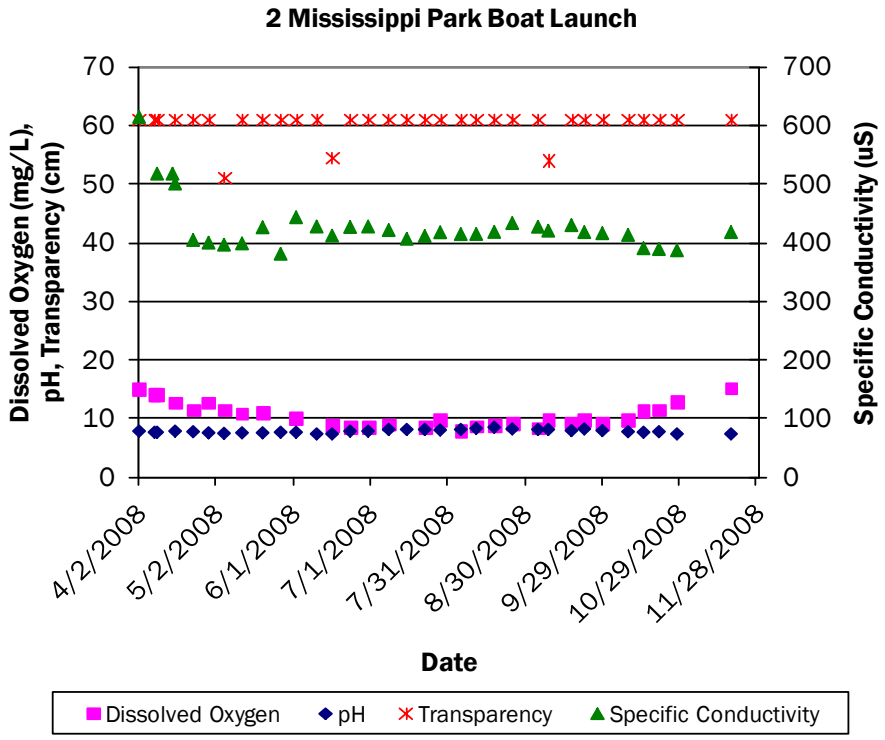

Figure C.8. Dissolved oxygen, pH, transparency, and specific conductivity for Mississippi River Site 2

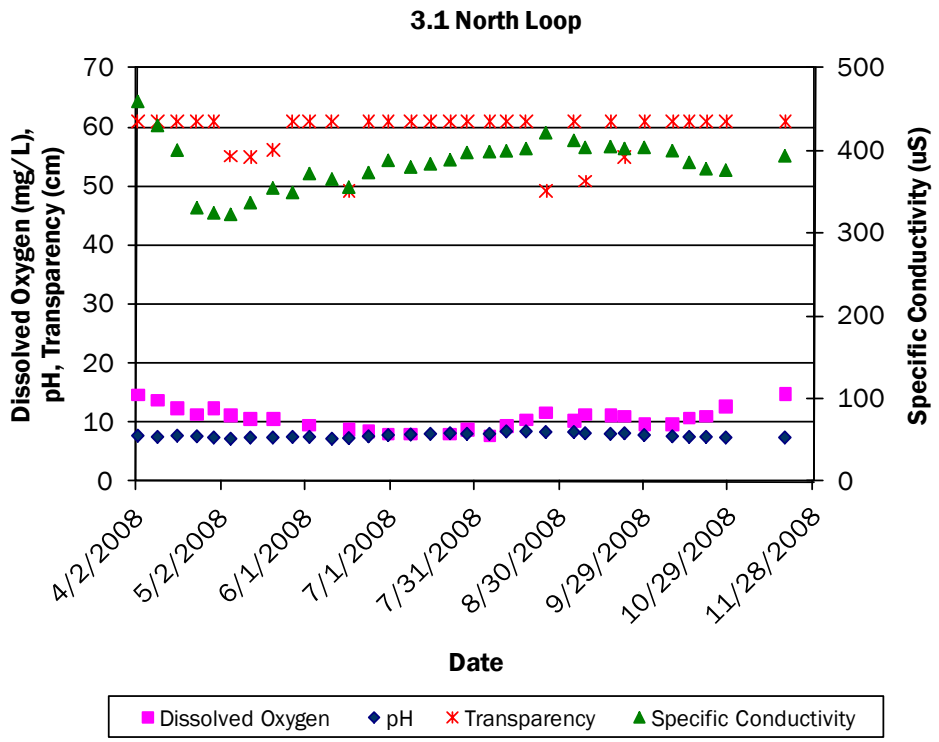

Figure C.9. Dissolved oxygen, pH, transparency, and specific conductivity for Mississippi River Site 3.1

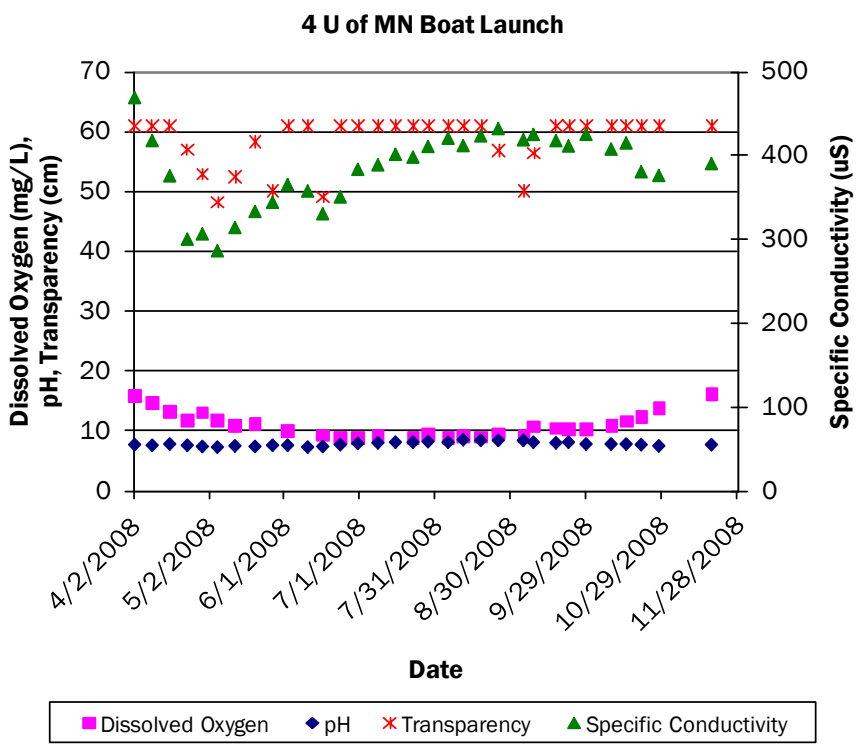

Figure C.10. Dissolved oxygen, pH, transparency, and specific conductivity for Mississippi River Site 4

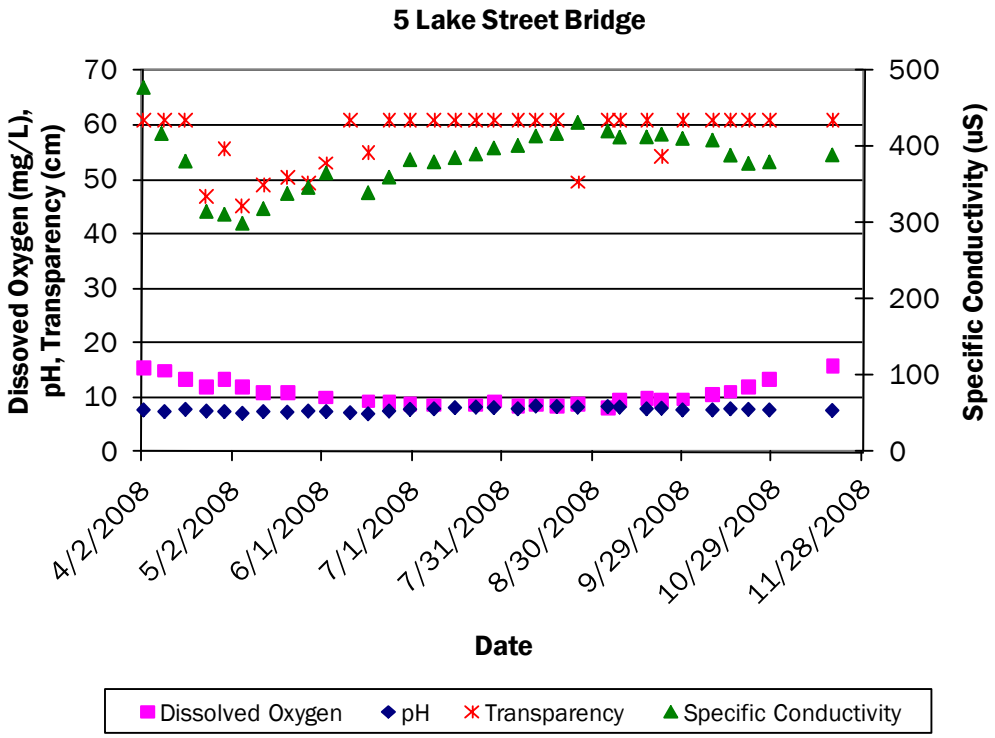

Figure C.11. Dissolved oxygen, pH, transparency, and specific conductivity for Mississippi River Site 5

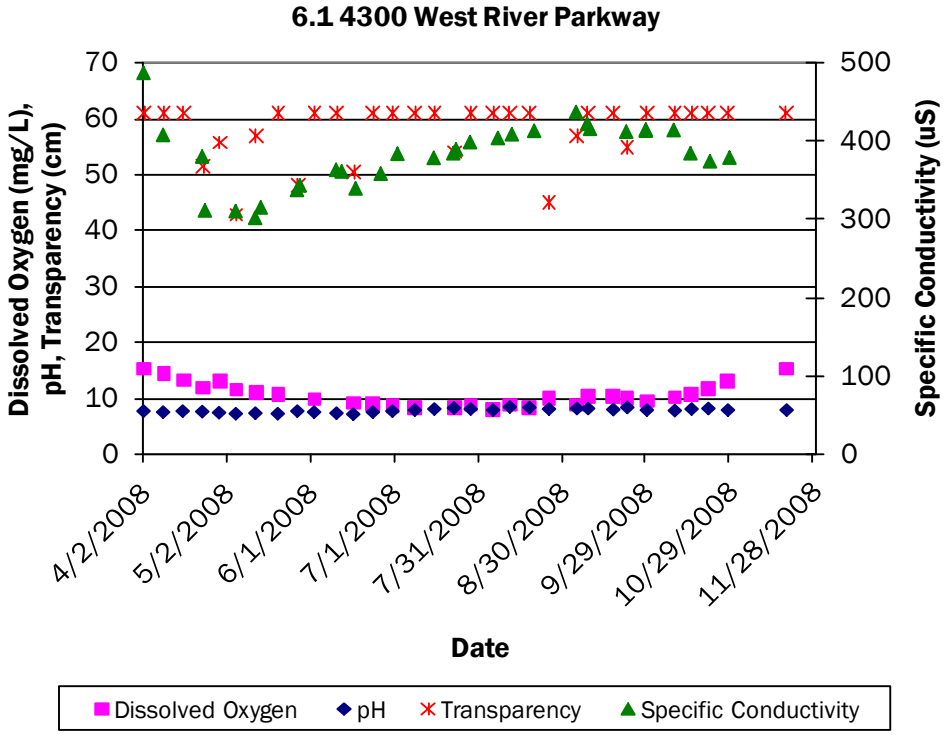

Figure C.12. Dissolved oxygen, pH, transparency, and specific conductivity for Mississippi River Site 6.1

Appendix D – Stormwater Monitoring Results

Table D.1 Monitoring results for 1NE outfall

Start Date Start Time	End Date End Time	Sample Type	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)
1/28/08 12:13	1/28/08 12:13	Melt Grab	44	47.7	10.55	1,921.0	2,793.0	7.7	15.0	1.5				9	22	1,680	146.0	0.038	0.089	0.026	3.2	0.28	0.05	1.19
3/10/08 14:48	3/10/08 14:48	Melt Grab		41.5	11.74	1,941.0	3,115.0	7.6	4.9	1.6				31	71	1,790	120.0	0.026	0.129	0.015	3.7	0.27	0.04	1.49
3/12/08 13:24	3/12/08 13:24	Melt Grab	46	41.9	11.54	1,230.0	1,959.0	7.1	10.3	1.0				18	46	1,100	40.8	0.338	0.518		7.9	1.16	0.11	1.31
3/13/08 11:38	3/13/08 14:19	Melt Composite	43	44.6	9.71	903.0	1,376.0		5.0	0.7				74	302	782	13.6	0.717	1.370	0.800	4.7	1.36	0.13	0.76
3/14/08 14:58	3/14/08 21:20	Melt Composite	39	47.1	8.07	487.0	713.0	5.2	20.8	0.3				12	28	411	10.8	0.723	0.981		4.3	1.34	0.08	0.54
3/18/08 11:44	3/18/08 15:44	Melt Composite	41	44.4	11.90	1,742.0	2,662.0	7.4		1.4				54	200	1,490	18.0	0.331	0.733		7.2	1.27	0.09	1.10
3/24/08 12:35	3/24/08 12:35	Base Grab	41	42.8	11.58	1,696.0	2,659.0	7.5	61.0	1.4				2	4	1,510	95.4	0.048	0.102	0.037	2.6	0.34	0.03	1.03
4/6/08 11:39	4/6/08 14:53	Melt Composite	37	43.0	10.84	307.0	480.3	7.3	5.2	0.2							11.6	0.072	0.675		3.1	0.28	0.04	0.46
4/7/08 9:39	4/7/08 9:39	Storm Grab	34	43.2	12.04	315.5	492.7	7.1	23.5	0.2				5	9	448	44.7	0.048	0.140	0.053	1.9	0.36	0.06	1.25
4/10/08 10:13	4/10/08 10:13	Base Grab	40	44.8	11.19	962.0	1,462.0	7.6	61.0	0.7				1	2	877	114.0	0.025	0.049	0.029	1.6	0.12	0.03	1.62
4/10/08 15:21	4/10/08 20:24	Storm Composite	36	36.9	13.81	196.9	342.9	7.2	8.4	0.2				36	132	186	11.1	0.104	0.332	0.089	1.6	0.22	0.02	0.42
4/15/08 12:57	4/15/08 12:57	Base Grab	62	48.9							800	1,000	0.44											
4/21/08 19:29	4/21/08 21:42	Storm Composite	47	54.0	8.44	202.5	268.3	7.2	6.9	0.1				124	500	156	12.4	0.118	0.689	0.118	3.5	0.54	0.05	0.65
4/24/08 12:17	4/24/08 12:17	Storm Grab	59	54.3								750	0.10											
4/28/08 12:15	4/28/08 12:15	Storm Grab	39	43.9								2	0.39											
5/2/08 12:56	5/2/08 14:40	Storm Composite	63	57.2	8.38	121.3	153.4	7.1	15.1	0.1						126	6.8	0.056	0.546		3.1	0.23	0.03	0.33
5/6/08 13:59	5/7/08 2:28	Storm Composite	57	54.7	8.71	474.0	620.0	7.3	22.4	0.3							40.9	0.075	0.242	0.035	3.1	0.34	0.08	1.63
5/8/08 10:05	5/8/08 10:05	Base Grab	59	49.6	10.69	822.0	1,158.0	7.5	61.0	0.6				1	1	733	98.2	0.033	0.068	0.030	1.5	0.26	0.02	2.86
5/10/08 19:37	5/11/08 3:33	Storm Composite	57	58.3	6.60	234.0	292.2	6.8	61.0	0.1				19	34	163	11.0	0.120	0.294		1.6	0.14	0.04	0.77
5/14/08 12:31	5/14/08 12:31	Base Grab	60	53.6								7	0.43											
5/22/08 10:40	5/22/08 10:40	Base Grab	64	52.3	10.66	624.0	845.0	7.5	61.0	0.4				1	5	519	84.8	0.012	0.011	0.005	0.8	0.05	0.02	2.35
5/28/08 10:30	5/28/08 10:30	Base Grab	64	54.7								15	0.31											
5/29/08 21:34	5/29/08 23:55	Storm Composite	58	57.7	6.46	154.4	194.0	6.9	7.0	0.1				170	386	226	12.5	0.254	1.330	0.170	6.1	0.24	0.05	0.75
6/3/08 11:50	6/3/08 11:50	Base Grab	55	54.5	9.94	605.0	794.0	7.3	61.0	0.4				2	5	491	70.0	0.047	0.041	0.011	1.1	0.08	0.06	1.70
6/5/08 15:29	6/5/08 20:54	Storm Composite	71	65.3	5.13	180.8	206.4	6.4	9.8	0.1				106	352	121	7.7	0.127	0.972	0.099	3.9	0.01	0.05	0.40
6/7/08 2:39	6/7/08 10:28	Storm Composite	68	66.0	5.36	270.6	306.3	6.5	25.0	0.1				41	81	193	10.8	0.247	0.621		3.0	0.27	0.05	0.19
6/11/08 10:26	6/11/08 23:50	Storm Composite	75	65.1		199.3	228.2	6.5	8.6	0.1				58	169	131	7.8	0.093	0.445		2.4	0.19	0.06	0.48
6/12/08 12:00	6/12/08 12:00	Storm Grab	69	64.8								2,900												
6/14/08 21:39	6/15/08 1:56	Storm Composite	67	65.8	5.18	217.4	246.5	7.3	16.0	0.1				32	97	148	9.8	0.182	0.700		1.3	0.28	0.05	0.23
6/17/08 11:50	6/17/08 11:50	Base Grab	71	60.3								70	0.41											
6/26/08 12:02	6/26/08 12:02	Base Grab	75	77.7								18												
6/27/08 13:26	6/27/08 13:26	Base Grab	81	53.1	10.77	1,053.0	1,412.0	7.8	61.0	0.7				1	1	911	147.0		0.005	0.005	0.6	0.06	0.02	2.56
6/27/08 16:02	6/27/08 18:10	Storm Composite	75	73.4	3.46	196.1	204.0	7.3	6.0	0.1				148	392	152	8.6	0.209	0.670		2.3	0.23	0.02	0.03
7/2/08 11:25	7/2/08 11:25	Base Grab	75	63.0								420	0.40											
7/3/08 10:56	7/3/08 10:56	Base Grab	69	53.6	10.91	1,074.0	1,428.0	7.7	61.0	0.7				1	5	938	155.0	0.005	0.024	0.006	1.5	0.05	0.02	2.63
7/11/08 2:21	7/11/08 4:41	Storm Composite	79	71.1	7.20	142.6	152.2	7.3	7.6	0.1				120	327	96	4.3	0.083	0.722	0.053	4.1	0.23	0.05	0.54
7/11/08 19:44	7/11/08 21:49	Storm Composite	74	70.7	5.46	188.5	202.1	7.0	5.0	0.1						134	5.0	0.102	0.351		1.9	0.25	0.08	0.44

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 values was ~. Value used for analysis was the ~value.

Table D.1 continued Monitoring results for 1NE outfall

Start Date Start Time	End Date End Time	Sample Type	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)
7/17/08 11:14	7/17/08 19:39	Storm Composite	76	73.4	5.90	292.9	304.4	7.2	12.0	0.1				15.0	33	203	16.5	0.137	0.338	0.112	2.1	0.16	0.12	0.62
7/17/08 12:10	7/17/08 12:10	Storm Grab	72	70.2	8.55	245.8	264.9	7.4	12.3	0.1				22.0	57	283	30.2	0.180	0.308	0.153	2.4	0.46	0.06	2.08
7/17/08 12:11	7/17/08 12:11	Storm Grab	72	70.2								19,000	0.38											
7/18/08 10:50	7/18/08 10:50	Base Grab	76	62.1	9.30	1,010.0	1,201.0	7.5	61.0	0.6						722	98.9	0.093	0.119	0.025	2.1	0.09	0.05	1.49
7/23/08 12:07	7/23/08 12:07	Base Grab	77	72.4								280	0.58											
7/25/08 10:01	7/25/08 10:01	Storm Grab	71	60.8								18,000	0.38											
7/29/08 10:15	7/29/08 10:15	Base Grab	81	58.3	9.98	1,119.0	1,398.0	7.6	61.0	0.7				0.5	2	919	160.0	0.005	0.005	0.009	1.4	0.08	0.02	2.22
7/31/08 12:14	7/31/08 12:14	Storm Grab	77	64.4								20,000	0.39											
8/4/08 0:02	8/4/08 7:17	Storm Composite	85	77.5	4.19	385.6	383.6	7.0	5.0	0.2							18.0	0.072	0.869	0.018	4.6	0.05	0.56	0.79
8/7/08 12:11	8/7/08 12:11	Base Grab	79	68.9								140	0.38											
8/12/08 12:16	8/12/08 12:16	Storm Grab	68	65.3								28,000	0.48											
8/12/08 19:12	8/12/08 23:11	Storm Composite	81	71.2	4.63	178.1	189.7	7.1	6.0	0.1				152.0	592	131	11.7	0.053	1.010	0.018	5.1	0.13	0.06	0.31
8/14/08 9:55	8/14/08 9:55	Base Grab	75	62.6	8.70	1,119.0	1,322.0	7.7	61.0	0.7				1.0	1	843		0.040	0.005	0.003	1.5	0.05	0.02	1.12
8/20/08 11:00	8/20/08 11:00	Base Grab	79	70.7								620	0.46											
8/26/08 11:35	8/26/08 11:35	Base Grab	73	62.6	9.07	1,241.0	1,464.0	7.7	61.0	0.7				1.0	6	967	170.0	0.014	0.020	0.006	1.4	0.05	0.02	1.56
8/27/08 6:28	8/27/08 10:04	Storm Composite	68	68.0	7.67	190.2	210.2	6.5	16.0	0.1				41.0	92	163	13.6	0.300	0.732	0.209	3.7	0.79	0.08	1.30
8/27/08 23:38	8/28/08 0:32	Storm Composite	68	69.6	6.87	75.2	81.6	7.2	9.7	0.0						50	4.7	0.082	0.512	0.065	3.0	0.40	0.03	0.48
9/2/08 10:16	9/2/08 15:25	Storm Composite	60	65.5	5.92	199.8	227.3	6.9	12.0	0.1							12.1	0.089	0.418	0.052	2.6	0.05	0.09	0.62
9/2/08 12:35	9/2/08 12:35	Storm Grab	68	71.1	7.70	148.5	158.5	7.3	20.1	0.1														
9/9/08 12:50	9/9/08 12:50	Base Grab	70	57.7								76	0.43											
9/11/08 3:59	9/11/08 7:06	Storm Composite	61	64.8	7.43	96.5	111.1	7.2	16.6	0.1						77	5.8	0.064	0.298		1.6	0.09	0.02	0.39
9/11/08 12:15	9/11/08 12:15	Storm Grab	66	63.7								5,100	0.12											
9/19/08 11:18	9/19/08 11:18	Base Grab	74	59.0	9.73	1,161.0	1,434.0	7.6	61.0	0.7				1.0	10	969	163.0	0.005		0.009	2.2	0.04	0.02	1.05
9/23/08 16:52	9/23/08 19:33	Storm Composite	62	66.6	7.00	74.9	84.3	7.4	8.4	0.0						75	4.7	0.055	0.368	0.061	2.0	0.23	0.02	0.34
9/30/08 12:00	9/30/08 12:00	Base Grab	54	54.5								280	0.43											
10/2/08 11:38	10/2/08 11:38	Base Grab	63	55.4	9.69	1,119.0	1,453.0	7.5	61.0	0.7				1.0	2	953	163.0	0.005	0.017	0.008	2.2	0.05	0.02	1.23
10/7/08 12:08	10/7/08 12:08	Storm Grab	56	59.4								8,100	0.11											
10/13/08 9:02	10/13/08 13:49	Storm Composite	50	51.1	7.47	148.9	205.2	6.6	15.0	0.1				21.0	54	335	17.2	0.175	0.389	0.172	1.5	0.01	0.02	0.16
10/13/08 12:49	10/13/08 12:49	Storm Grab	51	63.0																				
10/16/08 11:51	10/16/08 11:51	Base Grab	50	46.2								76	0.40											
10/20/08 9:42	10/20/08 9:42	Base Grab	66	53.4	10.44	1,103.0	1,470.0	7.6	61.0	0.7				0.5	1	949		0.011	0.017	0.015	2.6	0.06	0.02	1.19
10/22/08 11:41	10/22/08 11:41	Storm Grab	45	41.9								180	0.48											
10/27/08 11:35	10/27/08 11:35	Base Grab	39	50.2	10.23	804.0	1,123.0	7.4	61.0	0.6				1.0	2	722	118.0	0.067	0.117	0.052	1.7	0.01	0.02	0.55
10/29/08 11:43	10/29/08 11:43	Base Grab	46	55.4								40	0.88											
11/6/08 2:31	11/6/08 3:31	Storm Composite	38	53.6	6.66	160.3	213.0	6.2	7.2	0.1						199			0.435		0.3		0.02	0.03
12/10/08 12:03	12/10/08 12:03	Base Grab	17																					

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 values was ~. Value used for analysis was the ~value.

Table D.1 continued Monitoring results for 1NE outfall

Start Date Start Time	End Date End Time	Sample Type	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)
1/28/08 12:13	1/28/08 12:13	Melt Grab	319	655	298	45	5.4	3.00	3.0	0.0032	0.0076	0.0078	0.0090	0.00005	0.0030	0.0163	0.0353	0.00025	0.00025	0.0016	0.0018	0.006	4.0
3/10/08 14:48	3/10/08 14:48	Melt Grab	317	671	220	104	5.8	6.00	6.0	0.0095	0.0239	0.0097	0.0111	0.00120	0.0137		0.0844	0.00025	0.00025	0.0026	0.0066	0.053	5.0
3/12/08 13:24	3/12/08 13:24	Melt Grab	122	437	192	84	19.3																3.0
3/13/08 11:38	3/13/08 14:19	Melt Composite	40	324	90	211	24.5		26.0	0.0132	0.0420	0.0298	0.0298	0.00160	0.0440	0.0316	0.2220	0.00025	0.00025	0.0085	0.0151		15.0
3/14/08 14:58	3/14/08 21:20	Melt Composite	50	91	82	64	14.1																5.0
3/18/08 11:44	3/18/08 15:44	Melt Composite	52	785	128																		
3/24/08 12:35	3/24/08 12:35	Base Grab	258	692	232	36	5.1	1.67	2.2														0.5
4/6/08 11:39	4/6/08 14:53	Melt Composite	34	108	62	190	13.5																
4/7/08 9:39	4/7/08 9:39	Storm Grab	101	120	172	36	8.4	2.31	3.5														0.5
4/10/08 10:13	4/10/08 10:13	Base Grab	288	230	520	20	4.9	0.50	0.5														0.5
4/10/08 15:21	4/10/08 20:24	Storm Composite	32	74	68	94	7.1	6.20	7.0														3.0
4/15/08 12:57	4/15/08 12:57	Base Grab																					
4/21/08 19:29	4/21/08 21:42	Storm Composite	37	50	136	252	9.0	15.00	22.0	0.0053	0.0516	0.0016	0.0164	0.00070	0.0581	0.0171	0.3690	0.00025	0.00025	0.0024	0.0226	0.067	21.0
4/24/08 12:17	4/24/08 12:17	Storm Grab																					
4/28/08 12:15	4/28/08 12:15	Storm Grab																					
5/2/08 12:56	5/2/08 14:40	Storm Composite	37	22	96	149	6.2																8.0
5/6/08 13:59	5/7/08 2:28	Storm Composite	96	79	160	79	16.3	8.50	8.5														2.0
5/8/08 10:05	5/8/08 10:05	Base Grab	266	138	412	20	6.6	0.50	0.5														3.0
5/10/08 19:37	5/11/08 3:33	Storm Composite	54	42	96	34	18.2																16.0
5/14/08 12:31	5/14/08 12:31	Base Grab																					
5/22/08 10:40	5/22/08 10:40	Base Grab	199	89	316	10	6.9	0.50	0.5														0.5
5/28/08 10:30	5/28/08 10:30	Base Grab																					
5/29/08 21:34	5/29/08 23:55	Storm Composite	82	52	116	297	28.5	36.00	41.0														
6/3/08 11:50	6/3/08 11:50	Base Grab	174	92	296	34	7.0	0.50	0.5														0.5
6/5/08 15:29	6/5/08 20:54	Storm Composite	49	30	144	223	10.2	21.00	34.0	0.0065	0.0346	0.0020	0.0099	0.00080	0.0403	0.0119	0.1980	0.00025	0.00025	0.0020	0.0126	0.278	12.0
6/7/08 2:39	6/7/08 10:28	Storm Composite	57	45	72	82	12.5	10.43														0.030	3.0
6/11/08 10:26	6/11/08 23:50	Storm Composite	39	33	54	120	10.2	5.50															6.0
6/12/08 12:00	6/12/08 12:00	Storm Grab																					
6/14/08 21:39	6/15/08 1:56	Storm Composite	42	35	62	101	24.2																4.0
6/17/08 11:50	6/17/08 11:50	Base Grab																					
6/26/08 12:02	6/26/08 12:02	Base Grab																					
6/27/08 13:26	6/27/08 13:26	Base Grab	374	157	516	14	8.5	0.50	0.5														
6/27/08 16:02	6/27/08 18:10	Storm Composite	58	20	532	273	22.2																
7/2/08 11:25	7/2/08 11:25	Base Grab																					
7/3/08 10:56	7/3/08 10:56	Base Grab	348	158	544	15		0.50	0.5														0.5
7/11/08 2:21	7/11/08 4:41	Storm Composite	32	15	44	149	16.3	19.00	27.0														5.0
7/11/08 19:44	7/11/08 21:49	Storm Composite	35	31	76	68	11.7	0.50															2.0

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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 values was ~. Value used for analysis was the ~value.

Table D.1 continued Monitoring results for 1NE outfall

Start Date Start Time	End Date End Time	Sample Type	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)
7/17/08 11:14	7/17/08 19:39	Storm Composite	68	32	100	80	15.8	16.0	22.0	0.0056	0.0106	0.0028	0.0036	0.0004	0.0048	0.0220	0.0509	0.00025	0.00025	0.002	0.002		
7/17/08 12:10	7/17/08 12:10	Storm Grab	100	38	468	138	26.3	14.0	19.0														3.0
7/17/08 12:11	7/17/08 12:11	Storm Grab																					
7/18/08 10:50	7/18/08 10:50	Base Grab	284	144	444	29	5.1	1.8	2.6														0.5
7/23/08 12:07	7/23/08 12:07	Base Grab																					
7/25/08 10:01	7/25/08 10:01	Storm Grab																					
7/29/08 10:15	7/29/08 10:15	Base Grab	371	8	556	18	2.8	0.5	0.5														0.5
7/31/08 12:14	7/31/08 12:14	Storm Grab																					
8/4/08 0:02	8/4/08 7:17	Storm Composite	70	56	116	205	29.0		24.0														
8/7/08 12:11	8/7/08 12:11	Base Grab																					
8/12/08 12:16	8/12/08 12:16	Storm Grab																					
8/12/08 19:12	8/12/08 23:11	Storm Composite	44	20	72	296	14.5	16.0															7.0
8/14/08 9:55	8/14/08 9:55	Base Grab	338		464	22	9.0	0.5	1.2														
8/20/08 11:00	8/20/08 11:00	Base Grab																					
8/26/08 11:35	8/26/08 11:35	Base Grab	360	284	544	15	2.9	0.5	0.5														0.5
8/27/08 6:28	8/27/08 10:04	Storm Composite	40	24	70	185	37.5	24.0	45.0														6.0
8/27/08 23:38	8/28/08 0:32	Storm Composite	20	6	52	207	16.6	8.7	16.0														4.0
9/2/08 10:16	9/2/08 15:25	Storm Composite	39	31	66	120	16.2																3.0
9/2/08 12:35	9/2/08 12:35	Storm Grab																					
9/9/08 12:50	9/9/08 12:50	Base Grab																					
9/11/08 3:59	9/11/08 7:06	Storm Composite	25	12	64	65	12.8																0.5
9/11/08 12:15	9/11/08 12:15	Storm Grab																					
9/19/08 11:18	9/19/08 11:18	Base Grab	362	172	534	12	4.0	0.5	0.5														
9/23/08 16:52	9/23/08 19:33	Storm Composite	20	7	56	93	11.7	4.4	6.6														0.5
9/30/08 12:00	9/30/08 12:00	Base Grab																					
10/2/08 11:38	10/2/08 11:38	Base Grab	368	183	572	14	2.7	0.5	0.5														0.5
10/7/08 12:08	10/7/08 12:08	Storm Grab																					
10/13/08 9:02	10/13/08 13:49	Storm Composite	65	22	88	79	17.6	19.0	22.0														4.0
10/13/08 12:49	10/13/08 12:49	Storm Grab																					
10/16/08 11:51	10/16/08 11:51	Base Grab																					
10/20/08 9:42	10/20/08 9:42	Base Grab	368	184	596	9		0.5	0.5														
10/22/08 11:41	10/22/08 11:41	Storm Grab																					
10/27/08 11:35	10/27/08 11:35	Base Grab	286	129	464	24	7.6	3.3	4.6	0.0032		0.0086		0.0003		0.0104		0.00025		0.002			
10/29/08 11:43	10/29/08 11:43	Base Grab																					
11/6/08 2:31	11/6/08 3:31	Storm Composite	59	24	104	182																	
12/10/08 12:03	12/10/08 12:03	Base Grab		212																			

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Table D.2 Monitoring results for 2NNBC outfall

Start Date Start Time	End Date End Time	Sample Type	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)
3/12/08 14:15	3/12/08 14:15	Melt Grab	50	44.2	8.26	1,915.0	2,930.0	6.4	18.3	1.5				11	25	1,590	47.5	0.481	0.708	0.468	4.4	0.90	0.11	1.05
3/19/08 14:44	3/19/08 14:44	Melt Grab	52	40.1	9.11	751.0	1,234.0	7.1	12.2	0.6				9	21	706	30.8	0.532	0.672		5.3	1.05	0.13	1.13
4/7/08 10:49	4/7/08 10:49	Snow Grab	37	46.2	9.44	480.0	713.0	7.4	23.3	0.3				8	18	434	18.4	0.124	0.231		2.2	0.61	0.09	1.10
4/15/08 12:10	4/15/08 12:10	Base Grab	61	42.3							300	110	0.44							0.054				
4/24/08 11:35	4/24/08 11:35	Storm Grab	57	53.4								4,800	0.26											
4/24/08 15:32	4/24/08 15:32	Storm Grab	59	57.2	9.18	209.4	264.7	7.1	20.3	0.1				10	30	154	15.9	0.041	0.164		1.0	0.24	0.06	0.45
6/9/08 10:29	6/9/08 10:29	Base Grab	70	68.4	1.97	563.0	620.0	6.8	61.0	0.3				3	6	357	36.3	0.070	0.159	0.161	0.9	0.16	0.06	0.38
6/11/08 12:35	6/11/08 12:35	Storm Grab	65	64.2		320.6	370.5	6.8	22.6	0.2				17	32	227	19.5	0.197	0.320		1.3	0.30	0.11	0.88
6/12/08 11:15	6/12/08 11:15	Storm Grab	69	66.2								3,000												
6/17/08 10:55	6/17/08 10:55	Base Grab	73	69.3								140	0.43											
7/10/08 14:12	7/10/08 14:12	Storm Grab	68	70.9	7.14	119.4	127.7	7.3	10.5	0.1				53	147	96	5.9	0.155	0.585	0.069	3.0	0.43	0.06	0.92
7/17/08 11:36	7/17/08 11:36	Storm Grab	75	79.3	4.43	994.0	969.0	7.3	61.0	0.5				66	258	600	71.0	0.083	0.198		1.1	0.22	0.04	0.96
7/17/08 11:36	7/17/08 11:36	Storm Grab	75	79.3								100	0.95											
7/25/08 10:52	7/25/08 10:52	Storm Grab	69	74.7	.							80,001	0.68											
7/29/08 11:25	7/29/08 11:25	Base Grab	85	80.4	5.00	961.0	927.0	7.3	61.0	0.5				1	2	575	74.8	0.203	0.249		1.1	0.30	0.04	1.20
7/31/08 11:56	7/31/08 11:56	Storm Grab	74	82.0								170	1.25											
8/12/08 11:25	8/12/08 11:25	Storm Grab	67	78.8								16,000	1.40											
8/27/08 10:48	8/27/08 10:48	Storm Grab	65	68.9	6.36	453.0	495.7	7.1	19.2	0.2				10	40	351	35.8	0.233	0.366	0.143	2.5	0.62	0.10	1.13
9/2/08 12:10	9/2/08 12:10	Storm Grab	68	77.0	6.01	462.8	463.0	7.0	23.2	0.2				9	25	309	35.8	0.199	0.276		1.9	0.42	0.06	0.62
9/11/08 11:30	9/11/08 11:30	Storm Grab	66	66.7								4,800	0.34							0.225				
9/19/08 10:40	9/19/08 10:40	Base Grab	72	74.7	4.69	933.0	957.0	7.2	61.0	0.5				2	2	612	82.5	0.253	0.320		1.2	0.24	0.05	1.42
10/2/08 11:02	10/2/08 11:02	Base Grab	60	59.7	7.10	795.0	972.0	7.2	61.0	0.5				1	1	633	167.0	0.144	0.271		1.6	0.24	0.02	0.83
10/7/08 11:27	10/7/08 11:27	Storm Grab	56	60.6								9,700	0.14											
10/7/08 14:10	10/7/08 14:10	Storm Grab	56	60.6	8.24	190.9	231.2	6.8	15.0	0.1				7	16	143	14.2	0.098	0.147		0.7	0.20	0.03	0.38
10/13/08 11:55	10/13/08 11:55	Storm Grab	51	64.9	7.61	233.4	267.6	7.0	20.7	0.1														
10/22/08 14:05	10/22/08 14:05	Storm Grab	42	58.3	7.55	825.0	1,030.0	7.1	61.0	0.5						692	99.3	0.475	0.513		1.8	0.19	0.04	1.78
11/6/08 11:55	11/6/08 11:55	Storm Grab	58	58.1	8.54	149.7	187.5	6.7	20.2	0.1				9	21	128		0.221	0.261		0.7	0.10	0.04	0.39

All duplicates are omitted from analysis.

Green font indicates value was greater than the maximum detection 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 values was ~. Value used for analysis was the ~value.

Table D.2 continued Monitoring results for 2NNBC outfall

Start Date Start Time	End Date End Time	Sample Type	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)
3/12/08 14:15	3/12/08 14:15	Melt Grab	80	736	186	70	14.9			0.0209	0.0260	0.0040	0.0048	0.0036	0.0159	0.0408	0.0729	0.00025	0.00025	0.0058	0.0058		4.0
3/19/08 14:44	3/19/08 14:44	Melt Grab	83		114	63	17.2	7.0	10.0														0.5
4/7/08 10:49	4/7/08 10:49	Snow Grab	53	234	100	39	8.7	1.6	3.0														0.5
4/15/08 12:10	4/15/08 12:10	Base Grab																					
4/24/08 11:35	4/24/08 11:35	Storm Grab																					
4/24/08 15:32	4/24/08 15:32	Storm Grab	47	35	88	40	7.5	5.2	6.1	0.0060	0.0127	0.0014	0.0026	0.0003	0.0098	0.0276	0.0718	0.00025	0.00025	0.0020	0.0020		0.5
6/9/08 10:29	6/9/08 10:29	Base Grab	202	42	260	35	7.0	1.4	2.1	0.0029	0.0029	0.0039	0.0039	0.0002	0.0015	0.0090	0.0132	0.00025	0.00025	0.0020	0.0020	0.012	3.0
6/11/08 12:35	6/11/08 12:35	Storm Grab	61		94	64	18.7	10.0	12.0		0.0144		0.0361		0.0112		0.0641		0.00025		0.0040		3.0
6/12/08 11:15	6/12/08 11:15	Storm Grab																					
6/17/08 10:55	6/17/08 10:55	Base Grab																					
7/10/08 14:12	7/10/08 14:12	Storm Grab	23	13	48	153	30.6	30.0	38.0														10.0
7/17/08 11:36	7/17/08 11:36	Storm Grab	317	75	284	21	4.8	1.0	2.0														0.5
7/17/08 11:36	7/17/08 11:36	Storm Grab																					
7/25/08 10:52	7/25/08 10:52	Storm Grab																					
7/29/08 11:25	7/29/08 11:25	Base Grab	285	120	380	23	5.3	1.1	1.2														0.5
7/31/08 11:56	7/31/08 11:56	Storm Grab																					
8/12/08 11:25	8/12/08 11:25	Storm Grab																					
8/27/08 10:48	8/27/08 10:48	Storm Grab	109	64	170	114	38.0	24.0	23.0														12.0
9/2/08 12:10	9/2/08 12:10	Storm Grab	98	54	160	86	21.1	23.0	24.0														2.0
9/11/08 11:30	9/11/08 11:30	Storm Grab																					
9/19/08 10:40	9/19/08 10:40	Base Grab	261	97	364	17	6.4	0.5	0.5														2.0
10/2/08 11:02	10/2/08 11:02	Base Grab	330	90	440	15	4.1	0.5	0.5														0.5
10/7/08 11:27	10/7/08 11:27	Storm Grab																					
10/7/08 14:10	10/7/08 14:10	Storm Grab	64	19	100	34	9.1	5.3	6.9														6.0
10/13/08 11:55	10/13/08 11:55	Storm Grab																					
10/22/08 14:05	10/22/08 14:05	Storm Grab	310	97	480	22	8.9	0.5	1.5	0.0040	0.0049	0.0057	0.0057	0.0008	0.0013	0.0150	0.0150	0.00025	0.00025	0.0015	0.0015		
11/6/08 11:55	11/6/08 11:55	Storm Grab	48	20	88	63		17.0	21.0														

All duplicates are omitted from analysis.

Green font indicates value was greater than the maximum detection 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 values was ~. Value used for analysis was the ~value.

Table D.3 Monitoring results for 4PP outfall

Start Date Start Time	End Date End Time	Sample Type	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)
3/11/08 9:35	3/11/08 9:35	Base Grab	48	48.9	10.06	1,036.0	1,478.0	7.7	61.0	0.7				0.5	1	848	91.4	0.020	0.034	0.015	1.2	0.08	0.02	1.17
3/12/08 14:50	3/12/08 14:50	Melt Grab	45	46.0	9.98	1,677.0	2,494.0	6.9	10.2	1.3				24.0	51	1,440	58.3	0.173	0.372		7.0	1.02	0.14	1.25
3/19/08 13:30	3/19/08 13:30	Melt Grab	52	48.0	12.16	969.0	1,400.0	6.5	45.6	0.7				3.0	7	826	78.1	0.056	0.103	0.053	1.8	0.17	0.02	1.16
3/24/08 13:38	3/24/08 13:38	Base Grab	41	48.2	10.43	1,283.0	1,849.0	7.6	61.0	0.9				1.0	5	1,070	87.1	0.023	0.040	0.020	1.5	0.08	0.02	1.30
4/10/08 12:00	4/10/08 12:00	Base Grab	41	49.1	10.05	929.0	1,321.0	7.6	61.0	0.7				0.5	2	765	87.7	0.017	0.049	0.020	0.9	0.04	0.02	1.05
4/15/08 11:24	4/15/08 11:24	Base Grab	61	50.2							10	1	0.29											
4/24/08 10:40	4/24/08 10:40	Storm Grab	55	54.0								4,600	0.04											
4/24/08 10:40	4/24/08 10:40	Storm Grab	55	54.0	9.95	168.6	223.3	6.9	9.5	0.1				44.0	120	149	13.5	0.117	0.293	0.102	1.7	0.39	0.07	0.45
4/25/08 13:20	4/25/08 13:20	Storm Grab	43	48.9	10.44	317.8	452.3	7.0	6.4	0.2				19.0	101	261	26.4	0.062	0.304	0.059	1.2	0.18	0.05	0.81
5/9/08 12:30	5/9/08 12:30	Base Grab	53	51.6	9.60	917.0	1,256.0	7.6	61.0	0.6				1.0	1	949	77.8	0.035	0.058	0.022	1.2	0.10	0.02	1.70
5/28/08 12:30	5/28/08 12:30	Base Grab	64	54.0								44	0.34											
5/30/08 9:45	5/30/08 9:45	Base Grab	58	53.8	8.40	948.0	1,258.0	7.4	61.0	0.6				2.0	5	740	83.0	0.040	0.111	0.041	1.7	0.10	0.07	1.24
6/5/08 10:22	6/5/08 10:22	Base Grab	68	54.0	9.84	980.0	1,298.0	7.4	61.0	0.7				1.0	2	781	86.3	0.183	0.215	0.068	1.5	0.12	0.04	1.47
6/11/08 13:05	6/11/08 13:05	Storm Grab	64	61.3		156.5	187.7	6.7	14.8	0.1				31.0	63	122	11.4	0.317	0.532	0.258	2.6	0.43	0.07	0.50
6/12/08 10:45	6/12/08 10:45	Storm Grab	68	61.9								6,300												
6/27/08 11:55	6/27/08 11:55	Base Grab	75	54.3	10.39	1,113.0	1,465.0	7.8	61.0	0.7				2.0	3	872	94.9	0.038	0.052	0.025	0.7	0.06	0.04	1.95
7/2/08 10:07	7/2/08 10:07	Base Grab	74	56.1								790	0.39											
7/3/08 10:15	7/3/08 10:15	Base Grab	70	54.7	10.47	1,034.0	1,356.0	7.8	61.0	0.7				1.0	2	867	93.3	0.110	0.145	0.045	1.5	0.05	0.03	1.25
7/9/08 15:20	7/9/08 15:20	Storm Grab	74	68.0	7.89	158.1	174.8	7.6	6.5	7.6				190.0	420	111	6.9	0.106	0.583	0.106	2.8	0.22	0.06	0.64
7/17/08 10:55	7/17/08 10:55	Base Grab	76	56.7	10.33	1,028.0	1,310.0	7.7	61.0	0.7				1.0	4	764	83.0	0.045	0.140	0.046	1.3	0.06	0.02	1.48
7/23/08 10:36	7/23/08 10:36	Base Grab	70	57.7								590	0.40											
7/29/08 12:00	7/29/05 12:00	Base Grab	89	56.5	9.86	1,013.0	1,296.0	7.7	61.0	0.7				0.5	1	801	86.2	0.028	0.048	0.027	1.4	0.06	0.02	1.56
7/31/08 11:20	7/31/08 11:20	Storm Grab	69	63.7								13,000	0.60											
8/7/08 10:40	8/7/08 10:40	Base Grab	76	57.7								400	0.27											
8/12/08 10:42	8/12/08 10:42	Storm Grab	65	61.0								10,000	0.48											
8/14/08 11:35	8/14/08 11:35	Base Grab	79	59.0	9.10	1,095.0	1,354.0	7.6	61.0	0.7				1.0	2	810		0.027	0.023	0.026	1.2	0.04	0.02	1.35
8/20/08 9:58	8/20/08 9:58	Base Grab	70	58.3								160	0.33											
8/26/08 10:37	8/26/08 10:37	Base Grab	70	56.3	9.36	994.0	1,274.0	7.6	61.0	0.6				1.0	1	774	88.5	0.057	0.070	0.041	1.3	0.13	0.04	1.16
8/27/08 10:15	8/27/08 10:15	Storm Grab	66	63.5	6.86	454.6	531.0	7.0	15.5	0.3				19.0	51	407	36.1	0.355	0.574	0.258	3.5	0.82	0.16	1.48
9/2/08 11:45	9/2/08 11:45	Storm Grab	73	71.6	7.72	246.9	262.0	7.0	12.4	0.2				40.0	107	221	19.7	0.243	0.426	0.183	3.1	0.78	0.10	0.82
9/9/08 11:35	9/9/08 11:35	Base Grab	65	57.2								120	0.48											
9/11/08 10:45	9/11/08 10:45	Storm Grab	64	64.2								2,000	0.19											
9/19/08 10:13	9/19/08 10:13	Base Grab	74	55.8	10.27	1,023.0	1,320.0	7.7	61.0	0.7				1.0	3	824	44.9	0.022	0.034	0.025	2.2	0.04	0.02	1.38
9/30/08 10:45	9/30/08 10:45	Base Grab	53	54.9								430	0.23											
10/2/08 10:40	10/2/08 10:40	Base Grab	65	55.4	9.56	891.0	1,155.0	7.7	61.0	0.6				1.0	5	722	82.4	0.060	0.126	0.050	2.4	0.10	0.06	1.23
10/7/08 11:06	10/7/08 11:06	Storm Grab	56	59.9								8,800	0.02											
10/7/08 14:30	10/7/08 14:30	Storm Grab	56	58.5	9.28	204.0	253.6	7.0		0.1				21.0	90	203		0.076	0.280	0.068		0.15	0.05	0.40
10/13/08 11:14	10/13/08 11:14	Storm Grab	58	64.0	8.76	138.2	160.2	7.0	18.6	0.1														
10/16/08 10:40	10/16/08 10:40	Base Grab	50	54.1								5	0.32											
10/20/08 14:10	10/20/08 14:10	Base Grab	66	54.9	10.17	1,074.0	1,404.0	7.6	61.0	0.7				1.0	7	861	87.0	0.024	0.038	0.045	1.9	0.04	0.02	3.40
10/22/08 10:33	10/22/08 10:33	Storm Grab	45	54.1								190	0.33											
10/22/08 14:30	10/22/08 14:30	Storm Grab	42	52.3	10.39	383.1	518.0	7.6	10.0	0.3				40.0	104	334	28.6	0.604	0.938	0.283	3.3	0.24	0.11	1.50
10/27/08 10:50	10/27/08 10:50	Base Grab	39	53.1	10.37	1,042.0	1,396.0	7.8	61.0	0.7				0.5	1	852	91.9	0.031	0.042	0.023	2.2	0.04	0.02	2.21
10/29/08 10:32	10/29/08 10:32	Base Grab	42	52.9								40	0.31											
11/6/08 11:34	11/6/08 11:34	Storm Grab	58	56.8	9.35	248.5	315.9	6.9	10.8	0.2				23.0	78	220		0.221	0.364	0.202	1.5	0.09	0.06	0.53
12/10/08 10:58	12/10/08 10:58	Base Grab	17	47.3	10.94	1,042.0	1,522.0	7.7	61.0	0.8														

All duplicates are omitted from analysis.

Green font indicates value was greater than the maximum detection 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 values was ~. Value used for analysis was the ~value.

Table D.3 continued Monitoring results for 4PP outfall

Start Date Start Time	End Date End Time	Sample Type	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)
3/11/08 9:35	3/11/08 9:35	Base Grab	282	226	508	12	2.4	0.5	0.5	0.0021	0.0028	0.0056	0.0057	0.00005	0.0002	0.0228	0.0228	0.00090	0.00090	0.0014	0.0014	0.006	2.0
3/12/08 14:50	3/12/08 14:50	Melt Grab	172	601	364	83	13.8			0.0261	0.0349	0.0068	0.0068	0.00110	0.0181	0.1260	0.1260	0.00025	0.00025	0.0054	0.0061		5.0
3/19/08 13:30	3/19/08 13:30	Melt Grab	247	107	424	12	4.6	2.5	3.4														0.5
3/24/08 13:38	3/24/08 13:38	Base Grab	270	412	244	15	1.9	0.5	0.5														0.5
4/10/08 12:00	4/10/08 12:00	Base Grab	277	203	488	10	1.8	0.5	0.5														0.5
4/15/08 11:24	4/15/08 11:24	Base Grab																					
4/24/08 10:40	4/24/08 10:40	Storm Grab																					
4/24/08 10:40	4/24/08 10:40	Storm Grab	33	31	148	125	9.7	14.0	20.0	0.0149	0.0377	0.0025	0.0056	0.00100	0.0255	0.0299	0.1510	0.00025	0.00025	0.0092	0.0118		2.0
4/25/08 13:20	4/25/08 13:20	Storm Grab	77	72	188	58	7.5	4.4	5.4														0.5
5/9/08 12:30	5/9/08 12:30	Base Grab	268	223	472	13	5.3	0.5	1.0														0.5
5/28/08 12:30	5/28/08 12:30	Base Grab																					
5/30/08 9:45	5/30/08 9:45	Base Grab	269	188	64	17	5.3	3.6	4.3														0.5
6/5/08 10:22	6/5/08 10:22	Base Grab	274	204	486	14	3.9	0.5	0.5														0.5
6/11/08 13:05	6/11/08 13:05	Storm Grab	40	20	60	97	25.2	21.0	23.0		0.0200		0.0036		0.0145		0.0786		0.00025		0.0064		4.0
6/12/08 10:45	6/12/08 10:45	Storm Grab																					
6/27/08 11:55	6/27/08 11:55	Base Grab	327	217	82	13	6.7	0.5	0.5														
7/2/08 10:07	7/2/08 10:07	Base Grab																					
7/3/08 10:15	7/3/08 10:15	Base Grab		208	456	21		0.5	0.5														0.5
7/9/08 15:20	7/9/08 15:20	Storm Grab	39	19	72	134	12.9	14.0	22.0														50.0
7/17/08 10:55	7/17/08 10:55	Base Grab	277	206	572	15	7.5	0.5	1.0														0.5
7/23/08 10:36	7/23/08 10:36	Base Grab																					
7/29/08 12:00	7/29/05 12:00	Base Grab	275	206	472	13	2.0	0.5	0.5														0.5
7/31/08 11:20	7/31/08 11:20	Storm Grab																					
8/7/08 10:40	8/7/08 10:40	Base Grab																					
8/12/08 10:42	8/12/08 10:42	Storm Grab																					
8/14/08 11:35	8/14/08 11:35	Base Grab	285		496	16	2.6	0.5	0.5														4.0
8/20/08 9:58	8/20/08 9:58	Base Grab																					
8/26/08 10:37	8/26/08 10:37	Base Grab	294	210	500	13	2.5	0.5	0.5														5.0
8/27/08 10:15	8/27/08 10:15	Storm Grab		75	204	179		24.0	45.0														
9/2/08 11:45	9/2/08 11:45	Storm Grab	52	40	120	161	28.7	23.0	24.0														6.0
9/9/08 11:35	9/9/08 11:35	Base Grab																					
9/11/08 10:45	9/11/08 10:45	Storm Grab																					
9/19/08 10:13	9/19/08 10:13	Base Grab	294	214	484	12	3.1	0.5	0.5														2.0
9/30/08 10:45	9/30/08 10:45	Base Grab																					
10/2/08 10:40	10/2/08 10:40	Base Grab	247	186	412	15	2.7	0.5	0.5														0.5
10/7/08 11:06	10/7/08 11:06	Storm Grab																					
10/7/08 14:30	10/7/08 14:30	Storm Grab	59	37	104	61	17.7	5.6	7.9														2.0
10/13/08 11:14	10/13/08 11:14	Storm Grab																					
10/16/08 10:40	10/16/08 10:40	Base Grab																					
10/20/08 14:10	10/20/08 14:10	Base Grab	99	221	512	7		0.5	0.5														2.0
10/22/08 10:33	10/22/08 10:33	Storm Grab																					
10/22/08 14:30	10/22/08 14:30	Storm Grab	109	67	192	143		24.0	24.0														
10/27/08 10:50	10/27/08 10:50	Base Grab	305	240	500	5	2.9	0.5	0.5														
10/29/08 10:32	10/29/08 10:32	Base Grab																					
11/6/08 11:34	11/6/08 11:34	Storm Grab	78	40	140	128		34.0	41.0														
12/10/08 10:58	12/10/08 10:58	Base Grab		254																			

All duplicates are omitted from analysis.

Green font indicates value was greater than the maximum detection 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 values was ~. Value used for analysis was the ~value.

Table D.4 Monitoring results for 6UMN outfall

Start Date Start Time	End Date End Time	Sample Type	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)
1/28/08 14:40	1/28/08 14:40	Melt Grab	43	47.1	10.39	5,280.0	7,740.0	7.7	4.3	4.3				66.0	315	4,140	91.2	0.658	1.340	0.129	13.0	1.21	0.24	3.01
3/12/08 15:45	3/12/08 15:45	Melt Grab	45	45.3	10.83	1,269.0	1,908.0	7.7	2.8	1.0				42.0	238	1,110	52.4	0.064	0.579		2.8	0.42	0.16	2.83
3/19/08 12:10	3/19/08 12:10	Melt Grab	44	49.1	10.67	1,142.0	1,625.0	7.8	12.5	0.8				6.0	33	867	69.8	0.034	0.091	0.029	1.4	0.06	0.02	3.53
3/24/08 11:30	3/24/08 11:30	Base Grab	34	49.8	10.49	1,072.0	1,507.0	7.7	61.0	0.8				0.5	1	931	97.1	0.032	0.035	0.023	1.5	0.03	0.02	5.93
4/7/08 10:16	4/7/08 10:16	Storm Grab	37	49.1	10.82	885.0	1,256.0	7.7	20.7	0.6				6.0	24	742	64.4	0.019	0.101	0.024	1.7	0.17	0.04	4.33
4/15/08 10:36	4/15/08 10:36	Base Grab	54	51.1							20	60	0.35											
4/24/08 10:12	4/24/08 10:12	Storm Grab	54	54.9								1,000	0.07											
4/24/08 15:02	4/24/08 15:02	Storm Grab	59	55.4	9.28	438.1	568.0	7.3	14.0	0.3				10.0	37	329	34.6	0.413	0.191	0.087	0.8	0.14	0.07	2.18
4/25/08 11:47	4/25/08 11:47	Storm Grab	43	48.2	11.35	221.6	318.8	7.0	15.6	0.2				8.0	38	179	17.9	0.042	0.124	0.043	0.6	0.12	0.04	1.18
5/9/08 10:50	5/9/08 10:50	Base Grab	55	53.1	9.46	1,134.0	1,521.0	7.8	61.0	0.8				1.0	3	811	94.5	0.005	0.019	0.005	1.5	0.01	0.02	6.17
6/2/08 11:35	6/2/08 11:35	Base Grab	68	54.9	10.57	1,130.0	1,476.0	7.8	61.0	0.7				0.5	1	946	61.1	0.033	0.039	0.027	1.2	0.01	0.02	7.21
6/11/08 12:00	6/11/08 12:00	Storm Grab	65	61.3		140.3	168.2	6.8	17.3	0.1				20.0	59	101	12.0	0.083	0.192	0.082	1.0	0.24	0.05	0.69
6/12/08 10:22	6/12/08 10:22	Storm Grab	65	60.1								880												
6/27/08 11:05	6/27/08 11:05	Base Grab	74	56.7	9.95	1,104.0	1,409.0	7.6	61.0	0.7				1.0	6	887	97.9	0.012	0.017	0.033	0.8	0.01	0.02	6.27
7/2/08 9:37	7/2/08 9:37	Base Grab	69	56.8								3,400	0.38											
7/3/08 9:35	7/3/08 9:35	Base Grab	63	57.2	9.67	1,213.0	1,535.0	7.9	61.0	0.8				1.0	12	1,020			0.022	0.007	1.4	0.01	0.02	6.21
7/17/08 10:10	7/17/08 10:10	Base Grab	77	61.2	9.28	1,222.0	1,467.0	7.7	61.0	0.7				1.0	4	880	102.0	0.005	0.020	0.003	1.2	0.01	0.02	6.24
7/17/08 11:05	7/17/08 11:05	Storm Grab	72	70.7	3.01	781.0	838.0	7.3	14.0	0.4							30.0	0.111	0.835		5.1	0.02	0.02	0.03
7/17/08 11:50	7/17/08 11:50	Storm Grab	72	70.5	4.38	242.0	260.1	7.2	23.1	0.1							10.3	0.214	0.410		1.4	0.01	0.06	0.86
7/17/08 12:35	7/17/08 12:35	Storm Grab	72	70.2	6.27	199.7	215.3	7.2	28.5	0.1							39.5	0.152	0.206		1.3	0.13	0.07	1.81
7/23/08 9:59	7/23/08 9:59	Base Grab	68	62.8								40	0.50											
7/25/08 9:12	7/25/08 9:12	Storm Grab	82	68.4		754.0	831.0	7.7	9.0	0.4							33.5	0.083	0.354		3.9	0.12	0.09	2.01
7/25/08 9:57	7/25/08 9:57	Storm Grab	82	66.7	8.77	724.0	812.0	7.8	18.6	0.4							59.9	0.064	0.146		2.7	0.20	0.06	3.24
7/25/08 10:42	7/25/08 10:42	Storm Grab	82	67.1	8.71	548.0	613.0	7.7	15.0	0.3							40.9	0.125	0.254		2.1	0.25	0.07	2.31
7/25/08 11:15	7/25/08 11:15	Storm Grab	71	66.6								7,600	0.59											
7/29/08 10:55	7/29/08 10:55	Base Grab	82	64.0	8.84	1,217.0	1,411.0	7.8	61.0	0.7				0.5	4	899	101.0	0.011	0.005	0.017	1.3	0.01	0.02	6.32
7/31/08 10:59	7/31/08 10:59	Storm Grab	69	66.2								4,000	0.67											
8/4/08 0:40	8/4/08 0:40	Storm Grab	85	71.6	6.37	183.8	194.8	7.4		0.1								0.153	0.219		1.1	0.44	0.05	1.33
8/7/08 9:51	8/7/08 9:51	Base Grab	71	64.9								2,000	0.28											
8/12/08 10:04	8/12/08 10:04	Storm Grab	65	62.6								400	0.31											
8/14/08 8:17	8/14/08 8:17	Base Grab	71	59.0	9.12	1,158.0	1,430.0	7.7	61.0	0.7				1.0	1	926	99.2	0.020	0.005	0.015	1.2	0.01	0.02	6.00
8/20/08 9:34	8/20/08 9:34	Base Grab	71	65.3								110	0.30											
8/26/08 9:58	8/26/08 9:58	Base Grab	67	60.4	8.38	1,173.0	1,424.0	7.6	61.0	0.7				1.0	3	930	105.0	0.005	0.018	0.005	1.5	0.01	0.02	6.06
8/27/08 6:50	8/27/08 6:50	Storm Grab	72	65.7	6.17	890.0	1,011.0	7.4	14.7	0.5							46.7	0.234	1.470	0.018	7.0	0.26	0.23	1.94
8/27/08 7:35	8/27/08 7:35	Storm Grab	72	65.5	7.06	314.6	358.3	7.1	17.8	0.2							24.7	0.205	0.414	0.153	2.8	0.56	0.14	1.77
8/27/08 8:20	8/27/08 8:20	Storm Grab	72	65.3	7.78	293.4	335.1	7.1	24.5	0.2							26.5	0.258	0.411	0.225	2.3	0.57	0.10	2.08
8/27/08 23:10	8/27/08 23:10	Storm Grab	65	67.3	2.26	459.0	512.0	7.1	15.0	0.2							35.8	0.036	0.504	0.003	3.9	0.02	0.08	0.74
9/2/08 11:01	9/2/08 11:01	Storm Grab	58	66.2	0.34	499.0	563.0	6.6	11.3	0.3							26.8	0.057	0.444	0.005	2.9	0.02	0.13	0.61
9/2/08 11:46	9/2/08 11:46	Storm Grab	58	65.7	2.26	245.4	279.2	6.6	14.2	0.1							21.3		0.246		1.9	0.01	0.02	1.41
9/2/08 12:31	9/2/08 12:31	Storm Grab	58	65.3	4.35	456.0	523.0	6.8	17.8	0.3							36.2		0.638		2.4	0.14	0.14	2.56
9/9/08 11:10	9/9/08 11:10	Base Grab	58	59.9								28	0.33											
9/11/08 5:13	9/11/08 5:13	Storm Grab	69	63.1	5.73	555.0	652.0	7.5	22.0	0.3							49.3	0.178	0.444		3.7	0.10	0.04	1.41
9/11/08 5:58	9/11/08 5:58	Storm Grab	69	62.4	7.62	278.1	329.0	7.3	27.0	0.2							13.4	0.110	0.199		1.1	0.17	0.04	0.92
9/11/08 6:43	9/11/08 6:43	Storm Grab	69	62.2	8.22	308.0	365.2	7.4	32.0	0.2							26.1	0.148	0.218		1.2	0.17	0.04	1.90
9/11/08 10:15	9/11/08 10:15	Storm Grab	64	62.6								330	0.32											
9/19/08 9:36	9/19/08 9:36	Base Grab	70	60.8	9.03	1,064.0	1,284.0	7.8	61.0	0.6				2.0	4	915	98.3	0.005	0.005	0.008	2.2	0.01	0.02	5.33
9/30/08 10:25	9/30/08 10:25	Base Grab	53	59.4								30	0.35											
10/2/08 10:05	10/2/08 10:05	Base Grab	53	56.1	9.33	1,056.0	1,356.0	7.5	61.0	0.7				1.0	2	943	101.0	0.015	0.021	0.008	2.3	0.01	0.02	4.66
10/7/08 10:44	10/7/08 10:44	Storm Grab	56	59.9								7,400	0.06											
10/13/08 8:34	10/13/08 9:12	Storm Composite	49	53.2	8.98	370.2	494.4	6.4	12.5	0.2						274	30.2	0.029	0.250		1.7	0.01	0.04	1.02
10/13/08 10:55	10/13/08 10:55	Storm Grab	58	64.2																				
10/16/08 10:16	10/16/08 10:16	Base Grab	50	53.4								5	0.55											
10/20/08 14:32	10/20/08 14:32	Base Grab	66	58.6	8.97	870.0	1,080.0	7.7	61.0	0.5				1.0	1	781	79.2	0.028	0.012	0.008	1.9	0.01	0.02	2.20
10/22/08 10:10	10/22/08 10:10	Storm Grab	45	54.7								650	0.47											
10/22/08 14:16	10/22/08 15:54	Storm Composite	48	51.8	9.53	258.0	351.9	7.1	9.0	0.2						273	25.5	0.076	0.342	0.062	1.3	0.01	0.06	0.91
10/27/08 10:25	10/27/08 10:25	Base Grab	39	47.5	10.15	866.0	1,261.0	7.8	61.0	0.6				0.5	1	770	78.1	0.029	0.035	0.021	2.1	0.02	0.02	2.96
10/29/08 10:10	10/29/08 10:10	Base Grab	41	51.8								30	0.36											
12/23/08 10:00	12/23/08 10:00	Base Grab	10	50.7	10.92	1,546.0	2,143.0	7.8	61.0	1.1														

All duplicates are omitted from analysis.

Green font indicates value was greater than the maximum detection 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 values was ~. Value used for analysis was the ~value.

Table D.4 continued Monitoring results for 6UMN outfall

Start Date Start Time	End Date End Time	Sample Type	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)
1/28/08 14:40	1/28/08 14:40	Melt Grab	196	1954	416	226	22.0	34.0	46.0	0.0116	0.0939	0.0125	0.0429	0.00060	0.0444	0.1130	0.1580	0.00025	0.00025	0.0065	0.0456	14.00	0.04
3/12/08 15:45	3/12/08 15:45	Melt Grab	175	399	308	141	17.2			0.0138	0.0318	0.0067	0.0147	0.00030	0.0582	0.0119	0.1230	0.00025	0.00025	0.0065	0.0175	0.04	6.00
3/19/08 12:10	3/19/08 12:10	Melt Grab	314	280	310	16	3.7	0.5	1.4														0.50
3/24/08 11:30	3/24/08 11:30	Base Grab	345	217	800	12	2.6	0.5	0.5														0.50
4/7/08 10:16	4/7/08 10:16	Storm Grab	244	191	300	35	5.4	2.2	3.0														0.50
4/15/08 10:36	4/15/08 10:36	Base Grab																					
4/24/08 10:12	4/24/08 10:12	Storm Grab																					
4/24/08 15:02	4/24/08 15:02	Storm Grab	110	76	202	39	6.2	3.6	4.9	0.0052	0.0118	0.0042	0.0061	0.00025	0.0102	0.0196	0.0496	0.00025	0.00025	0.0042	0.0063		0.50
4/25/08 11:47	4/25/08 11:47	Storm Grab	61	46	152	27	6.6	2.1	2.9														0.50
5/9/08 10:50	5/9/08 10:50	Base Grab	355	197	552	13	7.0	2.4	2.7														0.50
6/2/08 11:35	6/2/08 11:35	Base Grab	358	182	592	15	6.1	0.5	0.5	0.0020	0.0020	0.0074	0.0074	0.00005	0.0001	0.0054	0.0054	0.00025	0.00025	0.0042	0.0042	0.01	18.00
6/11/08 12:00	6/11/08 12:00	Storm Grab	38	13	64	59	18.7	5.7	7.3		0.0118		0.0040		0.0123		0.0672		0.00025		0.0050		0.50
6/12/08 10:22	6/12/08 10:22	Storm Grab																					
6/27/08 11:05	6/27/08 11:05	Base Grab	354	177	396	13	6.9	0.5	0.5														
7/2/08 9:37	7/2/08 9:37	Base Grab																					
7/3/08 9:35	7/3/08 9:35	Base Grab	326	193	414	17		0.5	1.2														
7/17/08 10:10	7/17/08 10:10	Base Grab	344	211	96	13	6.3	2.1	3.0														0.50
7/17/08 11:05	7/17/08 11:05	Storm Grab	132	80	236	198	33.0				0.0293		0.0177		0.0133		0.1700		0.00025		0.0152		
7/17/08 11:50	7/17/08 11:50	Storm Grab	52	21	80	70	12.4				0.0131		0.0054		0.0072		0.0664		0.00025		0.0064		
7/17/08 12:35	7/17/08 12:35	Storm Grab	72	41	172	48	10.5				0.0093		0.0042		0.0029		0.0354		0.00025		0.0045		
7/23/08 9:59	7/23/08 9:59	Base Grab																					
7/25/08 9:12	7/25/08 9:12	Storm Grab	115	93	208	148	29.5																
7/25/08 9:57	7/25/08 9:57	Storm Grab	184	94	336	88	19.2																
7/25/08 10:42	7/25/08 10:42	Storm Grab	141	75	232	85	18.4																
7/25/08 11:15	7/25/08 11:15	Storm Grab																					
7/29/08 10:55	7/29/08 10:55	Base Grab	309	183	536	15	2.1	0.5	0.5														2.00
7/31/08 10:59	7/31/08 10:59	Storm Grab																					
8/4/08 0:40	8/4/08 0:40	Storm Grab	44	22		36	6.6																
8/7/08 9:51	8/7/08 9:51	Base Grab																					
8/12/08 10:04	8/12/08 10:04	Storm Grab																					
8/14/08 8:17	8/14/08 8:17	Base Grab	319	218	540	19	8.3	0.5	0.5	0.0018		0.0093		0.00005		0.1100		0.00025		0.0020			43.00
8/20/08 9:34	8/20/08 9:34	Base Grab																					
8/26/08 9:58	8/26/08 9:58	Base Grab	347	191	556	15	3.6	0.5	2.9														0.50
8/27/08 6:50	8/27/08 6:50	Storm Grab	155	87	232	265	53.1																
8/27/08 7:35	8/27/08 7:35	Storm Grab	70	38	228	145	39.6																
8/27/08 8:20	8/27/08 8:20	Storm Grab	71	40	124	97	32.4																
8/27/08 23:10	8/27/08 23:10	Storm Grab	128	58	192	155	28.6																
9/2/08 11:01	9/2/08 11:01	Storm Grab	79	37	144	159	14.0																
9/2/08 11:46	9/2/08 11:46	Storm Grab	56	35	120	102																	
9/2/08 12:31	9/2/08 12:31	Storm Grab	94	69	160	76																	
9/9/08 11:10	9/9/08 11:10	Base Grab																					
9/11/08 5:13	9/11/08 5:13	Storm Grab	175	95	264	95	13.9																
9/11/08 5:58	9/11/08 5:58	Storm Grab	47	31	92	56	12.5																
9/11/08 6:43	9/11/08 6:43	Storm Grab	81	50	144	35	12.2																
9/11/08 10:15	9/11/08 10:15	Storm Grab																					
9/19/08 9:36	9/19/08 9:36	Base Grab	337	194	512	16	4.4	3.3	3.5														2.00
9/30/08 10:25	9/30/08 10:25	Base Grab																					
10/2/08 10:05	10/2/08 10:05	Base Grab	350	202	536	24	6.1	7.1	7.6														0.50
10/7/08 10:44	10/7/08 10:44	Storm Grab																					
10/13/08 8:34	10/13/08 9:12	Storm Composite	107	54	178	82	8.8																6.00
10/13/08 10:55	10/13/08 10:55	Storm Grab																					
10/16/08 10:16	10/16/08 10:16	Base Grab																					
10/20/08 14:32	10/20/08 14:32	Base Grab	320	167	496	6		0.5	0.5														0.50
10/22/08 10:10	10/22/08 10:10	Storm Grab																					
10/22/08 14:16	10/22/08 15:54	Storm Composite	106	47	168	120	17.6	17.0	20.0														
10/27/08 10:25	10/27/08 10:25	Base Grab	313	171	520	6	2.8	0.5	0.5	0.0025		0.0096		0.00005		0.0039		0.00025		0.0051			
10/29/08 10:10	10/29/08 10:10	Base Grab																					
12/23/08 10:00	12/23/08 10:00	Base Grab		411																			

All duplicates are omitted from analysis.

Green font indicates value was greater than the maximum detection 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 values was ~. Value used for analysis was the ~value.

Table D.5 Monitoring results for 7LSTU outfall

Start Date Start Time	End Date End Time	Sample Type	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)
3/17/08 15:30	3/17/08 15:30	Snow Grab	32	37.9	7.25	2,078.0	3,546.0	7.0	5.2	1.8				66	230	1,950	26.0	0.249	0.823	0.239	9.9	1.30	0.11	0.78
3/19/08 14:00	3/19/08 14:00	Melt Grab	32	39.2	12.57	867.0	1,447.0	7.5	5.0	0.7				30	111	860	20.4	0.299	0.695	0.256	5.7	1.13	0.09	0.68
4/7/08 12:04	4/7/08 12:04	Storm Grab	37	42.1	11.87	653.0	1,034.0	7.4	16.0	0.5				11	30	576	17.8	0.074	0.243	0.081	2.7	0.43	0.07	0.72
4/15/08 9:55	4/15/08 9:55	Base Grab	53	43.3							40	17	0.32											
4/24/08 9:42	4/24/08 9:42	Storm Grab	54	53.8								760	0.09											
4/24/08 14:36	4/24/08 14:36	Storm Grab	59	54.5	9.99	388.2	510.0	7.1	5.7	0.2				20	95	320	16.3	0.076	0.484	0.072	1.3	0.19	0.07	0.49
4/25/08 11:00	4/25/08 11:00	Storm Grab	43	48.0	11.57	251.5	363.1	7.2	3.0	0.2				36	216	202	10.2	0.056	1.120	0.072	1.5	0.16	0.07	0.47
6/11/08 11:20	6/11/08 11:20	Storm Grab	64	61.7		133.8	159.4	6.9	12.2	0.1				41	81	125	7.8	0.096	0.260	0.081	1.9	0.49	0.06	0.63
6/12/08 9:51	6/12/08 9:51	Storm Grab	65	63.3								3,000												
7/29/08 12:50	7/29/08 12:50	Base Grab	88	66.7	8.73	1,184.0	1,329.0	7.9	61.0	0.7				1	1	838	59.2	0.038	0.058	0.039	1.6	0.07	0.05	2.34
7/31/08 10:27	7/31/08 10:27	Storm Grab	69	69.4								10,000	0.51											
8/12/08 9:35	8/12/08 9:35	Storm Grab	67	66.6								10,000	0.61											
8/12/08 19:14	8/12/08 19:14	Storm Grab	69	66.7	6.36	151.7	170.2	6.8	5.8	0.1							11.4	0.041	0.441		1.9	0.14	0.05	0.31
8/12/08 19:59	8/12/08 19:59	Storm Grab	69	67.3	3.62	235.1	262.3	6.9	5.0	0.1							16.1	0.013	0.809		3.1	0.04	0.12	0.03
8/12/08 20:44	8/12/08 20:44	Storm Grab	69	67.1	5.66	522.0	583.0	6.9	11.9	0.3							26.2	0.014	0.271		2.4	0.02	0.08	0.75
8/13/08 10:07	8/13/08 10:07	Base Grab	69	67.1	8.28	526.0	588.0	7.5	20.4	0.3				5	25	358	25.0	0.051	0.180	0.060	1.5	0.14	0.08	0.40
8/27/08 22:43	8/27/08 22:43	Storm Grab	67	67.8	5.50	102.1	113.1	7.0	15.4	0.1							6.5	0.042	0.423	0.036	2.1	0.13	0.04	0.52
8/28/08 0:13	8/28/08 0:13	Storm Grab	67	67.6	7.04	95.9	106.6	7.9	6.2	0.1							5.7	0.061	0.545	0.061	1.9	0.49	0.04	0.42
8/28/08 3:13	8/28/08 3:13	Storm Grab	67	67.1	7.88	207.9	232.5	7.4	15.3	0.1							12.2	0.067	0.200	0.061	1.1	0.27	0.05	0.57
9/2/08 11:05	9/2/08 11:05	Storm Grab	78	75.0	7.98	185.6	189.5	7.0	9.9	0.1				30	140	156	13.6	0.153	0.323	0.103	2.0	0.58	0.04	0.64
9/11/08 9:36	9/11/08 9:36	Storm Grab	65	63.0								2,100	0.30											
9/11/08 10:37	9/11/08 10:37	Storm Grab	72	65.1	5.74	97.0	111.0	6.6	16.0	0.1						83	5.5	0.020	0.252		1.1	0.05	0.03	0.48
9/11/08 11:22	9/11/08 11:22	Storm Grab	72	65.1	5.72	395.8	453.0	7.3	1.4	0.2						299	18.2	0.159	1.540		2.6	0.08	0.04	0.66
9/11/08 12:07	9/11/08 12:07	Storm Grab	72	65.1	6.24	362.8	415.4	7.5	5.8	0.2						267	17.7	0.103	0.385		2.1	0.01	0.04	0.68
9/23/08 17:04	9/23/08 17:04	Storm Grab	58	64.2	5.39	87.8	101.7	7.1	7.0	0.1							6.2	0.023	0.495	0.023	2.1	0.22	0.03	0.41
9/23/08 18:33	9/23/08 18:33	Storm Grab	58	64.2	7.07	408.9	473.3	6.9	4.3	0.2							24.1	0.066	0.352	0.068	1.7	0.22	0.06	0.74
9/23/08 21:33	9/23/08 21:33	Storm Grab	58	63.5	7.85	291.2	339.6	7.1	17.4	0.2							21.5	0.035	0.138		0.8	0.13	0.08	0.73
10/7/08 10:10	10/7/08 10:10	Storm Grab	56	59.5								18,000	0.01											
10/13/08 10:18	10/13/08 10:18	Storm Grab	61	63.0																				
10/29/08 9:32	10/29/08 9:32	Base Grab	37	41.5								580	0.36											
11/6/08 2:17	11/6/08 10:17	Storm Composite	38	49.3	8.10	231.0	327.0	6.9	7.6	0.2						218			0.100		0.3		0.02	0.07
11/13/08 10:29	11/13/08 10:29	Storm Grab	43	46.6	12.06	319.3	471.6	7.4	2.1	0.2				62	246	346								
12/23/08 11:00	12/23/08 11:00	Base Grab	10	34.0	13.57	1,213.0	2,256.0	7.9		1.1														

All duplicates are omitted from analysis.

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Table D.5 continued Monitoring results for 7LSTU outfall

Start Date Start Time	End Date End Time	Sample Type	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)
3/17/08 15:30	3/17/08 15:30	Snow Grab	89	925	156	296	20.7	16.0	24.0	0.0258	0.0695	0.0049	0.0173	0.00080	0.0655	0.0595	0.3100	0.00025	0.00025	0.0075	0.0206	0.044	22.0
3/19/08 14:00	3/19/08 14:00	Melt Grab		370	152	129	18.2	12.0	17.0														9.0
4/7/08 12:04	4/7/08 12:04	Storm Grab		239	148	53	8.2	3.8	5.8														0.5
4/15/08 9:55	4/15/08 9:55	Base Grab																					
4/24/08 9:42	4/24/08 9:42	Storm Grab																					
4/24/08 14:36	4/24/08 14:36	Storm Grab	65	85	102	80	7.7	4.6	5.7	0.0073	0.0210	0.0021	0.0061	0.00025	0.0271	0.0097	0.1060	0.00025	0.00025	0.0020	0.0078		2.0
4/25/08 11:00	4/25/08 11:00	Storm Grab	43	70	90	112	8.0	3.0	5.6														2.0
6/11/08 11:20	6/11/08 11:20	Storm Grab	38		56	98	14.4	10.5	14.0		0.0159		0.0042		0.0153		0.0980		0.00025		0.0051		2.0
6/12/08 9:51	6/12/08 9:51	Storm Grab																					
7/29/08 12:50	7/29/08 12:50	Base Grab	341	207	488	28	6.2	0.5	1.4	0.0028	0.0031	0.0056	0.0057	0.00010	0.0008	0.0039	0.0046	0.00025	0.00025	0.0020	0.0020	0.012	2.0
7/31/08 10:27	7/31/08 10:27	Storm Grab																					
8/12/08 9:35	8/12/08 9:35	Storm Grab																					
8/12/08 19:14	8/12/08 19:14	Storm Grab	17	6	52	125	7.2																
8/12/08 19:59	8/12/08 19:59	Storm Grab	34	46	112	234	15.8																
8/12/08 20:44	8/12/08 20:44	Storm Grab	83	112	194	78	14.9																
8/13/08 10:07	8/13/08 10:07	Base Grab	117	3	204	36	7.2	1.6	2.8														0.5
8/27/08 22:43	8/27/08 22:43	Storm Grab	33	7	68	127	14.4																
8/28/08 0:13	8/28/08 0:13	Storm Grab	22	14	56	106	12.2																
8/28/08 3:13	8/28/08 3:13	Storm Grab	32	30	88	48	12.9																
9/2/08 11:05	9/2/08 11:05	Storm Grab	37	21	80	147	21.1	21.1	24.0														4.0
9/11/08 9:36	9/11/08 9:36	Storm Grab																					
9/11/08 10:37	9/11/08 10:37	Storm Grab	34	7	48	70	11.9																
9/11/08 11:22	9/11/08 11:22	Storm Grab	49	99	192	208	14.2																
9/11/08 12:07	9/11/08 12:07	Storm Grab	76	71	156	73	13.1																
9/23/08 17:04	9/23/08 17:04	Storm Grab	40	5	78	155	8.4																
9/23/08 18:33	9/23/08 18:33	Storm Grab	74	86	178	73	14.6																
9/23/08 21:33	9/23/08 21:33	Storm Grab	64	49	124	32	8.8																
10/7/08 10:10	10/7/08 10:10	Storm Grab																					
10/13/08 10:18	10/13/08 10:18	Storm Grab																					
10/29/08 9:32	10/29/08 9:32	Base Grab																					
11/6/08 2:17	11/6/08 10:17	Storm Composite	85	43	114	99			23.0														
11/13/08 10:29	11/13/08 10:29	Storm Grab																					
12/23/08 11:00	12/23/08 11:00	Base Grab		533																			

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.

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Table D.6 Monitoring results for 10SA outfall

Start Date Start Time	End Date End Time	Sample Type	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)
1/6/08 12:39	1/6/09 15:10	Melt Composite	13															0.048						
1/7/08 9:37	1/7/09 21:56	Melt Composite	13																					
1/24/08 12:35	1/24/08 12:35	Base Grab	13	32.0				8.2	61.0							573			0.196		1.0			
1/28/08 12:39	1/28/08 12:39	Melt Grab	14	32.0												8,300			0.608		15.0			
1/28/08 13:05	1/28/08 15:41	Melt Composite	14	39.7	13.60	6,240.0	10,570.0	7.1	2.5	5.9						5,880	51.6	0.195	0.993	0.126	25.0	1.83	0.31	1.25
1/28/08 13:16	1/28/08 13:16	Melt Grab	14	40.3	12.16	7,530.0	12,350.0	8.0	2.6	7.0				72	230.0									
1/28/08 18:14	1/29/08 1:09	Melt Composite	14	37.2	13.08	3,399.0	5,870.0	7.3	5.0	3.1						3,180	36.1	0.221	0.454	0.172	12.0	1.35	0.18	0.81
2/4/08 12:01	2/4/08 12:01	Snow Grab	16	34.9	11.72	28,100.0	49,040.0	7.8		32.1						33,000			0.743		8.9			
2/17/08 15:07	2/17/08 17:01	Melt Composite	21	54.7	7.67	1,978.0	2,590.0	7.1	6.0	15.8														
2/23/08 13:11	2/23/08 17:53	Melt Composite	23	56.3	7.07	4,830.0	6,200.0	7.5	4.0	3.4														
2/24/08 12:46	2/24/08 19:43	Melt Composite	24	58.8	6.49	5,210.0	6,470.0	7.4	5.2	3.6														
2/29/08 11:08	2/29/08 17:03	Melt Composite	17	50.2	10.18	12,010.0	16,800.0	7.2	3.0	9.9				66	186.0	10,100	44.4	0.057	7.140	0.032	24.0	1.58	0.15	1.53
3/7/08 9:06	3/7/08 9:06	Base Grab	28	36.7	13.62	3,006.0	5,250.0	8.1		2.8						2,960	27.9		0.198		5.1			
3/10/08 15:07	3/11/08 1:00	Melt Composite		32.0																				
3/11/08 10:51	3/11/08 13:00	Melt Composite		42.8	9.38	2,255.0	3,544.0	7.0	3.4	1.9				64	4.0	1,950	20.4	0.210	0.872		8.3	0.73	0.14	0.62
3/13/08 15:03	3/13/08 19:00	Melt Composite	43	38.8	12.51	521.0	876.0	6.9	11.5	0.4				19	67.0	498	9.0	0.712	0.977		3.0	1.21	0.07	0.67
3/14/08 11:42	3/15/08 6:05	Snow Composite	34	34.2	12.31	531.0	951.0	6.9	20.9	0.5						539	11.0	0.701	0.876		4.5	1.2	0.06	0.63
3/24/08 10:30	3/24/08 10:30	Base Grab	32	37.6	13.04	1,744.0	2,996.0	7.3	29.2	1.5				4	11.0	1,620	22.4	0.110	0.193	0.093	3.0	0.46	0.05	0.90
3/31/08 9:23	4/1/08 4:45	Melt Composite	37	36.1	13.28	1,366.0	2,409.0	7.7	8.8	1.2						1,300	18.5	0.077	0.254		3.4	0.33	0.06	0.72
4/1/08 10:13	4/2/08 4:20	Melt Composite	45	37.9	12.90	1,529.0	2,614.0	8.0	10.1	1.3				19	69.0	1,370	19.0	0.113	0.258		2.9	0.24	0.06	0.60
4/3/08 10:29	4/4/08 2:07	Melt Composite	52	46.0	11.56	589.0	876.0	7.4	21.6	0.4				8	20.0	500	18.8	0.124	0.158		0.9	0.17	0.04	0.82
4/6/08 10:19	4/6/08 12:12	Storm Composite	39	43.7	11.15	572.0	883.0		2.5	0.4							17.1	0.062	0.525		2.3	0.24	0.04	0.56
4/7/08 9:10	4/7/08 9:10	Storm Grab	34	42.1	12.28	565.0	902.0	7.5	12.3	0.4				10	104.0	551	23.0	0.108	0.293	0.117	1.4	0.23	0.05	0.95
4/10/08 9:48	4/10/08 9:48	Base Grab	39	40.3	12.52	750.0	1,227.0	7.8	15.6	0.6				6	36.0	669	36.0	0.067	0.162	0.060	2.0	0.06	0.03	1.42
4/11/08 11:00	4/11/08 11:00	Storm Grab	36	35.8	14.52	618.0	1,098.0	7.4	12.0	0.5				13	57.0	570	11.2	0.078	0.185	0.074	2.9	0.17	0.02	0.69
4/15/08 12:36	4/15/08 12:36	Base Grab	64	46.2							500	850	0.29											
4/21/08 19:19	4/22/09 5:41	Snow Composite	52	55.6	9.37	447.9	580.0	7.3	14.9	0.3				31	147.0	293	15.4	0.076	0.205	0.075	2.1	0.44	0.04	0.75
4/24/08 12:43	4/24/08 12:43	Storm Grab	59	54.7								1,600	0.10											
4/28/08 12:45	4/28/08 12:45	Storm Grab	41	45.0								790	0.25											
5/2/08 12:24	5/2/08 14:04	Storm Composite	64	57.6	8.22	101.1	127.4	6.8	15.9	0.1						80	5.0	0.056	0.297		1.5	0.27	0.02	0.35
5/6/08 10:53	5/7/09 4:38	Storm Composite	57	57.2	8.96	477.0	604.0	7.3	27.5	0.3							25.2	0.103	0.196	0.061	2.1	0.37	0.07	1.35
5/8/08 9:30	5/8/08 9:30	Base Grab	58	50.5	10.53	635.0	884.0	7.5	61.0	0.4						519	43.7	0.035	0.040	0.021	0.8	0.06	0.02	1.46
5/10/08 14:39	5/11/08 1:48	Storm Composite	62	58.3	8.54	270.8	337.9	7.3	61.0	0.2				8	24.0	184	12.5	0.071	0.126		1.3	0.35	0.04	0.70
5/14/08 12:53	5/14/08 12:53	Base Grab	61	56.5								140	0.31											
5/22/08 10:01	5/22/08 10:01	Base Grab	64	54.3	9.95	1,135.0	1,493.0	7.6	61.0	0.8				3	26.0	877	75.4	0.099	0.139	0.094	1.7	0.07	0.08	2.65
5/28/08 10:50	5/28/08 10:50	Base Grab	64	53.6								18	0.25											
5/29/08 20:36	5/29/09 23:22	Storm Composite	58	56.7	8.10	160.8	204.8	6.9	10.0	0.1				102	404.0	159	14.9	0.129	0.696	0.106	4.8	0.52	0.05	0.69
6/2/08 15:53	6/2/08 17:15	Storm Composite	58	60.1	6.90	514.0	627.0	7.2	61.0	0.3				26	98.0	380			0.251		2.7			
6/3/08 10:10	6/3/08 10:10	Base Grab	58	52.5	10.05	506.0	684.0	7.4	30.0	0.3				5	31.0	435	34.8	0.139	0.144	0.097	0.4	0.01	0.02	0.38
6/5/08 15:24	6/5/08 20:06	Storm Composite	73	68.4	6.92	170.0	187.3	6.8	4.4	0.1				82	460.0	132	7.1	0.057	0.565	0.050		0.04	0.06	0.51
6/7/08 0:37	6/7/08 18:56	Storm Composite	76	70.7	6.43	355.5	380.9	6.8	9.9	0.2				26	110.0	249	15.1	0.049	0.261		1.2	0.14	0.08	0.40
6/11/08 9:39	6/12/08 2:24	Storm Composite	79	70.0		256.5	277.2	6.3	7.6	0.1				44	347.0	214	10.8	0.040	0.380		1.5	0.16	0.07	0.46
6/12/08 12:17	6/12/08 12:17	Strom Grab	76	66.9								2,900												
6/14/08 20:46	6/15/08 12:46	Storm Composite	69	62.1	5.50	326.1	387.6	7.4	5.0	0.2				68	504.0	241	14.7	0.058	0.621		2.3	0.13	0.08	0.50
6/17/08 12:10	6/17/08 12:10	Base Grab	77	61.7								32	0.31											
6/26/08 12:23	6/26/08 12:23	Base Grab	86	60.4								23												
6/27/08 14:02	6/27/08 14:02	Base Grab	93	52.3	10.83	608.0	822.0	7.9	61.0	0.4				1	0.5	502	47.3	0.015	0.021	0.018	0.2	0.01	0.02	0.77
6/27/08 16:02	6/27/08 17:40	Storm Composite	75	73.4	3.46	196.1	204.0	7.3	61.0	0.1														

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Table D.6 continued Monitoring results for 10SA outfall

Start Date Start Time	End Date End Time	Sample Type	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)
7/2/08 11:52	7/2/08 11:52	Base Grab	80	66.9								7,500	0.32											
7/3/08 11:18	7/3/08 11:18	Base Grab	75	53.6	10.81	582.0	775.0	7.7	61.0	0.4				1	1	490	50.8	0.033	0.034	0.038	0.4	0.01	0.02	0.88
7/11/08 2:23	7/11/08 6:17	Storm Composite	87	73.0	7.56	216.4	225.7	7.4	5.0	0.1				73	730	159	6.7	0.084	0.740	0.081	2.8	0.28	0.07	0.50
7/11/08 19:34	7/11/08 22:36	Storm Composite	84	76.1	4.76	189.2	191.1	7.1	5.0	0.1						167	7.9	0.054	0.698		1.1	0.22	0.16	0.37
7/17/08 10:26	7/17/08 17:36	Storm Composite	83	75.7	5.30	476.7	483.4	7.4	15.0	0.2				15	65	411	19.7	0.058	0.202	0.043	1.5	0.01	0.05	0.82
7/17/08 12:45	7/17/08 12:45	Storm Grab	72	70.3	8.37	158.6	170.6	7.5	18.0	0.1				8	37	147	8.3	0.163	0.255	0.151	1.2	0.36	0.05	0.52
7/18/08 11:55	7/18/08 11:55	Base Grab	83	75.7	9.72	627.0	735.0	7.7	61.0	0.4						461	41.8	0.045	0.051	0.021	0.4	0.01	0.02	0.73
7/23/08 12:27	7/23/08 12:27	Base Grab	83	72.0								280	0.40											
7/25/08 9:43	7/25/08 9:43	Storm Grab	72	70.5								18,000	0.24											
7/29/08 9:33	7/29/08 9:33	Base Grab	79	63.3	9.58	648.0	757.0	7.5	61.0	0.4				1	1	475	46.2	0.023	0.027	0.030	0.2	0.01	0.02	0.81
8/7/08 12:34	8/7/08 12:34	Base Grab	82	62.4								560	0.20											
8/12/08 12:49	8/12/08 12:49	Storm Grab	71	63.3								2,300	0.24											
8/12/08 19:03	8/13/08 4:17	Storm Composite	88	71.8	6.53	266.1	281.6	7.2		0.1				55	326	168	13.6	0.049	0.255	0.044	2.2	0.16	0.03	0.49
8/14/08 10:44	8/14/08 10:44	Base Grab	79	61.0	9.26	593.0	714.0	7.5	61.0	0.4				1	2	445	41.6	0.026	0.012	0.022	0.3	0.01	0.02	0.67
8/20/08 10:46	8/20/08 10:46	Base Grab	81	61.7								50	0.31											
8/26/08 11:12	8/26/08 11:12	Base Grab	76	61.5	9.69	642.0	769.0	7.8	61.0	0.4				1	1	481	51.7	0.028	0.017	0.013	0.1	0.01	0.02	0.80
8/27/08 6:08	8/27/08 6:08	Storm Grab	72	66.4	8.28	269.3	303.5	6.8	6.0	0.1				35	181	224	18.9	0.203	0.426	0.158	2.9	0.81	0.06	1.27
8/27/08 22:38	8/28/08 0:20	Storm Composite	75	68.9	7.59	112.0	122.5	7.5	9.0	0.1						83	6.2	0.048	0.333	0.053	1.6	0.42	0.03	0.55
9/2/08 9:34	9/3/08 1:20	Storm Composite	65	64.2	6.72	244.1	282.5	7.3	17.6	0.1						194	17.2	0.057	0.147	0.034	0.7	0.01	0.02	0.38
9/11/08 4:21	9/11/08 8:05	Storm Composite	60	63.9	7.54	197.1	229.2	6.7	7.0	0.1						158	11.8	0.042	0.272		1.6	0.05	0.02	0.48
9/11/08 11:52	9/11/08 11:52	Storm Grab	66	63.5								3,500	0.11											
9/19/08 12:00	9/19/08 12:00	Base Grab	82	54.5	10.52	576.0	757.0	7.7	61.0	0.5				1	1	506	53.6	0.005	0.020	0.016	0.3	0.01	0.02	0.83
9/23/08 16:50	9/23/08 17:16	Storm Composite	68	64.8	7.63	61.3	70.5	7.2	12.6	0.0						62	4.0	0.041	0.278	0.049	1.5	0.35	0.02	0.34
9/30/08 11:40	9/30/08 11:40	Base Grab	54	56.7								140	0.32											
10/2/08 12:10	10/2/08 12:10	Base Grab	62	57.6	9.81	534.0	707.0	7.6	61.0	0.3				1	1	456	48.7	0.018	0.021	0.021	0.3	0.01	0.02	0.56
10/7/08 11:49	10/7/08 11:49	Storm Grab	56	58.1								24,000	0.11											
10/13/08 12:25	10/13/08 12:25	Storm Grab	51	59.7																				
10/16/08 11:32	10/16/08 11:32	Base Grab	50	54.5								120	0.20											
10/22/08 11:22	10/22/08 11:22	Storm Grab	45	50.5								11,000	0.52											
11/6/08 1:36	11/6/08 7:49	Storm Composite	38	50.0	6.42	80.6	113.2	6.3	17.6	0.1						96							0.02	0.10
12/22/08 12:10	12/22/08 12:10	Base Grab	-7	42.3	12.23	748.0	1,185.0	8.0	61.0	0.6				2	3	655			0.188		0.9			

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Table D.6 continued Monitoring results for 10SA outfall

Start Date Start Time	End Date End Time	Sample Type	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)
1/6/08 12:39	1/6/09 15:10	Melt Composite		2,281																			
1/7/08 9:37	1/7/09 21:56	Melt Composite		2,044																			
1/24/08 12:35	1/24/08 12:35	Base Grab		130																			
1/28/08 12:39	1/28/08 12:39	Melt Grab		4,467																			
1/28/08 13:05	1/28/08 15:41	Melt Composite	87	3,077	240	318	13.4		51.0	0.0175	0.2350	0.0049	0.0182	0.00030	0.026	0.0299	0.2510	0.00025	0.00025	0.0068	0.0267		
1/28/08 13:16	1/28/08 13:16	Melt Grab						50.0															16.0
1/28/08 18:14	1/29/08 1:09	Melt Composite	132	1,567	218	134	20.8	20.0	24.0														
2/4/08 12:01	2/4/08 12:01	Snow Grab		18,044																			
2/17/08 15:07	2/17/08 17:01	Melt Composite		8,488																			
2/23/08 13:11	2/23/08 17:53	Melt Composite																					
2/24/08 12:46	2/24/08 19:43	Melt Composite		1,688																			
2/29/08 11:08	2/29/08 17:03	Melt Composite	72	5,322	180	569	30.0	20.0	27.0	0.0220	0.0532	0.0056	0.0158	0.00005	0.036	0.0476	0.2230	0.00500	0.00500	0.0110	0.0315		18.0
3/7/08 9:06	3/7/08 9:06	Base Grab		6,353																			
3/10/08 15:07	3/11/08 1:00	Melt Composite																					
3/11/08 10:51	3/11/08 13:00	Melt Composite	55	965	96	222	24.9																
3/13/08 15:03	3/13/08 19:00	Melt Composite	32	187	84	84	18.9																0.5
3/14/08 11:42	3/15/08 6:05	Snow Composite	76	214	116	61	12.5																118.0
3/24/08 10:30	3/24/08 10:30	Base Grab	98	930	186	47	8.6	2.1	2.9														0.5
3/31/08 9:23	4/1/08 4:45	Melt Composite	60	7	146	97	9.2																
4/1/08 10:13	4/2/08 4:20	Melt Composite	57	752	150	74	11.4	3.2															2.0
4/3/08 10:29	4/4/08 2:07	Melt Composite	68	199	128	41	10.8	1.8															3.0
4/6/08 10:19	4/6/08 12:12	Storm Composite	38	206	92	245	16.3																
4/7/08 9:10	4/7/08 9:10	Storm Grab	143	164	220	38	6.6	1.8	2.4														0.5
4/10/08 9:48	4/10/08 9:48	Base Grab	140	268	244	47	10.2	2.9	4.2														0.5
4/11/08 11:00	4/11/08 11:00	Storm Grab	46	280	106	45	5.5	2.1	3.1														3.0
4/15/08 12:36	4/15/08 12:36	Base Grab																					
4/21/08 19:19	4/22/09 5:41	Snow Composite	61	101	108	92	7.9	6.1	16.0	0.0055	0.0175	0.0021	0.0069	0.00030	0.011	0.0077	0.0774	0.00025	0.00025	0.0028	0.0080	0.012	0.5
4/24/08 12:43	4/24/08 12:43	Storm Grab																					
4/28/08 12:45	4/28/08 12:45	Storm Grab																					
5/2/08 12:24	5/2/08 14:04	Storm Composite	23	16	46	67	4.5																0.5
5/6/08 10:53	5/7/09 4:38	Storm Composite	131	85	152	57	11.6	6.9	8.5														2.0
5/8/08 9:30	5/8/08 9:30	Base Grab	248	89	316	14	6.4	1.3	1.6														0.5
5/10/08 14:39	5/11/08 1:48	Storm Composite		48	100	31	16.7																0.5
5/14/08 12:53	5/14/08 12:53	Base Grab																					
5/22/08 10:01	5/22/08 10:01	Base Grab	332	228	444	19	8.2	0.5	1.3														2.0
5/28/08 10:50	5/28/08 10:50	Base Grab																					
5/29/08 20:36	5/29/09 23:22	Storm Composite	38	24	64	183	16.8	17.0	21.0														7.0

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Table D.6 continued Monitoring results for 10SA outfall

Start Date Start Time	End Date End Time	Sample Type	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)
6/2/08 15:53	6/2/08 17:15	Storm Composite		64																			
6/3/08 10:10	6/3/08 10:10	Base Grab	290	39	336	17	3.9	0.5	0.5														0.5
6/5/08 15:24	6/5/08 20:06	Storm Composite	49	20		171	11.7	14.0	18.0	0.0042		0.0016		0.00040			0.1160	0.00025	0.00025	0.002		0.06	
6/7/08 0:37	6/7/08 18:56	Storm Composite	98	45	130	58	10.9	2.6															2.0
6/11/08 9:39	6/12/08 2:24	Storm Composite	61	33	96	108	11.4	3.6															8.0
6/12/08 12:17	6/12/08 12:17	Strom Grab																					
6/14/08 20:46	6/15/08 12:46	Storm Composite	82	47	128	144	30.5																5.0
6/17/08 12:10	6/17/08 12:10	Base Grab																					
6/26/08 12:23	6/26/08 12:23	Base Grab																					
6/27/08 14:02	6/27/08 14:02	Base Grab	335	46	540	7	7.5	1.1	0.5														
6/27/08 16:02	6/27/08 17:40	Storm Composite																					
7/2/08 11:52	7/2/08 11:52	Base Grab																					
7/3/08 11:18	7/3/08 11:18	Base Grab	319	41	404	12		0.5	0.5														0.5
7/11/08 2:23	7/11/08 6:17	Storm Composite	51	23	68	153	18.9	6.5	7.4														4.0
7/11/08 19:34	7/11/08 22:36	Storm Composite	45	15	84	115	11.4	1.5															2.0
7/17/08 10:26	7/17/08 17:36	Storm Composite	90	43	422	63	12.6	5.5	10.0	0.0045	0.0086	0.0028	0.0046	0.00005	0.0031	0.0066	0.0299	0.00025	0.00025	0.002	0.002		
7/17/08 12:45	7/17/08 12:45	Storm Grab	44	12	164	72	24.4	4.0	5.0														0.5
7/18/08 11:55	7/18/08 11:55	Base Grab	302	41	412	23	2.5	0.5	0.5														0.5
7/23/08 12:27	7/23/08 12:27	Base Grab																					
7/25/08 9:43	7/25/08 9:43	Storm Grab																					
7/29/08 9:33	7/29/08 9:33	Base Grab	250	43	388	11	1.8	0.5	0.5														0.5
8/7/08 12:34	8/7/08 12:34	Base Grab																					
8/12/08 12:49	8/12/08 12:49	Storm Grab																					
8/12/08 19:03	8/13/08 4:17	Storm Composite	95	21	128	110	8.8	6.1	11.0														4.0
8/14/08 10:44	8/14/08 10:44	Base Grab	292		378	12	6.8	0.5	0.5	0.0012		0.0041		0.00005				0.00025		0.002			
8/20/08 10:46	8/20/08 10:46	Base Grab																					
8/26/08 11:12	8/26/08 11:12	Base Grab	327	37	388	5	1.2	0.5	0.5														2.0
8/27/08 6:08	8/27/08 6:08	Storm Grab	79	29	144	162	41.3	24.0	37.0														
8/27/08 22:38	8/28/08 0:20	Storm Composite	35	10	58	85	12.5	5.6	9.6														8.0
9/2/08 9:34	9/3/08 1:20	Storm Composite	95	17	144	72	10.8	3.5															4.0
9/11/08 4:21	9/11/08 8:05	Storm Composite	77	16	104	58	10.6																0.5
9/11/08 11:52	9/11/08 11:52	Storm Grab																					
9/19/08 12:00	9/19/08 12:00	Base Grab	322	42	364	6	2.4	0.5	0.5														0.5
9/23/08 16:50	9/23/08 17:16	Storm Composite	26	4	42	65	7.7	4.2	5.0														0.5
9/30/08 11:40	9/30/08 11:40	Base Grab																					
10/2/08 12:10	10/2/08 12:10	Base Grab	312	33	394	6	1.6	0.5	0.5														0.5
10/7/08 11:49	10/7/08 11:49	Storm Grab																					
10/13/08 12:25	10/13/08 12:25	Storm Grab																					
10/16/08 11:32	10/16/08 11:32	Base Grab																					
10/22/08 11:22	10/22/08 11:22	Storm Grab																					
11/6/08 1:36	11/6/08 7:49	Storm Composite	38	9		73																	
12/22/08 12:10	12/22/08 12:10	Base Grab		173																			

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Appendix E – Kasota Ponds Monitoring Results

Table E.1 Monitoring results for KPEE

Date	Sample Time	Air Temp (F)	Water Temp (F)	Dissolved Oxygen (mg/L)	Conductivity (uS)	Specific Conductivity (uS)	pH	Salinity (ppt)	Volatile Suspended Solids (mg/L)	Total Suspended Solids (mg/L)	Total Dissolved Solids (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)	Chloride Ion (mg/L)	Hardness (mg/L CaCO3)	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)
4/17/2008	12:20	54	51.8	11.96	1,534.0	2,091.0	7.9	1.1	5	6	1,200	0.048	0.0025	1.8	0.01	0.015	0.025	518	372	0.0032	0.0033	0.0035	0.0035	0.00005	0.0003	0.0013	0.003	0.00025	0.00025	0.0005	0.0005
5/16/2008	11:20	72	67.5	12.27	1,876.0	2,090.0	7.9	1.1	2	3	1,160	0.022	0.0025	1.3	0.01	0.015	0.025	548	372	0.0035	0.0039	0.0041	0.0043	0.00005	0.0002	0.0005	0.002	0.00025	0.00025	0.0020	0.0020
6/19/2008	11:10	81	75.4	14.69	2,071.0	2,112.0	9.7	1.1	3	4	1,140	0.063	0.0080	2.2	0.02	0.015	0.025	572	292	0.0031	0.0031	0.0027	0.0027	0.00005	0.0001	0.0041	0.004	0.00025	0.00025	0.0020	0.0020
7/16/2008	11:00	80	76.6	8.56	2,465.0	2,473.0	9.8	1.3	44	58	1,370	0.107	0.0025	3.0	0.01	0.015	0.025	704	328	0.0026	0.0026	0.0024	0.0026	0.00005	0.0002	0.0023	0.004	0.00025	0.00025	0.0020	0.0020
10/3/2008	10:55	52	55.8	6.38	1,693.0	2,183.0	7.0	1.1	6	6	1,280	0.016	0.0025	3.1	0.03	0.015	0.025	626	416	0.0040	0.0040	0.0041	0.0041	0.00020	0.0006	0.0023	0.002	0.00025	0.00025	0.0015	0.0015
10/30/2008	10:20	56	42.1	4.50	1,319.0	2,094.0	7.1	1.1	32	73	1,160	0.164	0.0100	4.7	0.78	0.015	0.050	556	424	0.0039	0.0076	0.0047	0.0060	0.00005	0.0095	0.0042	0.020	0.00025	0.00025	0.0015	0.0015
11/12/2008	10:40	37	35.4	7.23	1,291.0	2,386.0	6.9	1.2	204	524	1,110	0.148	0.0025	3.8	1.40	0.015	0.070	492	400	0.0031	0.0338	0.0044	0.0144	0.00005	0.0622	0.0027	0.144	0.00025	0.00025	0.0015	0.0124

All duplicates are omitted from analysis.

Green font indicates value was greater than the maximum detection 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 E.2 Monitoring results for KPEN

Date	Sample Time	Air Temp (F)	Water Temp (F)	Dissolved Oxygen (mg/L)	Conductivity (uS)	Specific Conductivity (uS)	pH	Salinity (ppt)	Volatile Suspended Solids (mg/L)	Total Suspended Solids (mg/L)	Total Dissolved Solids (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)	Chloride Ion (mg/L)	Hardness (mg/L CaCO3)	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)
4/17/2008	11:55	54	52.0	11.41	1,527.0	2,078.0	7.8	1.1	6	8	1,190	0.086	0.0060	2.6	0.01	0.015	0.025	515	394	0.0032	0.0044	0.0035	0.0044	0.00005	0.0003	0.0015	0.0046	0.00025	0.00025	0.0006	0.0006
5/16/2008	10:50	72	67.6	10.92	1,856.0	2,063.0	7.4	1.1	1	1	1,160	0.005	0.0025	2.0	0.02	0.015	0.820	544	356	0.0040	0.0041	0.0042	0.0044	0.00005	0.0002	0.0010	0.0020	0.00025	0.00025	0.0020	0.0020
6/19/2008	10:40	82	77.0	12.62	1,643.0	1,635.0	9.7	0.8	30	46	941	0.112	0.0080	1.5	0.02	0.015	0.080	467	260	0.0035	0.0040	0.0044	0.0044	0.00140	0.0014	0.0064	0.0064	0.00025	0.00025	0.0020	0.0020
7/16/2008	10:30	80	73.9	3.40	2,183.0	2,257.0	7.2	1.2	74	95	1,180	0.365	0.0090	3.5	0.03	0.015	0.025	582	332	0.0024	0.0030	0.0033	0.0035	0.00005	0.0006	0.0005	0.0083	0.00025	0.00025	0.0020	0.0020
10/30/2008	10:05	56	42.6	5.97	1,331.0	2,095.0	7.1	1.1	13	22	1,180	0.269	0.0130	4.7	0.80	0.015	0.025	544	472	0.0035	0.0041	0.0040	0.0042	0.00005	0.0026	0.0037	0.0055	0.00025	0.00025	0.0020	0.0020
11/12/2008	10:30	37	36.5	6.81	1,157.0	2,028.0	6.9	1.0	9	13	1,140	0.084	0.0025	4.9	2.36	0.015	0.025	511	412	0.0028	0.0032	0.0043	0.0047	0.00005	0.0012	0.0021	0.0041	0.00025	0.00025	0.0015	0.0015

All duplicates are omitted from analysis.

Green font indicates value was greater than the maximum detection 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 E.3 Monitoring results for KPEW

Date	Sample Time	Air Temp (F)	Water Temp (F)	Dissolved Oxygen (mg/L)	Conductivity (uS)	Specific Conductivity (uS)	pH	Salinity (ppt)	Volatile Suspended Solids (mg/L)	Total Suspended Solids (mg/L)	Total Dissolved Solids (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)	Chloride ion (mg/L)	Hardness (mg/L CaCO3)	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)
4/17/2008	12:10	53.6	52.0	11.54	1,538.0	2,090.0	7.8	1.1	7	8.0	1,180	0.056	0.0025	2.4	0.01	0.015	0.025	520	366	0.0032	0.0034	0.0036	0.0036	0.00005	0.00030	0.0013	0.0029	0.00025	0.00025	0.0006	0.0006
5/16/2008	11:00	72	66.7	11.83	1,848.0	2,073.0	8.0	1.1	1	0.5	1,170	0.005	0.0025	1.5	0.03	0.015	0.025	555	348	0.0037	0.0039	0.0041	0.0042	0.00005	0.00005	0.0005	0.0012	0.00025	0.00025	0.0020	0.0020
6/19/2008	10:55	87.2	70.9	7.30	1,902.0	2,035.0	8.8	1.0	190	309.0	1,120	0.512	0.0150	6.9	0.08	0.015	0.025	552	288	0.0034	0.0045	0.0030	0.0048	0.00005	0.00050	0.0033	0.0164	0.00025	0.00050	0.0020	0.0020
7/16/2008	10:40	79.5	73.4	1.65	2,261.0	2,353.0	6.5	1.2	120	160.0	1,350	2.000	0.0480	11.0	0.05	0.015	0.025	668	356	0.0030	0.0060	0.0030	0.0040	0.00005	0.00330	0.0028	0.0168	0.00025	0.00025	0.0020	0.0020
8/19/2008	10:15	79	71.6	0.63	2,355.0	2,497.0	6.9	1.3	395	537.0	1,410	3.430	0.0120	13.0	0.27	0.015	0.025	726	384	0.0068	0.0122	0.0033	0.0066	0.00005	0.00890	0.0014	0.0427	0.00025	0.00025	0.0020	0.0020
10/3/2008	10:45	52	54.9	5.29	1,662.0	2,174.0	7.0	1.1	5	7.0	1,300	0.062	0.0090	3.7	0.06	0.015	0.025	687	388	0.0042	0.0042	0.0038	0.0039	0.00005	0.00050	0.0025	0.0025	0.00025	0.00025	0.0015	0.0015
10/30/2008	9:58	56	42.1	4.45	1,314.0	2,091.0	7.1	1.1	11	18.0	1,170	0.094	0.0110	3.5	0.85	0.015	0.025	554	432	0.0035	0.0044	0.0039	0.0046	0.00005	0.00190	0.0042	0.0042	0.00025	0.00025	0.0015	0.0015
11/12/2008	10:20	37	35.8	9.60	1,147.0	2,034.0	6.8	1.0	8	11.0	1,010	0.059	0.0100	6.7	1.73	0.015	0.025	567	428	0.0028	0.0030	0.0043	0.0044	0.00005	0.00080	0.0025	0.0029	0.00025	0.00025	0.0015	0.0015

All duplicates are omitted from analysis.

Green font indicates value was greater than the maximum detection 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 E.4 Monitoring results for KPNS

Date	Sample Time	Air Temp (F)	Water Temp (F)	Dissolved Oxygen (mg/L)	Conductivity (uS)	Specific Conductivity (uS)	pH	Salinity (ppt)	Volatile Suspended Solids (mg/L)	Total Suspended Solids (mg/L)	Total Dissolved Solids (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)	Chloride Ion (mg/L)	Hardness (mg/L CaCO3)	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)
4/17/2008	10:25	57	53.2	11.51	1,221.0	1,633.0	7.7	0.8	14	49	908	0.116	0.0025	3.3	0.01	0.015	0.230	398	214	0.0045	0.0115	0.0028	0.0040	0.00020	0.0115	0.0041	0.0359	0.00025	0.00025	0.0011	0.0019
5/16/2008	11:55	75	67.3	8.50	1,249.0	1,392.0	7.4	0.7	4	5	773	0.022	0.0025	1.9	0.02	0.015	0.025	305	248	0.0040	0.0040	0.0035	0.0040	0.00005	0.0005	0.0026	0.0026	0.00025	0.00025	0.0020	0.0020
6/19/2008	9:53	86	73.4	6.29	1,472.0	1,530.0	7.4	0.8	7	12	822	0.064	0.0025	2.7	0.02	0.015	0.060	333	268	0.0031	0.0036	0.0036	0.0037	0.00005	0.0022	0.0049	0.0085	0.00025	0.00025	0.0020	0.0020
7/16/2008	9:55	77	77.2	4.83	1,836.0	1,831.0	7.5	0.9	8	14	1,040	0.067	0.0025	2.9	0.01	0.015	0.025	473	316	0.0018	0.0022	0.0035	0.0038	0.00005	0.0016	0.0020	0.0034	0.00025	0.00025	0.0020	0.0020
8/19/2008	9:10	74	75.6	6.90	2,069.0	2,101.0	7.3	1.1	29	51	1,230	0.240	0.0025	6.2	0.01	0.015	0.025	594	298	0.0026	0.0043	0.0038	0.0045	0.00020	0.0057	0.0016	0.0102	0.00025	0.00025	0.0020	0.0020
10/30/2008	9:15	46	41.9	11.31	1,432.0	2,283.0	7.4	1.2	8	13	1,310	0.082	0.0025	2.2	0.01	0.015	0.025	606	496	0.0045	0.0045	0.0060	0.0060	0.00005	0.0021	0.0041	0.0052	0.00025	0.00025	0.0015	0.0015
11/12/2008	9:40	35	36.5	13.33	1,397.0	2,447.0	7.1	1.2	10	26	1,430	0.022	0.0025	1.2	0.01	0.015	0.025	626	564	0.0033	0.0043	0.0060	0.0064	0.00005	0.0042	0.0028	0.0098	0.00025	0.00025	0.0015	0.0015

All duplicates are omitted from analysis.

Green font indicates value was greater than the maximum detection 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 E.5 Monitoring results for KPNW

Date	Sample Time	Air Temp (F)	Water Temp (F)	Dissolved Oxygen (mg/L)	Conductivity (uS)	Specific Conductivity (uS)	pH	Salinity (ppt)	Volatile Suspended Solids (mg/L)	Total Suspended Solids (mg/L)	Total Dissolved Solids (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)	Chloride Ion (mg/L)	Hardness (mg/L CaCO3)	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)
4/17/2008	10:20	57	54.0	10.89	1,223.0	1,617.0	7.5	0.8	5	9	912	0.059	0.0050	2.10	0.01	0.015	0.230	394	232	0.0047	0.0055	0.0027	0.0030	0.00010	0.0012	0.0027	0.0080	0.00025	0.00025	0.0010
5/16/2008	11:38	75	67.3	8.63	1,232.0	1,375.0	7.4	0.7	4	6	758	0.034	0.0025	1.90	0.01	0.015	0.025	304	232	0.0031	0.0033	0.0037	0.0037	0.00010	0.0005	0.0005	0.0023	0.00025	0.00025	0.0020
6/19/2008	9:45	74	72.7	6.29	1,459.0	1,527.0	7.2	0.8	5	7	826	0.050	0.0025	2.50	0.01	0.015	0.060	332	256	0.0029	0.0031	0.0036	0.0037	0.00005	0.0008	0.0011	0.0032	0.00025	0.00025	0.0020
7/16/2008	9:45	76	77.4	4.02	1,834.0	1,828.0	7.4	0.9	10	17	1,040	0.101	0.0025	0.02	0.01	0.015	0.025	438	336	0.0018	0.0025	0.0036	0.0037	0.00005	0.0015	0.0015	0.0034	0.00025	0.00025	0.0020
8/19/2008	9:00	74	75.7	7.77	2,075.0	2,103.0	7.3	1.1	28	44	1,220	0.234	0.0025	6.80	0.02	0.015	0.025	578	302	0.0028	0.0028	0.0041	0.0041	0.00020	0.0002	0.0073	0.1520	0.00025	0.00025	0.0020
10/3/2008	9:40	52	53.4	8.12	1,725.0	2,301.0	7.0	1.2	16	26	1,390	0.168	0.0120	4.40	0.01	0.015	0.025	768	436	0.0057	0.0099	0.0055	0.0060	0.00020	0.0046	0.0045	0.0067	0.00025	0.00025	0.0015
10/30/2008	9:10	46	41.7	10.23	1,416.0	2,260.0	7.1	1.2	13	20	1,320	0.095	0.0025	2.20	0.01	0.015	0.025	660	520	0.0057	0.0057	0.0074	0.0074	0.00040	0.0024	0.0093	0.0093	0.00025	0.00025	0.0015
11/12/2008	9:25	35	34.9	10.82	1,163.0	1,409.0	6.9	1.1	7	10	1,430	0.027	0.0025	1.30	0.01	0.015	0.025	648		0.0037	0.0037	0.0062	0.0062	0.00010	0.0015		0.0039	0.00025	0.00025	0.0015

All duplicates are omitted from analysis.

Green font indicates value was greater than the maximum detection 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 E.6 Monitoring results for KPWE

Date	Sample Time	Air Temp (F)	Water Temp (F)	Dissolved Oxygen (mg/L)	Conductivity (uS)	Specific Conductivity (uS)	pH	Salinity (ppt)	Volatile Suspended Solids (mg/L)	Total Suspended Solids (mg/L)	Total Dissolved Solids (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)	Chloride Ion (mg/L)	Hardness (mg/L CaCO3)	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)
4/17/2008	11:00	52	50.7	17.19	1,381.0	1,918.0	8.2	1.0	6.0	9	1,100	0.056	0.0050	2.0	0.01	0.015	0.025	477	342	0.0036	0.0036	0.0035	0.0036	0.00005	0.0004	0.0017	0.0049	0.00025	0.00025	0.0006	0.0006
5/16/2008	10:40	68	63.3	8.51	1,793.0	2,098.0	7.4	1.1	2.0	2	1,200	0.005	0.0025	1.4	0.08	0.015	0.025	542	376	0.0040	0.0043	0.0042	0.0046	0.00005	0.0003	0.0005	0.0018	0.00025	0.00025	0.0020	0.0020
6/19/2008	10:19	77	72.5	4.24	2,081.0	2,186.0	7.4	1.1	2.0	1	1,210	0.016	0.0025	2.7	0.52	0.040	0.130	544	356	0.0040	0.0040	0.0041	0.0045	0.00020	0.0025	0.0035	0.0048	0.00025	0.00025	0.0020	0.0020
7/16/2008	10:20	81	77.0	9.08	2,181.0	2,183.0	8.2	1.1	20.0	31	1,220	0.176	0.0025	4.0	0.01	0.015	0.025	574	428	0.0027	0.0028	0.0038	0.0041	0.00005	0.0006	0.0025	0.0025	0.00025	0.00025	0.0020	0.0020
8/19/2008	9:40	73	76.3	10.73	2,091.0	2,108.0	8.3	1.1	13.0	17	1,220	0.073	0.0025	2.9	0.01	0.015	0.025	601	300	0.0026	0.0027	0.0031	0.0033	0.00005	0.0008	0.0016	0.0016	0.00025	0.00025	0.0020	0.0020
10/3/2008	10:30	52	58.5	4.33	1,540.0	1,918.0	6.9	1.0	6.0	6	1,130	0.027	0.0025	3.7	0.20	0.015	0.025	624	304	0.0039	0.0048	0.0040	0.0040	0.00030	0.0012	0.0033	0.0033	0.00025	0.00025	0.0015	0.0015
10/30/2008	9:45	56	43.9	4.47	1,178.0	1,819.0	7.1	0.9	1.0	2	1,040	0.085	0.0170	3.8	1.11	0.015	0.025	519	316	0.0040	0.0045	0.0038	0.0039	0.00040	0.0012	0.0039	0.0039	0.00025	0.00025	0.0015	0.0015
11/12/2008	10:05	37	39.0	6.85	1,054.0	1,765.0	6.9	0.9	0.5	1	1,150	0.074	0.0190	3.7	1.28	0.015	0.080	503	292	0.0030	0.0031	0.0038	0.0039	0.00040	0.0010	0.0024	0.0034	0.00025	0.00025	0.0015	0.0015

All duplicates are omitted from analysis.

Green font indicates value was greater than the maximum detection 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 E.7 Monitoring results for KPWN

Date	Sample Time	Air Temp (F)	Water Temp (F)	Dissolved Oxygen (mg/L)	Conductivity (uS)	Specific Conductivity (uS)	pH	Salinity (ppt)	Volatile Suspended Solids (mg/L)	Total Suspended Solids (mg/L)	Total Dissolved Solids (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)	Chloride Ion (mg/L)	Hardness (mg/L CaCO3)	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)
4/17/2008	11:08	52	50.4	17.19	1,374.0	1,915.0	8.3	1.0	6	11	1,100	0.052	0.0025	2.2	0.01	0.015	0.025	477	338	0.0036	0.0036	0.0033	0.0036	0.00005	0.0006	0.0028	0.0047	0.00025	0.00025	0.0006	0.0006
5/16/2008	10:35	68	62.2	8.20	1,769.0	2,100.0	7.4	1.1	1	2	1,200	0.005	0.0025	1.8	0.08	0.015	0.025	526	376	0.0038	0.0054	0.0044	0.0052	0.00005	0.0002	0.0029	0.0029	0.00025	0.00025	0.0020	0.0020
6/19/2008	10:14	83	72.0	4.05	2,062.0	2,179.0	7.3	1.1	2	2	1,220	0.022	0.0025	3.9	0.53	0.040	0.140	558	340	0.0040	0.0040	0.0042	0.0042	0.00005	0.0004	0.0023	0.0031	0.00025	0.00025	0.0020	0.0020
7/16/2008	10:09	81	77.2	9.25	2,190.0	2,186.0	8.0	1.1	12	24	1,280	0.064	0.0025	2.3	0.01	0.015	0.025	569	368	0.0025	0.0034	0.0036	0.0040	0.00005	0.0019	0.0005	0.0054	0.00025	0.00025	0.0020	0.0020
8/19/2008	9:30	73	76.6	10.59	2,100.0	2,109.0	8.2	1.1	33	57	1,200	0.265	0.0025	4.9	0.01	0.015	0.025	598	316	0.0044	0.0044	0.0032	0.0040	0.00020	0.0039	0.0049	0.0094	0.00025	0.00025	0.0020	0.0020
10/3/2008	10:10	56	59.2	4.39	1,554.0	1,918.0	7.0	1.0	4	4	1,150	0.019	0.0025	3.3	0.20	0.015	0.025	586	340	0.0037	0.0037	0.0037	0.0039	0.00030	0.0012	0.0024	0.0024	0.00025	0.00025	0.0015	0.0015
10/30/2008	9:38	56	43.9	4.76	1,178.0	1,816.0	7.5	0.9	1	3	1,020	0.076	0.0180	3.9	1.19	0.015	0.025	514	332	0.0043	0.0043	0.0039	0.0039	0.00040	0.0017	0.0048	0.0048	0.00025	0.00025	0.0015	0.0015
11/12/2008	9:55	37	38.1	7.09	1,014.0	1,725.0	7.0	0.9	2	2	950	0.052	0.0210	3.8	1.34	0.015	0.080	472	276	0.0030	0.0032	0.0036	0.0040	0.00040	0.0010	0.0040	0.0040	0.00025	0.00025	0.0015	0.0015

All duplicates are omitted from analysis.

Green font indicates value was greater than the maximum detection 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.