# 2008 ST. MARYS RIVER – SUGAR ISLAND MONITORING: A FINAL REPORT OF THE SUGAR ISLAND MONITORING WORK GROUP

**March 2009**

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## Executive Summary

The Sugar Island Monitoring Workgroup was established in February 2007 in response to reports of floating solids with high *Escherichia coli (E. coli)* levels periodically found in the Lake George channel of the St. Marys River. The multi-agency, bi-national workgroup was tasked by the Four Party Management Committee (consisting of representatives from the U.S. Environmental Protection Agency, Environment Canada, Michigan Department of Environmental Quality, and Ontario Ministry of the Environment) to develop and implement a monitoring plan to determine the source and nature of the floating materials and the cause(s) responsible for the periodic high levels of *E. coli* at the Sugar Island Township Park beach. In response to a recommendation from the report summarizing the 2007 results, the SIMWG developed and implemented an expanded monitoring plan for 2008.

The monitoring plan consisted of a surveillance program involving a coordinated response to any reports of floating materials in the river and weekly water monitoring of 39 stations for *E. coli* by Chippewa County Health Department, Sault Ste. Marie Tribe of Chippewa Indians, Algoma Public Health and the Ontario Ministry of the Environment. The Chippewa County Health Department sampled from June 4 to September 29, while the other three agencies concluded sampling on September 3. A Quality Assurance Project Plan was developed to ensure data quality and consistency among the agencies. The monitoring plan also called for the collection of an additional water sample from 18 of the sites for DNA-typing analysis, to identify potential origins of *E. coli* in the river, as well as site inspections of the wastewater treatment facilities on the Michigan and Ontario sides of the river.

There were four incidents of floating material reported during the 2008 season; one incident each in May, June, July, and October. Samples were collected for the first three incidents, and were found to be natural materials (cotton likely from cottonwood trees, pollen, detritus, mayfly exuvia, and green/blue-green algae) except for one condom in a July 23 sample. Although not a focus of this study, the presence of blue-green algae in some 2007 and 2008 samples suggests that additional assessment is warranted given the potential toxicity of this material. The fourth incident, reported on October 20, was described as a dark gray material with a sewage-like smell. By the time the complaint was investigated the next day, the material was no longer present and a sample could not be collected.

Results of the weekly water testing were mapped, integrating data taken within a 48 hour period. A total of 50 samples exceeded the 300 cfu/100 mL threshold set by the Sugar Island Monitoring Work Group (based on the Michigan Water Quality Standard). Of these exceedances, 42 were detected at Canadian storm sewer outfalls. The remaining 8 samples with *E. coli* levels greater than 300 cfu/100 mL were found at various near-shore locations with only one on the American side. Despite episodic, localized exceedances of the 300 cfu/100 mL threshold, the data never indicated that the exceedances affected river concentrations across the channel.

The source tracking study indicated relatively rare detection of the human *Bacteroides* DNA marker across the St. Marys River sampling sites in 2008. The human *Bacteroides* DNA marker was only detected in 7 out of 180 (4%) water samples collected in the St. Marys River. The most common occurrence of the human *Bacteroides* DNA marker was found at the Queen Street storm water outfall (4 of 10 samples). This finding is likely explained by the occurrence of a sanitary sewer pumping station connected to the outfall about 100m upstream.

Quality assurance/quality control procedures were established to ensure data quality. All field blanks collected in 2008 came back as below detection (> 10 *E. coli* cfu/100 mL). Field triplicate samples with values in the 100 – 500 cfu/100 mL range generally fell within acceptable criteria; standard deviations for these samples ranged from 11% to 45% for the 2008 sampling campaign with one exception. A set of triplicate samples collected by the MOE on July 23rd had a standard deviation of 70% based on individual replicate values of 270, 60 and 130 cfu/100 mL.

Inspections were conducted at the Ontario East End Wastewater Treatment Plant and the Michigan Sault Ste. Marie Wastewater Treatment Plant. Except for a combined sewer flow restriction at the Michigan plant on April 9 that resulted in the violation of 7 day and 30 day limits for fecal coliform, no problems were found at either facility. The discharge pipe from the Sugar Shack lagoons, which had been disconnected several years ago, was removed entirely by the property owner in April 2008.

Next steps for the workgroup include a public meeting in spring 2009, continued implementation of the Incident Response Protocol, and monthly SIMWG conference calls to maintain communication. Based on the lack of incidents (aside from natural sources) in 2007 and 2008, the SIMWG does not intend to continue coordinated weekly monitoring for *E. coli*. The SIMWG will evaluate St. Marys River/Sugar Island conditions in fall 2009 to determine how to proceed in future years.

# Section 1: Introduction

Background

The St. Marys River starts as the outlet of Lake Superior at Whitefish Bay and flows southeasterly through several channels to Lake Huron, a distance of 100-120 kilometers (depending on the route). The average flow volume is 2,144 cubic meters per second. Several islands were formed when the river divided into its numerous channels. Sugar Island is the largest upstream island, which separates Lake George (east) and Lake Nicolet (west). The watershed includes all of the Lake Superior drainage basin as well as a number of small tributaries which drain directly into the river. Michigan tributaries include the Waishkey, Charlotte, Little Munuscong, Munuscong, and Gogomain Rivers as well as other small streams. In Ontario, the main tributaries are the Big Carp, Little Carp, Root, Garden, Echo, and Bar Rivers, as well as East Davignon Creek, West Davignon Creek, and Fort Creek. The St. Marys River was identified in 1985 by the International Joint Commission as one of 42 Areas of Concern (AOC) in the Great Lakes basin. Details about the area and its designation as an AOC are provided in last year's report (Sugar Island Monitoring Work Group 2008).

A great deal of monitoring in the St. Marys River has occurred over the last 20 years, primarily in response to its designation as an AOC. These data collection efforts are described in the 1992 and 2003 RAP documents (Ontario Ministry of the Environment and Michigan Department of Natural Resources, 1992; Environment Canada et al. 2002). Since 2001, the Chippewa County Health Department (CCHD) has conducted *Escherichia coli (E. coli)* monitoring at three beaches along the St. Marys River (Four Mile Beach, Sherman Park Beach, and Sugar Island Township Park Beach). The CCHD issued a no body contact advisory in August 2005 due to a blended bypass from the East End Treatment Plant in Sault Ste. Marie, ON, after heavy rains. During summer 2006, residents along the north shore of Sugar Island reported numerous episodes of contaminants, floatable materials, and other indicators suggestive of sewage. These complaints were accompanied by photographs and water samples. In response, water quality agencies in Canada and the U.S. conducted extensive monitoring to characterize the severity of water quality impairment and to identify potential sources of bacteria and floating solids.

Comprehensive descriptions of most sampling activities in 2006 and 2007 by Canadian and U.S. agencies, along with resulting data summaries and discussion, have been provided in previous reports (DEQ 2007, Sugar Island Monitoring Work Group 2008). Additional sediment sampling, not discussed or cited in the previous reports, was conducted in 2006 and 2007 (Michigan State University, 2006; University of Wisconsin Oshkosh, 2006; Lake Superior State University, 2008). These studies found very low sediment levels of *E. coli*, other bacterial indicators, and pathogens at all sites, including those downstream from the Sault Ste. Marie (ON) East End Treatment Plant.

Description of 2008 Monitoring

The Sugar Island Monitoring Work Group (SIMWG) was formed in 2007 to develop a comprehensive, coordinated monitoring plan for the St. Marys River/Sugar Island. The SIMWG consists of representatives from local, tribal, provincial, state, and federal agencies in Canada and the U.S. Specifically, these include Algoma Public Health (APH); CCHD; Ontario Ministry of Environment (MOE); Michigan Department of Environmental Quality (DEQ); Environment Canada (EC); Health Canada; U.S. Environmental Protection Agency (USEPA); Bay Mills Indian Community; and Sault Ste. Marie Tribe of Chippewa Indians (Sault Tribe).

The SIMWG was charged with the following tasks:

1. Review previous water and sediment monitoring data, as well as various agency monitoring activities;
2. Identify data gaps and future monitoring needs;
3. Update/enhance the Sugar Island Incidence Response Protocol; and
4. Develop an interagency monitoring plan that incorporates ambient and event-response monitoring activities.

Based on 2006 and 2007 efforts, the SIMWG developed a monitoring plan for 2008 (Appendix A). This plan consisted of the following objectives:

a) Determine the nature of solid floatable material episodically impacting the north shore of Sugar Island reach.
b) Facilitate international cooperation and sampling to ensure data quality, consistency, and comparability.
c) Assess current water quality conditions and water quality standards attainment status along the Sugar Island reach.
d) Assess the final effluent quality of select point source discharges determined to have the potential to impair water quality conditions along Sugar Island.
e) Identify authorized/unauthorized point source or non-point source discharges and whether sediments are impairing water quality conditions or are responsible for any beach closures or health advisories.
f) Determine any other potential ecological sources or processes that could potentially impair water quality conditions and/or be responsible for any closure of the Sugar Island Township Park beach or health advisories along the Sugar Island reach of the Lake George Channel.

A coordinated monitoring effort requires a unified Quality Assurance Project Plan (QAPP), which describes the sampling and analytical protocols to be used by all agencies with monitoring responsibilities. A QAPP document was jointly prepared by the agencies prior to the field season. All sample collection and analysis procedures were fully consistent with the QAPP, ensuring data quality and comparability. Quality assurance results are included in this report, and the QAPP is in Appendix B.

Project Scope

The 2008 monitoring activities were specifically designed to 1) assess impacts on the north shore of Sugar Island in the St. Marys River; 2) sample ambient water, discharges from point and non-point sources, and floating material for *E. coli*; and 3) identify likely sources/causes of any water quality impairment, aesthetic impairment, beach closures, and/or health advisories.

# Section 2: Methods

Sampling Area

The 2008 monitoring effort, like the one implemented in 2007, focused on the Lake George Channel of the St. Marys River, particularly along the north shore of Sugar Island, and upstream as appropriate to characterize the extent of contamination and to identify potential contamination sources. Several storm water outfalls along the Canadian shore were included in the weekly monitoring. A total of 39 stations were monitored in 2008 (Figure 1); these include three transects of five stations. These transects sites were sampled by the Sault Tribe, analyzed for *E. coli* through the MOE and analyzed by EC for B*acteriode*. Most of the 39 sites were sampled from June 4 through September 3; the CCHD sampled their seven sites along the north shore of Sugar Island until September 29, 2008. Approximately 18 of the sites were located in the St. Marys River, while the others were along the Canadian and U.S. shores (including public beaches).

Sample Collection

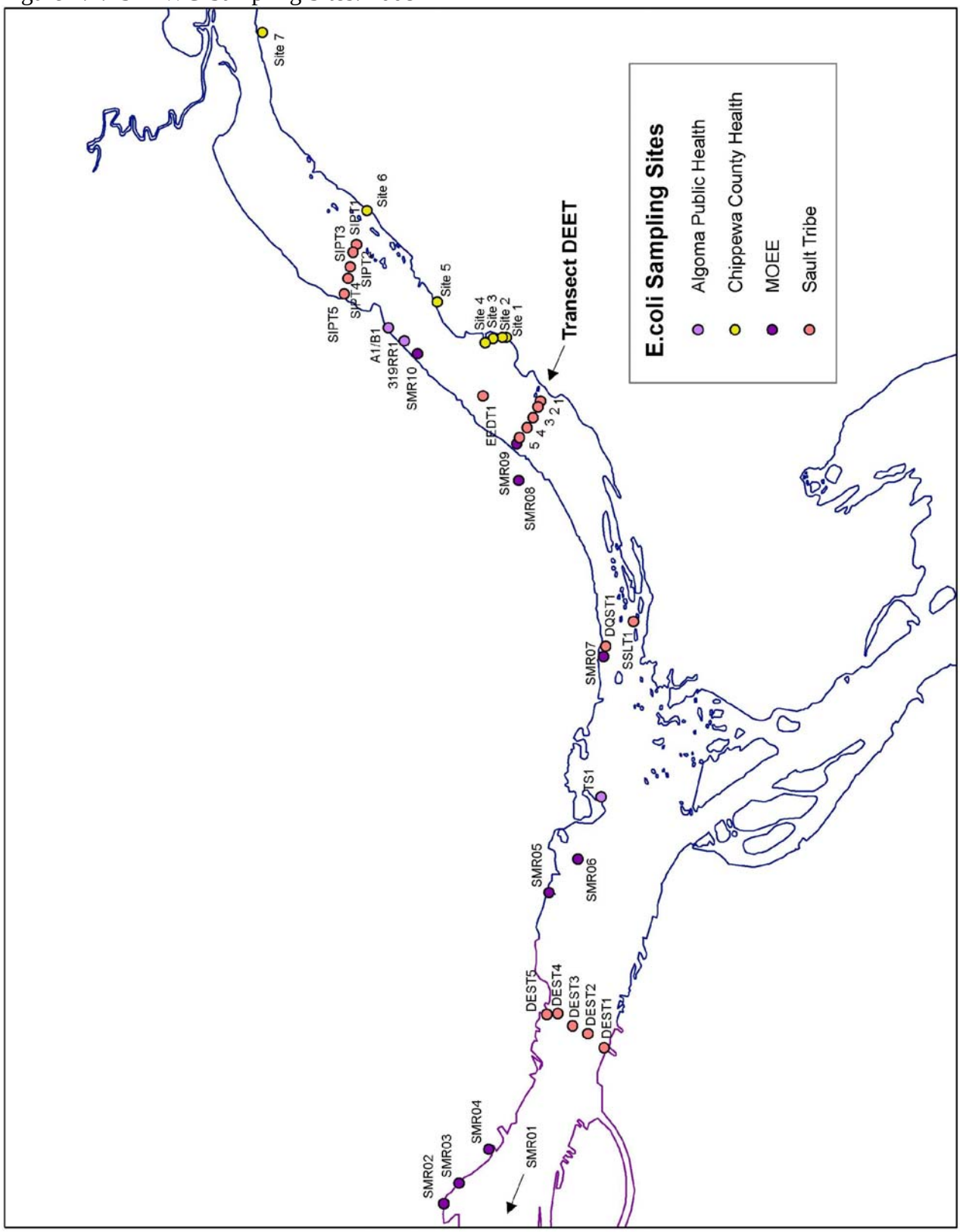
Coordinated sampling was conducted weekly from June 4 through October 1 by the CCHD, and from June 4 through September 3 by the APH, MOE, and the Sault Tribe. All agencies generally sampled on Wednesday of each week. Several samples were collected during or soon after rain events. The CCHD and APH used essentially the same sampling procedures as their beach monitoring programs. Three water samples (replicates) were collected at each beach/near-shore location. Samples collected by the MOE and Sault Tribe consisted of single grab samples at each monitoring station. *E. coli* samples were collected in sterilized bottles and preserved with sodium thiosulfate. Samples were immediately placed in a cooler with ice for delivery to the appropriate laboratory, within 6 hours of collection. Detailed sample collection procedures for all agencies can be found in the QAPP.

At the 18 stations monitored by the Sault Tribe, additional water samples were collected in sterile 500mL bottles and shipped overnight on ice to the National Water Research Institute, Environment Canada, in Burlington ON. These samples were screened for the presence of strains of the anaerobic bacterium *Bacteroides* that are associated with human fecal pollution.

In addition to routine weekly monitoring, potential point and non-point sources of contamination were identified. Daily effluent samples were collected on weekdays from the Sault Ste. Marie Ontario East End Wastewater Treatment Plant and the Sault Ste. Marie Michigan Wastewater Treatment Plant. The Sault Tribe sampled weekly at the mouth of an inlet to the Sugar Shack lagoons.

Area residents and others frequently on the river served as volunteers to alert the local health departments when excessive floating material was observed. The SIMWG received four reports of floatable materials in 2008. In three cases, samples were collected and provided to the DEQ and/or EC for identification.

Figure 2.1: SIMWG Sampling Sites: 2008



Sample Analysis

All samples were analyzed using approved methods and according to standard protocols. *E. coli* water samples collected by APH and MOE were analyzed by the Ontario Ministry of Health and Long-Term Care Public Health Laboratory using the membrane filtration technique (SOP-SD-W-006-006). MOE samples also were analyzed for other parameters, including total suspended solids, alkalinity, and total phosphorus. *E. coli* water samples collected by the CCHD and the Sault Tribe were analyzed by Lake Superior State University (LSSU) using an USEPA approved method, Colilert 18.

Floatable samples collected in response to reports from area residents were analyzed by DEQ and/or EC under a microscope and reportable out to the work group.

Analytical procedure details are available in the QAPP. Each laboratory followed its own Quality Assurance (QA)/Quality Control (QC) procedures during the study.

Quality Assurance/Quality Control

Quality control activities were implemented in 2008 to ensure data reliability and comparability among the participating agencies. These included field blanks and field replicates. Field blanks monitored potential contamination introduced into the samples by collection and handling procedures. The blanks were generated at the sample collection site by filling an empty sample bottle with distilled/deionized water. The blanks were delivered from the field to the laboratory in the same manner as the regular samples. The field blanks were collected by each agency at a frequency of one per sampling trip. Field blanks should fall below 10 cfu/100 mL.

Field replicates assessed the consistency and precision of field sampling procedures. The replicates were collected by filling a second sample bottle within 15 minutes of the first sample, from the same source as the first sample using identical procedures. The field replicates were collected by each sampling agency at a frequency of one per sampling trip, and were delivered to the laboratory in a cooler with the regular samples. Acceptable field replicate variation was defined as 30% or less.

In 2007, proficiency tests were conducted to evaluate analytical comparability. These tests were conducted for *E. coli*, total suspended solids, total solids, and conductivity. Sets of four bottles with water containing known concentrations of the target parameters were provided to LSSU and the Ontario Ministry of Health and Long-Term Care Public Health Laboratory. These proficiency tests were intended to demonstrate the level of analytical comparability among the participating laboratories. Because the same laboratories were used in 2008, additional proficiency tests were not considered necessary.

Sampling crews conducted side-by-side sampling events in 2007 on a rotating basis throughout the monitoring season. These events consisted of sampling crew representatives from each agency (APH, CCHD, MOE, Sault Tribe) going to the same locations at the same time, collecting sample replicates according to each of their

respective sampling protocols, and sending the samples to each of the participating laboratories. This QC check evaluated sample collection and analysis procedures for data consistency and comparability. Acceptable inter-agency variation for samples with *E. coli* values between 100 and 500 cfu/100 mL was defined as 50% or less. Because little variation was found in 2007, side-by-side sampling was not conducted in 2008.

Internal QC procedures for each laboratory were specified in its standard procedures. Method blanks, to be used at the discretion of the laboratories, were conducted by passing clean matrix through the analytical method steps to assess contamination resulting from laboratory procedures. Other types of QC checks (reagent/preparation blanks, matrix spike, and matrix spike duplicated, calibration standards, internal standards, surrogate standards, the frequency of each audit, the specific calibration check standards, duplicate analyses) also were employed by the laboratories according to their internal procedures. Laboratory blanks should fall below 10 cfu/100 mL.

The QA/QC results are discussed in the Results section of this report.

Source Tracking Study

A source tracking study was conducted by Environment Canada's Water Science & Technology Directorate (National Water Research Institute) in conjunction with the SIMWG to investigate the source of human sewage pollution, if it exists, in the St. Marys River near Sugar Island and the Cities of Sault Ste. Marie, MI and Sault Ste. Marie, ON in 2008. The study applied a microbial source tracking approach to investigate possible sources of sewage contamination (Edge and Schaefer, 2006). A library-independent approach to microbial source tracking was taken, rather than a library-dependent approach based on collecting large libraries of fecal indicator bacteria like *E. coli*.

Library-independent microbial source tracking methods are based on searching for host-specific microorganisms in water samples to make inferences about the source of fecal pollution. These host-specific microorganisms are adapted to specific gastrointestinal tracts, and they primarily occur only in the feces of their host (e.g. human or ruminant animal gut). If the DNA sequence of such a microorganism is detected in a water sample, it is an indication of fecal contamination from that host human or animal. Some of the most promising library-independent methods are based on detecting the DNA from host-specific strains of the anaerobic bacterium *Bacteroides*. This bacterium is generally found in much greater numbers in gastrointestinal tracts than *E. coli*. In particular, human-specific strains of *Bacteroides* have been increasingly tested as practical indicators of the presence of fecal contamination from sources like human sewage (Bernhard and Field, 2000; Bower et al., 2005; Field and Samadpour, 2007). The present study sought to determine the frequency of a human *Bacteroides* DNA sequence in water samples from the St. Marys River study area.

To date, the human *Bacteroides* DNA marker has not been detected in non-human fecal samples collected from around Ontario. This includes wildlife sources (e.g. Canada geese) and domestic pets (e.g. dogs) presumed to occur in the St. Marys River area. The human *Bacteroides* DNA marker has been regularly detected in raw sewage (e.g. CSO tank sample) and Sewage Treatment Plant (STP) final effluents in Ontario. However, the

human *Bacteroides* DNA marker has not been detectable in all STP final effluent samples even though the generic *Bacteroides* DNA marker (BAC32) can be detected indicating lack of PCR inhibition. This suggests that the human *Bacteroides* DNA marker is likely a conservative indicator of human sewage contamination, and that our detection of this DNA marker in surface water samples represents a minimum level of detection given the sensitivity of our method for 300 mL water samples.

Surface water samples were collected weekly at selected river locations and at three transects across the river from June 4 to September 3, 2008 as identified in Figure 1. Water was collected in sterile polypropylene bottles from approximately 10 cm below the water surface. The samples were stored on ice and shipped overnight to Burlington until water filtration on the day following collection. Water samples were analyzed in Burlington for the detection of a DNA sequence unique for anaerobic *Bacteroides* bacteria associated with human fecal pollution. Separate water samples were collected in parallel and simultaneously analyzed for enumeration of *E. coli* by different laboratories.

Water samples were screened for the presence of DNA from strains of the anaerobic bacterium *Bacteroides* that are associated with human fecal pollution (Bernhard and Field, 2000). The assay involved filtering as much water as the sample permitted, up to 300 mL, and extracting total genomic DNA from the filter. Filters were frozen at -80°C before DNA extraction. The filter was first homogenized in a Mini-Beadbeater (BioSpec Products Inc.) for 2 min. DNA was purified using a Powersoil DNA isolation kit (Mo BIO Laboratories, Inc.). A 1 µl extract was used as template in a polymerase chain reaction (PCR) assay using primer HF183F to amplify the human *Bacteroides* DNA sequences and BAC32 to amplify generic *Bacteroides* sequences if they were present in the sample. Primer BAC708R was the reverse primer for both reactions. For the PCR reaction, the following concentrations were used: 0.05 U/µL Hotmaster Taq and 1 x buffer (Intermedico), 0.8 mM dNTP mixture, 0.06% BSA, 1.56 pmol/ µL each primer and water to 25 µL. The PCR cycling conditions were: 2 min at 94°C followed by 35 cycles of 20 sec at 94°C, 10 sec anneal at 53°C for BAC32 or 63°C for HF183 primers, 50 sec at 65°C and a final single step at 65 °C for 7 min. A human fecal DNA extract was run as a positive control for each set of reactions, along with sterile water as a negative control. 5 µL of dye DNA mix was loaded into wells of a 1.25% agarose gel, and run at 170 V for approximately 1 hr to resolve the bands which were visualized by staining with ethidium bromide and imaging under UV light.

Reference samples to serve as a positive control for the human *Bacteroides* DNA marker were sought from a sewage source in Sault Ste. Marie, ON although it was only possible to obtain weekly samples from a storm water outfall (SMR07) which was believed to be contaminated at times with sewage. Field blank samples were collected weekly from tap water to serve as a negative control for the human *Bacteroides* DNA marker. Sterile lab water samples were also analyzed regularly as an additional negative control for the human *Bacteroides* DNA marker. Additional reference fecal samples from locations in Ontario were used to test the specificity of the human *Bacteroides*. Fecal DNA was extracted using a Qiagen stool kit following the manufacturer's directions.

Data Management and Reporting

Analytical results were transmitted from the laboratories to the sample collection agencies as individual measurements for all parameters. Immediately after receiving analytical results from the laboratories each week, the sample collection agencies provided the data to MOE. All results were consolidated into an Excel spreadsheet which was made available to the SIMWG through an e-mail distribution list. A web site was established by the USEPA on which the agencies had access to the water quality data.

At the conclusion of the 2008 monitoring, the CCHD and MOE prepared individual reports (available on request) that summarized the results and identified contaminant sources. Those reports, along with data provided by APH and the Sault Tribe, served as the basis for this report.

# Section 3: Incident Reports

Incident Responses

One component of the 2008 monitoring work plan was the reporting of any unusual floating material observations by Sugar Island residents, agencies, organizations frequently on the St. Marys River (e.g. Ontario Provincial Police, U.S. Coast Guard), and the general public. Observers were encouraged to immediately report such incidents to the local jurisdictions such as the CCHD or APH. An Incident Response Protocol was developed to immediately notify all SIMWG agencies, and to take photographs and collect samples if possible.

There were four incidents reported to the SIMWG during 2008. These reports were received between May and October. A summary of these incidents and associated findings are presented below, with individual reports listed in Appendix C.

Samples were taken for three of the four incidents. These samples were sent to LSSU, E C and/or MDEQ for analysis and identification. Table 3.1 describes each incident and the actions taken. Microscopic analyses were done for the samples taken from two of the incidents, while only a visual analysis was required for the third. The May 9 sample was identified as bottom debris containing cyanobacteria, green algae, benthic diatoms, and resuspended bottom sediment and debris. An elevated *E. coli* count of 463.4 cfu/100 mL was detected on June 2 in a sample identified as likely cottonwood seeds and pollen. Samples taken on this date had coliform counts of >2400 cfu/100 mL. Two samples were taken on July 23. One sample contained mayfly exuvia (shed skin after molting), while the other contained a condom. The fourth incident, on October 20, was described as a dark grey material with a sewage smell. By the time CCHD staff visited the site the day after the complaint, the material was gone; therefore, no sample was collected.

**Table 3.1**

| Date | Action taken | Samples collected by | Receiving Agency | Observations | Results | Conclusions |
|---|---|---|---|---|---|---|
| | | | | | | |
| 9-May-08 | samples collected, photos taken | Morley | Environment Canada, MDEQ | Floating material | microscopic analysis-bottom debris, benthic diatoms, cyanobacteria, copepods, green algae | resuspended bottom sediment/debris |
| 2-Jun-08 | samples collected; photos taken | CCHD | MDEQ | Thick Foamy Substance | microscopic analysis: cottonwood seed, pollen; elevated coliform; elevated E.coli | seeds and pollen collecting on water surface |
| 23-Jul-08 | Samples taken | CCHD | MDEQ | various Floating material | visual identification | Mayfly exuvia, condom |
| 20-Oct-08 | report to SIMWG | CCHD were unable to obtain samples on inspection | none | Dark Grey material with sewage smell | | no conclusions were made |

Blue-Green Algae

Some of the samples collected in response to incident reports in 2007 and 2008 included blue-green algae (also known as cyanobacteria). The St. Marys River Remedial Action Plan also identifies blue-green algae as a concern in the river. Cyanobacteria, ubiquitous primary producers and nitrogen fixers in aquatic and terrestrial environments, are particularly successful in extreme (e.g. polluted, eutrophic) environs. Many grow in close association with other species, and can be found at low levels in mats that become detached from shorelines or bottom areas and accumulate at the surface (as seen in some of the material found in the St. Marys River).

As with other organisms, unchecked growth of cyanobacteria can have negative impacts on ecosystem integrity and resilience. These include risks to human and animal/livestock health, drinking water impairment, fouling, beach closures, fish/shellfish tainting, and impacts on the biotic integrity of aquatic ecosystems. Many areas of the Great Lakes and connecting channels are increasingly prone to outbreaks of cyanobacteria and other algae. The levels of impairment by these blooms have been inadequately addressed and may be underestimated. Sporadic, episode-based outbreaks of high toxin levels have been reported of *Microcystis* blooms in nearshore areas of Lakes Huron, Michigan, Erie, and Ontario, where risk of exposure to humans is highest. In the past few years data collected by Ontario municipalities show periods of elevated toxins in raw water, but generally adequate removal by municipal treatment. Spatial and temporal levels of toxins in some AOCs indicate periodic but severe toxin and taste-odor impairment of nearshore sites by windblown accumulations of toxic material.

Impairments also occur in the absence of visible blooms, derived from ‘hidden’ benthic and littoral sources. Benthic algal proliferation is an increasing problem in near shore areas of the Lower Laurentian Great Lakes and St. Lawrence River. Often, these mats become detached and can be observed at the surface. The re-emergence of *Cladophora* in these lakes has promoted considerable concern. In addition, a second, more insidious threat has recently been identified in the form of dense, spatially segregated mats of benthic cyanobacteria (dominated by *Lyngbya* cf. *wollei*) reported from some of the major rivers and outflows. These mats can produce toxins and/or taste-odor causing compounds. Therefore, potentially harmful cyanobacteria (as seen in some of the St. Marys River samples) should be noted and investigated, since they may originate from larger hidden sources and serve as an early warning of deteriorating conditions in the area.

## Section 4: Weekly Monitoring Results

*E. coli* levels during the 2008 field season generally were low, with most samples below 100 cfu/100 mL. Of the 574 date/location combination samples taken by the SIMWG members, only 50 (9%) exceeded the Michigan Water Quality Standard of 300 cfu/100 mL (Figure 4.1, Table 4.1). Of these 50 samples, the vast majority were taken at storm water outfalls. In addition to the influence of storm water, other primary causes of high *E. coli* levels appeared to be heavy precipitation, high winds, and the presence of waterfowl. Shallow sampling sites are more susceptible to these factors than fast-moving, deeper channel sampling locations. It is also worth noting that of the 50 samples greater than 300 cfu/100 mL, 39 occurred between June 3 and July 9. Only eleven occurred from July 16 through September 3.

All weekly sampling results (Appendix D) were plotted on maps to allow for an integrated assessment of water quality along the St. Marys River (Appendix E). Data were integrated for sampling done within a 48-hour period, usually for the Tuesday, Wednesday, and Thursday of each week. During the weeks of June 11, 25, and July 8, two sets of samples were collected by the APH and MOE. On these occasions, more than one data map was produced for the week using the extra data sets as appropriate.

While the overall levels of *E. coli* were relatively low throughout the season, a few spatial distribution patterns were evident. Higher levels, including exceedances of the MWQS (>300 cfu/100 mL), were found at all but one storm sewer outfall at least once during the sampling season. The Dennis St. storm sewer outfall, upstream of all of the sampling transects, was the single site sampled by the MOE that did not have an *E. coli* sample exceed 300 cfu/100 mL during the entire season. The other storm sewers above the most upstream transect (DEST) accounted for 27% of all exceedances; storm sewers between the first and the middle transect accounted for 45% of the exceedances; the one storm sewer between the middle and last transect accounted for 10%. While the Millwood storm sewer outfall had *E. coli* levels in excess of 300 cfu/100 mL on several dates, the adjacent sample site remained low. High levels detected at the Dacey St. outfall did coincide with high levels found directly downstream on the Canadian side on several occasions. However, this was not a consistent observation throughout the season.

A June 11 sample collected along Sugar Island by CCHD (Smith property) was the only one on the U.S. side that exceeded 300 cfu/100 mL. While the transect values directly downstream of this site did not exceed the guideline, the values were elevated for the first two samples of the transect and declined to <10 cfu/100 mL at the Canadian shore. On July 8, localized high values seen at nine of the storm sewer outfalls may have been heavily influenced by rain events; however, water concentrations show signs of a quick recovery as levels were reduced at all sites by the next day. Likewise, high values from the APH sites on June 11 returned to normal when they were re-sampled on the next day.

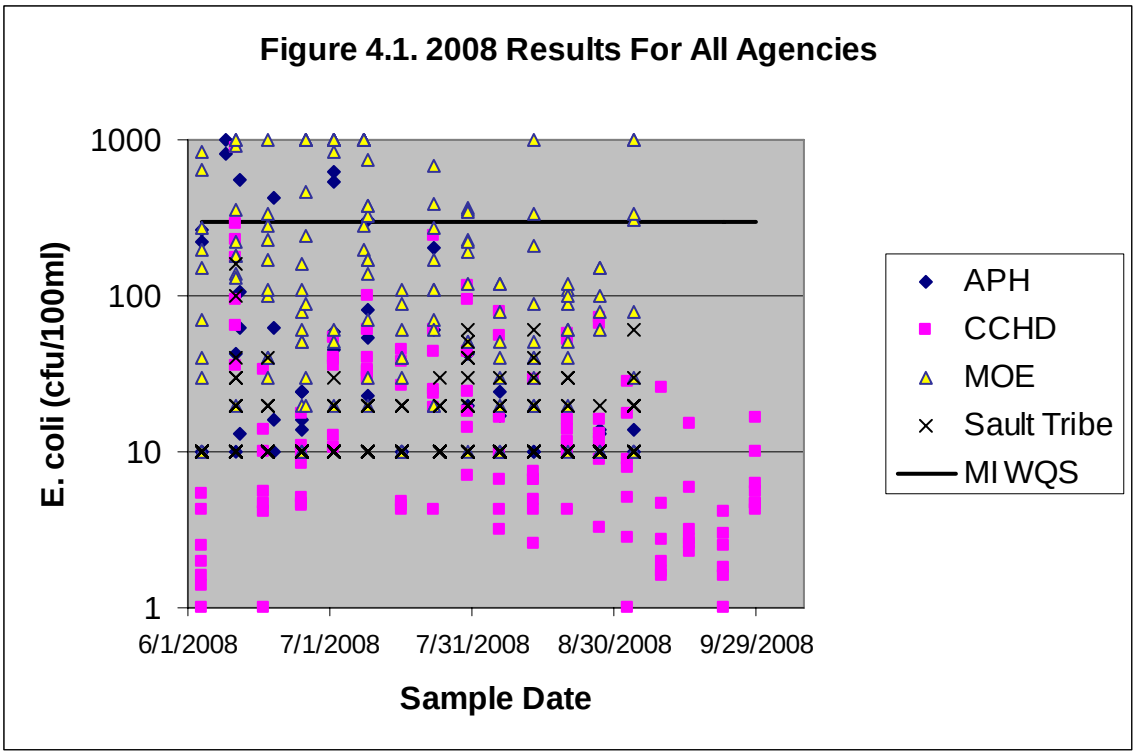



**Table 4.1. Numbers, locations, and ranges of *E. coli* exceedances.**

| Agency | Site | Number of exceedances | Range of *E. coli* exceedances (cfu/100 mL) |
|---|---|---|---|
| MOE | Fort Creek Storm Sewer Outfall | 6 | 340->1000 |
| MOE | Holiday Inn Storm Sewer Outfall | 5 | 380->1000 |
| MOE | Pine St. Storm Sewer Outfall | 5 | 340->1000 |
| MOE | Churchill Blvd Storm Sewer | 7 | 310->1000 |
| MOE | Queen St. Storm Sewer Outfall | 4 | >1000 |
| MOE | Millwood Storm Sewer Outfall | 7 | 320->1000 |
| MOE | Dacey Rd. Storm Sewer Outfall | 5 | 390->1000 |
| MOE | Davignon Creek Storm Sewer Outfall | 2 | 330->1000 |
| MOE | EEWTP @ UV | 1 | 340 |
| APH | 319RR | 1 | >1000 |
| APH | River Road A | 1 | 541 |
| APH | River Road B | 3 | 303-622 |
| APH | Top Sail Island | 2 | 553-809 |
| CCHD | Site 5-Smith | 1 | 886 |

The results of individual sampling agencies are discussed below. To improve graphic representation, *E. coli* concentrations greater than 1000 cfu/100 mL are plotted in Figures 4.1 – 4.5 as 1000 cfu. All individual sample results are listed in Appendix D.

Algoma Public Health

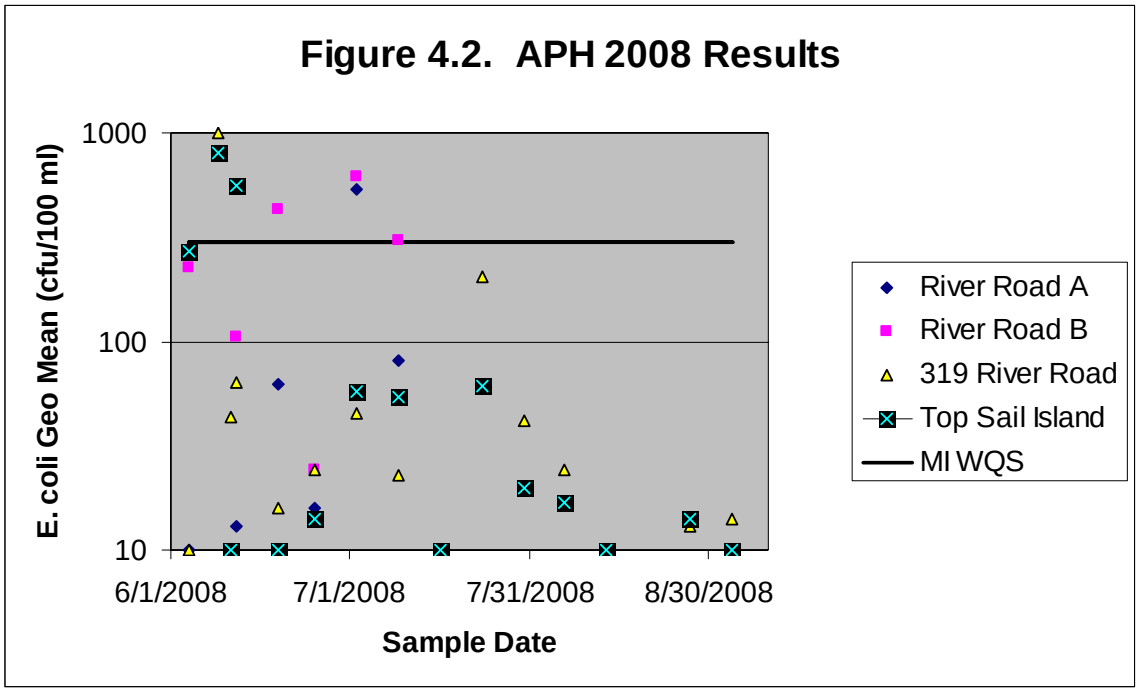
APH collected samples at a total of four locations from the shore with a sampling rod in shallow water areas. Two sites (River Road A and B) were only sampled through July 9 due to access issues, and the fact that another River Road location was being monitored. APH recorded seven incidents (geometric means) of *E. coli* levels greater than 300 cfu/100 mL, with at least one exceedance occurring at each of the four sampling locations (Figure 4.2). All of the exceedances were found between June 9 and July 9. Rainfall, waterfowl, and high winds with low water levels at sampling locations were potential factors contributing to the high *E. coli* levels.

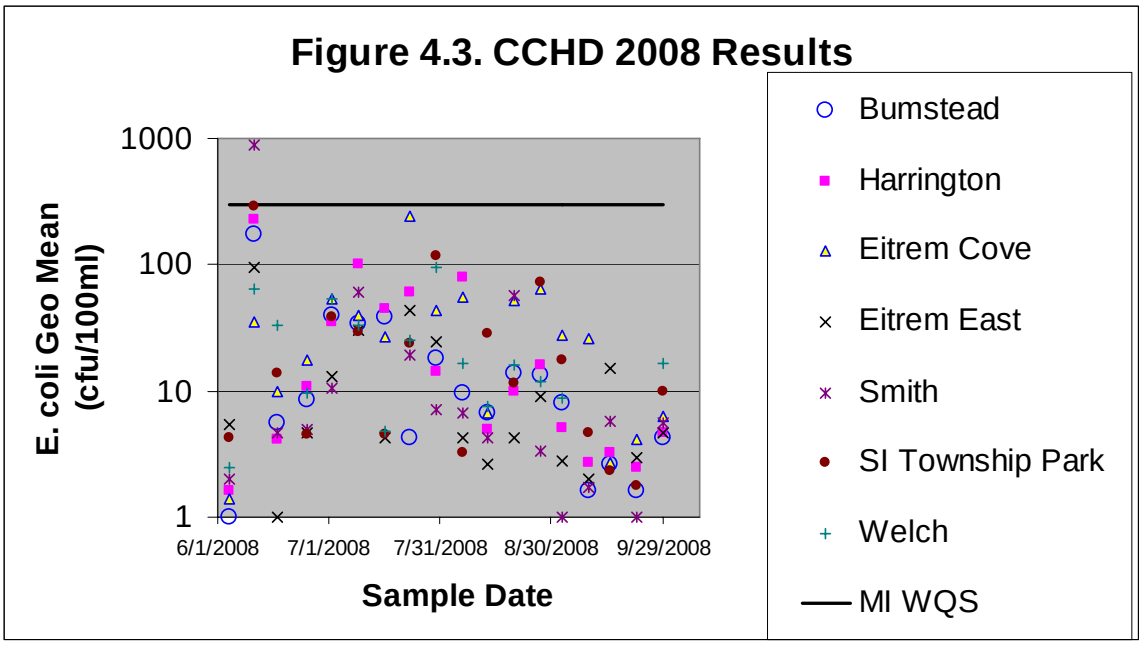
More information can be obtained by contacting Sherri Cleaves at (705) 541-7347 or scleaves@algomapublichealth.com.

Chippewa County Health Department

The CCHD sampled seven locations in slow-moving water; five were in shallow waters while two were deeper areas. The CCHD found only one instance (geometric means) where *E. coli* levels exceeded 300 cfu/100 mL in 2008 (Figure 4.3). This high level was found on June 11 at Smith's property.

More information can be obtained by contacting Christine Daley at (906) 635-3602 or cdaley@chippewahd.com.






Ontario Ministry of the Environment

The MOE found 41 exceedances in 2008 out of a total of 158 samples collected (25%, Figure 4.4). All of the sites sampled by MOE were storm water outfalls, except for the East End Treatment Plant. One exceedance occurred at the treatment plant, on June 18. As mentioned above, the exceedances at the storm water outfalls were common through early July and relatively rare after July 9. Several wet-weather events occurred in June and early July, and were less frequent through August and early September. It is not surprising that high *E. coli* levels would be found at storm water outfalls, especially after heavy rain. However, these high levels seemed to be localized, as we almost never saw elevated *E. coli* levels at river locations immediately downstream from the storm water outfalls.

More information can be obtained by contacting Rod Stewart at (705) 942-6384 or rod.stewart@ontario.ca.

Sault Ste. Marie Tribe of Chippewa Indians

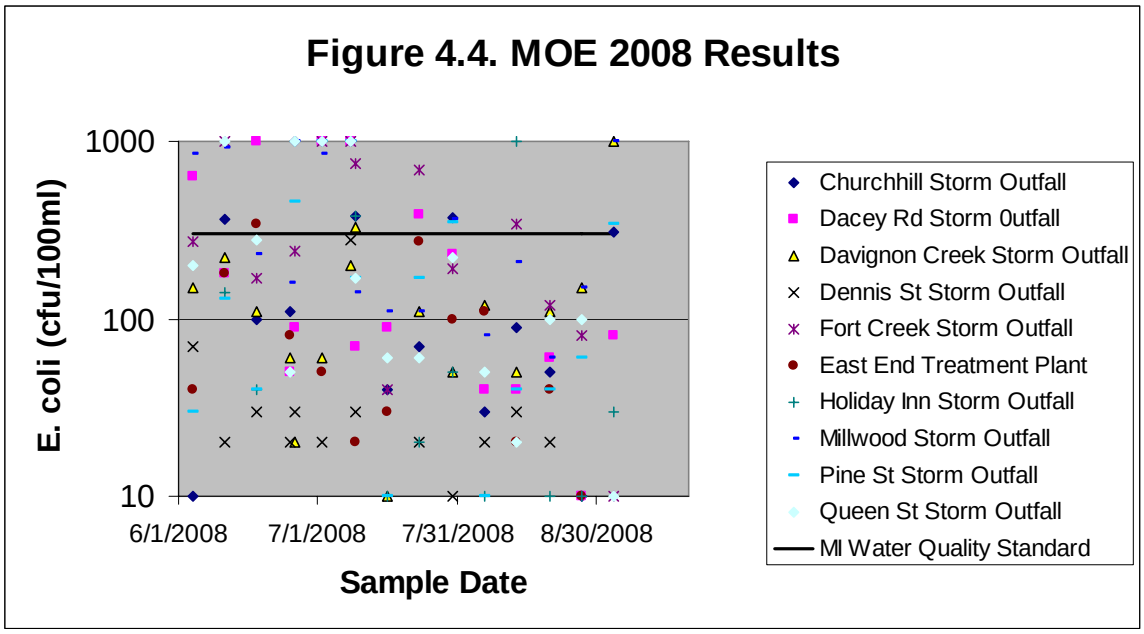
The Sault Tribe sampled three transects in the St. Marys River, each with five stations across the river. These transects were located immediately downstream from the old discharge pipe from the East End Treatment Plant, Edison Sault Electric, and Sugar Island Township Park. They also monitored near the Queen Street outfall, the current East End Treatment Plant discharge, the Sugar Shack lagoons. The Sault Tribe collected a total of 252 samples; none were above the 300 cfu/100 mL threshold (Figure 4.5). Only one sample even reached 100 cfu/100 mL.

More information can be obtained by contacting Dan Tadgerson at (906) 635-6050 or dtadgerson@saulttribe.net.

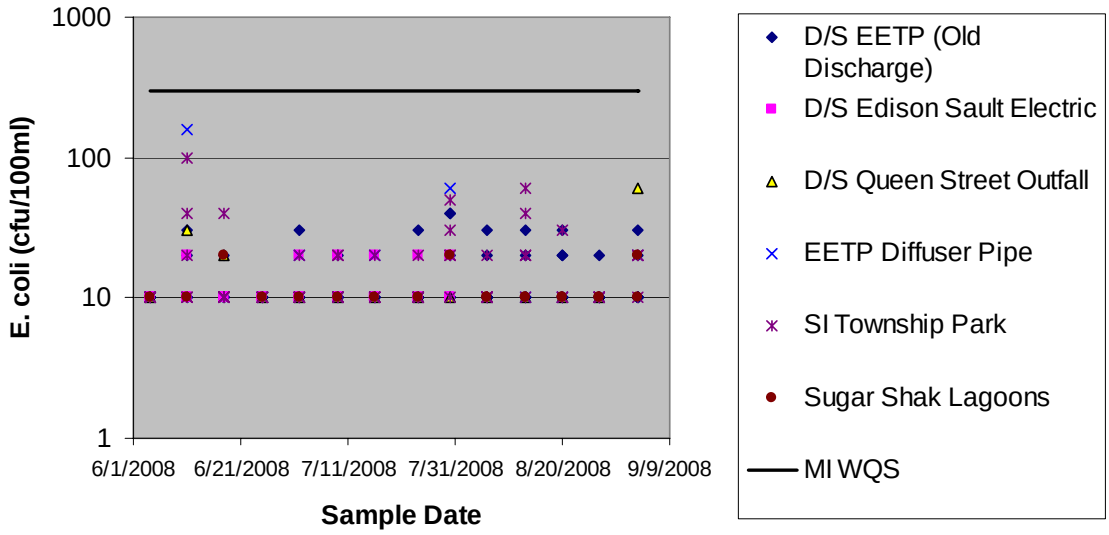
Garden River First Nation

The Garden River First Nation collected weekly samples from June 25 to August 6 along transects at three locations along the northern shore of the Lake George Channel. The Garden River First Nation's sampling and analytical protocols did not follow the QAPP procedures, so their results were not incorporated into the weekly maps in Appendix D. However, the data are included here for information purposes. Based on geometric means, there were no exceedances of the 300 cfu/100 mL WQS. Only one individual sample (at Bells Point on July 2) was above 300 cfu/100 mL, but other samples along the transect were much lower, resulting in a geometric mean of only 41 cfu/100 mL.

More information can be obtained by contacting Thuan Chau at (705) 941-4646 or thuan_chau@hc-sc.gc.ca.



## Figure 4.5. Sault Tribe 2008 Results



## Section 5: Source Tracking Study

In addition to analyzing for *E. coli*, water samples were screened for the presence of strains of the anaerobic bacterium *Bacteroides* associated with human fecal pollution by the Environment Canada Laboratory in Burlington Ontario. Results from validation of the human *Bacteroides* method are presented in Table 5.1.

Throughout the 2008 study period, the human *Bacteroides* DNA marker was not detected in the negative control sterile lab water samples. The field blank sample collected from tap water was also always negative for the human *Bacteroides* DNA marker, except for the September 3rd collection date. On this date, every St. Marys River sampling site except one (DEST1) also unexpectedly tested positive for the human *Bacteroides* DNA marker. Since detection of the human *Bacteroides* DNA marker in the field blank calls into question some kind of inadvertent contamination of samples that day, and there was no basis for explaining such a widespread occurrence of sewage contamination throughout the study area on this date (no preceding rainfall or knowledge of large sewage spills or releases etc.), the results of September 3rd were considered invalid and were not included in the results presented in Tables 5.1 and 5.2.

The results in Table 5.2 indicate that the highest frequency of detection for the human *Bacteroides* DNA marker occurred at site SMR07 (4 out of 10 samples positive). This site is at the Queen Street storm water outfall. The higher frequency of occurrence of the human *Bacteroides* DNA marker in this storm water outfall (40%) may be explained by the occurrence of a sanitary sewer pumping station connected to the outfall about 100m upstream. While there appears to be regular sewage contamination in this storm water outfall, the human *Bacteroides* DNA marker was not detected as commonly as typically seen for STP final effluents.

The results in Table 5.2 also indicate a relatively rare detection of the human *Bacteroides* DNA marker across the St. Marys River sampling sites in 2008. The human *Bacteroides* DNA marker was only detected in 7 out of 180 (4%) water samples collected in the St. Marys River. Since the generic BAC32 *Bacteroides* DNA marker was regularly detected in most water samples, we do not think that PCR inhibition would be a significant factor in explaining the lack of detection of the human *Bacteroides* DNA marker. However, given that the human *Bacteroides* DNA marker is not always detected in STP final effluents, and there were some water samples where no amplifiable DNA product (BAC 32 or HF183F primers) was recovered, our results should be considered as the minimum detectable presence of human sewage contamination. The results of infrequent human *Bacteroides* DNA marker detection in the St. Marys River study area in 2008 are consistent with generally low concentrations of *E. coli* measured in water samples collected at the same time in the study area.

The infrequent detection of the human *Bacteriodes* DNA marker in 2008 suggest caution in interpreting the occurrence data. This DNA marker was only detectable on June 4th and August 20th sampling dates. These dates were not proceeded by significant rain events. It is possible that low levels of human sewage contamination into the St. Marys

River may be less detectable in periods of significant rainfall through dilution and higher occurrence of background microorganisms and organic matter in surface water runoff.

The human *Bacteroides* DNA marker was not detected at the most upstream transect across the St. Marys River (DEST). The DNA marker was detectable only downstream at transects DEET (above the new Canadian STP outfall) and SIPT (below the new Canadian STP outfall). The human *Bacteroides* DNA marker was generally more frequently detected along the U.S. and Canadian shoreline than at sampling points in the middle of the St. Marys River. The downstream sampling point closest to the Canadian shoreline (SITP5) had the highest frequency of human *Bacteroides* DNA marker detection (2 out of 10 samples), although there was no comparable sampling point on this SITP transect to determine if this higher downstream occurrence was also found along the U.S. shoreline. There was no detection of the human *Bacteroides* DNA marker in surface water samples collected immediately downstream of the new Canadian STP outfall (EEDT). There did not appear to be significant sources of human sewage contamination in the study area in 2008, and the lack of a regular human *Bacteroides* DNA marker detection at any sampling location makes human sewage source attribution difficult. It is unknown whether the very high rainfalls during the sampling period may have made 2008 an anomalous year in terms of human sewage contamination events in the study area.

**Table 5.1.** Results of method validation using field blank samples collected in Sault St Marie, Ont., and fecal samples collected from Toronto and Ottawa, Ont. Human specific *Bacteroides* DNA marker is only detected in sewage samples.

| | | % positive signal | |
|---|---|---|---|
| Sample Type | N | Human | General |
| Field blank | 10 | 0 | 50 |
| Cat | 15 | 0 | 100 |
| Dog | 14 | 0 | 100 |
| Canada goose | 36 | 0 | 44 |
| Cormorant | 7 | 0 | 0 |
| Duck | 10 | 0 | 10 |
| Gull | 37 | 0 | 51 |
| Swan | 14 | 0 | 86 |
| CSO tank | 5 | 100 | 100 |
| STP Influent | 19 | 74 | 100 |
| STP effluent | 53 | 77 | 94 |

**Table 5.2.** Microbial source tracking results for detection of human (HF183F) and generic (BAC32) *Bacteroides* DNA markers in water samples from St. Marys River sampling locations. Sample location codes area described in Fig. 2.1 (N=10 water samples in 2008 for all locations).

| | % positive signal | |
|---|---|---|
| Location | Human | General |
| DEET1 | 10 | 90 |
| DEET2 | 0 | 90 |
| DEET3 | 10 | 90 |
| DEET4 | 10 | 90 |
| DEET5 | 10 | 80 |
| DEST1 | 0 | 70 |
| DEST2 | 0 | 50 |
| DEST3 | 0 | 70 |
| DEST4 | 0 | 90 |
| DEST5 | 0 | 100 |
| DQST1 | 0 | 80 |
| EEDT1 | 0 | 90 |
| SIPT1 | 0 | 100 |
| SIPT2 | 0 | 100 |
| SIPT3 | 0 | 100 |
| SIPT4 | 10 | 100 |
| SIPT5 | 20 | 90 |
| SMR07 | 40 | 100 |
| SSLT1 | 0 | 90 |
| *Total* | *6* | *88* |

## Section 6: Quality Assurance and Quality Control

To ensure the integrity of data upon which management decisions are made regarding responses to elevated *E. coli* contamination or floating solids, the SIMWG developed a QAPP detailing quality assurance and quality control (QA/QC) measures. These measures addressed sampling, custody, analysis, and data reporting on samples collected in the St. Marys River in support of the overall mission of the SIMWG.

Performance testing evaluation (proficiency testing) for basic water chemistry and *E. coli* was conducted in 2007 to assess the validity of inter-laboratory data comparisons. Results from the participating laboratories were compared to the reference values. Overall, the results of the proficiency testing were excellent; only 1 result (>20% deviation from reference for total suspended solids) of 60 test results fell outside the accepted deviation from reference. All *E. coli* results were within 20% deviation.

Extensive side-by-side sampling was conducted in 2007, and results generally were within acceptable variation criteria (SIMWG 2008). A comparison of the side-by-side *E. coli* samples taken in 2007 found no significant difference in results reported by the various agencies. The counts were paired by date and site; on occasions when an agency took multiple samples at a site, the geometric mean of those sample results was used. A total of 70 matched pairs resulted. Using the Wilcoxon signed-rank test (nonparametric) and the paired t-test, the "p" value was greater than 0.4 and the null hypothesis (that agency results were equivalent) was not rejected. Based on this information, the SIMWG determined that additional side-by-side sampling in 2008 was not necessary.

As was the case in 2007, all field blanks were less than 10 cfu/100 mL. Thus, there was no indication of external contamination of samples.

A total of 56 field triplicate samples were collected in 2008 by the various agencies. Of the 13 triplicate samples with values in the 100 – 500 cfu/100 mL range, twelve fell within acceptable criteria. Standard deviations for these samples ranged from 11% to 45%. These results are consistent with those in 2007, in which field triplicate samples with values between 100 – 500 cfu/100 mL had standard deviations ranging from 23% to 29%. One set of triplicates collected by the MOE in 2008 (July 23$^{rd}$) had a standard deviation of 70% based on individual replicate values of 270, 60 and 130 cfu/100 mL.

In summary, the SIMWG is satisfied that all of the agencies the collected high-quality data in 2008.

# Section 7: Inspections

As part of the 2008 St. Marys River Sugar Island work plan, inspections of the operations of pollution control facilities were undertaken throughout 2008 to evaluate compliance of the facilities with legal instruments. Specific inspections included:

i) Ontario Ministry of the Environment Inspection of the City of Sault Ste. Marie East End Sewage Treatment Plant: Inspection Number 2373-7HYHL3 dated August 26, 2008.
ii) Michigan Department of Environmental Quality Inspection of the City of Sault Ste. Marie Michigan Sewage Treatment Plant: Sampling and Wastewater Plant Inspection - Number 33648, Collection Sewer Inspection – Number 34244

Definitions

*Overflow* – raw or partially treated sewage that is directly or indirectly discharged from a sewer system onto land or into the water. Examples include sanitary sewer overflows (SSO) and combined sewer overflows (CSO).

*Bypass* - the intentional diversion of waste streams from any portion of a treatment facility, usually in response heavy flow volume following rain events or snow melt. A *blended bypass* occurs when partially treated effluent is blended with fully treated effluent and disinfected prior to discharge.

Inspections

*Ontario Ministry of the Environment Inspection of the City of Sault Ste. Marie East End Sewage Treatment Plant: August 26, 2008.*

On August 26, 2008, Provincial Officer Kirk Crosson completed a compliance inspection of the East End Sewage Treatment Plant in Sault Ste. Marie, Ontario. The plant is identified as Sewage Works Number 110000640, and as a Class IV facility. Nine operators at the plant are properly certified at appropriate corresponding levels.

The plant is owned by the City of Sault Ste. Marie and operated under contract by the Sault Ste. Marie PUC Services Inc. Ministry of the Environment Certificates of Approvals govern the operations at the plant; the primary Certificates Certificate Number is 9666-5WFKUC issued on June 18, 2004 prior to plant construction.

Plant View:


The sewage treatment plant is designed as biological nutrient reduction, secondary treatment with ultra violet light disinfection. The plant is currently operating as a modified conventional activated sludge treatment plant while the fermenter and other works continue to be brought on line to eventually operate as a Biological Nutrient Reduction facility.

Effluent quality was assessed based on plant laboratory submission and analysis records and effluent treatment limits as specified in the Certificate of Approval.

**Table 7.1. Effluent Quality Evaluation**

| Parameter | Average Result | Effluent Limit |
|---|---|---|
| Biological Oxygen Demand | 2.48 | 25 |
| Suspended Solids | 5.3 | 25 |
| Total Phosphorus | 0.27 | 1.0 |

All results in milligrams per litre

The plant is also required to sample for Acute Lethality tests for Rainbow trout and Daphnia magna as well as provide a geometric monthly mean of *E. coli* sample results. The range of *E. coli* geometric mean results was 1.14 to 97.17 cfu per 100 mLs with an average of 24.3 cfu per 100mL (the compliance limit is 200 cfu /100 mL). The data confirm compliance.

Disinfected blended plant bypass occurred 12 times in 2008 for a duration of 358 hours and a total flow of 84.95 1000 cubic metres due to rain events. No raw sewage was bypassed. Dates of blended bypasses and associated *E. coli* levels are listed in table 7.2.

**Table 7.2. EETP Blended Bypass Summary 2008.**

| Date | *E. coli* (cfu/100 ml) |
|---|---|
| January 7 | 45 |
| January 8 | 130 |
| January 29 | Lab closed, sample not taken |
| March 3 | 40 |
| April 1 | 95 |
| April 3 | 470 |
| April 14 | 10,000 |
| April 26 | No data |
| July 21 | 100 |
| November 13 | 2,900 |
| December 27 | 72,000 |
| December 29 | 745 |

Excess sludge from the plant is centrifuge dewatered and shipped to certified landfill for disposal.

The plant passed inspection.

*Michigan Department of Environmental Quality Inspection of the City of Sault Ste. Marie Michigan Treatment Plant: April 8, 2008*

On April 8, 2008, the UP District wastewater inspector conducted an inspection of the collection sewer overflow locations. The overflow locations either directly discharge to the environment or are no longer needed and have been bulkheaded. The remaining active overflow locations are scheduled to be bulkheaded in accordance with the combined sewer separation project with a completion date of December 31, 2018. Heavy rains and spring melt conditions did not result in overflows, however, a constricted combined sewer on April 9, 2008, resulted in a diluted raw sewage release to the Power Canal at CSO outfall #10 as the City responded to prevent flooding of basements.

*Michigan Department of Environmental Quality Inspection of the City of Sault Ste. Marie Michigan Treatment Plant: June 3, 2008*

The Sault Ste. Marie, Michigan wastewater plant is Class B and the Superintendent has the proper certification. Wastewater treatment consists of rotating biological contactors (RBC) for secondary treatment with 8 million gallons per day (MGD) capacity. The hydraulic and primary settling capacity of the plant is 17 MGD. Disinfection of the wastewater is provided with chlorine chemical treatment. The facility's current NPDES Permit (MI0024058) requires the City to conduct combined sewer separation projects to eliminate the remaining active overflows by December 31, 2018. Anaerobic digesters treat the sludge for pressing and disposal at a licensed landfill.

The City has complied with their Permit requirements to develop and submit to MDEQ a Mercury Pollutant Minimization Plan and provide annual updates. In addition to routine

five times per week monitoring, the City has sampled and analyzed their discharge quality in May 2008 for whole effluent toxicity, metals, and organics per the requirements of the Permit. No toxicity or significantly elevated concentrations were detected. No combined sewer overflows have been reported since spring of 2004, until an overflow due to high flows and a combined sewer flow restriction was reported on April 9, 2008. An estimated 0.715 million gallons was released to the Power Canal. Also, the MDEQ received bypass notification from the City on April 7, 2008. The City reported that a total of 7.4 million gallons was blended and disinfected. The facility also provided notification to MDEQ that the 7 day and 30 day limits for fecal coliform was violated during April 2008. The suspended solids percent removal minimum requirement was also violated during April 2008.

On June 3, 2008, UP District wastewater inspector Randy Conroy and state sampling crew staff inspected the wastewater treatment plant in Sault Ste. Marie, Michigan. An unspecified amount of wastewater was blended on that date. The June 2008 inspection required the facility to reset the bypass valve at a higher elevation to prevent the unnecessary bypass that was observed. The bypass valve had been set to a lower flow level due to maintenance work on one of the RBC drums. The chlorine feed line was observed, to confirm an increased rate of chemical feed to the contact chamber. The control panel was repaired in June 2008 to provide for flow proportioning of composite sample collection. The facility is also working on a meter installation for the bypass line. The MDEQ sampling was consistent with facility results although suspended solids were slightly higher.

Finally, 0.21 million gallons of wastewater was blended on November 12, 2008.

Plant View:

**Table 7.3. Year 2008 Sault Ste Marie Michigan Effluent Quality Results**:

| Parameter | Average Result | Effluent Limit |
|---|---|---|
| Carbonaceous Biochemical Oxygen Demand | 14.5<br>11.1 | 40 – 7 day average<br>25 - 30 day average |
| Total Suspended Solids | 13.2<br>9.3 | 45 – 7 day average<br>30 - 30 day average |
| Total Phosphorus | 0.46 | 1.0 – 30 day average of daily values |
| Fecal Coliform | 116<br><br>75 | 400 cfu/100 mL – 7 day average<br>200 cfu/100 mL – 30 day average |

CBOD, TSS, and phosphorous results in milligrams per litre

Sugar Shack Lagoons

The Sugar Shack Campground is located on the northwest shoreline of Sugar Island, upriver from the Sugar Island Township Park. It utilizes large oxidation ponds that currently operate as subsurface discharge for sewage disposal and is regulated under the CCHD with guidance from the MDEQ. In the early 1980's, the Sugar Shack oxidation ponds were regulated under the Michigan Department of Natural Resources and permitted to discharge by a direct connection to an outlet to the St. Marys River. A few years later, the pipe leading to the river was disconnected and the Sugar Shack began operating as subsurface discharge.

The Sugar Shack lagoons were inspected in July 2007 by the CCHD and a site visit by CCHD, MDEQ, and MOE occurred in November 2007. The results and observations of the inspection and site visit are summarized in last year's report (Sugar Island Monitoring Workgroup, 2008). In April 2008, the owner of the campground removed the pipe, which was later confirmed by CCHD.

# Section 8: Public Outreach

This section is a product of the St. Marys River Remedial Action Plan (RAP) Team members, who acted as the Communications Committee for the SIMWG. The 2000 Four Agency Compendium of Position Papers, which includes a Public Involvement and Outreach component, guided the communication and public involvement activities highlighted below.

Public Symposium

The Sugar Island and Lake George Channel Public Symposium was held on May 15, 2008, from 5-8 pm at the Cisler Center, Lake Superior State University in Sault Ste. Marie, Michigan. The purpose of the Symposium was to provide the public with information regarding the results from the 2007 sampling program on the north shore of Sugar Island and in the Lake George Channel. The symposium also provided an opportunity to discuss with the public the 2008 coordinated monitoring and event response procedures.

In consultation with the SIMWG, a letter of invitation, press release, and agenda for the Symposium were prepared. The press release was drafted by the Communication Committee and issued by the Canadian and U.S. local health agencies. The MDEQ also issued a press release. An agenda package, including an agenda, contact information, and summaries of the presentations, was distributed to participants at the Symposium. Copies of the 2007 SIMWG report were also made available to interested parties. A facilitator was engaged to chair the Symposium. A SIMWG display was also created for the Symposium to highlight the purpose of the coordinated monitoring effort; along with a map indicating proposed sampling sites for 2008 was also available for reference.

Representatives of the SIMWG made presentations and answered questions related to the 2007 water quality monitoring results and their agencies role in the 2008 coordinated monitoring activities. Copies of the Symposium presentations were made available upon request.

Approximately 60 people were in attendance encompassing the following organizations:

- Elected officials offices
- Tribes/First Nations
- Federal and Provincial/State government agencies
- Local government agencies (including local health departments)
- Universities
- Environmental non-government organizations
- Local residents (including Sugar Island residents)
- Media

Overall, attendees were encouraged by the level of bi-national cooperation, organization, and activity on the issue. Some, however, voiced their displeasure with the handling of the events in 2006.

Follow-up

At the Symposium, attendees were given the opportunity to join an E-mail distribution list for future correspondence on this issue. On July 25, 2008, a monitoring update was sent to those on that list.

Additional follow-up information on the SIMWG's 2008 activities and monitoring recommendations for 2009 will be developed and distributed once the final SIMWG report has been completed in early 2009.

Bi-National Public Advisory Committee Updates

The St. Marys River BPAC was kept informed of the SIMWG activities through the Four Agency Update documents prepared for 2008 BPAC meetings on April 29, June 3 September 18, and November 19.

# Section 9: Conclusions

Process

- The SIMWG, which included local, tribal, state, provincial, and federal agencies, continued to work together effectively to refine and implement a comprehensive, cooperative monitoring plan.
- Frequent communication among the agencies was maintained during the 2008 field season through regular conference calls. Cooperation and communication among the agencies were excellent.

Incident Reports

- Four incident reports from area residents were received in 2008, and were investigated consistent with the Incident Response Protocol. The first occurred on May 9, and the last was received on October 20.
- Samples were collected for the first three incidents, and were found to be natural materials (cotton likely from cottonwood trees, pollen, detritus, mayfly exuvia, and green/blue-green algae) except for one condom in a July 23 sample.
- The fourth incident, reported on October 20, was described as a dark gray material with a sewage-like smell. By the time the complaint was investigated the next day, the material was no longer present and a sample could not be collected.

Weekly Sampling

- Approximately 630 weekly samples were collected and analyzed for *E. coli* in 2008 (excluding field blank QA/QC samples) by the various agencies. This is substantially more samples than the approximately 450 samples collected in 2007.
- As was the case in 2007, *E. coli* levels generally were low during the 2008 sampling season. Of the 630 samples collected, only 57 (9%) had *E. coli* levels greater than the Michigan Water Quality Standard of 300 cfu/100 mL. Despite the Ontario Ministry of Environment sampling more storm sewer outfalls in 2008, and a much wetter summer, these results are almost identical to the 8% exceedance rate found in 2007.
- Of the 57 samples exceeding 300 cfu/100 mL, 48 (84%) were collected from sites at or near storm water outfalls. Such results are not surprising, especially during and after storms which were common in 2008. None of the samples greater than 300 cfu/100 mL were collected in the open river (i.e. all were along the shoreline). This finding is consistent with the results from 2007.
- High *E. coli* levels in 2008 were found much more often in June and early July, compared with the rest of July (after July 9) and the remainder of the sampling season. These results roughly correlate with rain events, which were more frequent in June and early July.
- In addition to rain and storm water outfalls, other factors likely to contribute to high bacteria levels included shallow water, high winds, and the presence of waterfowl.
- The source tracking study indicated relatively rare detection of the human *Bacteroides* DNA marker across the St. Marys River sampling sites in 2008. The human *Bacteroides* DNA marker was only detected in 7 out of 180 (4%) water samples collected in the St. Marys River.

- The most common occurrence of the human *Bacteroides* DNA marker was found at the Queen Street storm water outfall (4 of 10 samples). This finding is probably explained by the occurrence of a sanitary sewer pumping station connected to the outfall about 100m upstream.

Quality Assurance

- QA/QC results strongly suggest that data collected by each of the four sampling agencies are comparable and can be integrated into one comprehensive report.
- Analysis of all field blank samples resulted in *E. coli* levels < 10 cfu/100 mL, indicating that sample contamination did not occur during this project. Identical field blank results were found in 2007.
- Field triplicate samples with values in the 100 – 500 cfu/100 mL range generally fell within acceptable criteria; standard deviations for these samples ranged from 11% to 45% for the 2008 sampling campaign with one exception. A set of triplicate samples collected by the MOE on July 23rd had a standard deviation of 70% based on individual replicate values of 270, 60 and 130 cfu/100 mL.
- Side-by-side *E. coli* samples taken in the St Marys River in 2007 were compared statistically. No significant differences were found in the results reported by the various agencies. Thus, the SIMWG concluded that additional side-by-side sampling in 2008 was not warranted.

Inspections

- Provincial and state officials inspected the East End Wastewater Treatment Plant (Ontario) and the Sault Ste. Marie Wastewater Treatment Plant (Michigan) in 2008. No major issues were identified. The Michigan plant was in noncompliance for fecal coliform and suspended solids percent removal in April 2008, but no other violations occurred. Both facilities had blended bypasses (in which partially treated wastewater was mixed with fully treated wastewater and disinfected) during rain events.
- The discharge pipe from the Sugar Shack lagoons, which had been disconnected several years ago, was removed entirely by the property owner in April 2008.

# Section 10: Next Steps

1. A third public meeting will be held in spring 2009 (following previous ones in May 2007 and 2008) in Sault Ste. Marie, MI, perhaps on Sugar Island. The purpose of the meeting will be to discuss 2007 and 2008 sampling results, as well as future plans, with the public.

2. The SIMWG will continue to follow the Incident Response Protocol in 2009, as we have in previous years. If reports of floating material are received from area residents, samples will be collected and identified if feasible.

3. At this time, the SIMWG believes that a continuation of weekly, coordinated monitoring is not necessary in 2009. Individual agencies may continue some monitoring as funding allows.

4. If incidents of uncertain origin do occur, contingency monitoring can be conducted. Mechanisms are available to have periodic samples analyzed for *E. coli* and/or *Bacteriodes*, if necessary. It is not anticipated that such analyses will be needed on a frequent basis, however.

5. SIMWG monthly conference calls will be held during the 2009 field season to ensure consistent communication and information exchange. These calls will allow the SIMWG to evaluate events during 2009 and respond to unanticipated circumstances.

6. In fall 2009, the SIMWG will review the effectiveness of the approach outlined here, and determine whether any modifications are warranted for 2010.

## Section 11: Acknowledgements

Members of the SIMWG would like to acknowledge and thank the following people/agencies for their work on this program:

John Kraft of Environment Canada for field work and contaminant mapping

Carly Rebellato and Alexis Ness assisting MOE with sample collection

LSSU for hosting the 2008 SIMWG Public Symposium

Jason Hamilton (MOE) and Michelle Selzer (MDEQ) and for their work in organizing the 2008 SIMWG Symposium

Sarah LeSage from MDEQ for her microscopic analysis of algae samples

Sault Tribe of Chippewa Indians and the Ontario Ministry of Environment for the gracious hosting of SIMWG meetings

Susan Watson from Environment Canada for her analysis of algae samples

Tom Edge and Stephen Hill from Environment Canada for their *Bacteriodes* analysis

MDEQ for providing a Clean Michigan Initiative grant to CCHD to monitor the sites along the north shore of Sugar Island.

## Section 12: Literature Cited


Environment Canada, United States Environmental Protection Agency, Ontario Ministry of the Environment, and the Michigan Department of Environmental Quality. 2002. St. Marys River Remedial Action Plan Stage 2 Report: Remedial Strategies for Ecosystem Restoration. December 2002.

Michigan Department of Environmental Quality. 2007. St. Marys River *E. coli* Data Compilation and Summary. MI/DEQ/WB-07/040.

Ontario Ministry of the Environment and the Michigan Department of Natural Resources. 1992. St. Marys River Remedial Action Plan Stage 1: Environmental Conditions and Problem Definitions. March 1992.

Sugar Island Monitoring Workgroup. 2008. 2007 St. Marys River – Sugar Island Monitoring: A Final Report of the Sugar Island Monitoring Work Group. April 2008.

Bernhard, A.E., and K.G. Field. 2000. A PCR assay to discriminate human and ruminant feces on the basis of host differences in Bacteroides-Prevotella genes encoding 16S rRNA. Applied and Environmental Microbiology 66: 4571-4574.

Bower, P.A., C.O. Scopel, E.T. Jensen, M.M. Depas, and S.L. McLellan. 2005. Detection of genetic markers of fecal indicator bacteria in Lake Michigan and determination of their relationship to Escherichia coli densities using standard microbiological methods. Applied and Environmental Microbiology 71: 8305-8313.

Edge, T.A., and K.A. Schaefer (Eds.). 2006. Microbial source tracking in aquatic ecosystems: the state of the science and an assessment of needs. National Water Research Institute, Environment Canada, Burlington, Ontario. NWRI Scientific Assessment Report Series No. 7, and Linking Water Science to Policy Workshop Series. 26p.

Field, K.G., and M. Samadpour. 2007. Fecal source tracking, the indicator paradigm, and managing water quality. Water Research 41: 3517-3538.

# Appendices

Appendix A: Sugar Island Monitoring Work Group Monitoring Plan 2008

Appendix B: SIMWG Quality Assurance Project Plan 2008

Appendix C: 2008 Incident Reports

Appendix D: 2008 Data Results

Appendix E: 2008 Data Maps

# Appendix A

Sugar Island Monitoring Work Group Monitoring Plan 2008

**Sugar Island Monitoring Plan**
02/5/08

## Goal

Through effective monitoring, reporting, and citizen observation, the Sugar Island Monitoring Work Group (SIMWG) will collect and share scientific data and information regarding water quality conditions along the St. Marys River Sugar Island reach and the Lake George Channel.

## Monitoring Objectives

1. Determine the nature of solid floatable material episodically impacting the north shore of Sugar Island reach. ***Monitoring activity***

2. Facilitate international cooperation and sampling to ensure data quality, consistency, and comparability. ***Monitoring activities, program QAPP***

3. Assess current water quality conditions and water quality standards attainment status along the Sugar Island reach. ***Monitoring activity***
4. Assess the final effluent quality of select point source discharges determined to have the potential to impair water quality conditions along Sugar Island. ***Monitoring activity***
5. Determine any other potential ecological sources or processes (e.g. birds, groundwater, algal mats, etc.) that are impairing or could potentially impair water quality conditions along the Sugar Island reach in general, and that are responsible for any closure of the Sugar Island Township Park beach and/or health advisories along the Sugar Island reach. ***Monitoring activity***

## Scope

The focus of the monitoring activities will be:

- On impacts in the St. Marys River Lake George Channel on the north side of Sugar Island
- To sample ambient water and discharges from identified point and non-point sources, and floating material
- To analyze for relevant indicators including *Escherichia coli (E. Coli)*, suspended solids, total solids and suspended solids, total conductivity, and other relevant indicators
- To identify sources and/or causes of impacts related to aesthetic impairment, closure of the Sugar Island Township Park beach and/or health advisories

## Monitoring Activities

**Ongoing Program Monitoring**

1. Daily visual observation/surveillance of water quality conditions along the Sugar Island reach

   **Monitoring Entity:** trained non-agency volunteers
   **Indicators:** visual observation of floating solids, settleable solids, deposits, foams, human raw sewage and associated remnants
   **Monitoring Actions:** Immediately notify appropriate US and Canadian agencies to stimulate confirmation monitoring and follow-up source identification monitoring, maintain detailed field notes for all investigations.

2. Weekly monitoring of *E. coli* and other relevant water quality indicators along Sugar Island's north shoreline to assess water quality standard attainment status.

   **Monitoring Entity:** Monitoring team includes Chippewa County Health Dept., Ontario Ministry of the Environment, Algoma Health Dept., Sault Tribe of Chippewa Indians
   **Indicators:** *E. coli*, visual observation of floating solids, settleable solids, deposits, foams, human raw/partially treated sewage and associated remnants
   **Monitoring Actions:** collect *E. coli* samples in accordance with appropriate Standard Operating Procedures (S.O.P.s) from each selected station along Sugar Island's north shoreline, (minimum of weekly sampling from June 2 to October 31 and to include at least one rain event sampling), collect total solids/total suspended solids/total settleable solids/total conductivity grab samples from selected stations in the St. Marys River, collect samples of any observed pollution evidence and deliver samples to appropriate US and Canadian agencies, photograph pollution problems, immediately notify appropriate US and Canadian agencies to stimulate confirmation monitoring and follow-up source identification monitoring, maintain detailed field notes for all investigations, perform all water quality monitoring in accordance with the approved Quality Assurance Project Plan (QAPP).

3. Weekly monitoring of *E. coli* and other water quality indicators at select locations in the St. Marys River between the Navigation Locks and Sugar Island reach to assess water quality standard attainment status. Sampling sites are upstream of Sugar Island.

   **Monitoring Entity:** Monitoring team to include Chippewa County Health Dept., Ontario Ministry of the Environment, Algoma Health Dept., Sault Tribe of Chippewa Indians
   **Indicators:** *E. coli*, total solids, suspended solids, dissolved solids, total conductivity, and visual observation of floating solids, deposits, foams, human raw sewage and associated remnants
   **Monitoring Actions:** Collect *E. coli* samples in accordance with appropriate S.O.P.s from each identified station upstream of Sugar Island. (minimum of

weekly sampling events from June 2 to October 31 and to include at least one rain event), collect total solids/total suspended solids/ dissolved solids/total conductivity grab samples from selected stations in the St. Marys River, collect samples of any observed pollution evidence and deliver samples to appropriate US and Canadian agencies, photograph pollution problems, immediately notify appropriate US and Canadian agencies to stimulate confirmation monitoring and follow-up source identification monitoring, maintain detailed field notes for all investigations, perform all water quality monitoring in accordance with the approved QAPP.

*4.* Monitoring of both the Canadian East End Wastewater Treatment Plant and the Sault Ste Marie Michigan Wastewater Treatment Plant's final effluent for *E. coli* or total fecal coliform bacteria and total suspended solids.

**Monitoring Entity:** Public Utilities Commission Service Inc. East End Sewage Treatment Plant, Sault Ste Marie Michigan Wastewater Treatment Plant
**Indicators:** *E. coli* or total fecal coliform, total suspended solids, CBOD, total phosphorous, and visual observation of floating solids, deposits, foams, human raw /partially treated sewage and associated remnants.
**Monitoring Actions:** Current sampling protocols have testing being done five days a week according to the S.O.P in place at each plant. This monitoring will continue and reporting out will be done monthly or upon notice of noncompliance. Immediate notification of appropriate US and Canadian agencies in accordance with the St. Marys River Sugar Island Incident Response Protocol if unusual effluent quality conditions are observed or measured to stimulate follow-up water quality impact assessment monitoring along the Sugar Island Reach and other locations in the St. Marys River.

5. Regular monitoring of *E. coli* and other water quality indicators at beach locations in the Sugar Island reach to assess water quality standard attainment status.

**Monitoring Entity:** Chippewa County Health Dept (Sugar Island Township Park beach), Health Canada (Garden River First Nation beach at Bell's Point - Ojibway Park)
**Indicators:** *E-coli*
**Monitoring Actions:** Collect water and or sand samples from each selected beach station along the Sugar Island Reach. Issue health advisories as required based on *E. coli* levels. Notify appropriate agencies for follow-up source identification monitoring as required. Maintain detailed field notes for all investigations, perform all water quality monitoring in accordance with the approved beach sampling QAPP. At least one sample period should be done during a rain event to locate and sample temporary non point sources.

**Supplementary Monitoring**

**A trackdown study will be designed by Tom Edge. Joan Rose will be sought for her collaboration. The study will consist of weekly monitoring for *e-coli* and *bacteriodes*. Approximately 17 sites will be monitored. This monitoring is in addition to the SIMWG monitoring being conducted.**

Contingency Monitoring

1. If high levels of bacteria are reported from an STP or if an STP bypass is reported, immediate water sampling monitoring downstream of the STP to monitor the status of the water quality will be initiated. **Trigger:** Michigan STP - Noncompliant levels of total fecal coliform bacteria above a monthly geometric mean of 200 cfu/100mL or a geometric mean of the samples collected in any 7 day period above 400 cfu/100mL. Ontario East End STP - Noncompliant levels of the E. coli effluent objective of 300 cfu/100mL daily maximum or the monthly geometric mean of the samples collected exceed 200 cfu/100 mL.

**Quality Control/Assurance**

- The interagency Quality Assurance Project Plan will be written and formally adopted.
- The QAPP will address the following elements: a) project description; b) project organization and responsibilities; c) QA objectives for water quality measurement data; d) sampling procedures; e) custody procedures; f) calibration procedures and frequency; g) analytical procedures; h) internal QC checks; i) data reduction, validation, and reporting; j) performance and system audits; k) preventative maintenance; l) data quality assessment; and m) corrective action.

**Public Involvement/Participation**

This is the role of the Four Agency Work Group as per the Terms of Reference for the Monitoring Committee and outside the scope of this working group. Public involvement should be limited to presenting data on a request basis.

**Data Management, Mapping and Data Sharing**

1. All data will be sent within one week of sampling to the Ontario Ministry of the Environment where it will be consolidated and mapped.

2. All high levels will be reported to the co-chairs, Gary Kohlhepp and Debbie Burniston for follow up action. Follow up action will also proceed according to the incident report protocol as well as *individual* agency protocol.

3. All consolidated and mapped data will be posted on a web site available to agency and SIMWG members.

**Facilitation of Water Pollution Control/Corrective Action**

If monitoring activities confirm impaired water quality conditions along Sugar Island's north shoreline and also identify a source(s) responsible for the water quality impairment, the Sugar Island Monitoring Work Group will report these findings to Managers and the Four Agency Work Group for identifying and choosing remedial actions. The Sugar Island Monitoring Work Group's role is limited to reporting out.

# Appendix B

SIMWG Quality Assurance Project Plan 2008
(QAPP Appendices omitted, available on request))

# QUALITY ASSURANCE PROJECT PLAN

2008 ST. MARYS RIVER – SUGAR ISLAND MONITORING

May 2008

Prepared by the Sugar Island Monitoring Work Group

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## A. Distribution List

The Sugar Island Monitoring Work Group (SIMWG) co-chairs, Debbie Burniston and Gary Kohlhepp, are responsible for ensuring that all participating organizations have the most recent version of this project Quality Assurance Project Plan (QAPP). It will be distributed, along with any future QAPP updates, to the SIMWG representatives:

David Rockwell (U.S. Environmental Protection Agency)
Debbie Burniston (Environment Canada)
John Marsden (Environment Canada)
Chris Marvin (Environment Canada)
Kate Taillon (Environment Canada)
Randall Conroy (Michigan Department of Environmental Quality)
Gary Kohlhepp (Michigan Department of Environmental Quality)
Jason Hamilton (Ontario Ministry of Environment)
Lilian Keen (Ontario Ministry of Environment)
Rod Stewart (Ontario Ministry of Environment)
Christine Daley (Chippewa County Health Department)
Sherri Cleaves (Algoma Public Health)
Jennifer Francella (Algoma Public Health)
Thuan Chau (Health Canada)
Mike Ripley (Chippewa-Ottawa Resource Authority)
Amanda Bosak (Bay Mills Indian Community)
Dan Tadgerson (Sault Ste. Marie Tribe)
Libby Bobiwash (Garden River First Nation)

These SIMWG members, in turn, are responsible for ensuring that other appropriate personnel, both within their organizations and those in other organizations which are involved in this project (e.g. analytical laboratories), receive the QAPP and associated protocols. The QAPP also will be made available to any interested party upon request.

## B. Project Background/Problem Definition

The St. Marys River starts as the outlet of Lake Superior at Whitefish Bay and flows southeasterly through several channels to Lake Huron, a distance of 100-120 kilometers (depending on the route). The average flow volume is 2,144 cubic meters per second. Several islands were formed when the river divided into its numerous channels. Sugar Island is the largest upstream island, which separates Lake George (east) and Lake Nicolet (west). The watershed includes all of the Lake Superior drainage basin as well as a number of small tributaries which drain directly into the river. Michigan tributaries include the Waishkey, Charlotte, Little Munuscong, Munuscong, and Gogomain Rivers as well as other small streams. In Ontario, the main tributaries are the Big Carp, Little Carp, Root, Garden, Echo, and Bar Rivers, as well as East Davignon Creek, West Davignon Creek, and Fort Creek.

The St. Marys River was identified in 1985 by the International Joint Commission as one of 42 Areas of Concern (AOC) in the Great Lakes basin. The St. Marys River AOC boundary extends from Whitefish Bay between Point Iroquois, Michigan and Gros Cap, Ontario; east and downstream between Quebec Bay and Humbug Point, Ontario in the St. Joseph Channel; between the Michigan side of the river and St. Joseph Island, downstream to the De Tour Passage, Michigan. The St. Marys River was listed as an AOC due to problems associated with phosphorus, bacteria, metals, trace organics, contaminated sediments, fish consumption advisories, and impacted biota. The primary sources of these contaminants are industrial and municipal point sources, as well as historic combined sewer overflows. The Remedial Action Plan (RAP) Stage 1 report (problem definition) was first completed in 1992 (Ontario Ministry of the Environment and Michigan Department of Natural Resources, 1992); the Stage 2a report (remedial actions) was completed in 2003 (Environment Canada, U.S. Environmental Protection Agency, Ontario Ministry of the Environment, and Michigan Department of Environmental Quality, 2002).

A great deal of monitoring in the St. Marys River has occurred over the last 20 years, primarily in response to its designation as an AOC. These data collection efforts are described in the 1992 and 2003 RAP documents. Since 2001, the Chippewa County Health Department (CCHD) has conducted *E. coli* monitoring at three beaches along the St. Marys River (Four Mile Beach, Sherman Park Beach, and Sugar Island Township Park Beach). During summer 2006, residents along the north shore of Sugar Island reported numerous episodes of contaminants, floatable materials, and other indicators suggestive of sewage. These complaints were accompanied by photographs and water samples. In response, water quality agencies in Canada and the U.S. conducted extensive monitoring to characterize the severity of water quality impairment and to identify potential sources of bacteria and floating solids.

The CCHD sampled more extensively in 2006 to characterize the severity of water quality impairment and to identify potential sources. They collected and analyzed nearly 70 samples at or near the East End Sewage Treatment Plant (Ontario) discharge site, nearly 100 samples from residential shoreline areas, and a small number of samples at/near the Sault Ste. Marie, Michigan Sewage Treatment Plant. Beach and river water

samples were analyzed for *E. coli* and total coliform; river water samples also were analyzed for total suspended solids, total dissolved solids, and ortho-phosphorus. The results are summarized in two reports (Daley 2008; MDEQ, 2007).

The Ontario Ministry of Environment (MOE) and Algoma Public Health (APH) also monitored water quality in the St. Marys River in 2006. Samples were collected weekly from six locations in the St. Marys River, from July 19 through October 24, 2006. Sites were located above, at, and below the East End Sewage Treatment Plant (Ontario). Samples were analyzed for *E. coli,* and the data are available upon request.

The Sugar Island Monitoring Workgroup was established in February 2007 in response to reports of floating solids with high *Escherichia coli (E. coli)* levels periodically found in the Lake George channel of the St. Marys River. The multi-agency, bi-national workgroup was tasked by the Four Party Management Committee (consisting of representatives from the U.S. Environmental Protection Agency, Environment Canada, Michigan Department of Environmental Quality, and Ontario Ministry of the Environment) to develop and implement a monitoring plan to determine the source and nature of the floating materials and the cause(s) responsible for the periodic high levels of *E. coli* at the Sugar Island Township Park beach.

The SIMWG was charged with the following tasks:

1. review previous water and sediment monitoring data, as well as various agency monitoring activities;
2. identify data gaps and future monitoring needs;
3. update/enhance the Sugar Island Incidence Response Protocol; and
4. develop an interagency monitoring plan for 2007 that incorporates ambient and event-response monitoring activities.

Based on this charge, the SIMWG developed a monitoring plan for 2007. This plan consisted of the following objectives:

a) Determine the nature of solid floatable material episodically impacting the north shore of Sugar Island reach.

b) Facilitate international cooperation and sampling to ensure data quality, consistency, and comparability.

c) Assess current water quality conditions and water quality standards attainment status along the Sugar Island reach.

d) Assess the final effluent quality of select point source discharges determined to have the potential to impair water quality conditions along Sugar Island.

e) Identify authorized/unauthorized point source or non-point source discharges and whether sediments are impairing water quality conditions or are responsible for any beach closures or health advisories.

f) Determine any other potential ecological sources or processes (e.g. birds, groundwater, sediment resuspension, algal mats, etc.) that are impairing or could potentially impair water quality conditions and/or are responsible for any closure of the Sugar Island Township Park beach or health advisories along the Sugar Island reach of the Lake George Channel.

The SIMWG conducted extensive sampling in 2007. The 2007 sampling season ran from June 1st to October 3rd. There were five incidents of floating material reported during the 2007 season; four were determined to be algae- and/or detritus-based and one as pollen. There were no incidents of floating material reported after July 3, 2007.

A total of 36 samples exceeded the 300 cfu/100 mL threshold set by the Sugar Island Monitoring Work Group (based on the Michigan Water Quality Standard) in 2007. Of these exceedances, 15 were detected at Canadian storm sewer outfalls, six at Fort Creek (a tributary on the Canadian side that receives stormwater), one at a near-shore site near the former outfall of the Sugar Shack lagoons on Sugar Island, and one at a mid-river location. The remaining 13 samples with elevated *E. coli* levels were found at various near-shore locations on both sides of the river. Despite episodic, localized exceedances of the 300 cfu/100 mL threshold, the data never indicated that the exceedances affected river concentrations across the channel.

Sediment monitoring was carried out in September 2006 and September 2007 to assess surficial sediment quality along the Lake George channel. Core samples were taken to determine the extent of any bacterial contamination, among other parameters. The 2007 study assessed sites on the U.S. shoreline, storm sewer outfalls not regularly monitored, selected sites of interest (beach and lagoon), and augmented the 2006 study by re-sampling a limited number of sites. The levels of *E. coli* in 2006 ranged from <10 colony forming units (cfu)/g to 660 cfu/g wet weight; the levels taken in 2007 for non-storm sewer outfall sites ranged from <10cfu/g to 90 cfu/g wet weight. While *E. coli* values can vary substantially over small areas, and there were a larger number of sand samples taken the second year, overall the values were much lower.

All 2007 sampling data are presented and summarized in an April 2008 final report (Sugar Island Monitoring Work Group, 2008).

## C. Project Description

Based on last year's results, the 2007 work plan has been updated for 2008 (Appendix A). The 2008 monitoring effort will focus on the Lake George Channel, particularly the area along the north shore of Sugar Island, and upstream as necessary to characterize the extent of contamination (should elevated contaminant levels occur) and to identify potential contamination sources. Area residents and others frequently on the river will be used as volunteers to alert the local health departments in the event that episodes of excessive floating material are observed. Coordinated sampling will be conducted weekly from June 1 through the first week of October, as weather permits, and the distribution of routine sites will provide clues to potential sources if elevated contaminant

levels are observed or measured (Figure 1). In addition to weekly sampling, samples will be collected during and/or immediately after heavy rain events to the extent practicable. Routine monitoring also will include daily (on weekdays) measurement of U.S. and Canadian wastewater treatment plant effluent discharging to the St. Marys River. State, provincial, and local agencies will identify all potential point and non-point sources of contaminants on both sides of the river.

The MOE will collect weekly samples from eight storm sewer outfalls (Dacey Rd., Fort Creek, Station Mall, Bellevue Creek, and others to be determined). MOE also will take samples from six locations where snow is dumped. All samples will be analyzed for *E. coli*, and general chemistry parameters.

During the summer (exact date to be determined), the CCHD and the Sault Tribe will investigate the status of the Sugar Shak sewage lagoon discharge pipe. Although this pipe is thought to be disconnected from the lagoons and on-site sewage system, additional examination will be conducted to confirm that it is disconnected. A camera on a rigid cable will be fed into the pipe (it can be extended up to 150 feet), and the video will be viewed on a fixed monitor. This investigation should help to resolve the status of the pipe and whether any connections still exist.

Another component of the weekly sampling will be the implementation of a bacterial source tracking study. Water samples will be collected weekly by the Sault Tribe from 18 locations, including 3 transects with five sites each across the St. Marys River. The other three study locations include the new outfall for the East End Wastewater Treatment Plant, the Queen Street storm sewer outfall, and the Sugar Shak outfall. Like those collected from all locations, these samples will be analyzed for *E. coli* levels; however, they also will be screened for the presence of strains of the anaerobic bacterium *Bacteroides*. Analyses will be conducted by Environment Canada (Appendix E). This type of DNA analysis can identify bacteria that are associated with human fecal pollution. The resulting data can provide important clues about potential bacteria sources.

In the event that excessive visible floating materials and/or elevated contaminant levels are found, contingency monitoring of inventoried point and non-point sources will occur as soon as feasible to pinpoint the source(s) of the problem. Floatable samples will be collected and provided to the CCHD, APH, Michigan Department of Environmental Quality (MDEQ), and MOE for identification. Depending on the location and spatial extent of the problem, contingency monitoring could include sampling of combined sewer overflows, storm-water runoff/outfalls, beach sediment, tributaries, on-site wastewater systems, river sediments, and any other identified sources.

## D. Project Organization and Responsibilities

The SIMWG collectively designed the 2008 monitoring plan to characterize the severity of water quality impairment and to identify potential contaminant sources. Many of the sites would have been sampled regardless as a part of each agency's existing responsibilities, but some additional sites were identified to fill gaps. In addition, the

SIMWG is coordinating the timing/frequency of sample collection and the parameters to be measured, as well as ensuring the comparability of sampling and analytical methods.

The primary data users include the SIMWG (members identified above); the Four Party representatives (U.S. EPA, EC, MOE, MDEQ); and the public. Overall adherence to this QAPP will be overseen by Gary Kohlhepp (MDEQ) and Debbie Burniston (EC). Each organization with sample collection and analysis responsibilities will adhere to the Quality Assurance/Quality Control (QA/QC) requirements identified herein.

The agencies responsible for routine water sample collection include the MOE (Rod Stewart), the CCHD (Christine Daley), APH (Sherri Cleaves), and the Sault Ste. Marie Tribe (Dan Tadgerson).

Water samples collected by Canadian organizations will be analyzed by the Ontario Ministry of Health and Long-Term Care. Samples collected by the CCHD will be analyzed primarily by Lake Superior State University (LSSU). The City of Sault Ste. Marie (Michigan) Laboratory may also be used at times when analytical needs exceed LSSU capacity. Environment Canada will analyze samples for the source tracking study.

If high levels of bacteria are measured, or visible floatable material is noted, additional monitoring will be conducted to verify the extent and severity of contamination, as well as potential sources. The primary agencies (and lead person) responsible for contingency monitoring are the MOE (Rod Stewart), the MDEQ (Randall Conroy), the APH (Sherri Cleaves), and the CCHD (Christine Daley).

Each agency will review data for comparison against applicable water quality standards/criteria/guidelines. All data will be available within two weeks of collection, although all agencies will be notified immediately if high bacteria values are found, consistent with the Sugar Island Incidence Response Protocol (Appendix B). MOE will consolidate all agency-generated data into a database. The database will be readily accessible to the participating agencies. A final report will be prepared at the end of the project by the SIMWG members and likely will be completed in early 2009.

## E. Quality Objectives and Decision Criteria

The SIMWG has identified two primary objectives (i.e. decisions) for this study. The first objective is to assess the current water quality conditions in the Lake George Channel of the St. Marys River, particularly along the north shore of Sugar Island. Specifically, data will be reviewed to determine whether water quality standards are being attained. The two parameters that will be used to make this determination (with the associated "action level") include floating solids (presence of unnatural levels) and *E. coli* (>300 cfu/100mL). The presence of unnatural levels of floating solids, which could be indicative of untreated/partially treated sewage, is a somewhat subjective decision. Area residents and professionals frequently on the river (e.g. Coast Guard, Provincial Police) will be enlisted to alert the CCHD (U.S. side) and APH (Canadian side) to any obvious signs of floating material. When a report is received, the CCHD or APH will

follow-up as quickly as possible to verify the information. If the presence of floatables is verified, the responding agency will provide samples of the material to the local and state/provincial agencies for identification. Multiple, independent analyses of the material will greatly minimize the chance of decision errors. Action based on high levels of *E. coli* will be taken only if the samples were collected and analyzed by the organizations identified in this QAPP, consistent with the standard operating protocols and required QA/QC procedures. If these protocols and QA/QC conditions are met, the chances of decision error are considered small.

The second objective of this study is to identify the source of any contamination that may occur in the river or on a beach. In the event of a verified floating solids occurrence or elevated bacteria levels, the "contingency monitoring" component of the work plan (Appendix A) will be implemented. The MDEQ, MOE, CCHD, and/or APH will conduct the monitoring using comparable, standard sampling protocols. Samples will be analyzed by qualified laboratories for *E. coli* and other parameters as needed. The resulting data will be evaluated to locate the likely source(s).

A number of sampling and analytical QC checks were implemented during 2007 to assess data consistency and comparability among collection agencies and analytical laboratories. Some of these QC checks will continue in 2008. These QC checks will ensure data quality and minimize potential decision errors. The SIMWG has strived to ensure a satisfactory minimum standard for inter-agency data comparability in light of unavoidable differences in field procedures and analytical methods.

## F. Sampling Procedures

Sample collection will follow established protocols, which are detailed in Appendix C. Water samples will be collected weekly from established sites (Figure 1) by the MOE, APH, and the CCHD. Sample collection personnel will complete the Surface Water Observation and Collection Form (Appendix D). To the extent possible, all agencies will sample on Wednesday of each week. The CCHD and APH use essentially the same sampling procedures for beaches. Three water samples (replicates) will be collected at each beach. Samples collected in the St. Marys River will routinely consist of a single grab sample at each monitoring station. *E. coli* samples will be collected in sterilized bottles and preserved with sodium thiosulfate. A minimum of 100 mL of water will be collected by turning the bottle upside down and placing it approximately 6-12 inches (15-30 cm) below the water surface, then turning the bottle right side up or at an angle until full. Bottles will be capped immediately after removal from the water. Similar procedures will be followed when collecting samples for other analytical parameters (TSS, TDS, phosphorus), except that sodium thiosulfate will not be added to the bottles.

After samples are collected, they will immediately be placed in a cooler with ice (or otherwise chilled) for delivery to the appropriate laboratory. Samples to be analyzed for *E. coli* will be delivered to the laboratory within 6 hours of collection.

## G. Custody Procedures

*Field Custody Procedures*

Field logbooks will document all information pertinent to the collection of field samples, including all data sheets. All pages will be signed and dated.

Sample labels for each container will include sample identification and location, date and time, as well as type of analysis. Samples will be identified according to location.

Containers, labels, and tags will be prepared prior to field sampling (except time, which must be entered in the field). Water samples will be wiped clean, and stored in an iced cooler and/or refrigerator until delivered to the appropriate laboratory. Records also will verify that samples were properly stored during transport, and that applicable holding times were not exceeded.

*Laboratory Custody Procedures*

The laboratories will provide chain-of-custody forms to the sample collection personnel. Any staff involved with the transfer of samples will follow the appropriate procedure. The custody procedure when transferring samples from one custodian to the next includes signing and dating the form, and noting the time of custody change.

## H. Calibration Procedures and Frequency

Equipment and instrumentation used for field measurements will be maintained and calibrated according to the manufacturer's guidelines.

The laboratory instruments used at the analytical laboratories will be calibrated according to the laboratories' calibration procedures, including both initial and ongoing calibration.

## I. Analytical Procedures

All samples will be analyzed using approved methods and according to standard protocols. The laboratories will be responsible for following their QA/QC procedures throughout the duration of sample custody. *E. coli* water samples collected by Canadian agencies will be analyzed by the Ontario Ministry of Health and Long-term Care using the membrane filtration technique (SOP-SD-W-006-006; Appendix E). MOE samples also will be analyzed for other parameters, including pH, conductivity, alkalinity, and nitrogen. Water samples collected by the CCHD will be analyzed for *E. coli* primarily by LSSU using an U.S. EPA-approved method, Colilert 18 (Appendix E).

## J. Quality Control Checks

To ensure the integrity of data upon which management decisions are made regarding responses to elevated *E. coli* contamination or floating solids, the SIMWG developed a QAPP in 2007 detailing quality assurance and quality control (QA/QC) measures associated with the sampling, custody, analysis, and data reporting on samples collected in the St. Marys in support of the overall mission of the SIMWG. Performance testing evaluation (proficiency testing) for basic water chemistry and *E. coli* was conducted to assess the validity of inter-laboratory data comparisons. Samples were provided by the organic chemistry laboratory of the Centre d'expertise d'analyse environnmentale of the Ministry of the Environment of Quebec. This laboratory is an accredited testing laboratory by the Standards Council of Canada in accordance with the requirements of ISO 17025(309).

Results from the three participating laboratories were compared to the reference values. Participating laboratories were Lake Superior State University, White Water Associates Inc., and the Sault Ste Marie Office of the Ontario Ministry of the Environment. Overall, the results of the proficiency testing were excellent; only 1 result (>20% deviation from reference for total suspended solids) of 60 test results fell outside the accepted deviation from reference. All *E. coli* results were within 20% deviation. Since the same laboratories will analyze samples, additional proficiency testing in 2008 is not necessary.

The primary study objective for this monitoring effort is to identify incidents of high *E. coli* levels (defined as exceeding the Michigan Water Quality Standard of 300 cfu/100mL on any given day or a 5-sample geometric mean of 130 cfu/100mL over 30 days) in the St. Marys River and associated beaches. The secondary objective is to identify the potential source(s) of elevated bacteria. Therefore, we are less concerned about sample and analytical variability at very low (e.g. < 50 cfus) or very high (e.g. > 1000 cfus) levels. Values between 100 and 500 cfu/100 mL are the most critical, since the exact value within that range likely would be important in determining the agencies' response to the result. For analyses within this range, a difference of 50% between laboratories is deemed acceptable, based on our knowledge of typical variations in field replicates and inter-run analytical variation.

Therefore, the SIMWG focused on checking samples with values within the range of 100 – 500 cfu/100 mLs. Field triplicate samples with values in the 100 – 500 cfu/100 mL range all fell within acceptable criteria; standard deviations for these samples ranged from 23% to 29% for the 2007 sampling campaign. Some triplicate sampling will continue in 2008.

Sampling crews conducted side-by-side sampling events on a rotating basis throughout the 2007 monitoring season through the end of the study season in October, with at least one of the side-by-sides occurring during/after wet weather. These events consisted of sampling crew representatives from each agency (MOE, APH, CCHD) going to the same locations at the same time, collecting sample replicates according to each of their respective sampling protocols, and sending the samples to each of the participating laboratories. This QC check evaluated sample collection and analysis procedures for data

consistency and comparability. As detailed above, acceptable inter-agency variation for samples with *E. coli* values between 100 and 500 cfu/100mL is <50%.

Results of the 2007 side-by-side sampling generally were within acceptable variation criteria (50%). Five pairs of side-by-side samples out of a total of 133 (~ 4%) fell outside of acceptable limits. However, there was only one case where side-by-side sampling yielded a problematic result in terms of decision-making criteria; on August 8th, 2007, side-by-side samples by the OME and APH collected at the Dacey Road outfall yielded *E. coli* values of >1000 cfu/100 mL and 170 cfu/100 mL, respectively. The discrepancy likely is due to the differing depths at which samples were collected. The samples were taken approximately two meters apart, with the APH sample at a much shallower depth. Based on these results, the SIMWG has determined that additional side-by-side sampling in 2008 is not necessary.

Other QC checks agreed to by the SIMWG include field blanks and method blanks. Field blanks will be used to monitor potential contamination introduced into the samples by collection and handling procedures. The blank will be generated at the sample collection site by filling an empty sample bottle on site with bottled, distilled, or deionized water prepared prior to sampling. Blank samples using bottled water were analyzed in 2007, and all were below detection (< 10cfus/100 mL). The blank will be delivered from the field to the laboratory in the same manner as the regular samples. The field blanks will be collected at a frequency of one per sampling trip. Field blanks must fall below 10 cfu/mL. In 2007, all field and laboratory blanks were less than the 10 cfu/100 mL threshold. Field and laboratory blank collection and analysis will continue in 2008.

Internal QC procedures for the laboratories are specified in their standard procedures. Method blanks, to be used at the discretion of the laboratories, will be conducted by passing clean matrix through the analytical method steps to assess contamination resulting from laboratory procedures. Other types of QC checks (reagent/preparation blanks, matrix spike, and matrix spike duplicated, calibration standards, internal standards, surrogate standards, the frequency of each audit, the specific calibration check standards, duplicate analyses) will be employed by the laboratories according to their internal procedures. Laboratory blanks must fall below 10 cfu/mL.

Corrective actions for samples exceeding analytical QC criteria will be according to individual laboratory SOPs. Corrective actions for field blank contamination will include flagging of data, repeat sampling and analyses, re-implementation of the split sample inter-laboratory study, or a combination of all of these procedures.

## K. Data Reduction, Validation, and Reporting

Analytical results will be transmitted as PDF files from the laboratories to the sample collection agencies as individual measurements for all parameters. The CCHD, APH, and MOE will report daily geometric means for the *E. coli* replicates (where applicable) to the SIMWG. Analytical results for other parameters will be reported as individual measurements.

Immediately after receiving analytical results from the laboratories, the sample collection agencies will provide the data to MOE each week. All results will be consolidated into an Excel spreadsheet, which will be made available to the SIMWG through an e-mail distribution list. A web site is being established by the U.S. EPA on which the agencies will have access to all water quality data generated during this project. At the conclusion of the 2008 monitoring, the SIMWG will prepare a final report that summarizes the results, explains whether high contaminant levels were observed, and identifies contaminant sources to the extent possible. This report will be made available electronically and as hard-copy to all interested stakeholders as well as the general public.

Final evaluation of field data includes checking for transcription errors, and a review of data sheets. All holding times will be reviewed and results of the initial and continuing calibration will be reviewed. The SIMWG will be responsible for the final evaluation of field data.

The participating laboratories are responsible for reporting problems or concerns related to any sample analyses when transmitting data to the CCHD, APH, and MOE. Problems could include analytical equipment irregularities, contaminated field or method blanks, and calibration irregularities. The quality assurance managers (Kohlhepp and Marvin), along with other SIMWG members, will make a determination based on available information as to whether a sample result is valid. For example, elevated contaminant levels in a field blank (see Section N, below) likely will result in samples collected during that run to being regarded as suspect or even invalid. Likewise, high variability among replicates or split samples will lead to an evaluation by the QA managers as to whether data should be considered suspect/invalid. One possible outcome is that results may be reported but flagged to alert data users about a potential problem.

## L. Performance and System Audits

All participating agencies will follow the policies and procedures described in this QAPP. Audits will include the examination of field sampling records, field instrument operating records, sample collection, handling of samples in compliance with the established procedures, maintenance of QA procedures, and chain of custody. Additional audits may be conducted as necessary to correct deficiencies.

The participating laboratories periodically conduct internal laboratory audits. System audits include examination of laboratory documentation on sample receiving, sample log-in, sample storage, chain-of-custody, sample preparation and analysis, and instrument operation records. These laboratories have been audited as part of their accreditation process and will not be audited in conjunction with this study.

Any identified problems will be addressed in a timely manner by the appropriate agency(ies).

## M. Preventative Maintenance

All field and laboratory equipment and instrumentation will be maintained according to manufacturer guidelines. If no instructions exist, equipment will be inspected for mechanical function before each sampling run. Spare batteries will be taken for all equipment and any equipment that can be charged before fieldwork will be done the night before. All equipment will be maintained in working order and inspections documented.

## N. Data Quality Assessment and Corrective Action

As described in Section J, *E. coli* QA/QC samples will be regularly collected to ensure data quality. Given that the primary data quality objective for this monitoring effort is to identify incidents of high *E. coli* levels, the data quality assessment and any associated corrective action will be heavily dependent upon the reported *E. coli* levels. For example, if a field blank result is 25 cfu/100mL, and the reported value from an actual sample at the same site is 45 cfu/100mL, the conclusion would not change regardless of potential contamination: the sample value is below levels of concern. The same would be true if a blank sample resulted in 100 cfus while the actual sample value was 5000 cfus. On the other hand, positive hits in a blank when actual sample values are between 100 and 300 cfus may very well affect the data interpretation. The same conceptual issues apply to other types of QA/QC samples such as duplicates, replicates, and analytical method blanks. In all cases, analytical results and associated QA samples will be reviewed by the QA managers (Kohlhepp and Marvin), in consultation with other members of the Sugar Island Monitoring Work Group, to determine whether data are acceptable, and what corrective action may be necessary.

For beaches, the CCHD and APH will review *E. coli* data and report the dates and number of days that a beach area exceeded water quality standards, was posted with a health related advisory, or total body contact with the beach water was prohibited.

All corrective actions undertaken during this study will be documented in the final report.

## O. Literature Cited

Daley, Christine, David Martin, and Charity Little. 2007. The Investigation of the *Escherichia coli* Contamination in the St. Marys River. Draft Report.

Ontario Ministry of the Environment and the Michigan Department of Natural Resources. 1992. St. Marys River Remedial Action Plan Stage 1: Environmental Conditions and Problem Definitions. March 1992.

Environment Canada, United States Environmental Protection Agency, Ontario Ministry of the Environment, and the Michigan Department of Environmental Quality. 2002. St. Marys River Remedial Action Plan Stage 2 Report: Remedial Strategies for Ecosystem Restoration. December 2002.

Michigan Department of Environmental Quality. 2007. St. Marys River *E. Coli* Data Compilation and Summary. MI/DEQ/WB-07/040.

Sugar Island Monitoring Work Group. 2008. 2007 St. Marys River – Sugar Island Monitoring: A Final Report of the Sugar Island Monitoring Work Group. April 2008.

# Appendix C

2008 Incident Reports

# St. Marys River Incident Report 1

Incident date: May 9, 2008

Reported By: Morley (S.I. resident)

Reported to: C. Daley

Action Taken: Notification as per incident response protocol

Were samples taken? yes Samples taken by: Morley

Sample number/type: (water, solid, sediment) 3 water; 3 floating solids

Were pictures taken? yes

Samples sent to/date: May 12, 2008: EC and MDEQ

Samples received by/date: May 13

Results of analysis: microscopic analysis-bottom debris, benthic diatoms, cyanobacteria, copepods, green algae

Summary & Conclusions: resuspended bottom sediment/debris

Follow-up: None

# St. Marys River Incident Report 2

Incident date: June 2, 2008

Reported By: Sugar Island Residents

Reported to: C. Daley

Action Taken: Notification as per incident response protocol

Were samples taken? yes Samples taken by: CCHD

Sample number/type: 2 water containing solid material

Were pictures taken? yes

Samples sent to/date: MDEQ/ June 2, 2008

Samples received by/date: Kohlhepp: June 3

Results of analysis: coliform: >2419.6 cfu/100mL (both samples); *e-coli:* 463.4 cfu/100mL (camp003) and 52 cfu/100mL (Welch001)

Microscopic analysis: cottonwood or dandelion seed (camp 003)
Pollen from evergreen (Welch 001)

Summary & Conclusions: seeds and pollen collecting on water surface

Follow-up: None

# St. Marys River Incident Report: 3

Incident date: July 23, 2008

Reported By: C. Daley

Reported to: Burniston/Kohlhepp

Action Taken: Notification as per incident response protocol

Were samples taken? yes Samples taken by: CCHD

Sample number/type: (water, solid, sediment) 2 water containing solid/debris

Were pictures taken? No

Samples sent to/date: MDEQ July 23

Samples received by/date: MDEQ

Results of analysis: Analysis not necessary, identification made by visual observation

Summary & Conclusions:

Mayfly exuvia and a condom were identified

Follow-up: None

# St. Marys River Incident Report 4

Incident date: October 20, 2008

Reported By: USCG officer Ryser/ Jim Gray

Reported to: Randy Conroy MDEQ

Action Taken: Reported to Daley/Kohlhepp/Burniston

Technicians were sent out to collect the material but it had dissapated

Were samples taken? no Samples taken by:

Sample number/type: (water, solid, sediment)

Were pictures taken? no

Samples sent to/date:

Samples received by/date:

Results of analysis:

Incident was reported asa dark grey material with a sewage smell observed on the North Shore of Sugar Island about 20-25 ft out. Officer Ryser has observed this before

Summary & Conclusions: None

Follow-up: None

# Appendix D

2008 Data Results

| Agency | Sample Year | Sample Date (mm/dd/yy) | Sample Description/ID | Longitudes (DD.ddddd) | Latitudes (DD.ddddd) | E.coli (cfu/100ml) | Geometric Mean (3 E.coli samples collected per site) |
|---|---|---|---|---|---|---|---|
| **MINISTRY OF THE ENVIRONMENT** | | | | | | | |
| MOE | 2008 | 6/4/2008 | Davignon Creek SSO (triplicate)/SMR01 | -84.41304 | 46.51406 | 150 | |
| MOE | 2008 | 6/4/2008 | Fort Creek SSO/SMR02 | -84.34365 | 46.51464 | 270 | |
| MOE | 2008 | 6/4/2008 | Dennis Street SSO/SMR03 | -84.34124 | 46.51286 | 70 | |
| MOE | 2008 | 6/4/2008 | Holiday Inn SSO/SMR04 | -84.33730 | 46.50937 | <10 | |
| MOE | 2008 | 6/4/2008 | Pine Street SSO (Marina)/SMR05 | -84.30737 | 46.50236 | 30 | |
| MOE | 2008 | 6/4/2008 | Churchhill Blvd. SSO/SMR06 | -84.30345 | 46.49904 | 10 | |
| MOE | 2008 | 6/4/2008 | Queen Street SSO/SMR07 | -84.27987 | 46.49608 | 200 | |
| MOE | 2008 | 6/4/2008 | EESTP at UV/SMR08 | -84.25933 | 46.50589 | 40 | |
| MOE | 2008 | 6/4/2008 | Millwood SSO/SMR09 | -84.25509 | 46.50613 | 850 | |
| MOE | 2008 | 6/4/2008 | Dacey Road SSO/SMR10 | -84.24456 | 46.51772 | 640 | |
| MOE | 2008 | 6/4/2008 | Davignon Creek SSO (triplicate)/SMR11 | -84.41304 | 46.51406 | 100 | |
| MOE | 2008 | 6/4/2008 | Davignon Creek SSO (triplicate)/SMR12 | -84.41304 | 46.51406 | 60 | |
| MOE | 2008 | 6/4/2008 | Davignon CreekSSO (field blank)/SMR13 | -84.41304 | 46.51406 | <10 | |
| MOE | 2008 | 6/4/2008 | Davignon Creek SSO(field blank)/SMR14 | -84.41304 | 46.51406 | <10 | |
| | | | | | | | |
| MOE | 2008 | 6/11/2008 | Davignon Creek SSO/SMR01 | -84.41304 | 46.51406 | 220 | |
| MOE | 2008 | 6/11/2008 | Fort Creek SSO (triplicate)/SMR02 | -84.34365 | 46.51464 | 530 | |
| MOE | 2008 | 6/11/2008 | Dennis Street SSO/SMR03 | -84.34124 | 46.51286 | 20 | |
| MOE | 2008 | 6/11/2008 | Holiday Inn SSO/SMR04 | -84.33730 | 46.50937 | 140 | |
| MOE | 2008 | 6/11/2008 | Pine Street SSO (Marina)/SMR05 | -84.30737 | 46.50236 | 130 | |
| MOE | 2008 | 6/11/2008 | Churchhill Blvd. SSO/SMR06 | -84.30345 | 46.49904 | 360 | |
| MOE | 2008 | 6/11/2008 | Queen Street SSO/SMR07 | -84.27987 | 46.49608 | >1000 | |
| MOE | 2008 | 6/11/2008 | EESTP at UV/SMR08 | -84.25933 | 46.50589 | 180 | |
| MOE | 2008 | 6/11/2008 | Millwood SSO/SMR09 | -84.25509 | 46.50613 | 920 | |
| MOE | 2008 | 6/11/2008 | Dacey Road SSO/SMR10 | -84.24456 | 46.51772 | 180 | |
| MOE | 2008 | 6/11/2008 | Fort Creek SSO (triplicate)/SMR11 | -84.34365 | 46.51464 | >1000 | |
| MOE | 2008 | 6/11/2008 | Fort Creek SSO (triplicate)/SMR12 | -84.34365 | 46.51464 | 570 | |
| MOE | 2008 | 6/11/2008 | Fort CreekSSO(field blank)/SMR13 | -84.34365 | 46.51464 | <10 | |
| MOE | 2008 | 6/11/2008 | Fort CreekSSO(field blank)/SMR14 | -84.34365 | 46.51464 | <10 | |
| | | | | | | | |
| MOE | 2008 | 6/18/2008 | Davignon Creek SSO/SMR01 | -84.41304 | 46.51406 | 110 | |
| MOE | 2008 | 6/18/2008 | Fort Creek SSO/SMR02 | -84.34365 | 46.51464 | 170 | |
| MOE | 2008 | 6/18/2008 | Dennis Street SSO (triplicate)/SMR03 | -84.34124 | 46.51286 | 10 | |
| MOE | 2008 | 6/18/2008 | Holiday Inn SSO/SMR04 | -84.33730 | 46.50937 | 40 | |
| MOE | 2008 | 6/18/2008 | Pine Street SSO (Marina)/SMR05 | -84.30737 | 46.50236 | 40 | |

| Agency | Sample Year | Sample Date (mm/dd/yy) | Sample Description/ID | Longitudes (DD.ddddd) | Latitudes (DD.ddddd) | E.coli (cfu/100ml) | Geometric Mean (3 E.coli samples collected per site) |
|---|---|---|---|---|---|---|---|
| MOE | 2008 | 6/18/2008 | Churchhill Blvd. SSO/SMR06 | -84.30345 | 46.49904 | 100 | |
| MOE | 2008 | 6/18/2008 | Queen Street SSO/SMR07 | -84.27987 | 46.49608 | 280 | |
| MOE | 2008 | 6/18/2008 | EESTP at UV/SMR08 | -84.25933 | 46.50589 | 340 | |
| MOE | 2008 | 6/18/2008 | Millwood SSO/SMR09 | -84.25509 | 46.50613 | 230 | |
| MOE | 2008 | 6/18/2008 | Dacey Road SSO/SMR10 | -84.24456 | 46.51772 | >1000 | |
| MOE | 2008 | 6/18/2008 | Dennis Street SSO (triplicate)/SMR11 | -84.34124 | 46.51286 | 30 | |
| MOE | 2008 | 6/18/2008 | Dennis Street SSO (triplicate)/SMR12 | -84.34124 | 46.51286 | 20 | |
| MOE | 2008 | 6/18/2008 | Dennis StreetSSO (field blank)/SMR13 | -84.34124 | 46.51286 | <10 | |
| MOE | 2008 | 6/18/2008 | Dennis Street SSO(field blank)/SMR14 | -84.34124 | 46.51286 | <10 | |
| | | | | | | | |
| MOE | 2008 | 6/25/2008 | Davignon Creek SSO/SMR01 | -84.41304 | 46.51406 | 60 | |
| MOE | 2008 | 6/25/2008 | Fort Creek SSO/SMR02 | -84.34365 | 46.51464 | <10 | |
| MOE | 2008 | 6/25/2008 | Dennis Street SSO/SMR03 | -84.34124 | 46.51286 | 20 | |
| MOE | 2008 | 6/25/2008 | Holiday Inn SSO (triplicate)/SMR04 | -84.33730 | 46.50937 | <10 | |
| MOE | 2008 | 6/25/2008 | Pine Street SSO (Marina)/SMR05 | -84.30737 | 46.50236 | <10 | |
| MOE | 2008 | 6/25/2008 | Churchhill Blvd. SSO/SMR06 | -84.30345 | 46.49904 | 110 | |
| MOE | 2008 | 6/25/2008 | Queen Street SSO/SMR07 | -84.27987 | 46.49608 | 50 | |
| MOE | 2008 | 6/25/2008 | EESTP at UV/SMR08 | -84.25933 | 46.50589 | 80 | |
| MOE | 2008 | 6/25/2008 | Millwood SSO/SMR09 | -84.25509 | 46.50613 | 160 | |
| MOE | 2008 | 6/25/2008 | Dacey Road SSO/SMR10 | -84.24456 | 46.51772 | 50 | |
| MOE | 2008 | 6/25/2008 | Holiday Inn SSO (triplicate)/SMR11 | -84.33730 | 46.50937 | <10 | |
| MOE | 2008 | 6/25/2008 | Holiday Inn SSO (triplicate)/SMR12 | -84.33730 | 46.50937 | <10 | |
| MOE | 2008 | 6/25/2008 | Holiday InnSSO (field blank)/SMR13 | -84.33730 | 46.50937 | <10 | |
| MOE | 2008 | 6/25/2008 | Holiday Inn SSO(field blank)/SMR14 | -84.33730 | 46.50937 | <10 | |
| | | | | | | | |
| MOE | 2008 | 6/26/2008 | Davignon Creek SSO/SMR01 | -84.41304 | 46.51406 | 20 | |
| MOE | 2008 | 6/26/2008 | Fort Creek SSO/SMR02 | -84.34365 | 46.51464 | 240 | |
| MOE | 2008 | 6/26/2008 | Dennis Street SSO/SMR03 | -84.34124 | 46.51286 | 30 | |
| MOE | 2008 | 6/26/2008 | Holiday Inn SSO/SMR04 | -84.33730 | 46.50937 | >1000 | |
| MOE | 2008 | 6/26/2008 | Pine Street SSO (Marina)/SMR05 | -84.30737 | 46.50236 | 460 | |
| MOE | 2008 | 6/26/2008 | Churchhill Blvd. SSO/SMR06 | -84.30345 | 46.49904 | >1000 | |
| MOE | 2008 | 6/26/2008 | Queen Street SSO/SMR07 | -84.27987 | 46.49608 | >1000 | |
| MOE | 2008 | 6/26/2008 | Millwood SSO/SMR09 | -84.25509 | 46.50613 | >1000 | |
| MOE | 2008 | 6/26/2008 | Dacey Road SSO/SMR10 | -84.24456 | 46.51772 | 90 | |
| MOE | 2008 | 6/26/2008 | Holiday Inn SSO (field blank)/SMR13 | -84.33730 | 46.50937 | <10 | |
| MOE | 2008 | 6/26/2008 | Holiday Inn SSO (field blank)/SMR14 | -84.33730 | 46.50937 | <10 | |

| Agency | Sample Year | Sample Date (mm/dd/yy) | Sample Description/ID | Longitudes (DD.ddddd) | Latitudes (DD.ddddd) | E.coli (cfu/100ml) | Geometric Mean (3 E.coli samples collected per site) |
|---|---|---|---|---|---|---|---|
| MOE | 2008 | 7/2/2008 | Davignon Creek SSO/SMR01 | -84.41304 | 46.51406 | 60 | |
| MOE | 2008 | 7/2/2008 | Fort Creek SSO/SMR02 | -84.34365 | 46.51464 | >1000 | |
| MOE | 2008 | 7/2/2008 | Dennis Street SSO/SMR03 | -84.34124 | 46.51286 | 20 | |
| MOE | 2008 | 7/2/2008 | Holiday Inn SSO/SMR04 | -84.33730 | 46.50937 | >1000 | |
| MOE | 2008 | 7/2/2008 | Pine Street SSO (Marina) (triplicate)/SMR05 | -84.30737 | 46.50236 | >1000 | |
| MOE | 2008 | 7/2/2008 | Churchhill Blvd. SSO/SMR06 | -84.30345 | 46.49904 | >1000 | |
| MOE | 2008 | 7/2/2008 | Queen Street SSO/SMR07 | -84.27987 | 46.49608 | >1000 | |
| MOE | 2008 | 7/2/2008 | EESTP at UV/SMR08 | -84.25933 | 46.50589 | 50 | |
| MOE | 2008 | 7/2/2008 | Millwood SSO/SMR09 | -84.25509 | 46.50613 | 840 | |
| MOE | 2008 | 7/2/2008 | Dacey Road SSO/SMR10 | -84.24456 | 46.51772 | >1000 | |
| MOE | 2008 | 7/2/2008 | Pine Street SSO (Marina) (triplicate)/SMR11 | -84.30737 | 46.50236 | >1000 | |
| MOE | 2008 | 7/2/2008 | Pine Street SSO (Marina) (triplicate)/SMR12 | -84.30737 | 46.50236 | >1000 | |
| MOE | 2008 | 7/2/2008 | Pine Street SSO(Marina) (field blank)/SMR13 | -84.30737 | 46.50236 | <10 | |
| MOE | 2008 | 7/2/2008 | Pine Street SSO(Marina) (field blank)/SMR14 | -84.30737 | 46.50236 | <10 | |
| | | | | | | | |
| MOE | 2008 | 7/8/2008 | Davignon Creek SSO/SMR01 | -84.41304 | 46.51406 | 200 | |
| MOE | 2008 | 7/8/2008 | Fort Creek SSO/SMR02 | -84.34365 | 46.51464 | >1000 | |
| MOE | 2008 | 7/8/2008 | Dennis Street SSO/SMR03 | -84.34124 | 46.51286 | 280 | |
| MOE | 2008 | 7/8/2008 | Holiday Inn SSO/SMR04 | -84.33730 | 46.50937 | >1000 | |
| MOE | 2008 | 7/8/2008 | Pine Street SSO (Marina)/SMR05 | -84.30737 | 46.50236 | >1000 | |
| MOE | 2008 | 7/8/2008 | Churchhill Blvd. SSO/SMR06 | -84.30345 | 46.49904 | >1000 | |
| MOE | 2008 | 7/8/2008 | Queen Street SSO/SMR07 | -84.27987 | 46.49608 | >1000 | |
| MOE | 2008 | 7/8/2008 | Millwood SSO/SMR09 | -84.25509 | 46.50613 | >1000 | |
| MOE | 2008 | 7/8/2008 | Dacey Road SSO/SMR10 | -84.24456 | 46.51772 | >1000 | |
| MOE | 2008 | 7/8/2008 | Pine Street SSO (Marina) (field blank)/SMR13 | -84.30737 | 46.50236 | <10 | |
| MOE | 2008 | 7/8/2008 | Pine StreetSSO (Marina) (field blank)/SMR14 | -84.30737 | 46.50236 | <10 | |
| | | | | | | | |
| MOE | 2008 | 7/9/2008 | Davignon Creek SSO/SMR01 | -84.41304 | 46.51406 | 330 | |
| MOE | 2008 | 7/9/2008 | Fort Creek SSO/SMR02 | -84.34365 | 46.51464 | 750 | |
| MOE | 2008 | 7/9/2008 | Dennis Street SSO/SMR03 | -84.34124 | 46.51286 | 30 | |
| MOE | 2008 | 7/9/2008 | Holiday Inn SSO/SMR04 | -84.33730 | 46.50937 | 380 | |
| MOE | 2008 | 7/9/2008 | Pine Street SSO (Marina)/SMR05 | -84.30737 | 46.50236 | 170 | |
| MOE | 2008 | 7/9/2008 | Churchhill Blvd. SSO (triplicate)/SMR06 | -84.30345 | 46.49904 | 350 | |
| MOE | 2008 | 7/9/2008 | Queen Street SSO/SMR07 | -84.27987 | 46.49608 | 170 | |
| MOE | 2008 | 7/9/2008 | EESTP at UV/SMR08 | -84.25933 | 46.50589 | 20 | |
| MOE | 2008 | 7/9/2008 | Millwood SSO/SMR09 | -84.25509 | 46.50613 | 140 | |
| MOE | 2008 | 7/9/2008 | Dacey Road SSO/SMR10 | -84.24456 | 46.51772 | 70 | |
| MOE | 2008 | 7/9/2008 | Churchhill Blvd. SSO (triplicate)/SMR11 | -84.30345 | 46.49904 | 300 | |

| Agency | Sample Year | Sample Date (mm/dd/yy) | Sample Description/ID | Longitudes (DD.ddddd) | Latitudes (DD.ddddd) | E.coli (cfu/100ml) | Geometric Mean (3 E.coli samples collected per site) |
|---|---|---|---|---|---|---|---|
| MOE | 2008 | 7/9/2008 | Churchhill Blvd. SSO (triplicate)/SMR12 | -84.30345 | 46.49904 | 380 | |
| MOE | 2008 | 7/9/2008 | Churchhill Blvd. SSO (field blank)/SMR13 | -84.30345 | 46.49904 | <10 | |
| MOE | 2008 | 7/9/2008 | Churchhill Blvd. SSO (field blank)/SMR14 | -84.30345 | 46.49904 | <10 | |
| | | | | | | | |
| MOE | 2008 | 7/16/2008 | Davignon Creek SSO/SMR01 | -84.41304 | 46.51406 | 10 | |
| MOE | 2008 | 7/16/2008 | Fort Creek SSO/SMR02 | -84.34365 | 46.51464 | 40 | |
| MOE | 2008 | 7/16/2008 | Dennis Street SSO/SMR03 | -84.34124 | 46.51286 | <10 | |
| MOE | 2008 | 7/16/2008 | Holiday Inn SSO/SMR04 | -84.33730 | 46.50937 | 10 | |
| MOE | 2008 | 7/16/2008 | Pine Street SSO (Marina)/SMR05 | -84.30737 | 46.50236 | 10 | |
| MOE | 2008 | 7/16/2008 | Churchhill Blvd. SSO/SMR06 | -84.30345 | 46.49904 | 40 | |
| MOE | 2008 | 7/16/2008 | Queen Street SSO (triplicate)/SMR07 | -84.27987 | 46.49608 | 60 | |
| MOE | 2008 | 7/16/2008 | EESTP at UV/SMR08 | -84.25933 | 46.50589 | 30 | |
| MOE | 2008 | 7/16/2008 | Millwood SSO/SMR09 | -84.25509 | 46.50613 | 110 | |
| MOE | 2008 | 7/16/2008 | Dacey Road SSO/SMR10 | -84.24456 | 46.51772 | 90 | |
| MOE | 2008 | 7/16/2008 | Queen Street SSO (triplicate)/SMR11 | -84.27987 | 46.49608 | 50 | |
| MOE | 2008 | 7/16/2008 | Queen Street SSO (triplicate)/SMR12 | -84.27987 | 46.49608 | 50 | |
| MOE | 2008 | 7/16/2008 | Queen Street SSO(field blank)/SMR13 | -84.27987 | 46.49608 | <10 | |
| MOE | 2008 | 7/16/2008 | Queen Street SSO(field blank)/SMR14 | -84.27987 | 46.49608 | <10 | |
| MOE | 2008 | 7/16/2008 | EESTP at UV (split sample)/SMR 08 | -84.25933 | 46.50589 | 20 | |
| | | | | | | | |
| MOE | 2008 | 7/23/2008 | Davignon Creek SSO/SMR01 | -84.41304 | 46.51406 | 110 | |
| MOE | 2008 | 7/23/2008 | Fort Creek SSO/SMR02 | -84.34365 | 46.51464 | 690 | |
| MOE | 2008 | 7/23/2008 | Dennis Street SSO/SMR03 | -84.34124 | 46.51286 | 20 | |
| MOE | 2008 | 7/23/2008 | Holiday Inn SSO/SMR04 | -84.33730 | 46.50937 | 20 | |
| MOE | 2008 | 7/23/2008 | Pine Street SSO (Marina)/SMR05 | -84.30737 | 46.50236 | 170 | |
| MOE | 2008 | 7/23/2008 | Churchhill Blvd. SSO/SMR06 | -84.30345 | 46.49904 | 70 | |
| MOE | 2008 | 7/23/2008 | Queen Street SSO/SMR07 | -84.27987 | 46.49608 | 60 | |
| MOE | 2008 | 7/23/2008 | EESTP at UV (triplicate)/SMR08 | -84.25933 | 46.50589 | 270 | |
| MOE | 2008 | 7/23/2008 | Millwood SSO/SMR09 | -84.25509 | 46.50613 | 110 | |
| MOE | 2008 | 7/23/2008 | Dacey Road SSO/SMR10 | -84.24456 | 46.51772 | 390 | |
| MOE | 2008 | 7/23/2008 | EESTP at UV (triplicate)/SMR11 | -84.25933 | 46.50589 | 60 | |
| MOE | 2008 | 7/23/2008 | EESTP at UV (triplicate)/SMR12 | -84.25933 | 46.50589 | 190 | |
| MOE | 2008 | 7/23/2008 | EESTP at UV (field blank)/SMR13 | -84.25933 | 46.50589 | <10 | |
| MOE | 2008 | 7/23/2008 | EESTP at UV (field blank)/SMR14 | -84.25933 | 46.50589 | <10 | |
| MOE | 2008 | 7/23/2008 | EESTP at UV (split sample)/SMR 08 | -84.25933 | 46.50589 | 210 | |
| | | | | | | | |
| MOE | 2008 | 7/30/2008 | Davignon Creek SSO/SMR01 | -84.41304 | 46.51406 | 50 | |
| MOE | 2008 | 7/30/2008 | Fort Creek SSO/SMR02 | -84.34365 | 46.51464 | 190 | |

| Agency | Sample Year | Sample Date (mm/dd/yy) | Sample Description/ID | Longitudes (DD.ddddd) | Latitudes (DD.ddddd) | E.coli (cfu/100ml) | Geometric Mean (3 E.coli samples collected per site) |
|---|---|---|---|---|---|---|---|
| MOE | 2008 | 7/30/2008 | Dennis Street SSO/SMR03 | -84.34124 | 46.51286 | 10 | |
| MOE | 2008 | 7/30/2008 | Holiday Inn SSO/SMR04 | -84.33730 | 46.50937 | 50 | |
| MOE | 2008 | 7/30/2008 | Pine Street SSO (Marina)/SMR05 | -84.30737 | 46.50236 | 350 | |
| MOE | 2008 | 7/30/2008 | Churchhill Blvd. SSO/SMR06 | -84.30345 | 46.49904 | 370 | |
| MOE | 2008 | 7/30/2008 | Queen Street SSO/SMR07 | -84.27987 | 46.49608 | 220 | |
| MOE | 2008 | 7/30/2008 | EESTP at UV/SMR08 | -84.25933 | 46.50589 | 120 | |
| MOE | 2008 | 7/30/2008 | Millwood SSO (triplicate)/SMR09 | -84.25509 | 46.50613 | 320 | |
| MOE | 2008 | 7/30/2008 | Dacey Road SSO/SMR10 | -84.24456 | 46.51772 | 230 | |
| MOE | 2008 | 7/30/2008 | Millwood SSO (triplicate)/SMR11 | -84.25509 | 46.50613 | 360 | |
| MOE | 2008 | 7/30/2008 | Millwood SSO (triplicate)/SMR12 | -84.25509 | 46.50613 | 280 | |
| MOE | 2008 | 7/30/2008 | Millwood SSO (field blank)/SMR13 | -84.25509 | 46.50613 | <10 | |
| MOE | 2008 | 7/30/2008 | Millwood SSO (field blank)/SMR14 | -84.25509 | 46.50613 | <10 | |
| MOE | 2008 | 7/30/2008 | EESTP at UV (split sample)/SMR 08 | -84.25933 | 46.50589 | 100 | |
| | | | | | | | |
| MOE | 2008 | 8/6/2008 | Davignon Creek SSO/SMR01 | -84.41304 | 46.51406 | 120 | |
| MOE | 2008 | 8/6/2008 | Fort Creek SSO/SMR02 | -84.34365 | 46.51464 | <10 | |
| MOE | 2008 | 8/6/2008 | Dennis Street SSO/SMR03 | -84.34124 | 46.51286 | 20 | |
| MOE | 2008 | 8/6/2008 | Holiday Inn SSO/SMR04 | -84.33730 | 46.50937 | 10 | |
| MOE | 2008 | 8/6/2008 | Pine Street SSO (Marina)/SMR05 | -84.30737 | 46.50236 | 10 | |
| MOE | 2008 | 8/6/2008 | Churchhill Blvd. SSO/SMR06 | -84.30345 | 46.49904 | 30 | |
| MOE | 2008 | 8/6/2008 | Queen Street SSO/SMR07 | -84.27987 | 46.49608 | 50 | |
| MOE | 2008 | 8/6/2008 | EESTP at UV/SMR08 | -84.25933 | 46.50589 | 120 | |
| MOE | 2008 | 8/6/2008 | Millwood SSO/SMR09 | -84.25509 | 46.50613 | 80 | |
| MOE | 2008 | 8/6/2008 | Dacey Road SSO (triplicate)/SMR10 | -84.24456 | 46.51772 | 40 | |
| MOE | 2008 | 8/6/2008 | Dacey Road SSO (triplicate)/SMR11 | -84.24456 | 46.51772 | 30 | |
| MOE | 2008 | 8/6/2008 | Dacey Road SSO (triplicate)/SMR12 | -84.24456 | 46.51772 | 30 | |
| MOE | 2008 | 8/6/2008 | Dacey Road SSO (field blank)/SMR13 | -84.24456 | 46.51772 | <10 | |
| MOE | 2008 | 8/6/2008 | Dacey Road SSO (field blank)/SMR14 | -84.24456 | 46.51772 | <10 | |
| MOE | 2008 | 8/6/2008 | EESTP at UV (duplicate 2)/SMR08 | -84.25933 | 46.50589 | 110 | |
| | | | | | | | |
| MOE | 2008 | 8/13/2008 | Davignon Creek SSO (triplicate)/SMR01 | -84.41304 | 46.51406 | 50 | |
| MOE | 2008 | 8/13/2008 | Fort Creek SSO/SMR02 | -84.34365 | 46.51464 | 340 | |
| MOE | 2008 | 8/13/2008 | Dennis Street SSO/SMR03 | -84.34124 | 46.51286 | 30 | |
| MOE | 2008 | 8/13/2008 | Holiday Inn SSO/SMR04 | -84.33730 | 46.50937 | >1000 | |
| MOE | 2008 | 8/13/2008 | Pine Street SSO (Marina)/SMR05 | -84.30737 | 46.50236 | 40 | |
| MOE | 2008 | 8/13/2008 | Churchhill Blvd. SSO/SMR06 | -84.30345 | 46.49904 | 90 | |
| MOE | 2008 | 8/13/2008 | Queen Street SSO/SMR07 | -84.27987 | 46.49608 | 20 | |
| MOE | 2008 | 8/13/2008 | EESTP at UV/SMR08 | -84.25933 | 46.50589 | 20 | |

| Agency | Sample Year | Sample Date (mm/dd/yy) | Sample Description/ID | Longitudes (DD.ddddd) | Latitudes (DD.ddddd) | E.coli (cfu/100ml) | Geometric Mean (3 E.coli samples collected per site) |
|---|---|---|---|---|---|---|---|
| MOE | 2008 | 8/13/2008 | Millwood SSO/SMR09 | -84.25509 | 46.50613 | 210 | |
| MOE | 2008 | 8/13/2008 | Dacey Road SSO/SMR10 | -84.24456 | 46.51772 | 40 | |
| MOE | 2008 | 8/13/2008 | Davignon Creek SSO(triplicate)/SMR11 | -84.41304 | 46.51406 | 30 | |
| MOE | 2008 | 8/13/2008 | Davignon Creek SSO(triplicate)/SMR12 | -84.41304 | 46.51406 | 20 | |
| MOE | 2008 | 8/13/2008 | Davignon Creek SSO (field blank)/SMR13 | -84.41304 | 46.51406 | <10 | |
| MOE | 2008 | 8/13/2008 | Davignon Creek SSO (field blank)/SMR14 | -84.41304 | 46.51406 | <10 | |
| MOE | 2008 | 8/13/2008 | EESTP at UV (side sample)/SMR08 | -84.25933 | 46.50589 | <10 | |
| | | | | | | | |
| MOE | 2008 | 8/20/2008 | Davignon Creek SSO/SMR01 | -84.41304 | 46.51406 | 110 | |
| MOE | 2008 | 8/20/2008 | Fort Creek SSO (triplicate)/SMR02 | -84.34365 | 46.51464 | 40 | |
| MOE | 2008 | 8/20/2008 | Dennis Street SSO/SMR03 | -84.34124 | 46.51286 | 20 | |
| MOE | 2008 | 8/20/2008 | Holiday Inn SSO/SMR04 | -84.33730 | 46.50937 | 10 | |
| MOE | 2008 | 8/20/2008 | Pine Street SSO (Marina)/SMR05 | -84.30737 | 46.50236 | 40 | |
| MOE | 2008 | 8/20/2008 | Churchhill Blvd. SSO/SMR06 | -84.30345 | 46.49904 | 50 | |
| MOE | 2008 | 8/20/2008 | Queen Street SSO/SMR07 | -84.27987 | 46.49608 | 100 | |
| MOE | 2008 | 8/20/2008 | EESTP at UV/SMR08 | -84.25933 | 46.50589 | 90 | |
| MOE | 2008 | 8/20/2008 | Millwood SSO/SMR09 | -84.25509 | 46.50613 | 60 | |
| MOE | 2008 | 8/20/2008 | Dacey Road SSO/SMR10 | -84.24456 | 46.51772 | 60 | |
| MOE | 2008 | 8/20/2008 | Fort Creek SSO (triplicate)SMR11 | -84.34365 | 46.51464 | 120 | |
| MOE | 2008 | 8/20/2008 | Fort Creek SSO (triplicate)SMR12 | -84.34365 | 46.51464 | 80 | |
| MOE | 2008 | 8/20/2008 | Fort Creek SSO (field blank)SMR13 | -84.34365 | 46.51464 | <10 | |
| MOE | 2008 | 8/20/2008 | Fort Creek SSO (field blank)SMR14 | -84.34365 | 46.51464 | <10 | |
| MOE | 2008 | 8/20/2008 | EESTP at UV (side sample)/SMR08 | -84.25933 | 46.50589 | 40 | |
| | | | | | | | |
| MOE | 2008 | 8/27/2008 | Davignon Creek SSO/SMR01 | -84.41304 | 46.51406 | 150 | |
| MOE | 2008 | 8/27/2008 | Fort Creek SSO/SMR02 | -84.34365 | 46.51464 | 80 | |
| MOE | 2008 | 8/27/2008 | Dennis Street SSO (triplicate)/SMR03 | -84.34124 | 46.51286 | <10 | |
| MOE | 2008 | 8/27/2008 | Holiday Inn SSO/SMR04 | -84.33730 | 46.50937 | 10 | |
| MOE | 2008 | 8/27/2008 | Pine Street SSO (Marina)/SMR05 | -84.30737 | 46.50236 | 60 | |
| MOE | 2008 | 8/27/2008 | Churchhill Blvd. SSO/SMR06 | -84.30345 | 46.49904 | 10 | |
| MOE | 2008 | 8/27/2008 | Queen Street SSO/SMR07 | -84.27987 | 46.49608 | 100 | |
| MOE | 2008 | 8/27/2008 | EESTP at UV/SMR08 | -84.25933 | 46.50589 | 10 | |
| MOE | 2008 | 8/27/2008 | Millwood SSO/SMR09 | -84.25509 | 46.50613 | 150 | |
| MOE | 2008 | 8/27/2008 | Dacey Road SSO/SMR10 | -84.24456 | 46.51772 | 10 | |
| MOE | 2008 | 8/27/2008 | Dennis Street SSO (triplicate)/SMR11 | -84.34124 | 46.51286 | <10 | |
| MOE | 2008 | 8/27/2008 | Dennis Street SSO (triplicate)/SMR12 | -84.34124 | 46.51286 | <10 | |
| MOE | 2008 | 8/27/2008 | Dennis Street SSO (triplicate)/SMR13 | -84.34124 | 46.51286 | <10 | |
| MOE | 2008 | 8/27/2008 | Dennis Street SSO (triplicate)/SMR14 | -84.34124 | 46.51286 | <10 | |

| Agency | Sample Year | Sample Date (mm/dd/yy) | Sample Description/ID | Longitudes (DD.ddddd) | Latitudes (DD.ddddd) | E.coli (cfu/100ml) | Geometric Mean (3 E.coli samples collected per site) |
|---|---|---|---|---|---|---|---|
| MOE | 2008 | 9/3/2008 | Davignon Creek SSO/SMR01 | -84.41304 | 46.51406 | >1000 | |
| MOE | 2008 | 9/3/2008 | Fort Creek SSO/SMR02 | -84.34365 | 46.51464 | 10 | |
| MOE | 2008 | 9/3/2008 | Dennis Street SSO/SMR03 | -84.34124 | 46.51286 | <10 | |
| MOE | 2008 | 9/3/2008 | Holiday Inn SSO (triplicate)/SMR04 | -84.33730 | 46.50937 | 30 | |
| MOE | 2008 | 9/3/2008 | Pine Street SSO (Marina)/SMR05 | -84.30737 | 46.50236 | 340 | |
| MOE | 2008 | 9/3/2008 | Churchhill Blvd. SSO/SMR06 | -84.30345 | 46.49904 | 310 | |
| MOE | 2008 | 9/3/2008 | Queen Street SSO/SMR07 | -84.27987 | 46.49608 | 10 | |
| MOE | 2008 | 9/3/2008 | EESTP at UV/SMR08 | -84.25933 | 46.50589 | <10 | |
| MOE | 2008 | 9/3/2008 | Millwood SSO/SMR09 | -84.25509 | 46.50613 | >1000 | |
| MOE | 2008 | 9/3/2008 | Dacey Road SSO/SMR10 | -84.24456 | 46.51772 | 80 | |
| MOE | 2008 | 9/3/2008 | Holiday Inn SSO (triplicate)/SMR11 | -84.33730 | 46.50937 | 20 | |
| MOE | 2008 | 9/3/2008 | Holiday Inn SSO (triplicate)/SMR12 | -84.33730 | 46.50937 | <10 | |
| MOE | 2008 | 9/3/2008 | Holiday Inn SSO (field blank)SMR13 | -84.33730 | 46.50937 | <10 | |
| MOE | 2008 | 9/3/2008 | Holiday Inn SSO (field blank)SMR14 | -84.33730 | 46.50937 | <10 | |
| **ALGOMA PUBLIC HEALTH** | | | | | | | |
| APH | 2008 | 6/4/2008 | 285 River Road A/A1 | -84.24154 | 46.52111 | 10 | |
| APH | 2008 | 6/4/2008 | 285 River Road A/A2 | -84.24154 | 46.52111 | 10 | |
| APH | 2008 | 6/4/2008 | 285 River Road A/A3 | -84.24154 | 46.52111 | 10 | 10 |
| APH | 2008 | 6/4/2008 | 285 River Road B/B1 | -84.24154 | 46.52111 | 190 | |
| APH | 2008 | 6/4/2008 | 285 River Road B/B2 | -84.24154 | 46.52111 | 260 | |
| APH | 2008 | 6/4/2008 | 285 River Road B/B3 | -84.24154 | 46.52111 | 230 | 224.8113645 |
| APH | 2008 | 6/4/2008 | 319 River Road/RR1 | -84.24310 | 46.51922 | 10 | |
| APH | 2008 | 6/4/2008 | 319 River Road/RR2 | -84.24310 | 46.51922 | 10 | |
| APH | 2008 | 6/4/2008 | 319 River Road/RR3 | -84.24310 | 46.51922 | 10 | 10 |
| APH | 2008 | 6/4/2008 | Top Sail Island/TS1 | -84.29622 | 46.49633 | 280 | |
| APH | 2008 | 6/4/2008 | Top Sail Island/TS2 | -84.29622 | 46.49633 | 430 | |
| APH | 2008 | 6/4/2008 | Top Sail Island/TS3 | -84.29622 | 46.49633 | 160 | 268.0703758 |
| APH | 2008 | 6/4/2008 | QA Blank/A | -84.24154 | 46.52111 | 10 | |
| APH | 2008 | 6/9/2008 | 319 River Road/RR1 | -84.24310 | 46.51922 | >1000 | |
| APH | 2008 | 6/9/2008 | 319 River Road/RR2 | -84.24310 | 46.51922 | >1000 | |
| APH | 2008 | 6/9/2008 | 319 River Road/RR3 | -84.24310 | 46.51922 | >1000 | >1000 |
| APH | 2008 | 6/9/2008 | Top Sail Island/TS1 | -84.29622 | 46.49633 | 750 | |
| APH | 2008 | 6/9/2008 | Top Sail Island/TS2 | -84.29622 | 46.49633 | 760 | |

| Agency | Sample Year | Sample Date (mm/dd/yy) | Sample Description/ID | Longitudes (DD.ddddd) | Latitudes (DD.ddddd) | E.coli (cfu/100ml) | Geometric Mean (3 E.coli samples collected per site) |
|---|---|---|---|---|---|---|---|
| APH | 2008 | 6/9/2008 | Top Sail Island/TS3 | -84.29622 | 46.49633 | 930 | 809.3181276 |
| APH | 2008 | 6/9/2008 | QA Blank/RR | -84.24310 | 46.51922 | <10 | |
| | | | | | | | |
| APH | 2008 | 6/11/2008 | 319 River Road/RR1 | -84.24310 | 46.51922 | 50 | |
| APH | 2008 | 6/11/2008 | 319 River Road/RR2 | -84.24310 | 46.51922 | 20 | |
| APH | 2008 | 6/11/2008 | 319 River Road/RR3 | -84.24310 | 46.51922 | 80 | 43.0886938 |
| APH | 2008 | 6/11/2008 | Top Sail Island/TS1 | -84.29622 | 46.49633 | <10 | |
| APH | 2008 | 6/11/2008 | Top Sail Island/TS2 | -84.29622 | 46.49633 | <10 | |
| APH | 2008 | 6/11/2008 | Top Sail Island/TS3 | -84.29622 | 46.49633 | <10 | <10 |
| APH | 2008 | 6/11/2008 | QA Blank/RR | -84.24310 | 46.51922 | <10 | |
| | | | | | | | |
| APH | 2008 | 6/12/2008 | 285 River Road A/A1 | -84.24154 | 46.52111 | 20 | |
| APH | 2008 | 6/12/2008 | 285 River Road A/A2 | -84.24154 | 46.52111 | 10 | |
| APH | 2008 | 6/12/2008 | 285 River Road A/A3 | -84.24154 | 46.52111 | 10 | 12.5992105 |
| APH | 2008 | 6/12/2008 | 285 River Road B/B1 | -84.24154 | 46.52111 | 60 | |
| APH | 2008 | 6/12/2008 | 285 River Road B/B2 | -84.24154 | 46.52111 | 150 | |
| APH | 2008 | 6/12/2008 | 285 River Road B/B3 | -84.24154 | 46.52111 | 130 | 105.3728243 |
| APH | 2008 | 6/12/2008 | 319 River Road/RR1 | -84.24310 | 46.51922 | 90 | |
| APH | 2008 | 6/12/2008 | 319 River Road/RR2 | -84.24310 | 46.51922 | 40 | |
| APH | 2008 | 6/12/2008 | 319 River Road/RR3 | -84.24310 | 46.51922 | 70 | 63.16359598 |
| APH | 2008 | 6/12/2008 | Top Sail Island/TS1 | -84.29622 | 46.49633 | 300 | |
| APH | 2008 | 6/12/2008 | Top Sail Island/TS2 | -84.29622 | 46.49633 | 830 | |
| APH | 2008 | 6/12/2008 | Top Sail Island/TS3 | -84.29622 | 46.49633 | 680 | 553.2262176 |
| APH | 2008 | 6/12/2008 | QA Blank/TS | -84.29622 | 46.49633 | <10 | |
| APH | 2008 | 6/12/2008 | QA Blank/RR | -84.24310 | 46.51922 | <10 | |
| | | | | | | | |
| APH | 2008 | 6/19/2008 | 285 River Road A/A1 | -84.24154 | 46.52111 | 50 | |
| APH | 2008 | 6/19/2008 | 285 River Road A/A2 | -84.24154 | 46.52111 | 120 | |
| APH | 2008 | 6/19/2008 | 285 River Road A/A3 | -84.24154 | 46.52111 | 40 | 62.14465012 |
| APH | 2008 | 6/19/2008 | 285 River Road B/B1 | -84.24154 | 46.52111 | 430 | |
| APH | 2008 | 6/19/2008 | 285 River Road B/B2 | -84.24154 | 46.52111 | 610 | |
| APH | 2008 | 6/19/2008 | 285 River Road B/B3 | -84.24154 | 46.52111 | 300 | 428.5220578 |
| APH | 2008 | 6/19/2008 | 319 River Road/RR1 | -84.24310 | 46.51922 | 20 | |
| APH | 2008 | 6/19/2008 | 319 River Road/RR2 | -84.24310 | 46.51922 | 10 | |
| APH | 2008 | 6/19/2008 | 319 River Road/RR3 | -84.24310 | 46.51922 | 20 | 15.87401052 |
| APH | 2008 | 6/19/2008 | Top Sail Island/TS1 | -84.29622 | 46.49633 | <10 | |

| Agency | Sample Year | Sample Date (mm/dd/yy) | Sample Description/ID | Longitudes (DD.ddddd) | Latitudes (DD.ddddd) | E.coli (cfu/100ml) | Geometric Mean (3 E.coli samples collected per site) |
|---|---|---|---|---|---|---|---|
| APH | 2008 | 6/19/2008 | Top Sail Island/TS2 | -84.29622 | 46.49633 | <10 | |
| APH | 2008 | 6/19/2008 | Top Sail Island/TS3 | -84.29622 | 46.49633 | <10 | <10 |
| APH | 2008 | 6/19/2008 | QA Blank/RR | -84.24310 | 46.51922 | <10 | |
| APH | 2008 | 6/25/2008 | 285 River Road A/A1 | -84.24154 | 46.52111 | 20 | |
| APH | 2008 | 6/25/2008 | 285 River Road A/A2 | -84.24154 | 46.52111 | 10 | |
| APH | 2008 | 6/25/2008 | 285 River Road A/A3 | -84.24154 | 46.52111 | 20 | 15.87401052 |
| APH | 2008 | 6/25/2008 | 285 River Road B/B1 | -84.24154 | 46.52111 | 10 | |
| APH | 2008 | 6/25/2008 | 285 River Road B/B2 | -84.24154 | 46.52111 | 70 | |
| APH | 2008 | 6/25/2008 | 285 River Road B/B3 | -84.24154 | 46.52111 | 20 | 24.10142264 |
| APH | 2008 | 6/25/2008 | 319 River Road/RR1 | -84.24310 | 46.51922 | 30 | |
| APH | 2008 | 6/25/2008 | 319 River Road/RR2 | -84.24310 | 46.51922 | <10 | |
| APH | 2008 | 6/25/2008 | 319 River Road/RR3 | -84.24310 | 46.51922 | 20 | 24.49489743 |
| APH | 2008 | 6/25/2008 | Top Sail Island/TS1 | -84.29622 | 46.49633 | 10 | |
| APH | 2008 | 6/25/2008 | Top Sail Island/TS2 | -84.29622 | 46.49633 | 20 | |
| APH | 2008 | 6/25/2008 | Top Sail Island/TS3 | -84.29622 | 46.49633 | <10 | 14.14213562 |
| APH | 2008 | 6/25/2008 | QA Blank/TS | -84.29622 | 46.49633 | 10 | |
| APH | 2008 | 7/2/2008 | 285 River Road A/A1 | -84.24154 | 46.52111 | 520 | |
| APH | 2008 | 7/2/2008 | 285 River Road A/A2 | -84.24154 | 46.52111 | 500 | |
| APH | 2008 | 7/2/2008 | 285 River Road A/A3 | -84.24154 | 46.52111 | 610 | 541.2954722 |
| APH | 2008 | 7/2/2008 | 285 River Road B/B1 | -84.24154 | 46.52111 | 690 | |
| APH | 2008 | 7/2/2008 | 285 River Road B/B2 | -84.24154 | 46.52111 | 530 | |
| APH | 2008 | 7/2/2008 | 285 River Road B/B3 | -84.24154 | 46.52111 | 660 | 622.619854 |
| APH | 2008 | 7/2/2008 | 319 River Road/RR1 | -84.24310 | 46.51922 | 50 | |
| APH | 2008 | 7/2/2008 | 319 River Road/RR2 | -84.24310 | 46.51922 | 30 | |
| APH | 2008 | 7/2/2008 | 319 River Road/RR3 | -84.24310 | 46.51922 | 60 | 44.81404747 |
| APH | 2008 | 7/2/2008 | Top Sail Island/TS1 | -84.29622 | 46.49633 | 40 | |
| APH | 2008 | 7/2/2008 | Top Sail Island/TS2 | -84.29622 | 46.49633 | 70 | |
| APH | 2008 | 7/2/2008 | Top Sail Island/TS3 | -84.29622 | 46.49633 | 70 | 58.08785734 |
| APH | 2008 | 7/2/2008 | QA Blank/TS | -84.29622 | 46.49633 | <10 | |
| APH | 2008 | 7/9/2008 | 285 River Road A/A1 | -84.24154 | 46.52111 | 120 | |
| APH | 2008 | 7/9/2008 | 285 River Road A/A2 | -84.24154 | 46.52111 | 90 | |
| APH | 2008 | 7/9/2008 | 285 River Road A/A3 | -84.24154 | 46.52111 | 50 | 81.4325285 |
| APH | 2008 | 7/9/2008 | 285 River Road B/B1 | -84.24154 | 46.52111 | 370 | |
| APH | 2008 | 7/9/2008 | 285 River Road B/B2 | -84.24154 | 46.52111 | 230 | |
| APH | 2008 | 7/9/2008 | 285 River Road B/B3 | -84.24154 | 46.52111 | 330 | 303.9586451 |

| Agency | Sample Year | Sample Date (mm/dd/yy) | Sample Description/ID | Longitudes (DD.ddddd) | Latitudes (DD.ddddd) | E.coli (cfu/100ml) | Geometric Mean (3 E.coli samples collected per site) |
|---|---|---|---|---|---|---|---|
| APH | 2008 | 7/9/2008 | 319 River Road/RR1 | -84.24310 | 46.51922 | 30 | |
| APH | 2008 | 7/9/2008 | 319 River Road/RR2 | -84.24310 | 46.51922 | 20 | |
| APH | 2008 | 7/9/2008 | 319 River Road/RR3 | -84.24310 | 46.51922 | 20 | 22.89428485 |
| APH | 2008 | 7/9/2008 | Top Sail Island/TS1 | -84.29622 | 46.49633 | 40 | |
| APH | 2008 | 7/9/2008 | Top Sail Island/TS2 | -84.29622 | 46.49633 | 50 | |
| APH | 2008 | 7/9/2008 | Top Sail Island/TS3 | -84.29622 | 46.49633 | 80 | 54.28835233 |
| APH | 2008 | 7/9/2008 | QA Blank/TS | -84.29622 | 46.49633 | <10 | |
| | | | | | | | |
| APH | 2008 | 7/16/2008 | 319 River Road/RR1 | -84.24310 | 46.51922 | <10 | |
| APH | 2008 | 7/16/2008 | 319 River Road/RR2 | -84.24310 | 46.51922 | <10 | |
| APH | 2008 | 7/16/2008 | 319 River Road/RR3 | -84.24310 | 46.51922 | 10 | 10 |
| APH | 2008 | 7/16/2008 | Top Sail Island/TS1 | -84.29622 | 46.49633 | <10 | |
| APH | 2008 | 7/16/2008 | Top Sail Island/TS2 | -84.29622 | 46.49633 | 10 | |
| APH | 2008 | 7/16/2008 | Top Sail Island/TS3 | -84.29622 | 46.49633 | 10 | 10 |
| APH | 2008 | 7/16/2008 | QA Blank/TS | -84.29622 | 46.49633 | <10 | |
| | | | | | | | |
| APH | 2008 | 7/23/2008 | 319 River Road/RR1 | -84.24310 | 46.51922 | 260 | |
| APH | 2008 | 7/23/2008 | 319 River Road/RR2 | -84.24310 | 46.51922 | 160 | |
| APH | 2008 | 7/23/2008 | 319 River Road/RR3 | -84.24310 | 46.51922 | 200 | 202.6318808 |
| APH | 2008 | 7/23/2008 | Top Sail Island/TS1 | -84.29622 | 46.49633 | 70 | |
| APH | 2008 | 7/23/2008 | Top Sail Island/TS2 | -84.29622 | 46.49633 | 40 | |
| APH | 2008 | 7/23/2008 | Top Sail Island/TS3 | -84.29622 | 46.49633 | 80 | 60.73177944 |
| APH | 2008 | 7/23/2008 | QA Blank/TS | -84.29622 | 46.49633 | <10 | |
| | | | | | | | |
| APH | 2008 | 7/30/2008 | 319 River Road/RR1 | -84.24310 | 46.51922 | 60 | |
| APH | 2008 | 7/30/2008 | 319 River Road/RR2 | -84.24310 | 46.51922 | 30 | |
| APH | 2008 | 7/30/2008 | 319 River Road/RR3 | -84.24310 | 46.51922 | 40 | 41.60167646 |
| APH | 2008 | 7/30/2008 | Top Sail Island/TS1 | -84.29622 | 46.49633 | 40 | |
| APH | 2008 | 7/30/2008 | Top Sail Island/TS2 | -84.29622 | 46.49633 | 20 | |
| APH | 2008 | 7/30/2008 | Top Sail Island/TS3 | -84.29622 | 46.49633 | 10 | 20 |
| | | | | | | | |
| APH | 2008 | 8/6/2008 | 319 River Road/RR1 | -84.24310 | 46.51922 | <10 | |
| APH | 2008 | 8/6/2008 | 319 River Road/RR2 | -84.24310 | 46.51922 | 30 | |
| APH | 2008 | 8/6/2008 | 319 River Road/RR3 | -84.24310 | 46.51922 | 20 | 24.49489743 |
| APH | 2008 | 8/6/2008 | Top Sail Island/TS1 | -84.29622 | 46.49633 | 10 | |
| APH | 2008 | 8/6/2008 | Top Sail Island/TS2 | -84.29622 | 46.49633 | 30 | |
| APH | 2008 | 8/6/2008 | Top Sail Island/TS3 | -84.29622 | 46.49633 | <10 | 17.32050808 |
| APH | 2008 | 8/6/2008 | QA Blank/TS | -84.29622 | 46.49633 | <10 | |

| Agency | Sample Year | Sample Date (mm/dd/yy) | Sample Description/ID | Longitudes (DD.ddddd) | Latitudes (DD.ddddd) | E.coli (cfu/100ml) | Geometric Mean (3 E.coli samples collected per site) |
|---|---|---|---|---|---|---|---|
| APH | 2008 | 8/13/2008 | 319 River Road/RR1 | -84.24310 | 46.51922 | <10 | |
| APH | 2008 | 8/13/2008 | 319 River Road/RR2 | -84.24310 | 46.51922 | 10 | |
| APH | 2008 | 8/13/2008 | 319 River Road/RR3 | -84.24310 | 46.51922 | <10 | 10 |
| APH | 2008 | 8/13/2008 | Top Sail Island/TS1 | -84.29622 | 46.49633 | <10 | |
| APH | 2008 | 8/13/2008 | Top Sail Island/TS2 | -84.29622 | 46.49633 | <10 | |
| APH | 2008 | 8/13/2008 | Top Sail Island/TS3 | -84.29622 | 46.49633 | 10 | 10 |
| APH | 2008 | 8/13/2008 | QA Blank/TS | -84.29622 | 46.49633 | <10 | |
| APH | 2008 | 8/27/2008 | 319 River Road/RR1 | -84.24310 | 46.51922 | 10 | |
| APH | 2008 | 8/27/2008 | 319 River Road/RR2 | -84.24310 | 46.51922 | 20 | |
| APH | 2008 | 8/27/2008 | 319 River Road/RR3 | -84.24310 | 46.51922 | 10 | 12.5992105 |
| APH | 2008 | 8/27/2008 | Top Sail Island/TS1 | -84.29622 | 46.49633 | 10 | |
| APH | 2008 | 8/27/2008 | Top Sail Island/TS2 | -84.29622 | 46.49633 | 30 | |
| APH | 2008 | 8/27/2008 | Top Sail Island/TS3 | -84.29622 | 46.49633 | 10 | 14.4224957 |
| APH | 2008 | 8/27/2008 | QA Blank/TS | -84.29622 | 46.49633 | NA | |
| APH | 2008 | 9/3/2008 | 319 River Road/RR1 | -84.24310 | 46.51922 | 10 | |
| APH | 2008 | 9/3/2008 | 319 River Road/RR2 | -84.24310 | 46.51922 | 30 | |
| APH | 2008 | 9/3/2008 | 319 River Road/RR3 | -84.24310 | 46.51922 | 10 | 14.4224957 |
| APH | 2008 | 9/3/2008 | Top Sail Island/TS1 | -84.29622 | 46.49633 | 10 | |
| APH | 2008 | 9/3/2008 | Top Sail Island/TS2 | -84.29622 | 46.49633 | 10 | |
| APH | 2008 | 9/3/2008 | Top Sail Island/TS3 | -84.29622 | 46.49633 | 10 | 10 |
| APH | 2008 | 9/3/2008 | QA Blank/RR | -84.24310 | 46.51922 | <10 | |
| **CHIPPEWA COUNTY HEALTH DEPARTMENT** | | | | | | | |
| CCHD | 2008 | 6/4/2008 | 55 N. Westshore Dr./Site 1 | -84.24268 | 46.50738 | 1 | |
| CCHD | 2008 | 6/4/2008 | 89 N. Westshore Dr./Site 2 | -84.24265 | 46.50782 | 1.6 | |
| CCHD | 2008 | 6/4/2008 | 182 N. Westshore Dr./Site 3 | -84.24282 | 46.50890 | 1.4 | |
| CCHD | 2008 | 6/4/2008 | 182 N. Westshore Dr./Site 4 | -84.24333 | 46.50980 | 5.4 | |
| CCHD | 2008 | 6/4/2008 | 6100 E. Pt. Lewis Lane/Site 5 | -84.23852 | 46.51537 | 2 | |
| CCHD | 2008 | 6/4/2008 | 1175 N. Westshore Dr./Site 6 | -84.22791 | 46.52355 | 4.3 | |
| CCHD | 2008 | 6/4/2008 | 2023 N. Williams Dr./Site 7 | -84.20715 | 46.53572 | 2.5 | |
| CCHD | 2008 | 6/11/2008 | 55 N. Westshore Dr./Site 1 | -84.24268 | 46.50738 | 172.8 | |
| CCHD | 2008 | 6/11/2008 | 89 N. Westshore Dr./Site 2 | -84.24265 | 46.50782 | 225.4 | |

| Agency | Sample Year | Sample Date (mm/dd/yy) | Sample Description/ID | Longitudes (DD.ddddd) | Latitudes (DD.ddddd) | E.coli (cfu/100ml) | Geometric Mean (3 E.coli samples collected per site) |
|---|---|---|---|---|---|---|---|
| CCHD | 2008 | 6/11/2008 | 182 N. Westshore Dr./Site 3 | -84.24282 | 46.50890 | 35.2 | |
| CCHD | 2008 | 6/11/2008 | 182 N. Westshore Dr./Site 4 | -84.24333 | 46.50980 | 94.2 | |
| CCHD | 2008 | 6/11/2008 | 6100 E. Pt. Lewis Lane/Site 5 | -84.23852 | 46.51537 | 885.9 | |
| CCHD | 2008 | 6/11/2008 | 1175 N. Westshore Dr./Site 6 | -84.22791 | 46.52355 | 288.9 | |
| CCHD | 2008 | 6/11/2008 | 2023 N. Williams Dr./Site 7 | -84.20715 | 46.53572 | 63.6 | |
| CCHD | 2008 | 6/17/2008 | 55 N. Westshore Dr./Site 1 | -84.24268 | 46.50738 | 5.5 | |
| CCHD | 2008 | 6/17/2008 | 89 N. Westshore Dr./Site 2 | -84.24265 | 46.50782 | 4.1 | |
| CCHD | 2008 | 6/17/2008 | 182 N. Westshore Dr./Site 3 | -84.24282 | 46.50890 | 9.9 | |
| CCHD | 2008 | 6/17/2008 | 182 N. Westshore Dr./Site 4 | -84.24333 | 46.50980 | 1 | |
| CCHD | 2008 | 6/17/2008 | 6100 E. Pt. Lewis Lane/Site 5 | -84.23852 | 46.51537 | 4.7 | |
| CCHD | 2008 | 6/17/2008 | 1175 N. Westshore Dr./Site 6 | -84.22791 | 46.52355 | 13.8 | |
| CCHD | 2008 | 6/17/2008 | 2023 N. Williams Dr./Site 7 | -84.20715 | 46.53572 | 33.2 | |
| CCHD | 2008 | 6/25/2008 | 55 N. Westshore Dr./Site 1 | -84.24268 | 46.50738 | 8.4 | |
| CCHD | 2008 | 6/25/2008 | 89 N. Westshore Dr./Site 2 | -84.24265 | 46.50782 | 10.8 | |
| CCHD | 2008 | 6/25/2008 | 182 N. Westshore Dr./Site 3 | -84.24282 | 46.50890 | 17.3 | |
| CCHD | 2008 | 6/25/2008 | 182 N. Westshore Dr./Site 4 | -84.24333 | 46.50980 | 4.7 | |
| CCHD | 2008 | 6/25/2008 | 6100 E. Pt. Lewis Lane/Site 5 | -84.23852 | 46.51537 | 5 | |
| CCHD | 2008 | 6/25/2008 | 1175 N. Westshore Dr./Site 6 | -84.22791 | 46.52355 | 4.5 | |
| CCHD | 2008 | 6/25/2008 | 2023 N. Williams Dr./Site 7 | -84.20715 | 46.53572 | 9.7 | |
| CCHD | 2008 | 7/2/2008 | 55 N. Westshore Dr./Site 1 | -84.24268 | 46.50738 | 39.9 | |
| CCHD | 2008 | 7/2/2008 | 89 N. Westshore Dr./Site 2 | -84.24265 | 46.50782 | 35.2 | |
| CCHD | 2008 | 7/2/2008 | 182 N. Westshore Dr./Site 3 | -84.24282 | 46.50890 | 54.3 | |
| CCHD | 2008 | 7/2/2008 | 182 N. Westshore Dr./Site 4 | -84.24333 | 46.50980 | 12.8 | |
| CCHD | 2008 | 7/2/2008 | 6100 E. Pt. Lewis Lane/Site 5 | -84.23852 | 46.51537 | 10.5 | |
| CCHD | 2008 | 7/2/2008 | 1175 N. Westshore Dr./Site 6 | -84.22791 | 46.52355 | 38.4 | |
| CCHD | 2008 | 7/2/2008 | 2023 N. Williams Dr./Site 7 | -84.20715 | 46.53572 | 53.7 | |
| CCHD | 2008 | 7/9/2008 | 55 N. Westshore Dr./Site 1 | -84.24268 | 46.50738 | 34 | |
| CCHD | 2008 | 7/9/2008 | 89 N. Westshore Dr./Site 2 | -84.24265 | 46.50782 | 100 | |
| CCHD | 2008 | 7/9/2008 | 182 N. Westshore Dr./Site 3 | -84.24282 | 46.50890 | 39.7 | |
| CCHD | 2008 | 7/9/2008 | 182 N. Westshore Dr./Site 4 | -84.24333 | 46.50980 | 30.2 | |
| CCHD | 2008 | 7/9/2008 | 6100 E. Pt. Lewis Lane/Site 5 | -84.23852 | 46.51537 | 61.3 | |
| CCHD | 2008 | 7/9/2008 | 1175 N. Westshore Dr./Site 6 | -84.22791 | 46.52355 | 28.9 | |
| CCHD | 2008 | 7/9/2008 | 2023 N. Williams Dr./Site 7 | -84.20715 | 46.53572 | 33 | |

| Agency | Sample Year | Sample Date (mm/dd/yy) | Sample Description/ID | Longitudes (DD.ddddd) | Latitudes (DD.ddddd) | E.coli (cfu/100ml) | Geometric Mean (3 E.coli samples collected per site) |
|---|---|---|---|---|---|---|---|
| CCHD | 2008 | 7/16/2008 | 55 N. Westshore Dr./Site 1 | -84.24268 | 46.50738 | 38.1 | |
| CCHD | 2008 | 7/16/2008 | 89 N. Westshore Dr./Site 2 | -84.24265 | 46.50782 | 45.2 | |
| CCHD | 2008 | 7/16/2008 | 182 N. Westshore Dr./Site 3 | -84.24282 | 46.50890 | 26.8 | |
| CCHD | 2008 | 7/16/2008 | 182 N. Westshore Dr./Site 4 | -84.24333 | 46.50980 | 4.2 | |
| CCHD | 2008 | | 6100 E. Pt. Lewis Lane/Site 5 | -84.23852 | 46.51537 | | |
| CCHD | 2008 | 7/16/2008 | 1175 N. Westshore Dr./Site 6 | -84.22791 | 46.52355 | 4.5 | |
| CCHD | 2008 | 7/16/2008 | 2023 N. Williams Dr./Site 7 | -84.20715 | 46.53572 | 4.8 | |
| | | | | | | | |
| CCHD | 2008 | 7/23/2008 | 55 N. Westshore Dr./Site 1 | -84.24268 | 46.50738 | 4.2 | |
| CCHD | 2008 | 7/23/2008 | 89 N. Westshore Dr./Site 2 | -84.24265 | 46.50782 | 60.7 | |
| CCHD | 2008 | 7/23/2008 | 182 N. Westshore Dr./Site 3 | -84.24282 | 46.50890 | 243.3 | |
| CCHD | 2008 | 7/23/2008 | 182 N. Westshore Dr./Site 4 | -84.24333 | 46.50980 | 43.9 | |
| CCHD | 2008 | 7/23/2008 | 6100 E. Pt. Lewis Lane/Site 5 | -84.23852 | 46.51537 | 19.2 | |
| CCHD | 2008 | 7/23/2008 | 1175 N. Westshore Dr./Site 6 | -84.22791 | 46.52355 | 23.5 | |
| CCHD | 2008 | 7/23/2008 | 2023 N. Williams Dr./Site 7 | -84.20715 | 46.53572 | 25 | |
| | | | | | | | |
| CCHD | 2008 | 7/30/2008 | 55 N. Westshore Dr./Site 1 | -84.24268 | 46.50738 | 18.2 | |
| CCHD | 2008 | 7/30/2008 | 89 N. Westshore Dr./Site 2 | -84.24265 | 46.50782 | 14.2 | |
| CCHD | 2008 | 7/30/2008 | 182 N. Westshore Dr./Site 3 | -84.24282 | 46.50890 | 43.4 | |
| CCHD | 2008 | 7/30/2008 | 182 N. Westshore Dr./Site 4 | -84.24333 | 46.50980 | 24.3 | |
| CCHD | 2008 | 7/30/2008 | 6100 E. Pt. Lewis Lane/Site 5 | -84.23852 | 46.51537 | 7 | |
| CCHD | 2008 | 7/30/2008 | 1175 N. Westshore Dr./Site 6 | -84.22791 | 46.52355 | 116.4 | |
| CCHD | 2008 | 7/30/2008 | 2023 N. Williams Dr./Site 7 | -84.20715 | 46.53572 | 93.8 | |
| | | | | | | | |
| CCHD | 2008 | 8/6/2008 | 55 N. Westshore Dr./Site 1 | -84.24268 | 46.50738 | 9.6 | |
| CCHD | 2008 | 8/6/2008 | 89 N. Westshore Dr./Site 2 | -84.24265 | 46.50782 | 78.9 | |
| CCHD | 2008 | 8/6/2008 | 182 N. Westshore Dr./Site 3 | -84.24282 | 46.50890 | 54.7 | |
| CCHD | 2008 | 8/6/2008 | 182 N. Westshore Dr./Site 4 | -84.24333 | 46.50980 | 4.3 | |
| CCHD | 2008 | 8/6/2008 | 6100 E. Pt. Lewis Lane/Site 5 | -84.23852 | 46.51537 | 6.7 | |
| CCHD | 2008 | 8/6/2008 | 1175 N. Westshore Dr./Site 6 | -84.22791 | 46.52355 | 3.2 | |
| CCHD | 2008 | 8/6/2008 | 2023 N. Williams Dr./Site 7 | -84.20715 | 46.53572 | 16.3 | |
| | | | | | | | |
| CCHD | 2008 | 8/13/2008 | 55 N. Westshore Dr./Site 1 | -84.24268 | 46.50738 | 6.6 | |
| CCHD | 2008 | 8/13/2008 | 89 N. Westshore Dr./Site 2 | -84.24265 | 46.50782 | 4.9 | |
| CCHD | 2008 | 8/13/2008 | 182 N. Westshore Dr./Site 3 | -84.24282 | 46.50890 | 6.6 | |
| CCHD | 2008 | 8/13/2008 | 182 N. Westshore Dr./Site 4 | -84.24333 | 46.50980 | 2.6 | |
| CCHD | 2008 | 8/13/2008 | 6100 E. Pt. Lewis Lane/Site 5 | -84.23852 | 46.51537 | 4.3 | |
| CCHD | 2008 | 8/13/2008 | 1175 N. Westshore Dr./Site 6 | -84.22791 | 46.52355 | 28.6 | |

| Agency | Sample Year | Sample Date (mm/dd/yy) | Sample Description/ID | Longitudes (DD.ddddd) | Latitudes (DD.ddddd) | E.coli (cfu/100ml) | Geometric Mean (3 E.coli samples collected per site) |
|---|---|---|---|---|---|---|---|
| CCHD | 2008 | 8/13/2008 | 2023 N. Williams Dr./Site 7 | -84.20715 | 46.53572 | 7.5 | |
| CCHD | 2008 | 8/20/2008 | 55 N. Westshore Dr./Site 1 | -84.24268 | 46.50738 | 13.7 | |
| CCHD | 2008 | 8/20/2008 | 89 N. Westshore Dr./Site 2 | -84.24265 | 46.50782 | 9.9 | |
| CCHD | 2008 | 8/20/2008 | 182 N. Westshore Dr./Site 3 | -84.24282 | 46.50890 | 52.1 | |
| CCHD | 2008 | 8/20/2008 | 182 N. Westshore Dr./Site 4 | -84.24333 | 46.50980 | 4.3 | |
| CCHD | 2008 | 8/20/2008 | 6100 E. Pt. Lewis Lane/Site 5 | -84.23852 | 46.51537 | 56.6 | |
| CCHD | 2008 | 8/20/2008 | 1175 N. Westshore Dr./Site 6 | -84.22791 | 46.52355 | 11.5 | |
| CCHD | 2008 | 8/20/2008 | 2023 N. Williams Dr./Site 7 | -84.20715 | 46.53572 | 15.9 | |
| CCHD | 2008 | 8/27/2008 | 55 N. Westshore Dr./Site 1 | -84.24268 | 46.50738 | 13.2 | |
| CCHD | 2008 | 8/27/2008 | 89 N. Westshore Dr./Site 2 | -84.24265 | 46.50782 | 15.9 | |
| CCHD | 2008 | 8/27/2008 | 182 N. Westshore Dr./Site 3 | -84.24282 | 46.50890 | 65.2 | |
| CCHD | 2008 | 8/27/2008 | 182 N. Westshore Dr./Site 4 | -84.24333 | 46.50980 | 9 | |
| CCHD | 2008 | 8/27/2008 | 6100 E. Pt. Lewis Lane/Site 5 | -84.23852 | 46.51537 | 3.3 | |
| CCHD | 2008 | 8/27/2008 | 1175 N. Westshore Dr./Site 6 | -84.22791 | 46.52355 | 72.9 | |
| CCHD | 2008 | 8/27/2008 | 2023 N. Williams Dr./Site 7 | -84.20715 | 46.53572 | 11.7 | |
| CCHD | 2008 | 9/2/2008 | 55 N. Westshore Dr./Site 1 | -84.24268 | 46.50738 | 7.9 | |
| CCHD | 2008 | 9/2/2008 | 89 N. Westshore Dr./Site 2 | -84.24265 | 46.50782 | 5.1 | |
| CCHD | 2008 | 9/2/2008 | 182 N. Westshore Dr./Site 3 | -84.24282 | 46.50890 | 27.7 | |
| CCHD | 2008 | 9/2/2008 | 182 N. Westshore Dr./Site 4 | -84.24333 | 46.50980 | 2.8 | |
| CCHD | 2008 | 9/2/2008 | 6100 E. Pt. Lewis Lane/Site 5 | -84.23852 | 46.51537 | 1 | |
| CCHD | 2008 | 9/2/2008 | 1175 N. Westshore Dr./Site 6 | -84.22791 | 46.52355 | 17.7 | |
| CCHD | 2008 | 9/2/2008 | 2023 N. Williams Dr./Site 7 | -84.20715 | 46.53572 | 8.8 | |
| CCHD | 2008 | 9/9/2008 | 55 N. Westshore Dr./Site 1 | -84.24268 | 46.50738 | 1.6 | |
| CCHD | 2008 | 9/9/2008 | 89 N. Westshore Dr./Site 2 | -84.24265 | 46.50782 | 2.7 | |
| CCHD | 2008 | 9/9/2008 | 182 N. Westshore Dr./Site 3 | -84.24282 | 46.50890 | 26 | |
| CCHD | 2008 | 9/9/2008 | 182 N. Westshore Dr./Site 4 | -84.24333 | 46.50980 | 2 | |
| CCHD | 2008 | 9/9/2008 | 6100 E. Pt. Lewis Lane/Site 5 | -84.23852 | 46.51537 | 1.7 | |
| CCHD | 2008 | 9/9/2008 | 1175 N. Westshore Dr./Site 6 | -84.22791 | 46.52355 | 4.7 | |
| CCHD | 2008 | | 2023 N. Williams Dr./Site 7 | -84.20715 | 46.53572 | | |
| CCHD | 2008 | 9/15/2008 | 55 N. Westshore Dr./Site 1 | -84.24268 | 46.50738 | 2.6 | |
| CCHD | 2008 | 9/15/2008 | 89 N. Westshore Dr./Site 2 | -84.24265 | 46.50782 | 3.2 | |
| CCHD | 2008 | 9/15/2008 | 182 N. Westshore Dr./Site 3 | -84.24282 | 46.50890 | 2.7 | |
| CCHD | 2008 | 9/15/2008 | 182 N. Westshore Dr./Site 4 | -84.24333 | 46.50980 | 14.9 | |

| Agency | Sample Year | Sample Date (mm/dd/yy) | Sample Description/ID | Longitudes (DD.ddddd) | Latitudes (DD.ddddd) | E.coli (cfu/100ml) | Geometric Mean (3 E.coli samples collected per site) |
|---|---|---|---|---|---|---|---|
| CCHD | 2008 | 9/15/2008 | 6100 E. Pt. Lewis Lane/Site 5 | -84.23852 | 46.51537 | 5.8 | |
| CCHD | 2008 | 9/15/2008 | 1175 N. Westshore Dr./Site 6 | -84.22791 | 46.52355 | 2.3 | |
| CCHD | 2008 | | 2023 N. Williams Dr./Site 7 | -84.20715 | 46.53572 | | |
| CCHD | 2008 | 9/22/2008 | 55 N. Westshore Dr./Site 1 | -84.24268 | 46.50738 | 1.6 | |
| CCHD | 2008 | 9/22/2008 | 89 N. Westshore Dr./Site 2 | -84.24265 | 46.50782 | 2.5 | |
| CCHD | 2008 | 9/22/2008 | 182 N. Westshore Dr./Site 3 | -84.24282 | 46.50890 | 4.1 | |
| CCHD | 2008 | 9/22/2008 | 182 N. Westshore Dr./Site 4 | -84.24333 | 46.50980 | 3 | |
| CCHD | 2008 | 9/22/2008 | 6100 E. Pt. Lewis Lane/Site 5 | -84.23852 | 46.51537 | 1 | |
| CCHD | 2008 | 9/22/2008 | 1175 N. Westshore Dr./Site 6 | -84.22791 | 46.52355 | 1.8 | |
| CCHD | 2008 | | 2023 N. Williams Dr./Site 7 | -84.20715 | 46.53572 | | |
| CCHD | 2008 | 9/29/2008 | 55 N. Westshore Dr./Site 1 | -84.24268 | 46.50738 | 4.3 | |
| CCHD | 2008 | 9/29/2008 | 89 N. Westshore Dr./Site 2 | -84.24265 | 46.50782 | 4.7 | |
| CCHD | 2008 | 9/29/2008 | 182 N. Westshore Dr./Site 3 | -84.24282 | 46.50890 | 6.3 | |
| CCHD | 2008 | 9/29/2008 | 182 N. Westshore Dr./Site 4 | -84.24333 | 46.50980 | 4.6 | |
| CCHD | 2008 | 9/29/2008 | 6100 E. Pt. Lewis Lane/Site 5 | -84.23852 | 46.51537 | 5.5 | |
| CCHD | 2008 | 9/29/2008 | 1175 N. Westshore Dr./Site 6 | -84.22791 | 46.52355 | 10 | |
| CCHD | 2008 | 9/29/2008 | 2023 N. Williams Dr./Site 7 | -84.20715 | 46.53572 | 16.7 | |
| **SAULT TRIBE** | | | | | | | |
| Sault Tribe | 2008 | 6/4/2008 | Sugar Shack Lagoons T1 | -84.27581 | 46.49257 | <10 | |
| Sault Tribe | 2008 | 6/4/2008 | D/S East End WWTP (Old) T1 | -84.25008 | 46.50341 | <10 | |
| Sault Tribe | 2008 | 6/4/2008 | D/S East End WWTP (Old) T2 | -84.25081 | 46.50367 | <10 | |
| Sault Tribe | 2008 | 6/4/2008 | D/S East End WWTP (Old) T3 | -84.25206 | 46.50423 | <10 | |
| Sault Tribe | 2008 | 6/4/2008 | D/S East End WWTP (Old) T4 | -84.25320 | 46.50495 | 10 | |
| Sault Tribe | 2008 | 6/4/2008 | D/S East End WWTP (Old) T5 | -84.25435 | 46.50582 | 10 | |
| Sault Tribe | 2008 | 6/4/2008 | D/S Edison Sault Electric T1 | -84.32547 | 46.49599 | <10 | |
| Sault Tribe | 2008 | 6/4/2008 | D/S Edison Sault Electric T2 | -84.32381 | 46.49786 | <10 | |
| Sault Tribe | 2008 | 6/4/2008 | D/S Edison Sault Electric T3 | -84.32291 | 46.49963 | 10 | |
| Sault Tribe | 2008 | 6/4/2008 | D/S Edison Sault Electric T4 | -84.32147 | 46.50134 | 10 | |
| Sault Tribe | 2008 | 6/4/2008 | D/S Edison Sault Electric T5 | -84.32156 | 46.50267 | <10 | |
| Sault Tribe | 2008 | 6/4/2008 | D/S Queen Street Outfall T1 | -84.27868 | 46.49579 | <10 | |
| Sault Tribe | 2008 | 6/4/2008 | East End WWTP Diffuser Pipe T1/1 | -84.24947 | 46.51007 | <10 | |
| Sault Tribe | 2008 | 6/4/2008 | East End WWTP Diffuser Pipe T1/2 | -84.24947 | 46.51007 | 10 | |
| Sault Tribe | 2008 | 6/4/2008 | East End WWTP Diffuser Pipe T1/3 | -84.24947 | 46.51007 | <10 | |

| Agency | Sample Year | Sample Date (mm/dd/yy) | Sample Description/ID | Longitudes (DD.ddddd) | Latitudes (DD.ddddd) | E.coli (cfu/100ml) | Geometric Mean (3 E.coli samples collected per site) |
|---|---|---|---|---|---|---|---|
| Sault Tribe | 2008 | 6/4/2008 | Sugar Island Township Park T1 | -84.23184 | 46.52481 | 10 | |
| Sault Tribe | 2008 | 6/4/2008 | Sugar Island Township Park T2 | -84.23278 | 46.52517 | <10 | |
| Sault Tribe | 2008 | 6/4/2008 | Sugar Island Township Park T3 | -84.23444 | 46.52552 | <10 | |
| Sault Tribe | 2008 | 6/4/2008 | Sugar Island Township Park T4 | -84.23581 | 46.52580 | <10 | |
| Sault Tribe | 2008 | 6/4/2008 | Sugar Island Township Park T5 | -84.23761 | 46.52620 | <10 | |
| Sault Tribe | 2008 | 6/4/2008 | Field Blank | | | <10 | |
| | | | | | | | |
| Sault Tribe | 2008 | 6/11/2008 | Sugar Shack Lagoons T1 | -84.27581 | 46.49257 | <10 | |
| Sault Tribe | 2008 | 6/11/2008 | D/S East End WWTP (Old) T1 | -84.25008 | 46.50341 | 10 | |
| Sault Tribe | 2008 | 6/11/2008 | D/S East End WWTP (Old) T2 | -84.25081 | 46.50367 | 30 | |
| Sault Tribe | 2008 | 6/11/2008 | D/S East End WWTP (Old)/T3 | -84.25206 | 46.50423 | 10 | |
| Sault Tribe | 2008 | 6/11/2008 | D/S East End WWTP (Old) T4 | -84.25320 | 46.50495 | 10 | |
| Sault Tribe | 2008 | 6/11/2008 | D/S East End WWTP (Old) T5 | -84.25435 | 46.50582 | 20 | |
| Sault Tribe | 2008 | 6/11/2008 | D/S Edison Sault Electric T1 | -84.32547 | 46.49599 | 10 | |
| Sault Tribe | 2008 | 6/11/2008 | D/S Edison Sault Electric T2 | -84.32381 | 46.49786 | 20 | |
| Sault Tribe | 2008 | 6/11/2008 | D/S Edison Sault Electric T3 | -84.32291 | 46.49963 | <10 | |
| Sault Tribe | 2008 | 6/11/2008 | D/S Edison Sault Electric T4 | -84.32147 | 46.50134 | <10 | |
| Sault Tribe | 2008 | 6/11/2008 | D/S Edison Sault Electric T5 | -84.32156 | 46.50267 | 10 | |
| Sault Tribe | 2008 | 6/11/2008 | D/S Queen Street Outfall T1/1 | -84.27868 | 46.49579 | 30 | |
| Sault Tribe | 2008 | 6/11/2008 | D/S Queen Street Outfall T1/2 | -84.27868 | 46.49579 | 20 | |
| Sault Tribe | 2008 | 6/11/2008 | D/S Queen Street Outfall T1/3 | -84.27868 | 46.49579 | 20 | |
| Sault Tribe | 2008 | 6/11/2008 | East End WWTP Diffuser Pipe T1 | -84.24947 | 46.51007 | 160 | |
| Sault Tribe | 2008 | 6/11/2008 | Sugar Island Township Park T1 | -84.23184 | 46.52481 | 100 | |
| Sault Tribe | 2008 | 6/11/2008 | Sugar Island Township Park T2 | -84.23278 | 46.52517 | 20 | |
| Sault Tribe | 2008 | 6/11/2008 | Sugar Island Township Park T3 | -84.23444 | 46.52552 | 10 | |
| Sault Tribe | 2008 | 6/11/2008 | Sugar Island Township Park T4 | -84.23581 | 46.52580 | 40 | |
| Sault Tribe | 2008 | 6/11/2008 | Sugar Island Township Park T5 | -84.23761 | 46.52620 | <10 | |
| Sault Tribe | 2008 | 6/11/2008 | Field Blank | | | <10 | |
| | | | | | | | |
| Sault Tribe | 2008 | 6/18/2008 | Sugar Shack Lagoons T1/1 | -84.27581 | 46.49257 | 20 | |
| Sault Tribe | 2008 | 6/18/2008 | Sugar Shack Lagoons T1/2 | -84.27581 | 46.49257 | <10 | |
| Sault Tribe | 2008 | 6/18/2008 | Sugar Shack Lagoons T1/3 | -84.27581 | 46.49257 | 20 | |
| Sault Tribe | 2008 | 6/18/2008 | D/S East End WWTP (Old) T1 | -84.25008 | 46.50341 | <10 | |
| Sault Tribe | 2008 | 6/18/2008 | D/S East End WWTP (Old) T2 | -84.25081 | 46.50367 | <10 | |
| Sault Tribe | 2008 | 6/18/2008 | D/S East End WWTP (Old) T3 | -84.25206 | 46.50423 | <10 | |
| Sault Tribe | 2008 | 6/18/2008 | D/S East End WWTP (Old) T4 | -84.25320 | 46.50495 | 20 | |
| Sault Tribe | 2008 | 6/18/2008 | D/S East End WWTP (Old) T5 | -84.25435 | 46.50582 | <10 | |
| Sault Tribe | 2008 | 6/18/2008 | D/S Edison Sault Electric T1 | -84.32547 | 46.49599 | <10 | |

| Agency | Sample Year | Sample Date (mm/dd/yy) | Sample Description/ID | Longitudes (DD.ddddd) | Latitudes (DD.ddddd) | E.coli (cfu/100ml) | Geometric Mean (3 E.coli samples collected per site) |
|---|---|---|---|---|---|---|---|
| Sault Tribe | 2008 | 6/18/2008 | D/S Edison Sault Electric T2 | -84.32381 | 46.49786 | <10 | |
| Sault Tribe | 2008 | 6/18/2008 | D/S Edison Sault Electric T3 | -84.32291 | 46.49963 | <10 | |
| Sault Tribe | 2008 | 6/18/2008 | D/S Edison Sault Electric T4 | -84.32147 | 46.50134 | <10 | |
| Sault Tribe | 2008 | 6/18/2008 | D/S Edison Sault Electric T5 | -84.32156 | 46.50267 | 10 | |
| Sault Tribe | 2008 | 6/18/2008 | D/S Queen Street Outfall T1 | -84.27868 | 46.49579 | 20 | |
| Sault Tribe | 2008 | 6/18/2008 | East End WWTP Diffuser Pipe T1 | -84.24947 | 46.51007 | <10 | |
| Sault Tribe | 2008 | 6/18/2008 | Sugar Island Township Park T1 | -84.23184 | 46.52481 | 10 | |
| Sault Tribe | 2008 | 6/18/2008 | Sugar Island Township Park T2 | -84.23278 | 46.52517 | <10 | |
| Sault Tribe | 2008 | 6/18/2008 | Sugar Island Township Park T3 | -84.23444 | 46.52552 | <10 | |
| Sault Tribe | 2008 | 6/18/2008 | Sugar Island Township Park T4 | -84.23581 | 46.52580 | 40 | |
| Sault Tribe | 2008 | 6/18/2008 | Sugar Island Township Park T5 | -84.23761 | 46.52620 | 10 | |
| Sault Tribe | 2008 | 6/18/2008 | Field Blank | | | <10 | |
| | | | | | | | |
| Sault Tribe | 2008 | 6/25/2008 | Sugar Shack Lagoons T1 | -84.27581 | 46.49257 | <10 | |
| Sault Tribe | 2008 | 6/25/2008 | D/S East End WWTP (Old) T1 | -84.25008 | 46.50341 | <10 | |
| Sault Tribe | 2008 | 6/25/2008 | D/S East End WWTP (Old) T2 | -84.25081 | 46.50367 | <10 | |
| Sault Tribe | 2008 | 6/25/2008 | D/S East End WWTP (Old) T3 | -84.25206 | 46.50423 | <10 | |
| Sault Tribe | 2008 | 6/25/2008 | D/S East End WWTP (Old) T4 | -84.25320 | 46.50495 | <10 | |
| Sault Tribe | 2008 | 6/25/2008 | D/S East End WWTP (Old) T5 | -84.25435 | 46.50582 | <10 | |
| Sault Tribe | 2008 | 6/25/2008 | D/S Edison Sault Electric T1 | -84.32547 | 46.49599 | <10 | |
| Sault Tribe | 2008 | 6/25/2008 | D/S Edison Sault Electric T2 | -84.32381 | 46.49786 | 10 | |
| Sault Tribe | 2008 | 6/25/2008 | D/S Edison Sault Electric T3 | -84.32291 | 46.49963 | <10 | |
| Sault Tribe | 2008 | 6/25/2008 | D/S Edison Sault Electric T4 | -84.32147 | 46.50134 | <10 | |
| Sault Tribe | 2008 | 6/25/2008 | D/S Edison Sault Electric T5 | -84.32156 | 46.50267 | 10 | |
| Sault Tribe | 2008 | 6/25/2008 | D/S Queen Street Outfall T1 | -84.27868 | 46.49579 | <10 | |
| Sault Tribe | 2008 | 6/25/2008 | East End WWTP Diffuser Pipe T1 | -84.24947 | 46.51007 | 10 | |
| Sault Tribe | 2008 | 6/25/2008 | Sugar Island Township Park T1 | -84.23184 | 46.52481 | <10 | |
| Sault Tribe | 2008 | 6/25/2008 | Sugar Island Township Park T2 | -84.23278 | 46.52517 | <10 | |
| Sault Tribe | 2008 | 6/25/2008 | Sugar Island Township Park T3 | -84.23444 | 46.52552 | <10 | |
| Sault Tribe | 2008 | 6/25/2008 | Sugar Island Township Park T4 | -84.23581 | 46.52580 | <10 | |
| Sault Tribe | 2008 | 6/25/2008 | Sugar Island Township Park T5/1 | -84.23761 | 46.52620 | 10 | |
| Sault Tribe | 2008 | 6/25/2008 | Sugar Island Township Park T5/2 | -84.23761 | 46.52620 | <10 | |
| Sault Tribe | 2008 | 6/25/2008 | Sugar Island Township Park T5/3 | -84.23761 | 46.52620 | <10 | |
| Sault Tribe | 2008 | 6/25/2008 | Field Blank | | | <10 | |
| | | | | | | | |
| Sault Tribe | 2008 | 7/2/2008 | Sugar Shack Lagoons T1 | -84.27581 | 46.49257 | <10 | |
| Sault Tribe | 2008 | 7/2/2008 | D/S East End WWTP (Old) T1 | -84.25008 | 46.50341 | <10 | |
| Sault Tribe | 2008 | 7/2/2008 | D/S East End WWTP (Old) T2 | -84.25081 | 46.50367 | <10 | |

| Agency | Sample Year | Sample Date (mm/dd/yy) | Sample Description/ID | Longitudes (DD.ddddd) | Latitudes (DD.ddddd) | E.coli (cfu/100ml) | Geometric Mean (3 E.coli samples collected per site) |
|---|---|---|---|---|---|---|---|
| Sault Tribe | 2008 | 7/2/2008 | D/S East End WWTP (Old) T3/1 | -84.25206 | 46.50423 | 30 | |
| Sault Tribe | 2008 | 7/2/2008 | D/S East End WWTP (Old) T3/2 | -84.25206 | 46.50423 | <10 | |
| Sault Tribe | 2008 | 7/2/2008 | D/S East End WWTP (Old) T3/3 | -84.25206 | 46.50423 | <10 | |
| Sault Tribe | 2008 | 7/2/2008 | D/S East End WWTP (Old) T4 | -84.25320 | 46.50495 | <10 | |
| Sault Tribe | 2008 | 7/2/2008 | D/S East End WWTP (Old) T5 | -84.25435 | 46.50582 | 10 | |
| Sault Tribe | 2008 | 7/2/2008 | D/S Edison Sault Electric T1 | -84.32547 | 46.49599 | <10 | |
| Sault Tribe | 2008 | 7/2/2008 | D/S Edison Sault Electric T2 | -84.32381 | 46.49786 | <10 | |
| Sault Tribe | 2008 | 7/2/2008 | D/S Edison Sault Electric T3 | -84.32291 | 46.49963 | <10 | |
| Sault Tribe | 2008 | 7/2/2008 | D/S Edison Sault Electric T4 | -84.32147 | 46.50134 | <10 | |
| Sault Tribe | 2008 | 7/2/2008 | D/S Edison Sault Electric T5 | -84.32156 | 46.50267 | 20 | |
| Sault Tribe | 2008 | 7/2/2008 | D/S Queen Street Outfall T1 | -84.27868 | 46.49579 | 10 | |
| Sault Tribe | 2008 | 7/2/2008 | East End WWTP Diffuser Pipe T1 | -84.24947 | 46.51007 | 20 | |
| Sault Tribe | 2008 | 7/2/2008 | Sugar Island Township Park T1 | -84.23184 | 46.52481 | 20 | |
| Sault Tribe | 2008 | 7/2/2008 | Sugar Island Township Park T2 | -84.23278 | 46.52517 | 10 | |
| Sault Tribe | 2008 | 7/2/2008 | Sugar Island Township Park T3 | -84.23444 | 46.52552 | 10 | |
| Sault Tribe | 2008 | 7/2/2008 | Sugar Island Township Park T4 | -84.23581 | 46.52580 | 10 | |
| Sault Tribe | 2008 | 7/2/2008 | Sugar Island Township Park T5 | -84.23761 | 46.52620 | <10 | |
| Sault Tribe | 2008 | 7/2/2008 | Field Blank | | | <10 | |
| | | | | | | | |
| Sault Tribe | 2008 | 7/9/2008 | Sugar Shack Lagoons T1 | -84.27581 | 46.49257 | 10 | |
| Sault Tribe | 2008 | 7/9/2008 | D/S East End WWTP (Old) T1 | -84.25008 | 46.50341 | <10 | |
| Sault Tribe | 2008 | 7/9/2008 | D/S East End WWTP (Old) T2 | -84.25081 | 46.50367 | <10 | |
| Sault Tribe | 2008 | 7/9/2008 | D/S East End WWTP (Old) T3 | -84.25206 | 46.50423 | 10 | |
| Sault Tribe | 2008 | 7/9/2008 | D/S East End WWTP (Old) T4 | -84.25320 | 46.50495 | 20 | |
| Sault Tribe | 2008 | 7/9/2008 | D/S East End WWTP (Old) T5 | -84.25435 | 46.50582 | <10 | |
| Sault Tribe | 2008 | 7/9/2008 | D/S Edison Sault Electric T1/1 | -84.32547 | 46.49599 | <10 | |
| Sault Tribe | 2008 | 7/9/2008 | D/S Edison Sault Electric T1/2 | -84.32547 | 46.49599 | 20 | |
| Sault Tribe | 2008 | 7/9/2008 | D/S Edison Sault Electric T1/3 | -84.32547 | 46.49599 | 10 | |
| Sault Tribe | 2008 | 7/9/2008 | D/S Edison Sault Electric T2 | -84.32381 | 46.49786 | 10 | |
| Sault Tribe | 2008 | 7/9/2008 | D/S Edison Sault Electric T3 | -84.32291 | 46.49963 | <10 | |
| Sault Tribe | 2008 | 7/9/2008 | D/S Edison Sault Electric T4 | -84.32147 | 46.50134 | <10 | |
| Sault Tribe | 2008 | 7/9/2008 | D/S Edison Sault Electric T5 | -84.32156 | 46.50267 | 10 | |
| Sault Tribe | 2008 | 7/9/2008 | D/S Queen Street Outfall T1 | -84.27868 | 46.49579 | 10 | |
| Sault Tribe | 2008 | 7/9/2008 | East End WWTP Diffuser Pipe T1 | -84.24947 | 46.51007 | 10 | |
| Sault Tribe | 2008 | 7/9/2008 | Sugar Island Township Park T1 | -84.23184 | 46.52481 | 10 | |
| Sault Tribe | 2008 | 7/9/2008 | Sugar Island Township Park T2 | -84.23278 | 46.52517 | 20 | |
| Sault Tribe | 2008 | 7/9/2008 | Sugar Island Township Park T3 | -84.23444 | 46.52552 | 20 | |
| Sault Tribe | 2008 | 7/9/2008 | Sugar Island Township Park T4 | -84.23581 | 46.52580 | <10 | |

| Agency | Sample Year | Sample Date (mm/dd/yy) | Sample Description/ID | Longitudes (DD.ddddd) | Latitudes (DD.ddddd) | E.coli (cfu/100ml) | Geometric Mean (3 E.coli samples collected per site) |
|---|---|---|---|---|---|---|---|
| Sault Tribe | 2008 | 7/9/2008 | Sugar Island Township Park T5 | -84.23761 | 46.52620 | <10 | |
| Sault Tribe | 2008 | 7/9/2008 | Field Blank | | | <10 | |
| | | | | | | | |
| Sault Tribe | 2008 | 7/16/2008 | Sugar Shack Lagoons T1 | -84.27581 | 46.49257 | <10 | |
| Sault Tribe | 2008 | 7/16/2008 | D/S East End WWTP (Old) T1 | -84.25008 | 46.50341 | <10 | |
| Sault Tribe | 2008 | 7/16/2008 | D/S East End WWTP (Old) T2 | -84.25081 | 46.50367 | <10 | |
| Sault Tribe | 2008 | 7/16/2008 | D/S East End WWTP (Old) T3 | -84.25206 | 46.50423 | <10 | |
| Sault Tribe | 2008 | 7/16/2008 | D/S East End WWTP (Old) T4 | -84.25320 | 46.50495 | 10 | |
| Sault Tribe | 2008 | 7/16/2008 | D/S East End WWTP (Old) T5 | -84.25435 | 46.50582 | <10 | |
| Sault Tribe | 2008 | 7/16/2008 | D/S Edison Sault Electric T1 | -84.32547 | 46.49599 | <10 | |
| Sault Tribe | 2008 | 7/16/2008 | D/S Edison Sault Electric T2 | -84.32381 | 46.49786 | <10 | |
| Sault Tribe | 2008 | 7/16/2008 | D/S Edison Sault Electric T3 | -84.32291 | 46.49963 | <10 | |
| Sault Tribe | 2008 | 7/16/2008 | D/S Edison Sault Electric T4 | -84.32147 | 46.50134 | 20 | |
| Sault Tribe | 2008 | 7/16/2008 | D/S Edison Sault Electric T5 | -84.32156 | 46.50267 | <10 | |
| Sault Tribe | 2008 | 7/16/2008 | D/S Queen Street Outfall T1 | -84.27868 | 46.49579 | 10 | |
| Sault Tribe | 2008 | 7/16/2008 | East End WWTP Diffuser Pipe T1/1 | -84.24947 | 46.51007 | <10 | |
| Sault Tribe | 2008 | 7/16/2008 | East End WWTP Diffuser Pipe T1/2 | -84.24947 | 46.51007 | 20 | |
| Sault Tribe | 2008 | 7/16/2008 | East End WWTP Diffuser Pipe T1/3 | -84.24947 | 46.51007 | <10 | |
| Sault Tribe | 2008 | 7/16/2008 | Sugar Island Township Park T1 | -84.23184 | 46.52481 | 10 | |
| Sault Tribe | 2008 | 7/16/2008 | Sugar Island Township Park T2 | -84.23278 | 46.52517 | 10 | |
| Sault Tribe | 2008 | 7/16/2008 | Sugar Island Township Park T3 | -84.23444 | 46.52552 | <10 | |
| Sault Tribe | 2008 | 7/16/2008 | Sugar Island Township Park T4 | -84.23581 | 46.52580 | 20 | |
| Sault Tribe | 2008 | 7/16/2008 | Sugar Island Township Park T5 | -84.23761 | 46.52620 | <10 | |
| Sault Tribe | 2008 | 7/16/2008 | Field Blank | | | <10 | |
| | | | | | | | |
| Sault Tribe | 2008 | 7/24/2008 | Sugar Shack Lagoons T1 | -84.27581 | 46.49257 | <10 | |
| Sault Tribe | 2008 | 7/24/2008 | D/S East End WWTP (Old) T1 | -84.25008 | 46.50341 | <10 | |
| Sault Tribe | 2008 | 7/24/2008 | D/S East End WWTP (Old) T2 | -84.25081 | 46.50367 | 10 | |
| Sault Tribe | 2008 | 7/24/2008 | D/S East End WWTP (Old) T3 | -84.25206 | 46.50423 | <10 | |
| Sault Tribe | 2008 | 7/24/2008 | D/S East End WWTP (Old) T4 | -84.25320 | 46.50495 | 10 | |
| Sault Tribe | 2008 | 7/24/2008 | D/S East End WWTP (Old) T5 | -84.25435 | 46.50582 | 10 | |
| Sault Tribe | 2008 | 7/24/2008 | D/S Edison Sault Electric T1 | -84.32547 | 46.49599 | 30 | |
| Sault Tribe | 2008 | 7/24/2008 | D/S Edison Sault Electric T2 | -84.32381 | 46.49786 | <10 | |
| Sault Tribe | 2008 | 7/24/2008 | D/S Edison Sault Electric T3 | -84.32291 | 46.49963 | <10 | |
| Sault Tribe | 2008 | 7/24/2008 | D/S Edison Sault Electric T4 | -84.32147 | 46.50134 | | |
| Sault Tribe | 2008 | 7/24/2008 | D/S Edison Sault Electric T5 | -84.32156 | 46.50267 | 20 | |
| Sault Tribe | 2008 | 7/24/2008 | D/S Queen Street Outfall T1/1 | -84.27868 | 46.49579 | 10 | |
| Sault Tribe | 2008 | 7/24/2008 | D/S Queen Street Outfall T1/2 | -84.27868 | 46.49579 | <10 | |

| Agency | Sample Year | Sample Date (mm/dd/yy) | Sample Description/ID | Longitudes (DD.ddddd) | Latitudes (DD.ddddd) | E.coli (cfu/100ml) | Geometric Mean (3 E.coli samples collected per site) |
|---|---|---|---|---|---|---|---|
| Sault Tribe | 2008 | 7/24/2008 | D/S Queen Street Outfall T1/3 | -84.27868 | 46.49579 | 10 | |
| Sault Tribe | 2008 | 7/24/2008 | East End WWTP Diffuser Pipe T1 | -84.24947 | 46.51007 | | |
| Sault Tribe | 2008 | 7/24/2008 | Sugar Island Township Park T1 | -84.23184 | 46.52481 | <10 | |
| Sault Tribe | 2008 | 7/24/2008 | Sugar Island Township Park T2 | -84.23278 | 46.52517 | 20 | |
| Sault Tribe | 2008 | 7/24/2008 | Sugar Island Township Park T3 | -84.23444 | 46.52552 | <10 | |
| Sault Tribe | 2008 | 7/24/2008 | Sugar Island Township Park T4 | -84.23581 | 46.52580 | <10 | |
| Sault Tribe | 2008 | 7/24/2008 | Sugar Island Township Park T5 | -84.23761 | 46.52620 | <10 | |
| Sault Tribe | 2008 | 7/24/2008 | Field Blank | | | <10 | |
| | | | | | | | |
| Sault Tribe | 2008 | 7/30/2008 | Sugar Shack Lagoons T1 | -84.27581 | 46.49257 | 20 | |
| Sault Tribe | 2008 | 7/30/2008 | D/S East End WWTP (Old) T1 | -84.25008 | 46.50341 | <10 | |
| Sault Tribe | 2008 | 7/30/2008 | D/S East End WWTP (Old) T2 | -84.25081 | 46.50367 | 10 | |
| Sault Tribe | 2008 | 7/30/2008 | D/S East End WWTP (Old) T3 | -84.25206 | 46.50423 | 10 | |
| Sault Tribe | 2008 | 7/30/2008 | D/S East End WWTP (Old) T4/1 | -84.25320 | 46.50495 | <10 | |
| Sault Tribe | 2008 | 7/30/2008 | D/S East End WWTP (Old) T4/2 | -84.25320 | 46.50495 | 40 | |
| Sault Tribe | 2008 | 7/30/2008 | D/S East End WWTP (Old) T4/3 | -84.25320 | 46.50495 | <10 | |
| Sault Tribe | 2008 | 7/30/2008 | D/S East End WWTP (Old) T5 | -84.25435 | 46.50582 | 40 | |
| Sault Tribe | 2008 | 7/30/2008 | D/S Edison Sault Electric T1 | -84.32547 | 46.49599 | 20 | |
| Sault Tribe | 2008 | 7/30/2008 | D/S Edison Sault Electric T2 | -84.32381 | 46.49786 | 10 | |
| Sault Tribe | 2008 | 7/30/2008 | D/S Edison Sault Electric T3 | -84.32291 | 46.49963 | 20 | |
| Sault Tribe | 2008 | 7/30/2008 | D/S Edison Sault Electric T4 | -84.32147 | 46.50134 | 10 | |
| Sault Tribe | 2008 | 7/30/2008 | D/S Edison Sault Electric T5 | -84.32156 | 46.50267 | <10 | |
| Sault Tribe | 2008 | 7/30/2008 | D/S Queen Street Outfall T1 | -84.27868 | 46.49579 | <10 | |
| Sault Tribe | 2008 | 7/30/2008 | East End WWTP Diffuser Pipe T1 | -84.24947 | 46.51007 | 60 | |
| Sault Tribe | 2008 | 7/30/2008 | Sugar Island Township Park T1 | -84.23184 | 46.52481 | 10 | |
| Sault Tribe | 2008 | 7/30/2008 | Sugar Island Township Park T2 | -84.23278 | 46.52517 | 20 | |
| Sault Tribe | 2008 | 7/30/2008 | Sugar Island Township Park T3 | -84.23444 | 46.52552 | 20 | |
| Sault Tribe | 2008 | 7/30/2008 | Sugar Island Township Park T4 | -84.23581 | 46.52580 | 50 | |
| Sault Tribe | 2008 | 7/30/2008 | Sugar Island Township Park T5 | -84.23761 | 46.52620 | 30 | |
| Sault Tribe | 2008 | 7/30/2008 | Field Blank | | | <10 | |
| | | | | | | | |
| Sault Tribe | 2008 | 8/6/2008 | Sugar Shack Lagoons T1 | -84.27581 | 46.49257 | <10 | |
| Sault Tribe | 2008 | 8/6/2008 | D/S East End WWTP (Old) T1 | -84.25008 | 46.50341 | <10 | |
| Sault Tribe | 2008 | 8/6/2008 | D/S East End WWTP (Old) T2 | -84.25081 | 46.50367 | 10 | |
| Sault Tribe | 2008 | 8/6/2008 | D/S East End WWTP (Old) T3 | -84.25206 | 46.50423 | <10 | |
| Sault Tribe | 2008 | 8/6/2008 | D/S East End WWTP (Old) T4 | -84.25320 | 46.50495 | 10 | |
| Sault Tribe | 2008 | 8/6/2008 | D/S East End WWTP (Old) T5 | -84.25435 | 46.50582 | <10 | |
| Sault Tribe | 2008 | 8/6/2008 | D/S Edison Sault Electric T1/1 | -84.32547 | 46.49599 | <10 | |

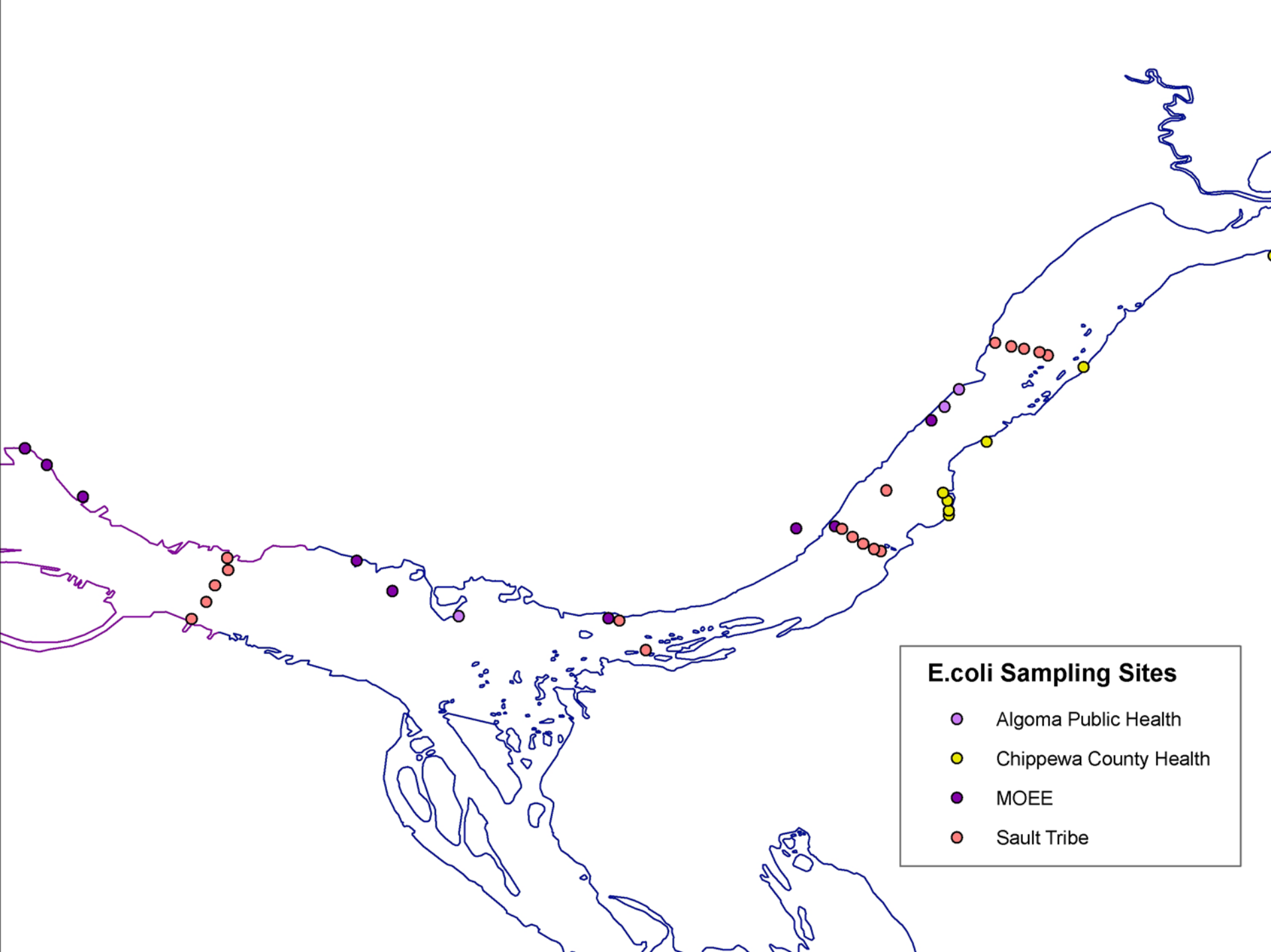
| Agency | Sample Year | Sample Date (mm/dd/yy) | Sample Description/ID | Longitudes (DD.ddddd) | Latitudes (DD.ddddd) | E.coli (cfu/100ml) | Geometric Mean (3 E.coli samples collected per site) |
|---|---|---|---|---|---|---|---|
| Sault Tribe | 2008 | 8/6/2008 | D/S Edison Sault Electric T1/2 | -84.32547 | 46.49599 | <10 | |
| Sault Tribe | 2008 | 8/6/2008 | D/S Edison Sault Electric T1/3 | -84.32547 | 46.49599 | 20 | |
| Sault Tribe | 2008 | 8/6/2008 | D/S Edison Sault Electric T2 | -84.32381 | 46.49786 | 10 | |
| Sault Tribe | 2008 | 8/6/2008 | D/S Edison Sault Electric T3 | -84.32291 | 46.49963 | 30 | |
| Sault Tribe | 2008 | 8/6/2008 | D/S Edison Sault Electric T4 | -84.32147 | 46.50134 | 10 | |
| Sault Tribe | 2008 | 8/6/2008 | D/S Edison Sault Electric T5 | -84.32156 | 46.50267 | <10 | |
| Sault Tribe | 2008 | 8/6/2008 | D/S Queen Street Outfall T1 | -84.27868 | 46.49579 | 10 | |
| Sault Tribe | 2008 | 8/6/2008 | East End WWTP Diffuser Pipe T1 | -84.24947 | 46.51007 | <10 | |
| Sault Tribe | 2008 | 8/6/2008 | Sugar Island Township Park T1 | -84.23184 | 46.52481 | 10 | |
| Sault Tribe | 2008 | 8/6/2008 | Sugar Island Township Park T2 | -84.23278 | 46.52517 | 20 | |
| Sault Tribe | 2008 | 8/6/2008 | Sugar Island Township Park T3 | -84.23444 | 46.52552 | <10 | |
| Sault Tribe | 2008 | 8/6/2008 | Sugar Island Township Park T4 | -84.23581 | 46.52580 | 10 | |
| Sault Tribe | 2008 | 8/6/2008 | Sugar Island Township Park T5 | -84.23761 | 46.52620 | 10 | |
| Sault Tribe | 2008 | 8/6/2008 | Field Blank | | | <10 | |
| | | | | | | | |
| Sault Tribe | 2008 | 8/13/2008 | Sugar Shack Lagoons T1 | -84.27581 | 46.49257 | <10 | |
| Sault Tribe | 2008 | 8/13/2008 | D/S East End WWTP (Old) T1 | -84.25008 | 46.50341 | 10 | |
| Sault Tribe | 2008 | 8/13/2008 | D/S East End WWTP (Old) T2 | -84.25081 | 46.50367 | 10 | |
| Sault Tribe | 2008 | 8/13/2008 | D/S East End WWTP (Old) T3 | -84.25206 | 46.50423 | 20 | |
| Sault Tribe | 2008 | 8/13/2008 | D/S East End WWTP (Old) T4 | -84.25320 | 46.50495 | <10 | |
| Sault Tribe | 2008 | 8/13/2008 | D/S East End WWTP (Old) T5 | -84.25435 | 46.50582 | <10 | |
| Sault Tribe | 2008 | 8/13/2008 | D/S Edison Sault Electric T1 | -84.32547 | 46.49599 | <10 | |
| Sault Tribe | 2008 | 8/13/2008 | D/S Edison Sault Electric T2 | -84.32381 | 46.49786 | <10 | |
| Sault Tribe | 2008 | 8/13/2008 | D/S Edison Sault Electric T3 | -84.32291 | 46.49963 | <10 | |
| Sault Tribe | 2008 | 8/13/2008 | D/S Edison Sault Electric T4 | -84.32147 | 46.50134 | <10 | |
| Sault Tribe | 2008 | 8/13/2008 | D/S Edison Sault Electric T5/1 | -84.32156 | 46.50267 | 10 | |
| Sault Tribe | 2008 | 8/13/2008 | D/S Edison Sault Electric T5/2 | -84.32156 | 46.50267 | <10 | |
| Sault Tribe | 2008 | 8/13/2008 | D/S Edison Sault Electric T5/3 | -84.32156 | 46.50267 | 30 | |
| Sault Tribe | 2008 | 8/13/2008 | D/S Queen Street Outfall T1 | -84.27868 | 46.49579 | 10 | |
| Sault Tribe | 2008 | 8/13/2008 | East End WWTP Diffuser Pipe T1 | -84.24947 | 46.51007 | 10 | |
| Sault Tribe | 2008 | 8/13/2008 | Sugar Island Township Park T1 | -84.23184 | 46.52481 | <10 | |
| Sault Tribe | 2008 | 8/13/2008 | Sugar Island Township Park T2 | -84.23278 | 46.52517 | 20 | |
| Sault Tribe | 2008 | 8/13/2008 | Sugar Island Township Park T3 | -84.23444 | 46.52552 | 40 | |
| Sault Tribe | 2008 | 8/13/2008 | Sugar Island Township Park T4 | -84.23581 | 46.52580 | 60 | |
| Sault Tribe | 2008 | 8/13/2008 | Sugar Island Township Park T5 | -84.23761 | 46.52620 | 20 | |
| Sault Tribe | 2008 | 8/13/2008 | Field Blank | | | <10 | |
| | | | | | | | |
| Sault Tribe | 2008 | 8/20/2008 | Sugar Shack Lagoons T1 | -84.27581 | 46.49257 | <10 | |

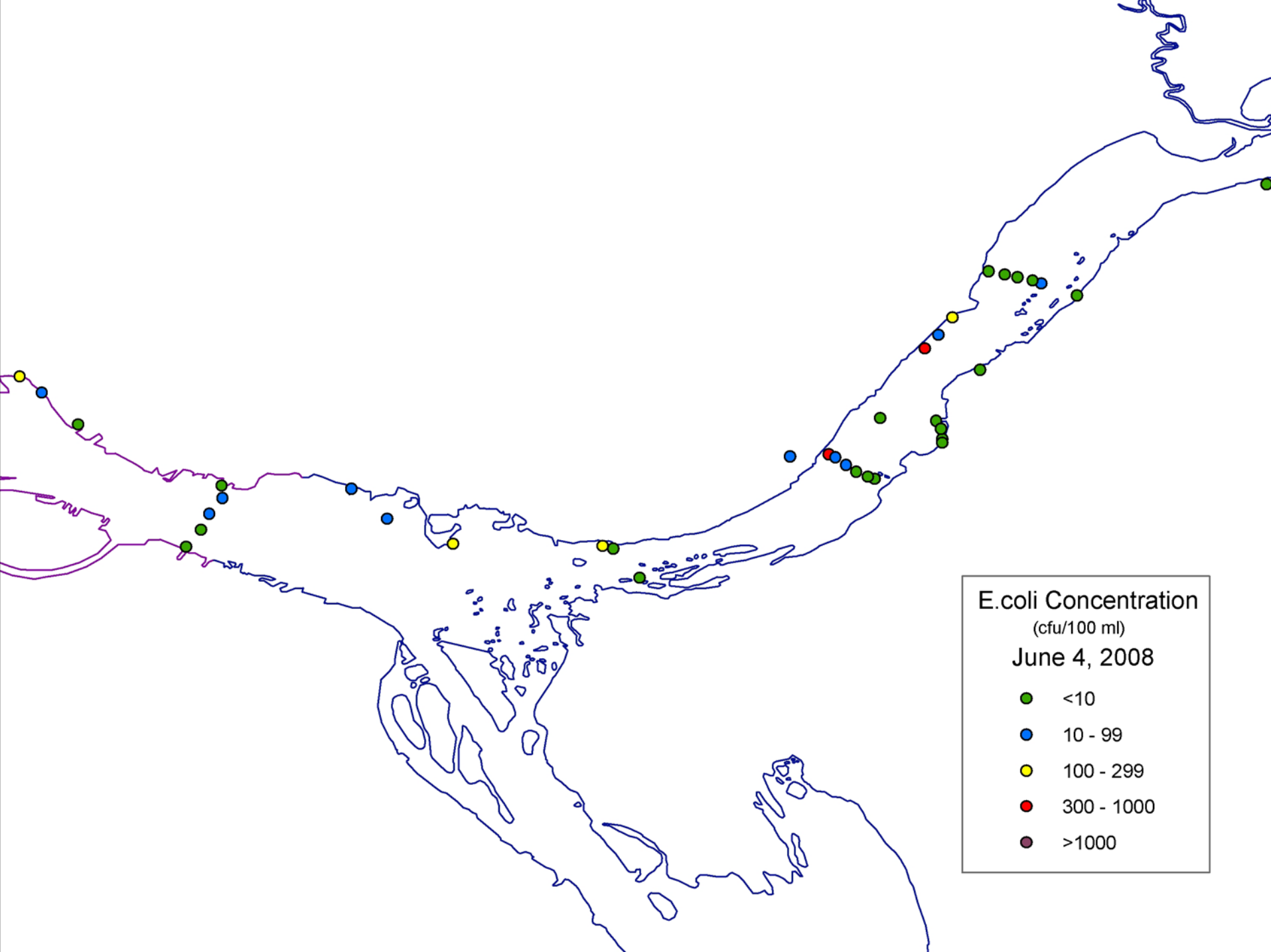
| Agency | Sample Year | Sample Date (mm/dd/yy) | Sample Description/ID | Longitudes (DD.ddddd) | Latitudes (DD.ddddd) | E.coli (cfu/100ml) | Geometric Mean (3 E.coli samples collected per site) |
|---|---|---|---|---|---|---|---|
| Sault Tribe | 2008 | 8/20/2008 | D/S East End WWTP (Old) T1 | -84.25008 | 46.50341 | 20 | |
| Sault Tribe | 2008 | 8/20/2008 | D/S East End WWTP (Old) T2 | -84.25081 | 46.50367 | 10 | |
| Sault Tribe | 2008 | 8/20/2008 | D/S East End WWTP (Old) T3 | -84.25206 | 46.50423 | <10 | |
| Sault Tribe | 2008 | 8/20/2008 | D/S East End WWTP (Old) T4 | -84.25320 | 46.50495 | <10 | |
| Sault Tribe | 2008 | 8/20/2008 | D/S East End WWTP (Old) T5 | -84.25435 | 46.50582 | <10 | |
| Sault Tribe | 2008 | 8/20/2008 | D/S Edison Sault Electric T1 | -84.32547 | 46.49599 | 10 | |
| Sault Tribe | 2008 | 8/20/2008 | D/S Edison Sault Electric T2 | -84.32381 | 46.49786 | 10 | |
| Sault Tribe | 2008 | 8/20/2008 | D/S Edison Sault Electric T3 | -84.32291 | 46.49963 | 10 | |
| Sault Tribe | 2008 | 8/20/2008 | D/S Edison Sault Electric T4 | -84.32147 | 46.50134 | 20 | |
| Sault Tribe | 2008 | 8/20/2008 | D/S Edison Sault Electric T5 | -84.32156 | 46.50267 | 10 | |
| Sault Tribe | 2008 | 8/20/2008 | D/S Queen Street Outfall T1 | -84.27868 | 46.49579 | <10 | |
| Sault Tribe | 2008 | 8/20/2008 | East End WWTP Diffuser Pipe T1 | -84.24947 | 46.51007 | 30 | |
| Sault Tribe | 2008 | 8/20/2008 | Sugar Island Township Park T1 | -84.23184 | 46.52481 | 10 | |
| Sault Tribe | 2008 | 8/20/2008 | Sugar Island Township Park T2 | -84.23278 | 46.52517 | <10 | |
| Sault Tribe | 2008 | 8/20/2008 | Sugar Island Township Park T3 | -84.23444 | 46.52552 | 10 | |
| Sault Tribe | 2008 | 8/20/2008 | Sugar Island Township Park T4 | -84.23581 | 46.52580 | 30 | |
| Sault Tribe | 2008 | 8/20/2008 | Sugar Island Township Park T5/1 | -84.23761 | 46.52620 | <10 | |
| Sault Tribe | 2008 | 8/20/2008 | Sugar Island Township Park T5/2 | -84.23761 | 46.52620 | <10 | |
| Sault Tribe | 2008 | 8/20/2008 | Sugar Island Township Park T5/3 | -84.23761 | 46.52620 | 10 | |
| Sault Tribe | 2008 | 8/20/2008 | Field Blank | | | <10 | |
| | | | | | | | |
| Sault Tribe | 2008 | 8/27/2008 | Sugar Shack Lagoons T1 | -84.27581 | 46.49257 | 10 | |
| Sault Tribe | 2008 | 8/27/2008 | D/S East End WWTP (Old) T1 | -84.25008 | 46.50341 | 10 | |
| Sault Tribe | 2008 | 8/27/2008 | D/S East End WWTP (Old) T2 | -84.25081 | 46.50367 | <10 | |
| Sault Tribe | 2008 | 8/27/2008 | D/S East End WWTP (Old) T3 | -84.25206 | 46.50423 | <10 | |
| Sault Tribe | 2008 | 8/27/2008 | D/S East End WWTP (Old) T4 | -84.25320 | 46.50495 | 20 | |
| Sault Tribe | 2008 | 8/27/2008 | D/S East End WWTP (Old) T5 | -84.25435 | 46.50582 | <10 | |
| Sault Tribe | 2008 | 8/27/2008 | D/S Edison Sault Electric T1 | -84.32547 | 46.49599 | <10 | |
| Sault Tribe | 2008 | 8/27/2008 | D/S Edison Sault Electric T2 | -84.32381 | 46.49786 | <10 | |
| Sault Tribe | 2008 | 8/27/2008 | D/S Edison Sault Electric T3 | -84.32291 | 46.49963 | <10 | |
| Sault Tribe | 2008 | 8/27/2008 | D/S Edison Sault Electric T4 | -84.32147 | 46.50134 | <10 | |
| Sault Tribe | 2008 | 8/27/2008 | D/S Edison Sault Electric T5 | -84.32156 | 46.50267 | 10 | |
| Sault Tribe | 2008 | 8/27/2008 | D/S Queen Street Outfall T1 | -84.27868 | 46.49579 | <10 | |
| Sault Tribe | 2008 | 8/27/2008 | East End WWTP Diffuser Pipe T1 | -84.24947 | 46.51007 | <10 | |
| Sault Tribe | 2008 | 8/27/2008 | Sugar Island Township Park T1 | -84.23184 | 46.52481 | <10 | |
| Sault Tribe | 2008 | 8/27/2008 | Sugar Island Township Park T2 | -84.23278 | 46.52517 | <10 | |
| Sault Tribe | 2008 | 8/27/2008 | Sugar Island Township Park T3 | -84.23444 | 46.52552 | 10 | |
| Sault Tribe | 2008 | 8/27/2008 | Sugar Island Township Park T4 | -84.23581 | 46.52580 | <10 | |

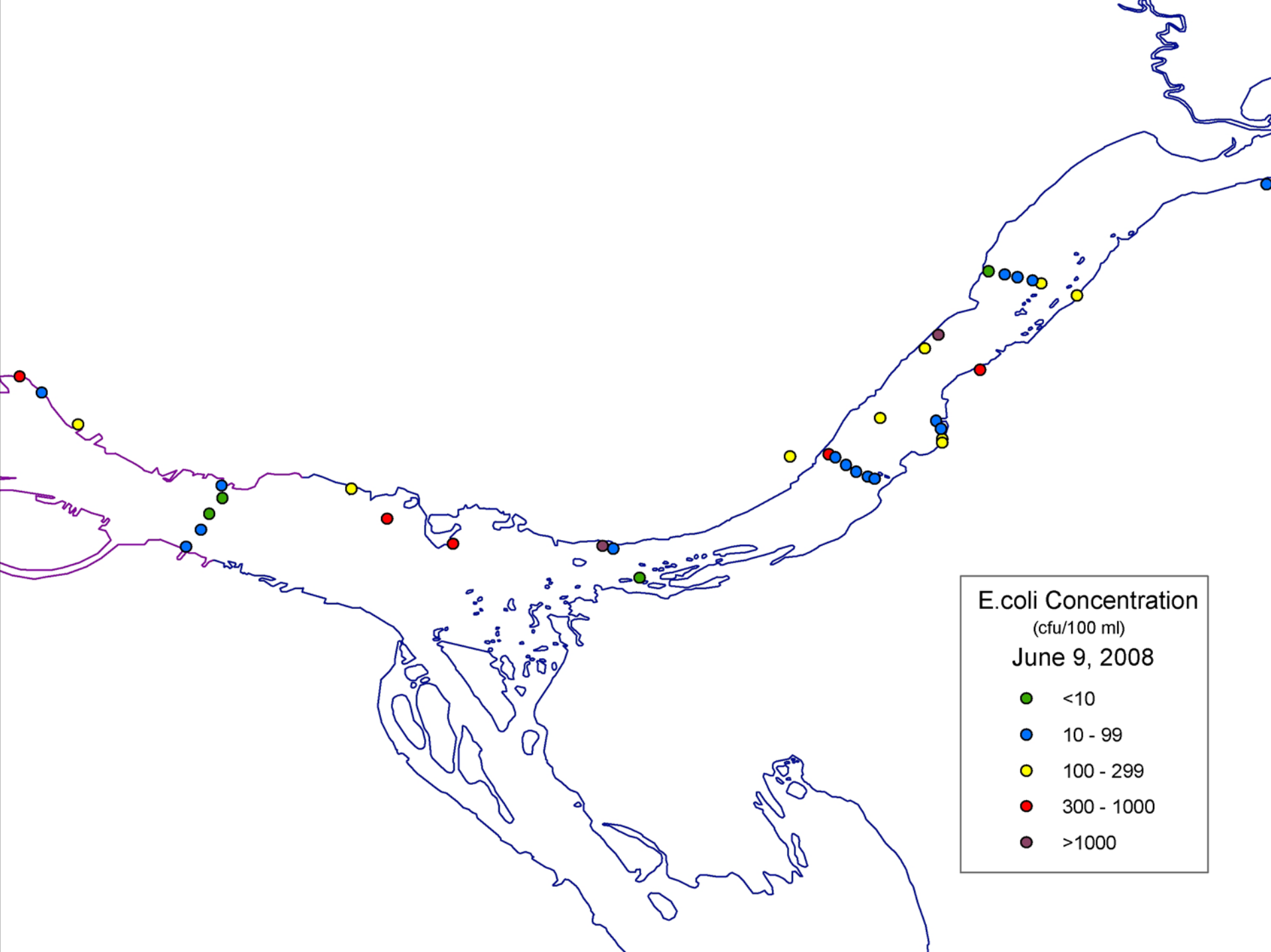
| Agency | Sample Year | Sample Date (mm/dd/yy) | Sample Description/ID | Longitudes (DD.ddddd) | Latitudes (DD.ddddd) | E.coli (cfu/100ml) | Geometric Mean (3 E.coli samples collected per site) |
|---|---|---|---|---|---|---|---|
| Sault Tribe | 2008 | 8/27/2008 | Sugar Island Township Park T5/1 | -84.23761 | 46.52620 | <10 | |
| Sault Tribe | 2008 | 8/27/2008 | Sugar Island Township Park T5/2 | -84.23761 | 46.52620 | <10 | |
| Sault Tribe | 2008 | 8/27/2008 | Sugar Island Township Park T5/3 | -84.23761 | 46.52620 | <10 | |
| Sault Tribe | 2008 | 8/27/2008 | Field Blank | | | <10 | |
| | | | | | | | |
| Sault Tribe | 2008 | 9/3/2008 | Sugar Shack Lagoons T1 | -84.27581 | 46.49257 | <10 | |
| Sault Tribe | 2008 | 9/3/2008 | D/S East End WWTP (Old) T1/1 | -84.25008 | 46.50341 | <10 | |
| Sault Tribe | 2008 | 9/3/2008 | D/S East End WWTP (Old) T1/2 | -84.25008 | 46.50341 | 30 | |
| Sault Tribe | 2008 | 9/3/2008 | D/S East End WWTP (Old) T1/3 | -84.25008 | 46.50341 | 10 | |
| Sault Tribe | 2008 | 9/3/2008 | D/S East End WWTP (Old) T2 | -84.25081 | 46.50367 | <10 | |
| Sault Tribe | 2008 | 9/3/2008 | D/S East End WWTP (Old) T3 | -84.25206 | 46.50423 | 10 | |
| Sault Tribe | 2008 | 9/3/2008 | D/S East End WWTP (Old) T4 | -84.25320 | 46.50495 | <10 | |
| Sault Tribe | 2008 | 9/3/2008 | D/S East End WWTP (Old) T5 | -84.25435 | 46.50582 | 20 | |
| Sault Tribe | 2008 | 9/3/2008 | D/S Edison Sault Electric T1 | -84.32547 | 46.49599 | 10 | |
| Sault Tribe | 2008 | 9/3/2008 | D/S Edison Sault Electric T2 | -84.32381 | 46.49786 | <10 | |
| Sault Tribe | 2008 | 9/3/2008 | D/S Edison Sault Electric T3 | -84.32291 | 46.49963 | <10 | |
| Sault Tribe | 2008 | 9/3/2008 | D/S Edison Sault Electric T4 | -84.32147 | 46.50134 | <10 | |
| Sault Tribe | 2008 | 9/3/2008 | D/S Edison Sault Electric T5 | -84.32156 | 46.50267 | <10 | |
| Sault Tribe | 2008 | 9/3/2008 | D/S Queen Street Outfall T1 | -84.27868 | 46.49579 | 10 | |
| Sault Tribe | 2008 | 9/3/2008 | East End WWTP Diffuser Pipe T1 | -84.24947 | 46.51007 | 20 | |
| Sault Tribe | 2008 | 9/3/2008 | Sugar Island Township Park T1 | -84.23184 | 46.52481 | 60 | |
| Sault Tribe | 2008 | 9/3/2008 | Sugar Island Township Park T2 | -84.23278 | 46.52517 | 20 | |
| Sault Tribe | 2008 | 9/3/2008 | Sugar Island Township Park T3 | -84.23444 | 46.52552 | 20 | |
| Sault Tribe | 2008 | 9/3/2008 | Sugar Island Township Park T4 | -84.23581 | 46.52580 | 10 | |
| Sault Tribe | 2008 | 9/3/2008 | Sugar Island Township Park T5 | -84.23761 | 46.52620 | 20 | |
| Sault Tribe | 2008 | 9/3/2008 | Field Blank | | | <10 | |

# Appendix E

2008 Data Maps


E.coli Sampling Sites
Algoma Public Health
Chippewa County Health
MOEE
Sault Tribe


E.coli Concentration
(cfu/100 ml)
June 4, 2008
<10
10 - 99
100 - 299
300 - 1000
>1000


E.coli Concentration
(cfu/100 ml)
June 9, 2008
<10
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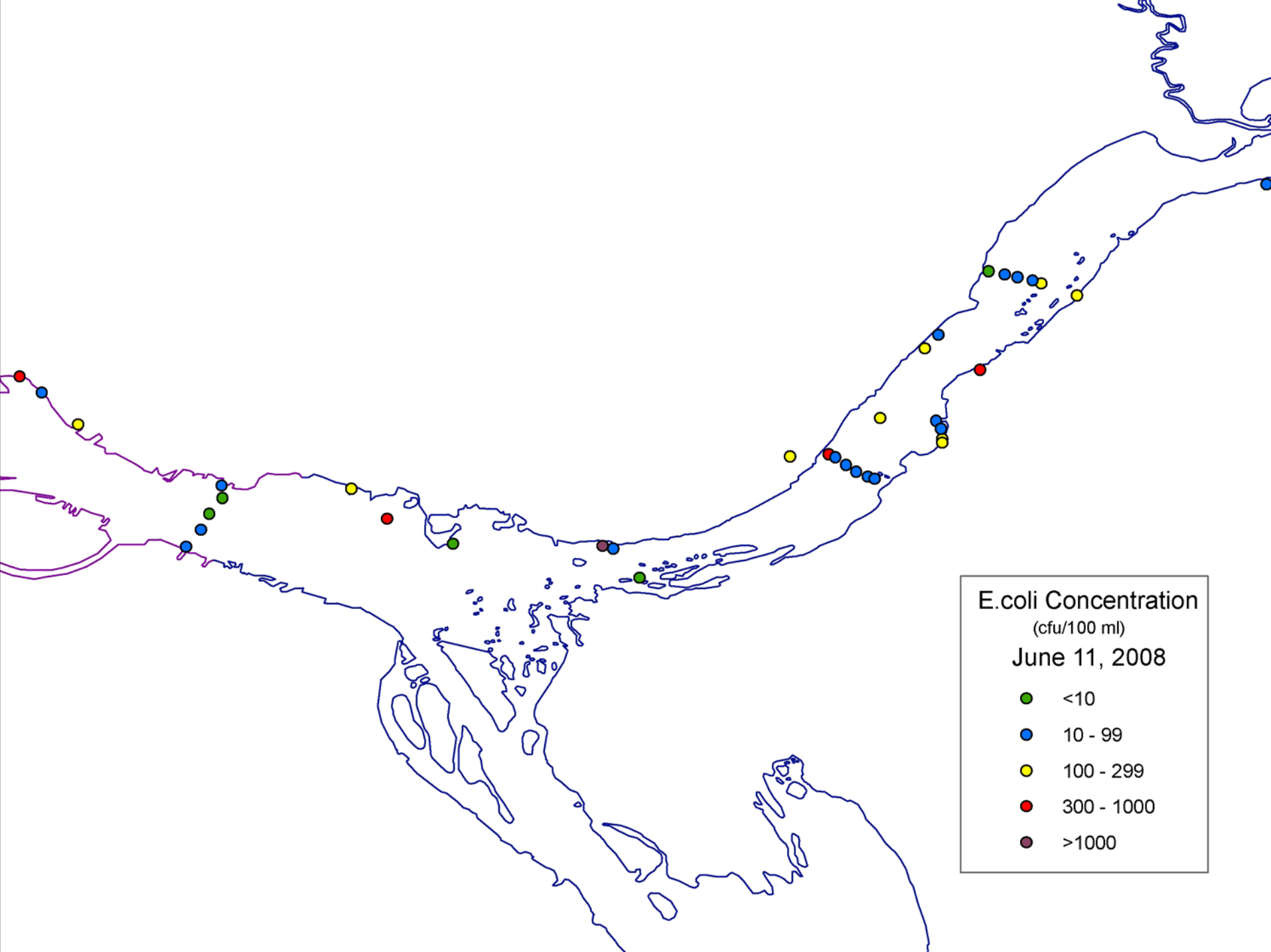
100 - 299
300 - 1000
>1000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(cfu/100 ml)
June 11, 2008
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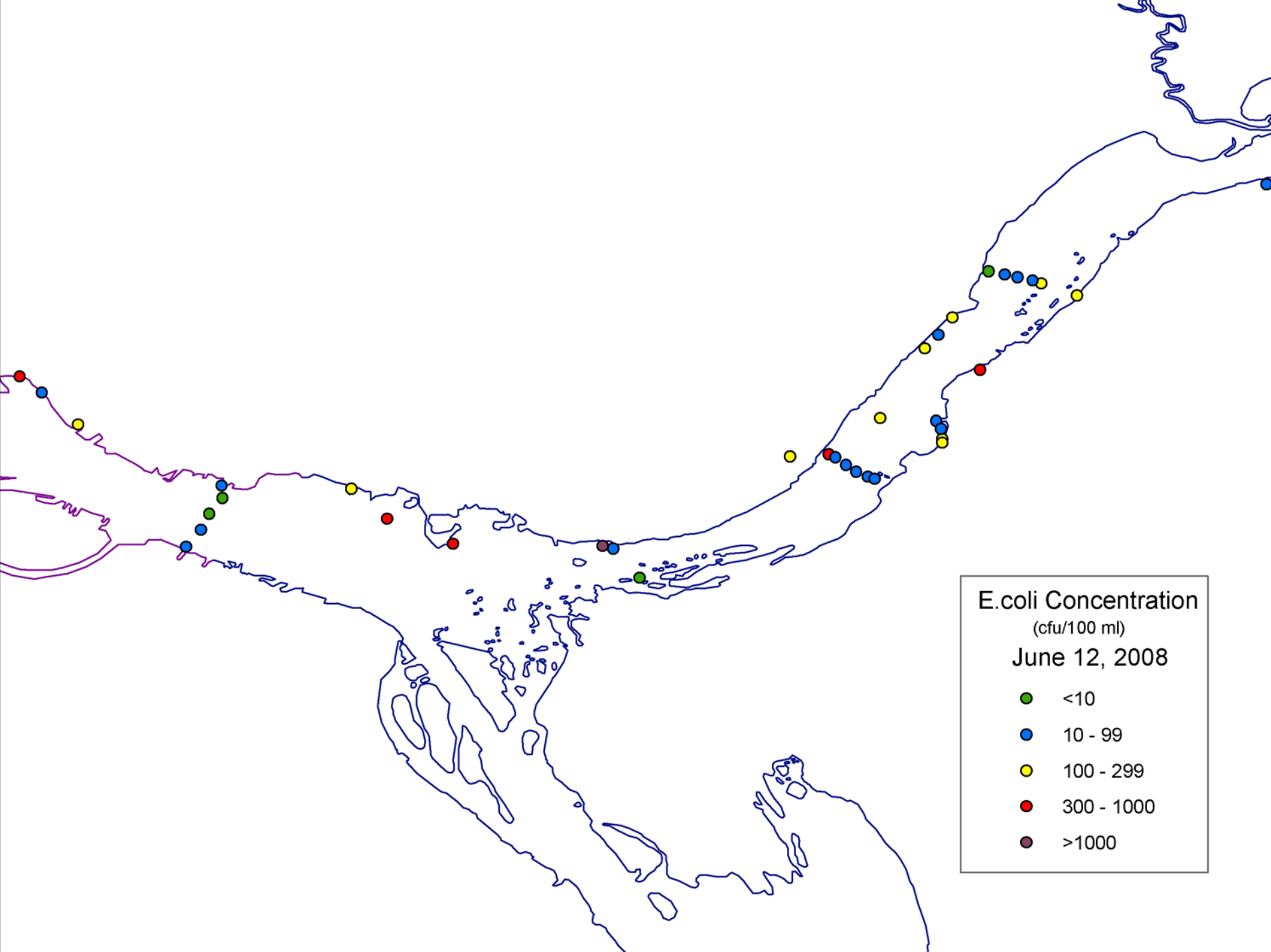
100 - 299
300 - 1000
>1000


E.coli Concentration
(cfu/100 ml)
June 12, 2008
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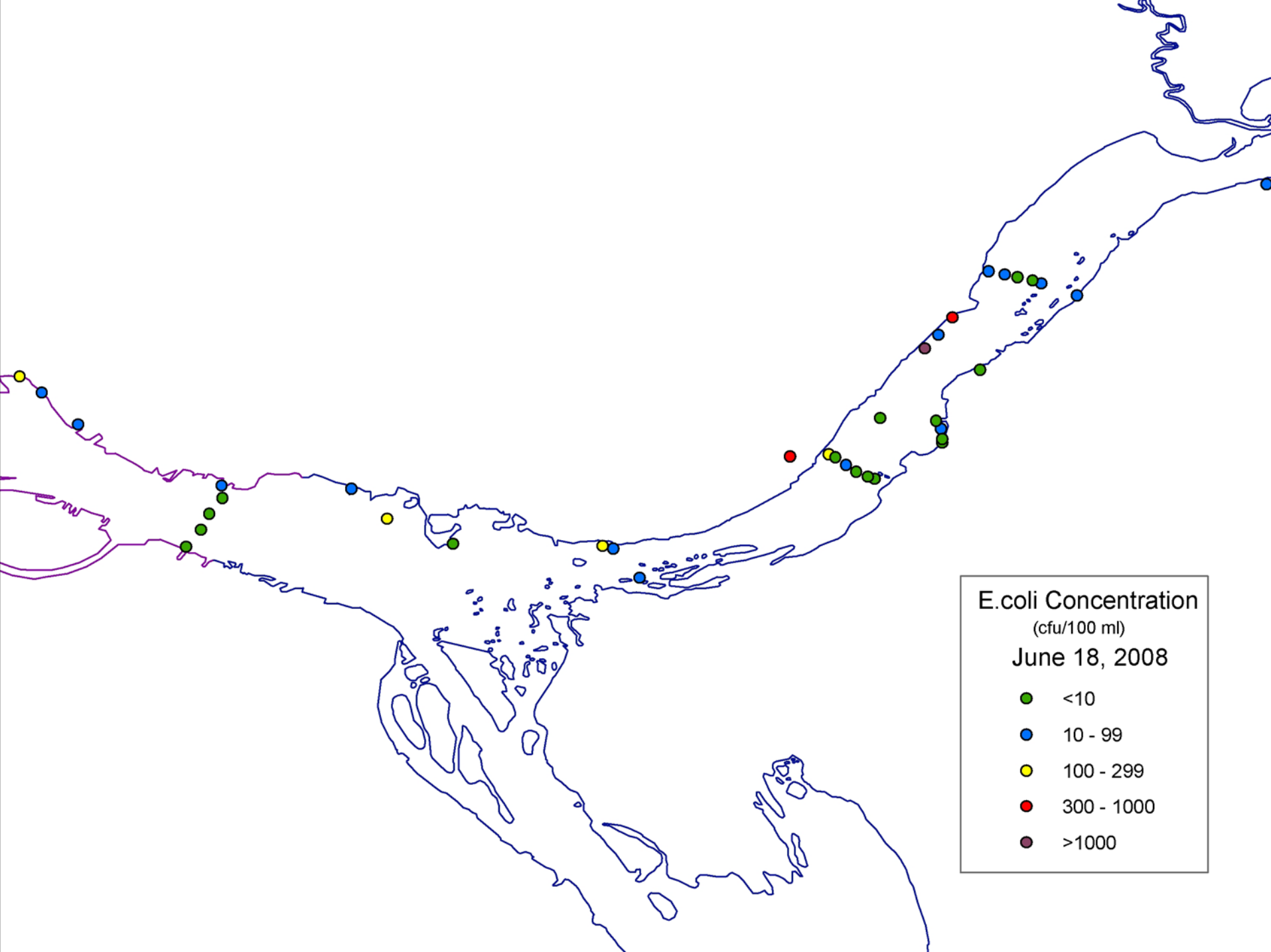
100 - 299
300 - 1000
>1000


E.coli Concentration
(cfu/100 ml)
June 18, 2008
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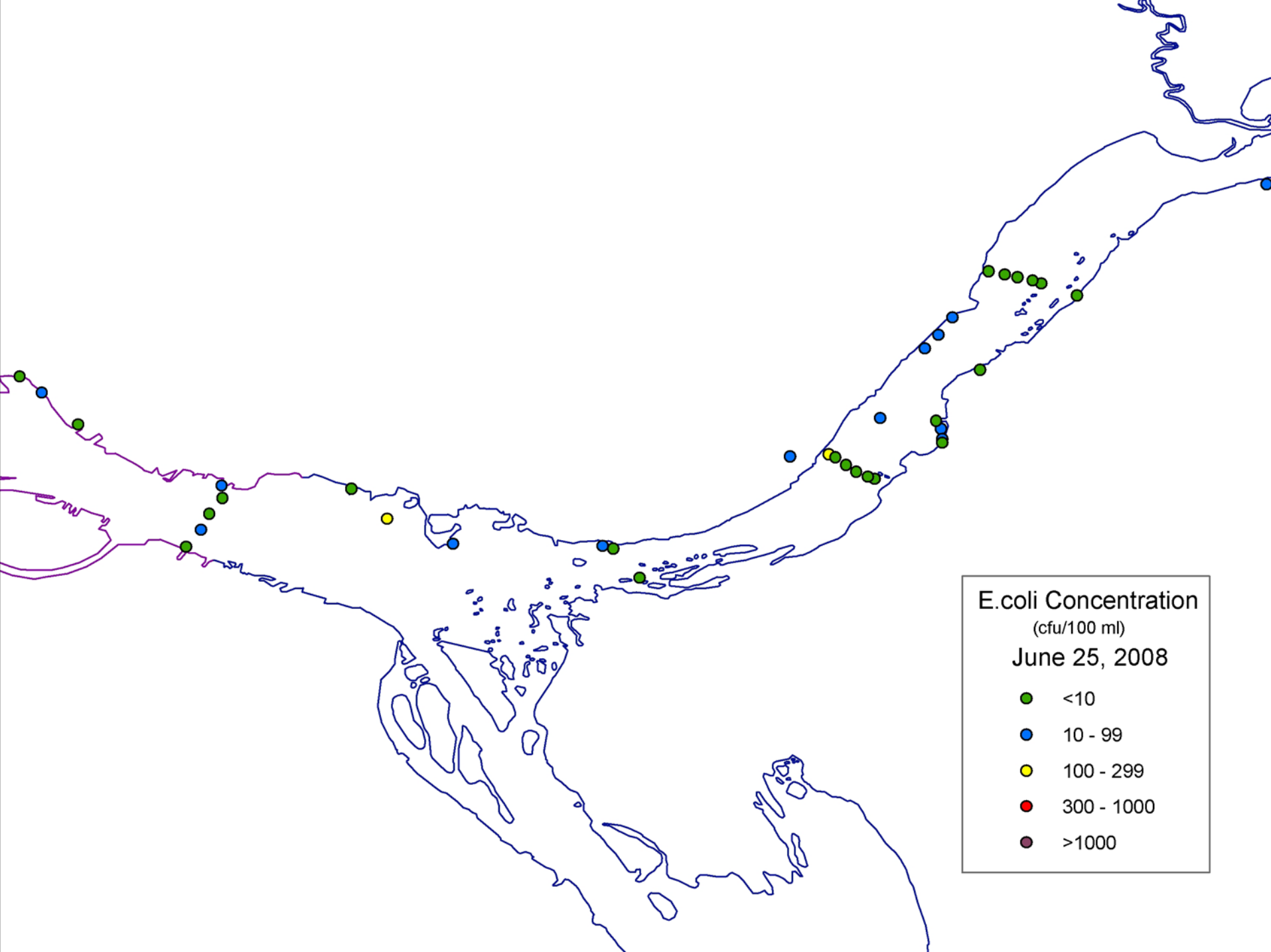
100 - 299
300 - 1000
>1000


E.coli Concentration
(cfu/100 ml)
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300 - 1000
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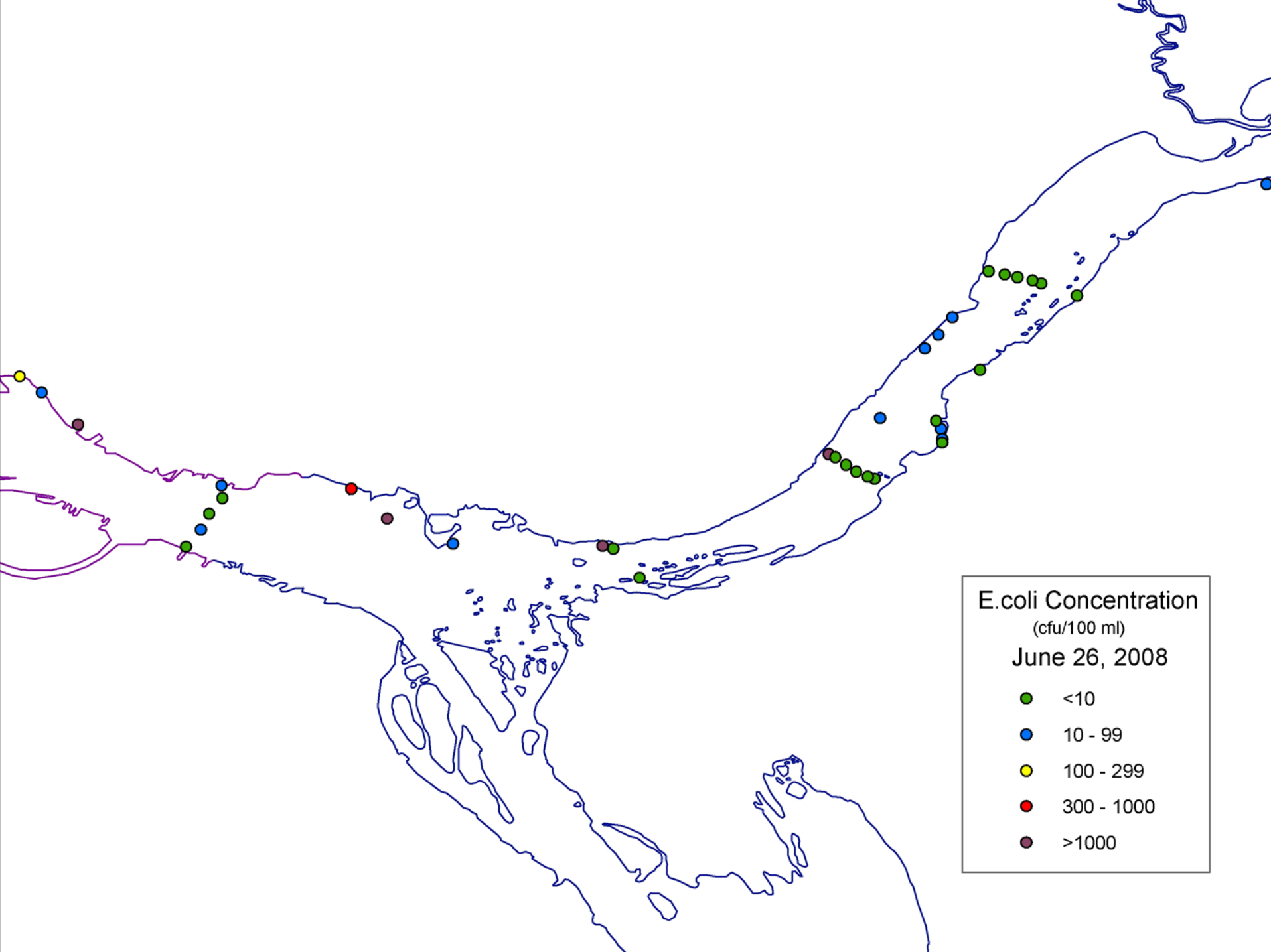
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(cfu/100 ml)
June 26, 2008
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300 - 1000
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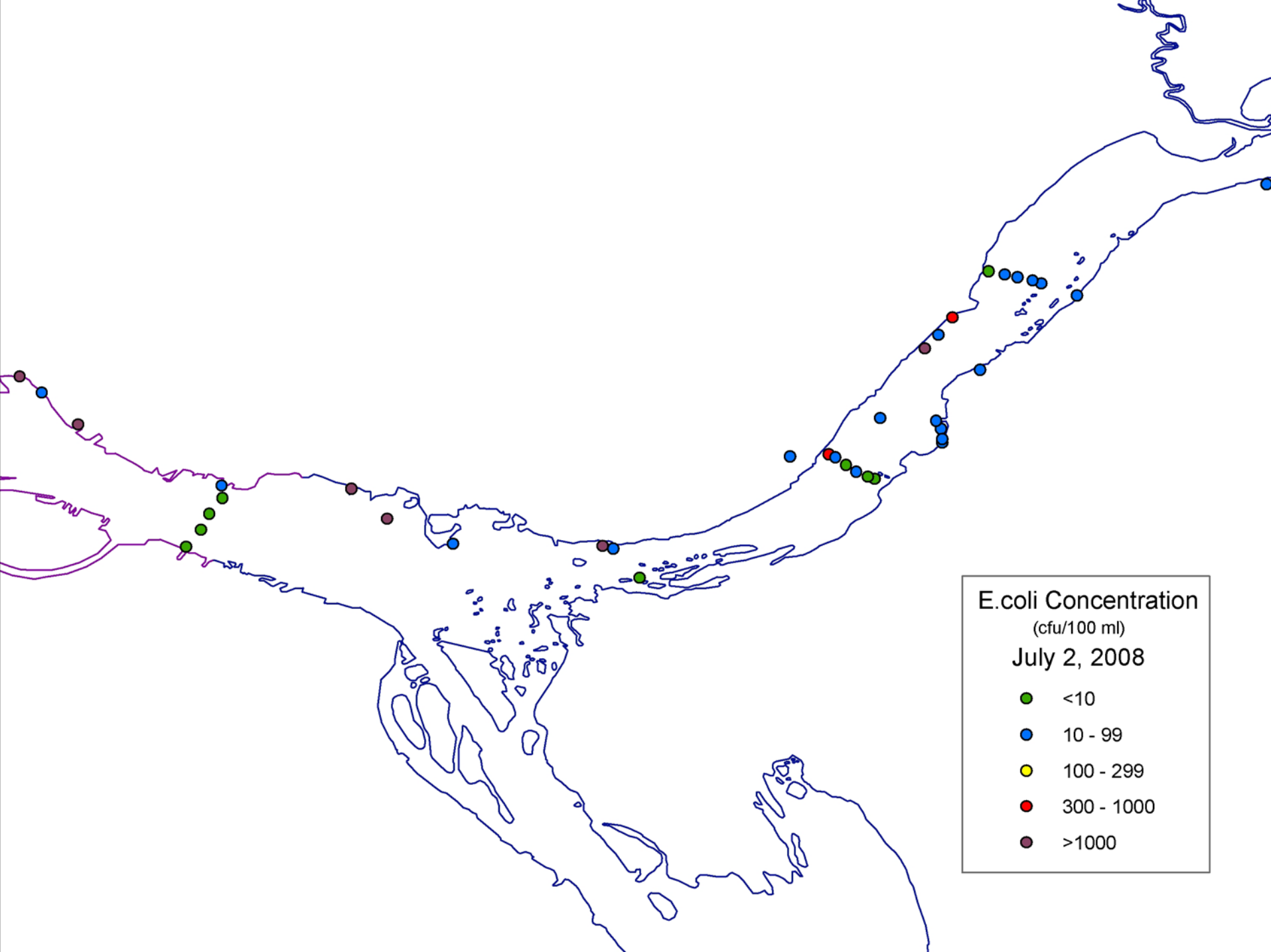
E.coli Concentration
(cfu/100 ml)
July 2, 2008
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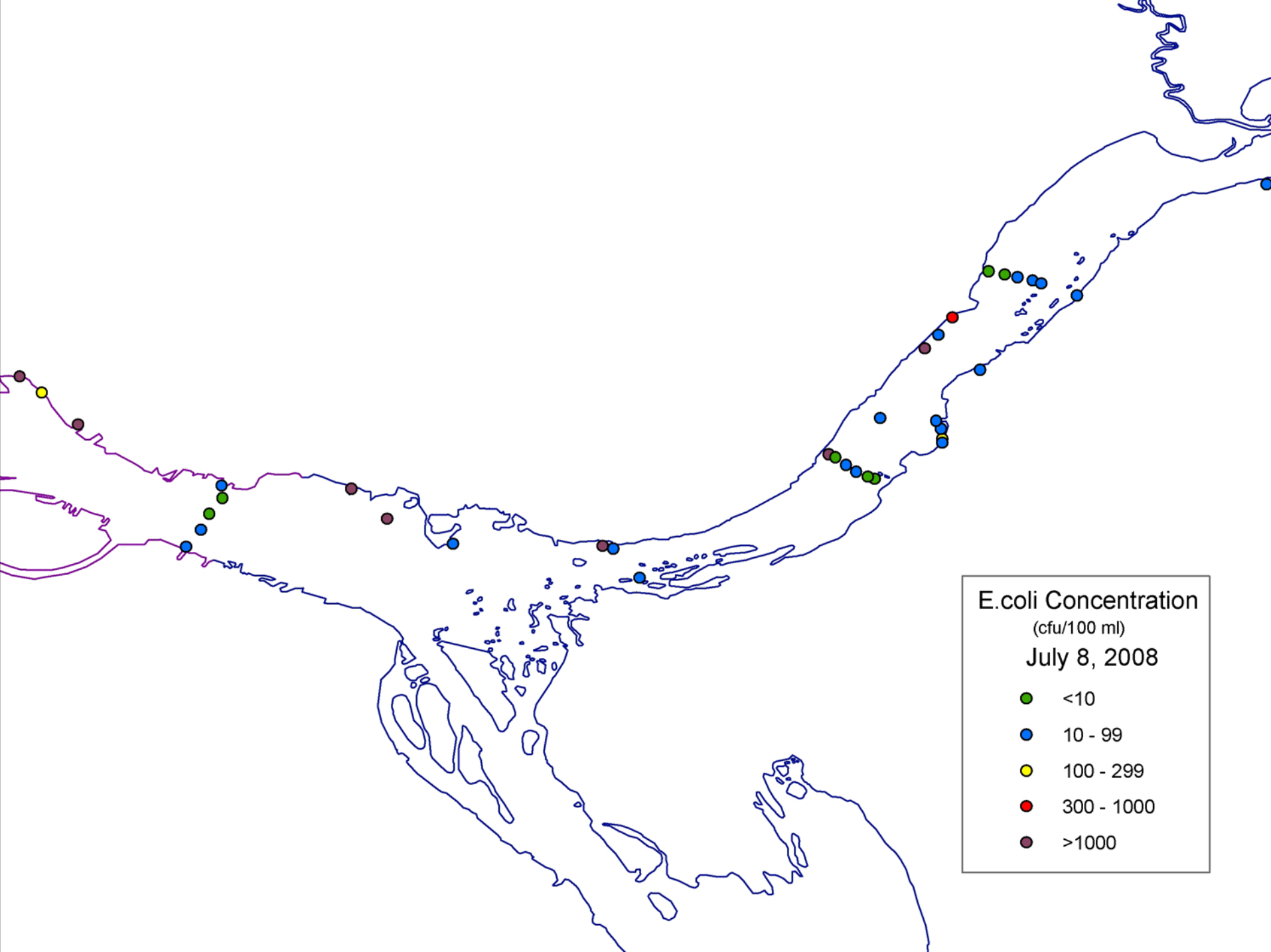
100 - 299
300 - 1000
>1000


E.coli Concentration
(cfu/100 ml)
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100 - 299
300 - 1000
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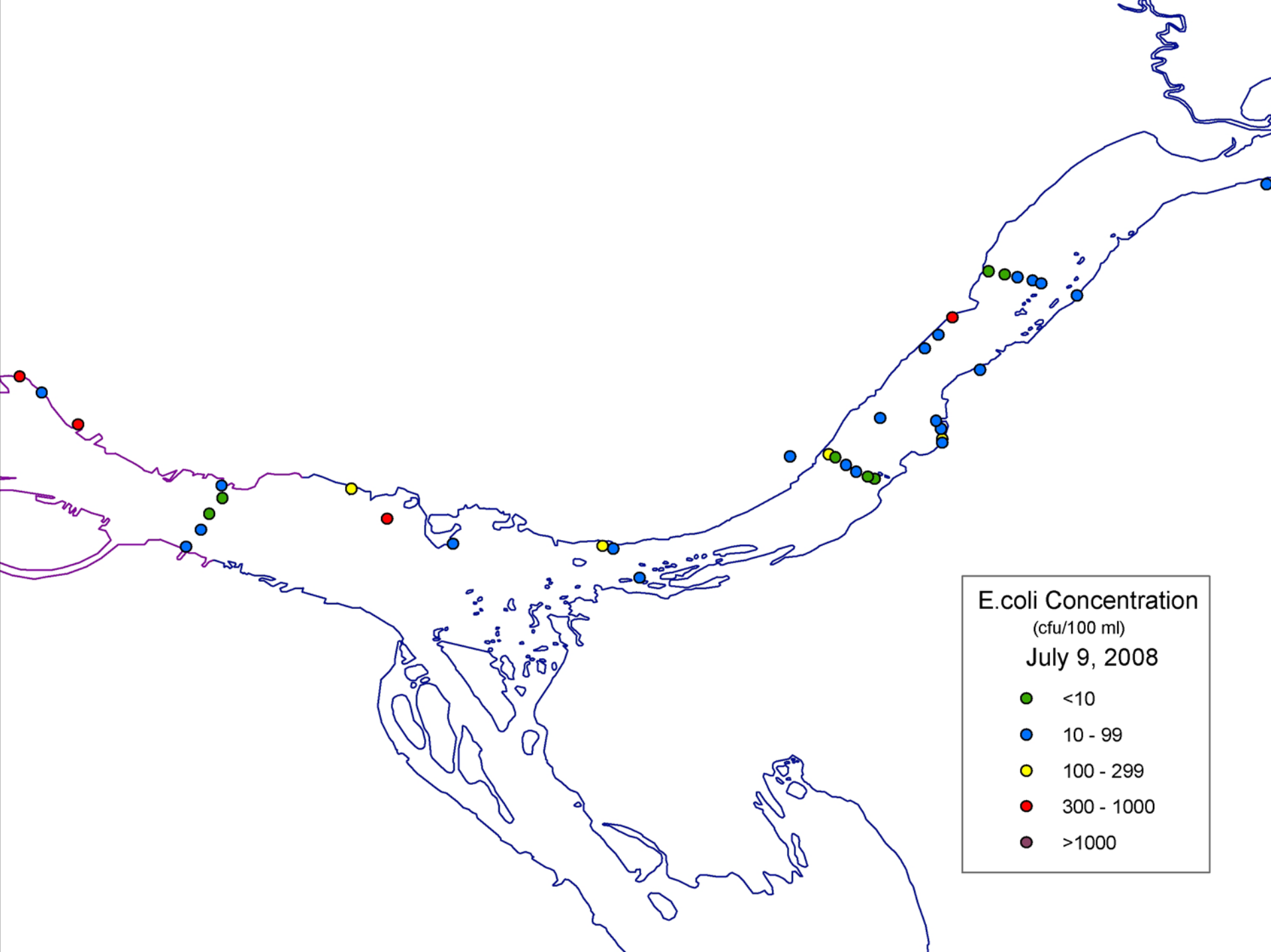
E.coli Concentration
(cfu/100 ml)
July 9, 2008
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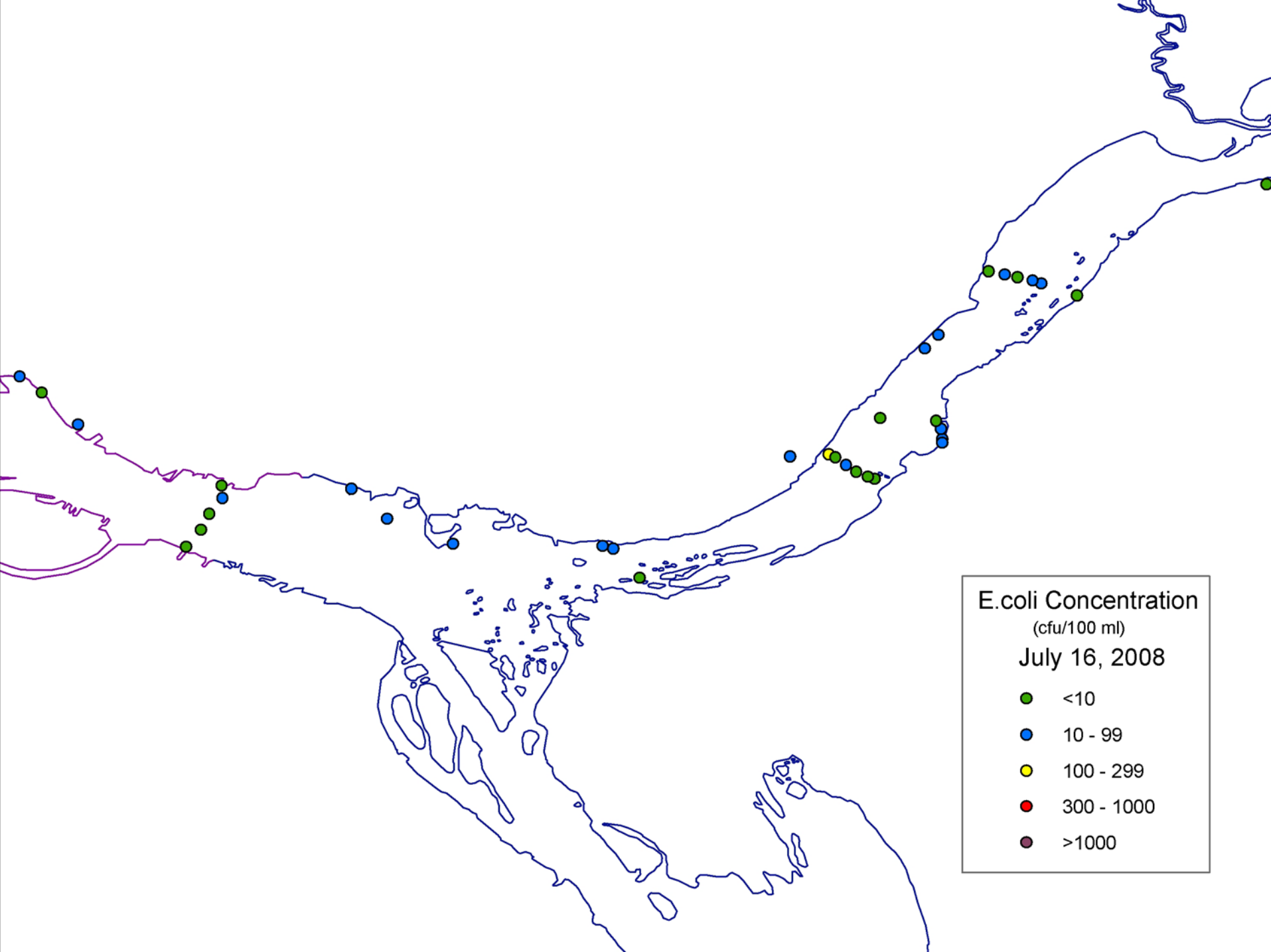
100 - 299
300 - 1000
>1000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(cfu/100 ml)
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300 - 1000
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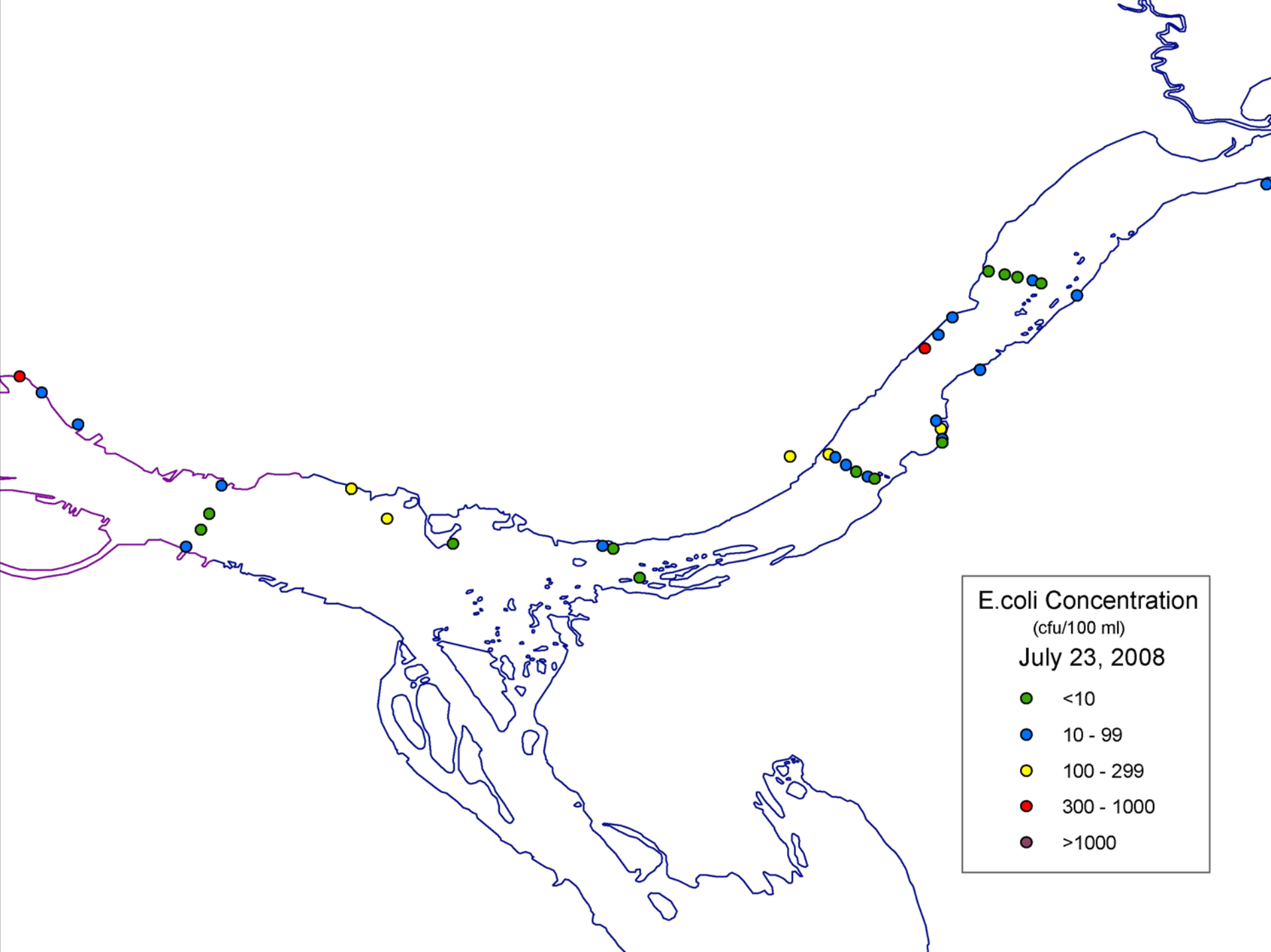
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(cfu/100 ml)
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300 - 1000
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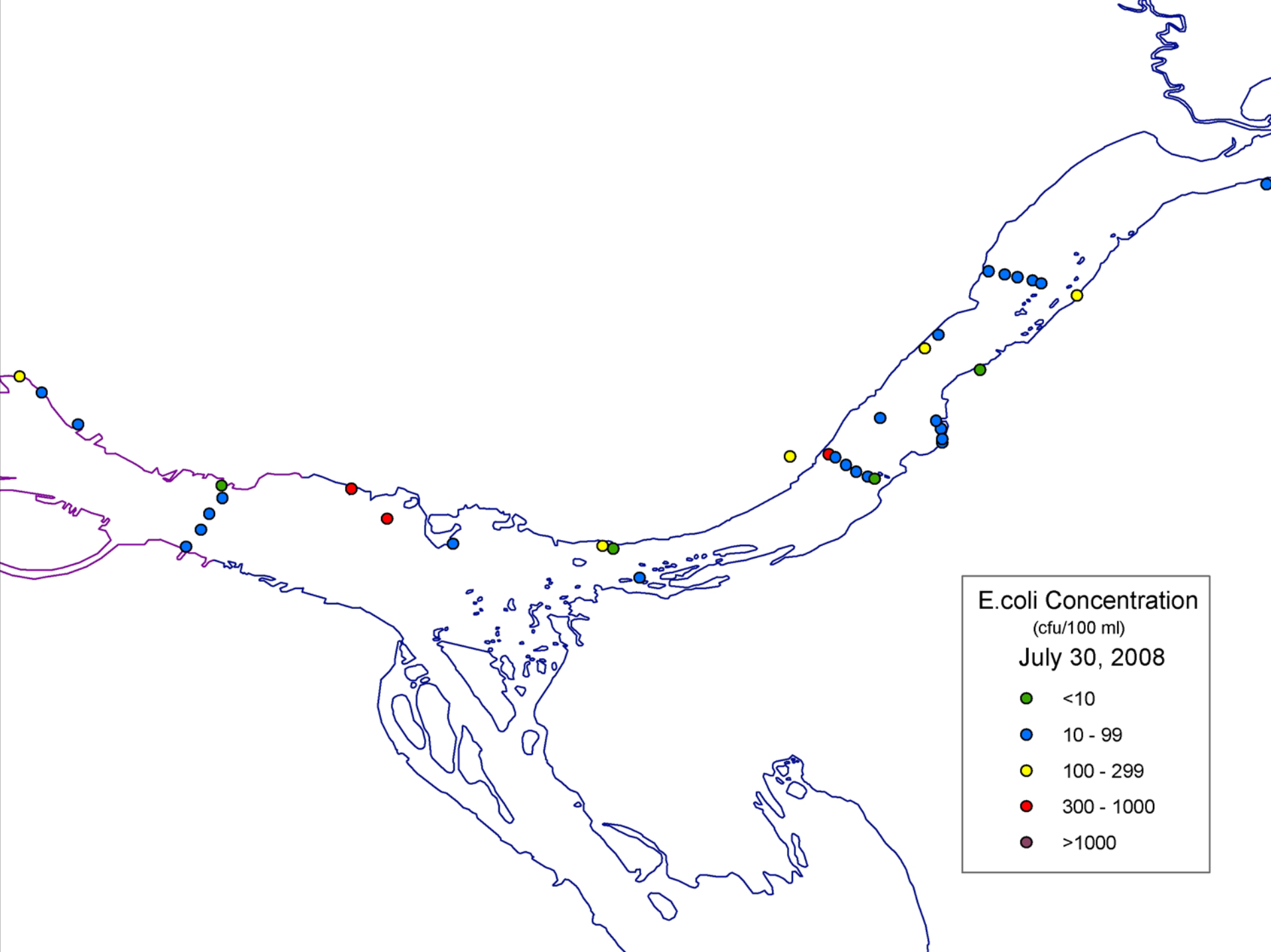
E.coli Concentration
(cfu/100 ml)
July 30, 2008
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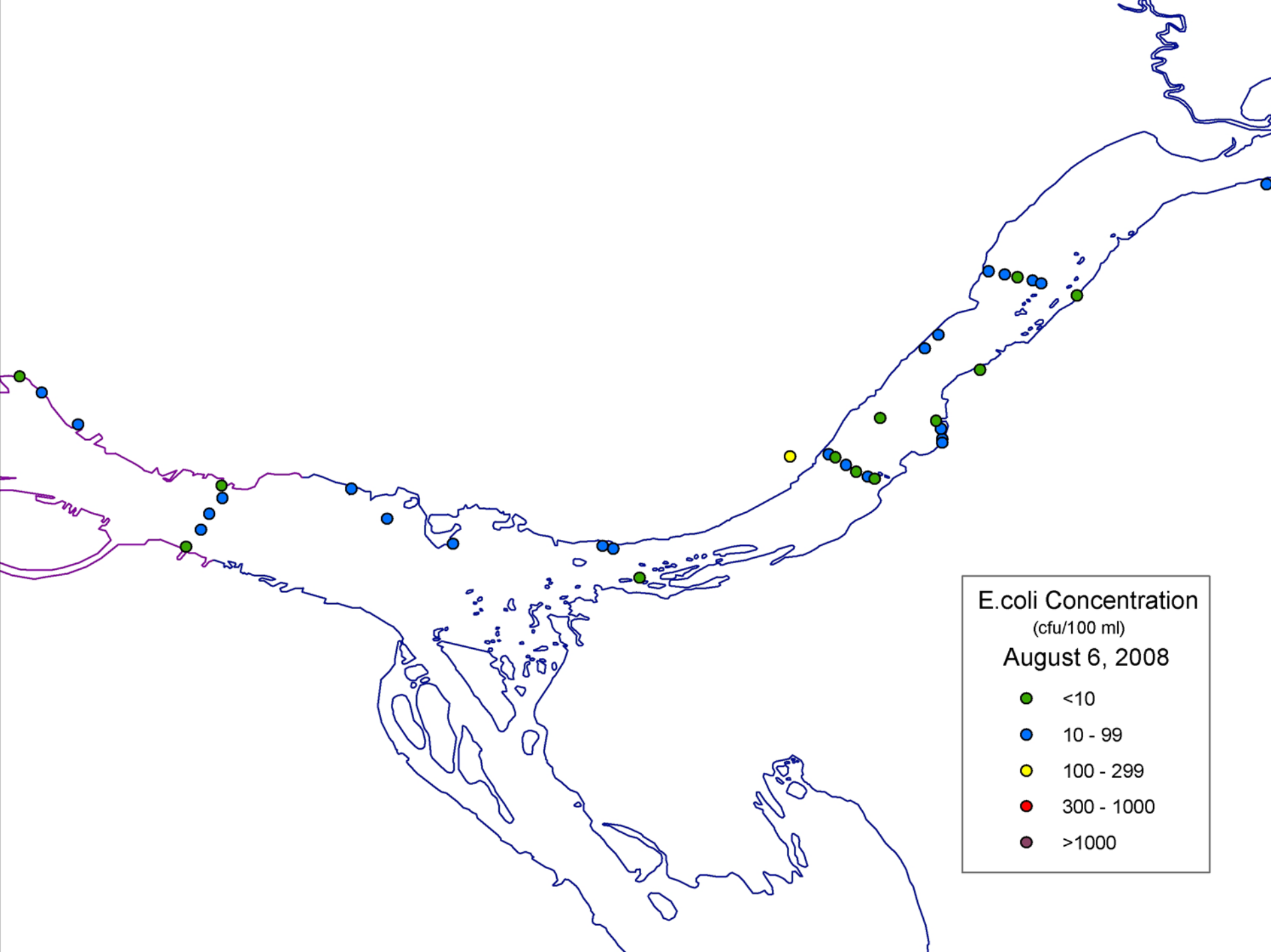
100 - 299
300 - 1000
>1000


E.coli Concentration
(cfu/100 ml)
August 6, 2008
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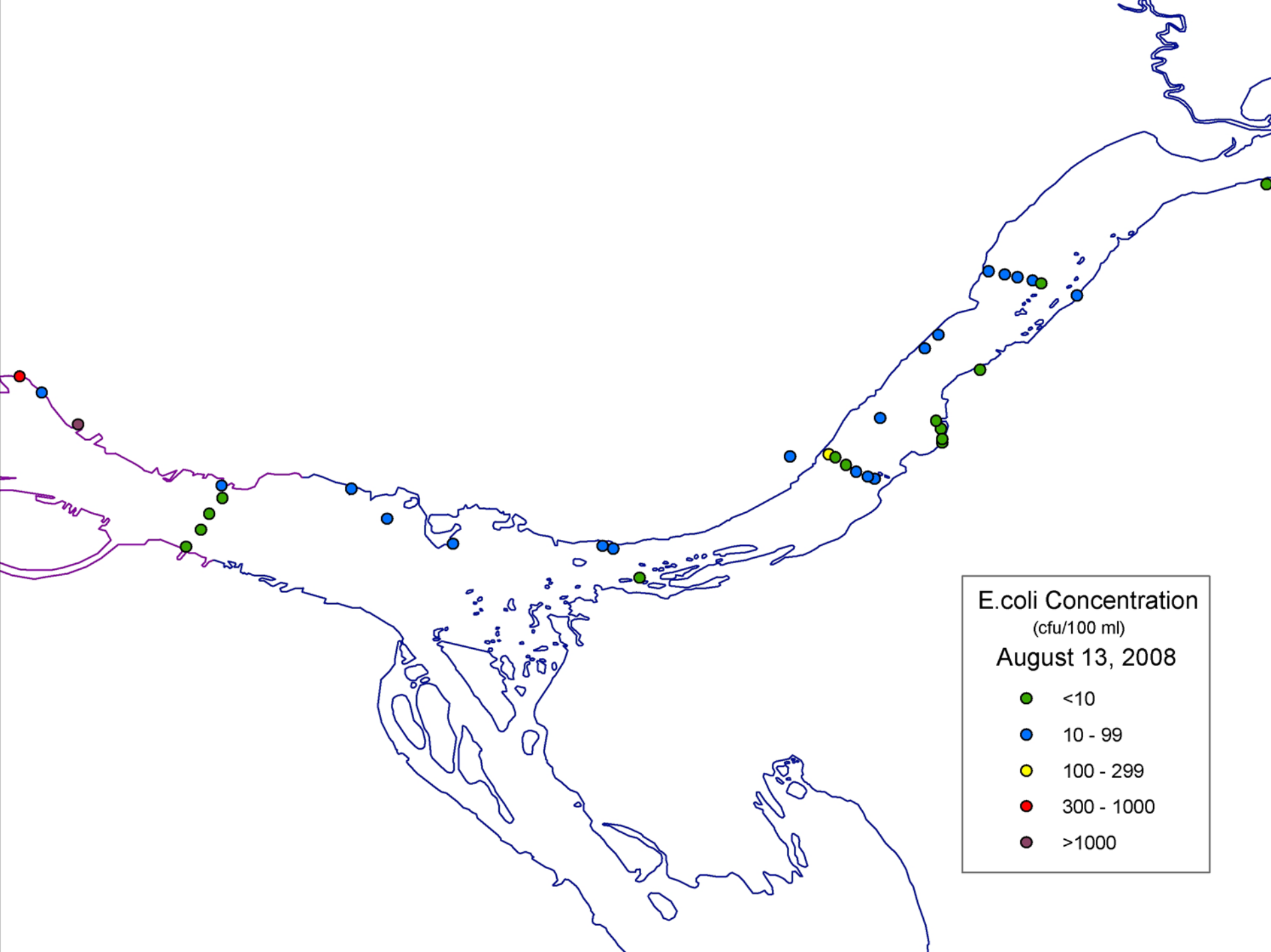
100 - 299
300 - 1000
>1000


E.coli Concentration
(cfu/100 ml)
August 13, 2008
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300 - 1000
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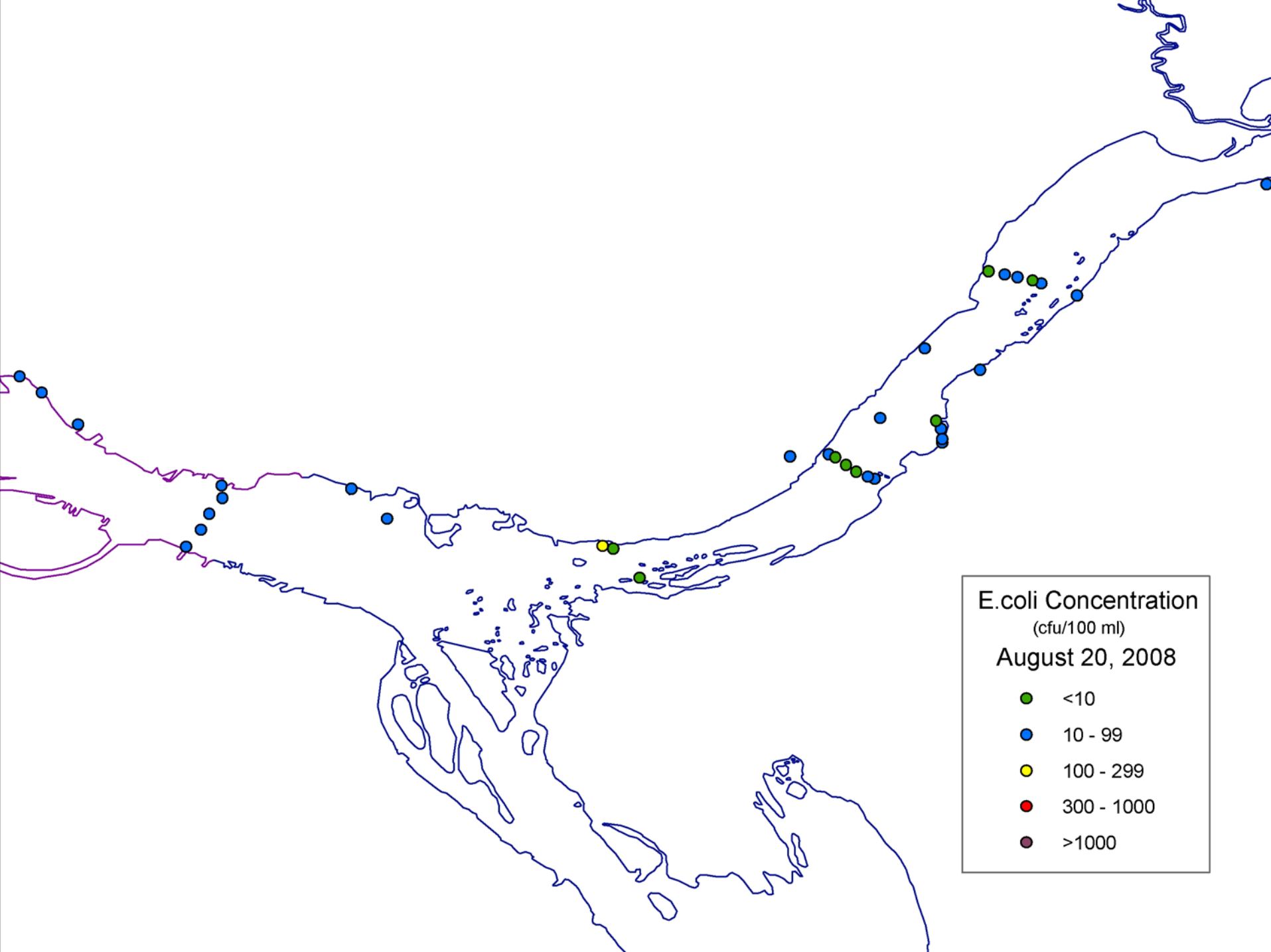
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(cfu/100 ml)
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300 - 1000
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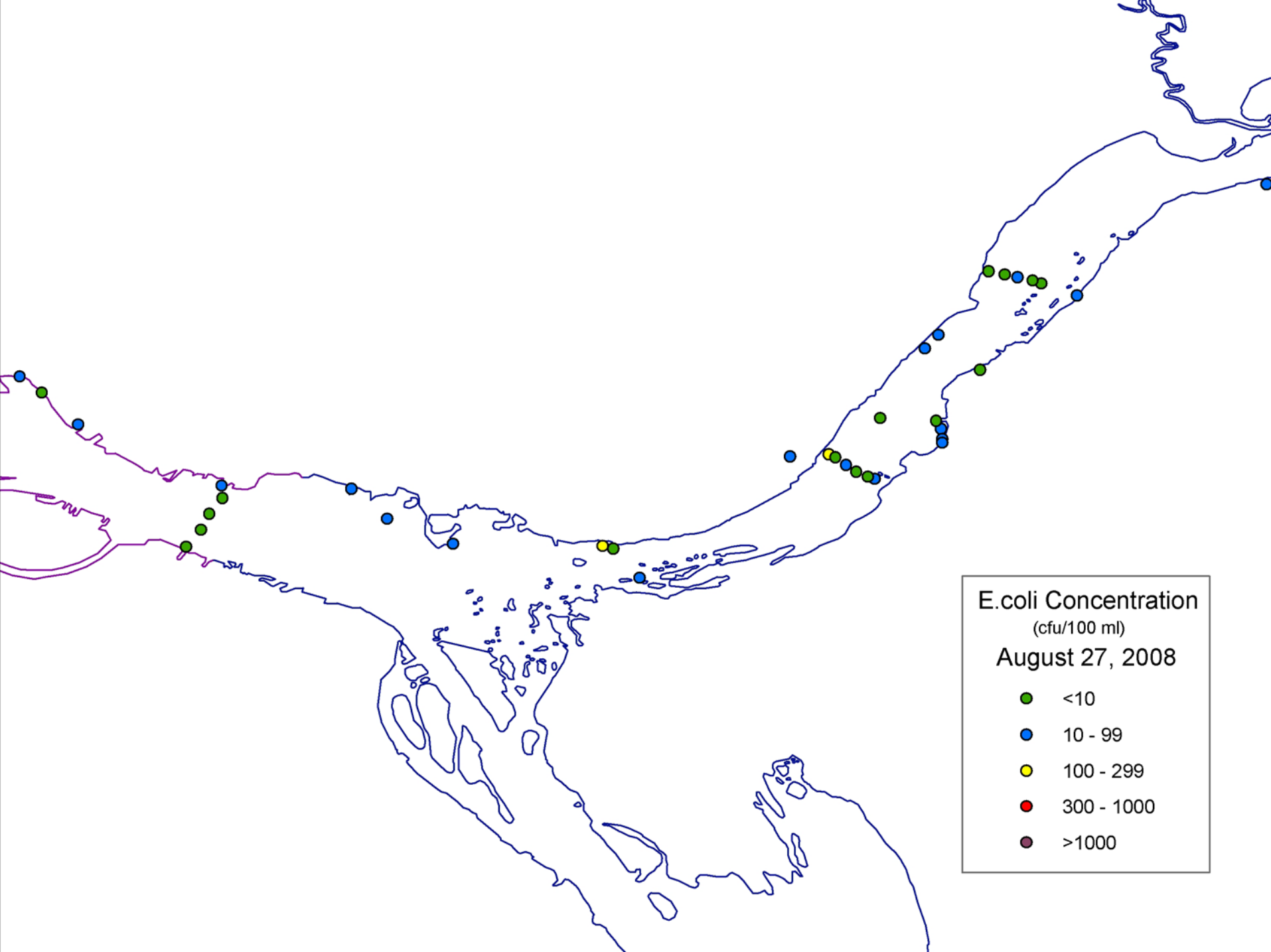
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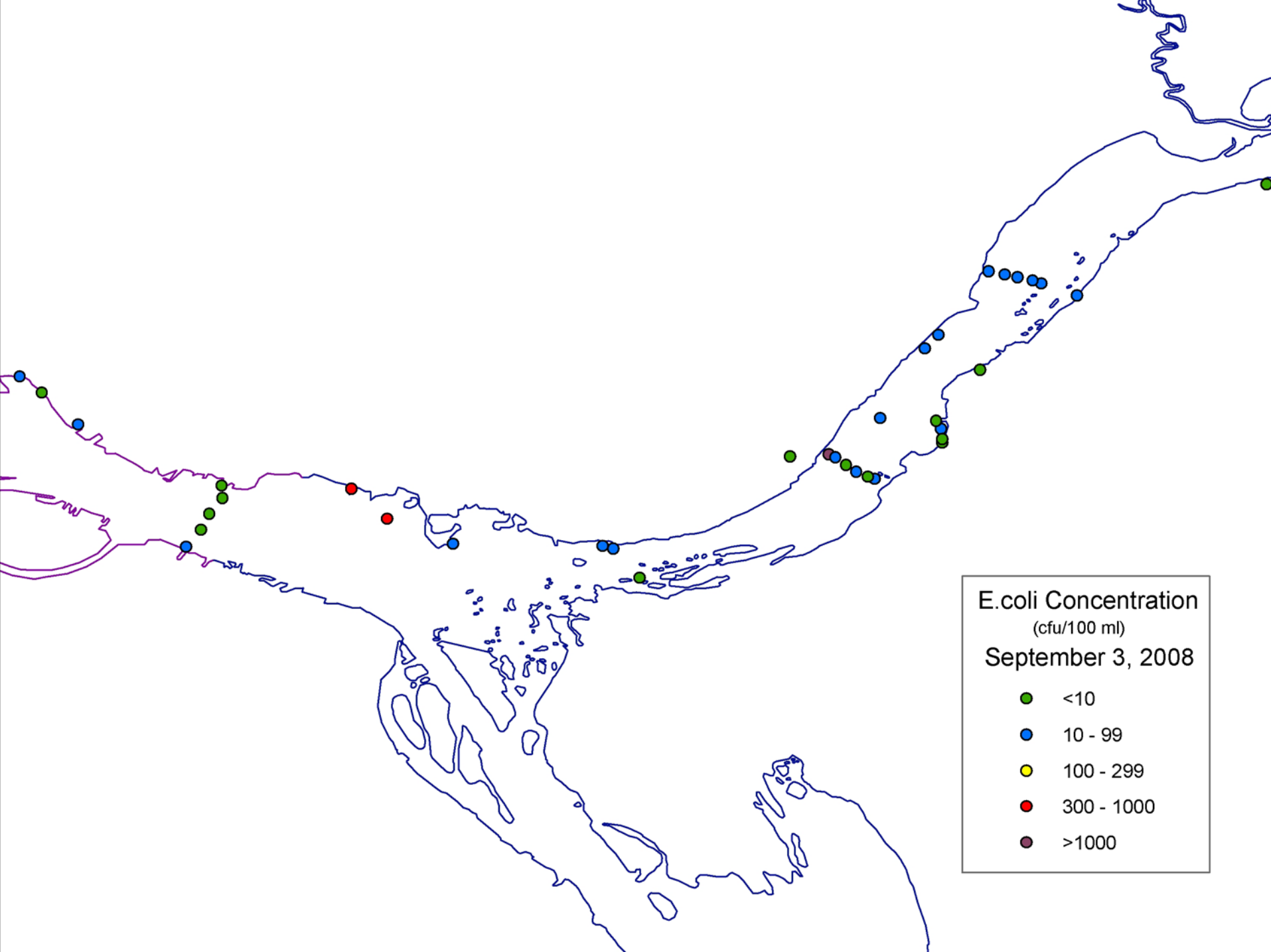
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(cfu/100 ml)
September 3, 2008
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300 - 1000
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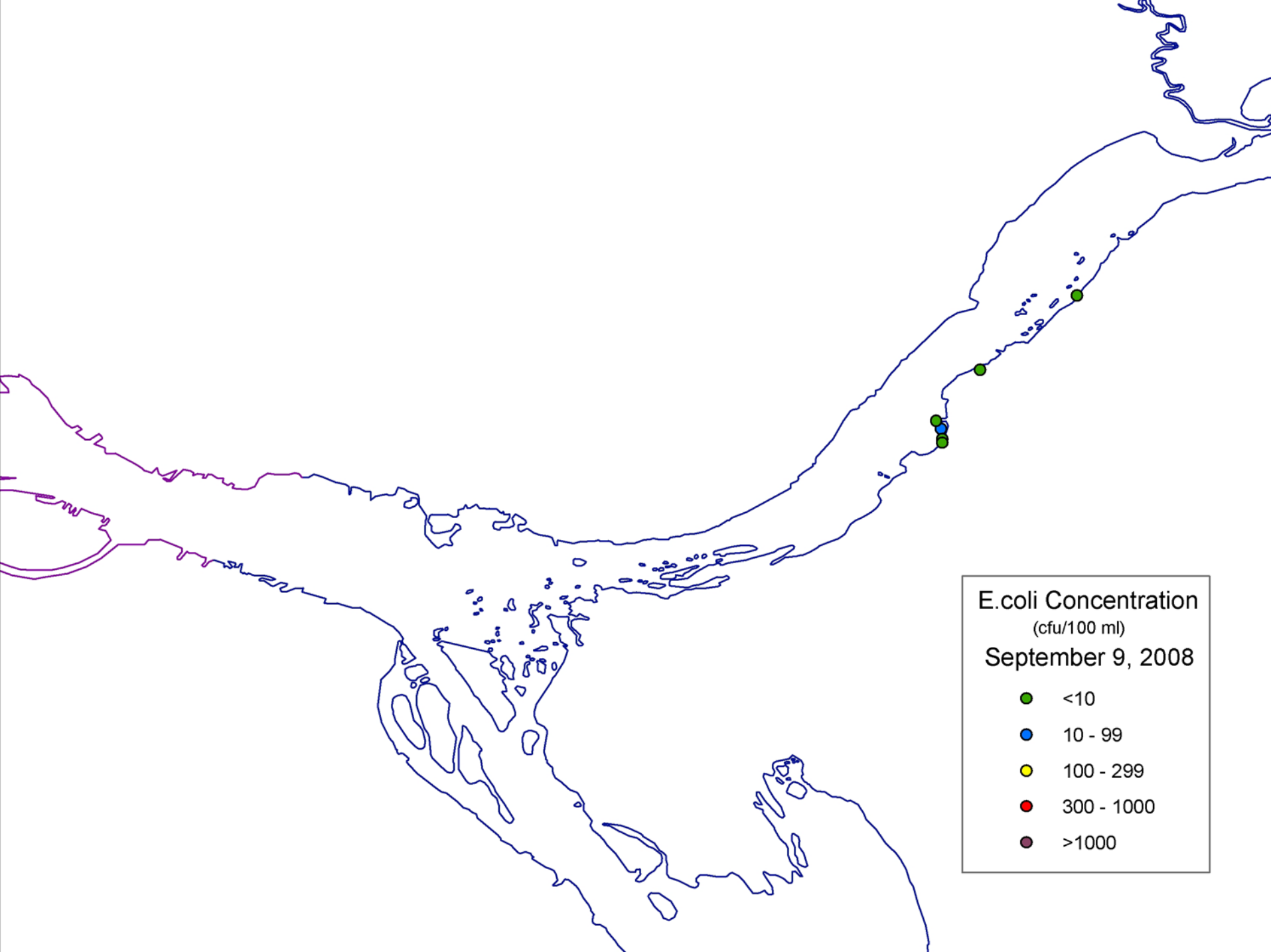
E.coli Concentration
(cfu/100 ml)
September 9, 2008
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100 - 299
300 - 1000
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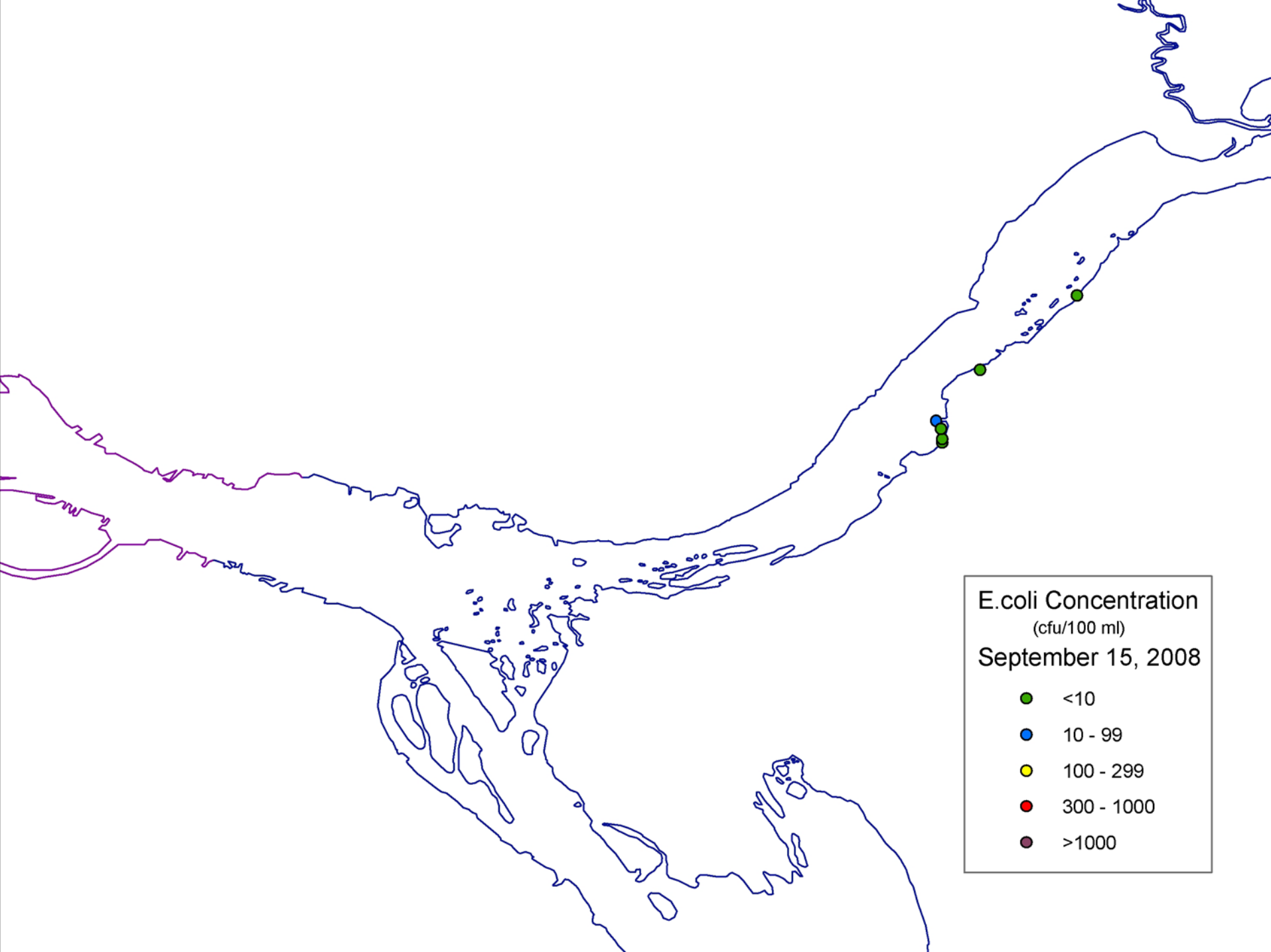
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300 - 1000
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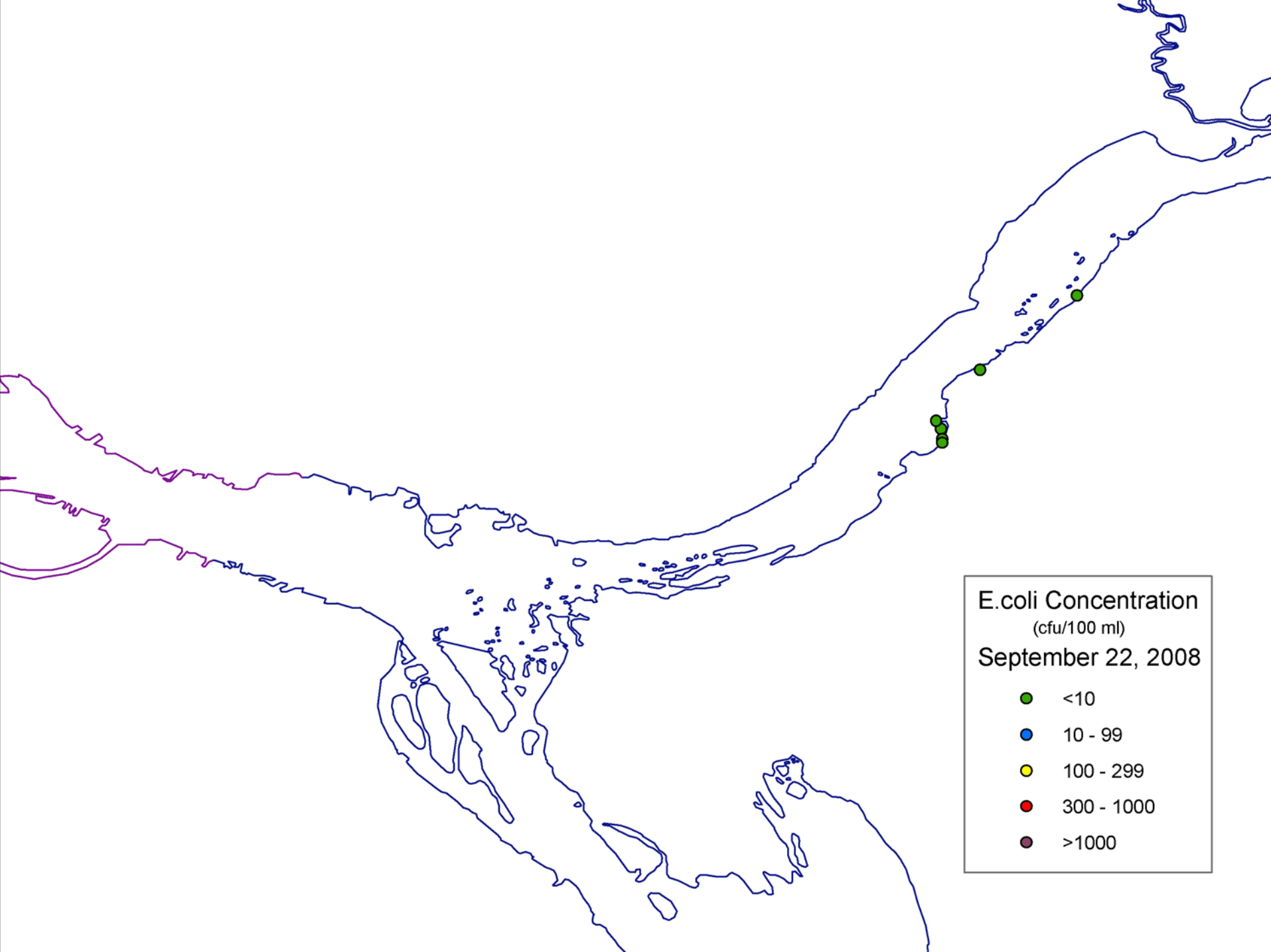
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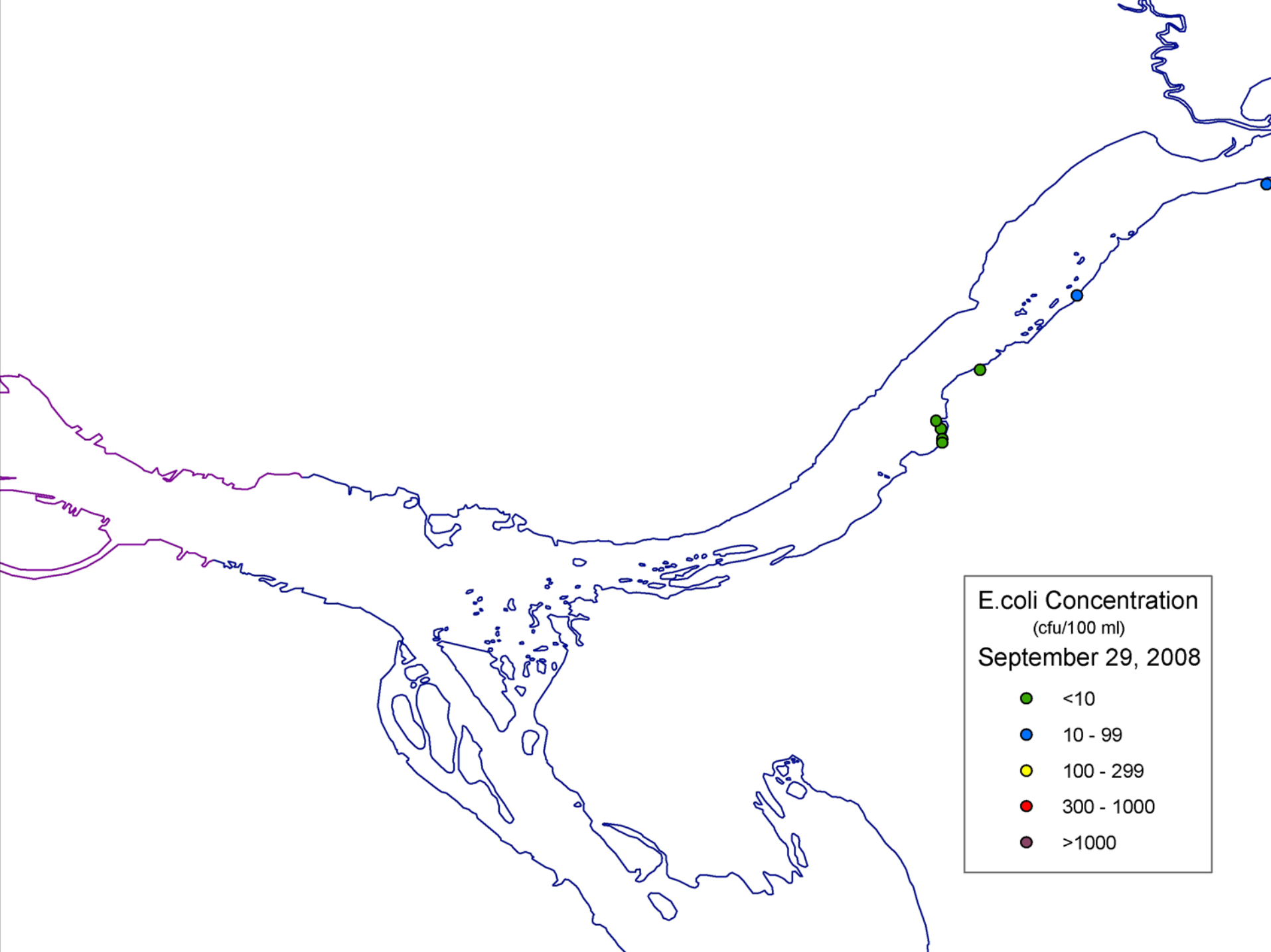
100 - 299
300 - 1000
>1000


E.coli Concentration
(cfu/100 ml)
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100 - 299
300 - 1000
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