Appendix 2. QAPP for Sanitary Survey Project

Wisconsin Great Lakes GLNPO Sanitary Survey Quality Assurance Project Plan

January 01, 2010 to December 31, 2012

2010

University of Wisconsin – Oshkosh
Oshkosh, WI 54901

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TABLE OF CONTENTS

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EXECUTIVE SUMMARY

Wisconsin recreational waters are vital to our individual well-being and our local and state economies. Lake Michigan and Lake Superior have afforded the state of Wisconsin valuable natural resources for aquatic recreational activities. It is important to provide safe and healthy aquatic recreational activities to the public for both social and economic reasons.

This is a Quality Assurance Project Plan for the Beach Sanitary Surveys for Wisconsin's Great Lakes. Water quality standards staff, along with UW-Oshkosh staff and local health departments, has developed a procedure to conduct sanitary surveys on public beaches on Lake Michigan and Lake Superior coastlines based on the Sanitary Survey form and procedures developed during pilot testing by the U.S. EPA. This program supports beach sanitary surveys on impaired beaches within all of Wisconsin's coastal counties. Sanitary surveys may help identify sources of microbial pollution which may help with control of these sources and result in improved water quality. The goal of this project is to accurately characterize beaches with impaired water quality (as defined by Wisconsin's 303d list) on Lake Michigan and Superior in terms of the source of microbial pollution entering the beach area. This project will provide a basis for each of the communities participating in this study to begin to develop recommendations on addressing the causes of microbial contamination at their beaches.

A. PROGRAM ORGANIZATION

The Beach Sanitary Surveys will be supported by partners in all local municipalities where the selected beaches are housed.

Greg Kleinheinz and Julie Kinzelman will serve as the Supervisors responsible for oversight and evaluation activities to ensure project implementation.

The Beach Program Coordinator is responsible for contractual agreements for funding, data evaluation, organizing meetings and assisting with report writing. He is responsible for ensuring that technical and scheduling objectives as specified in the QAPP are achieved successfully and for maintaining the official, approved QA Project Plan. He assures that the project proceeds in compliance with grant requirements.

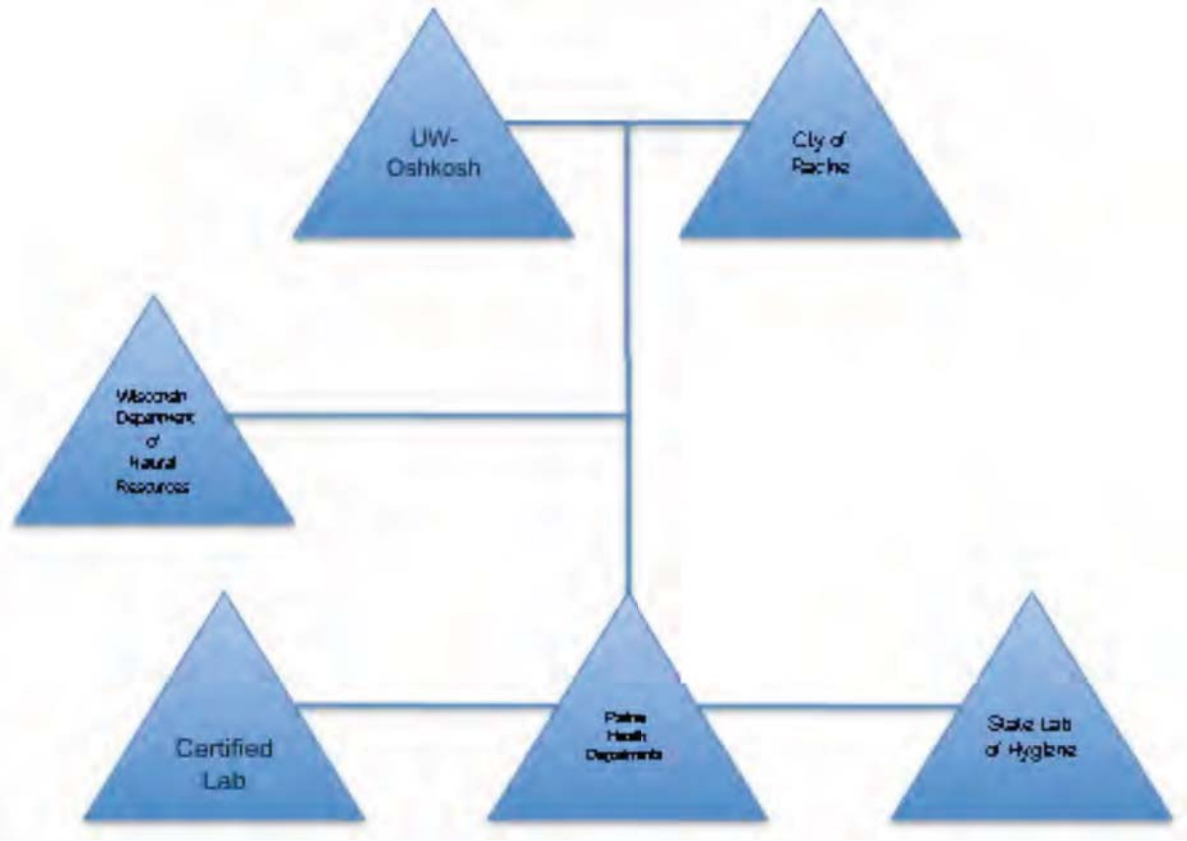
The "Participating Members" are representatives of local and state public health departments located along the Great Lakes. The City of Racine and UW-Oshkosh will be contracted to work within the counties with beaches chosen for sanitary surveys to be completed.

The labs are required to conduct testing based on current best practices, and have agreed to deliver results within 24 to 48 hours after sample submission.

Table 1 – Lab Analysis and Beaches Monitored

Labs To Analyze Samples
Racine Health Department
Kenosha County Health Department
UW-Oshkosh Environmental Microbiology Lab at UW-Extension Manitowoc
UW-Lab at Crossroads at Big Creek (UW-Oshkosh)
UW-Lab at Northland College (UW-Oshkosh)

Organizational Chart



Principal Data Users

- Wisconsin Department of Natural Resources
- Local Health Departments
- Beach Managers
- Bureau of Parks
- Administrator, USEPA
- Local Health Department Laboratories

1. Problem Definition & Background

In October 2000, Congress passed the Beaches Environmental Assessment and Coastal Health Act (BEACH Act) designed to reduce the risk of disease to users of the nation's coastal recreation waters including the Great Lakes. Wisconsin was one of the first states to implement a statewide BEACH Act Program to monitor beaches for microbial pollution and notify the public of risk associated with water quality. The program was developed to address health risks to beach users by the Wisconsin DNR, the BEACH Workgroup, and state and local health officials. The Lake Michigan and Lake Superior shorelines are lined with 192 public beaches. These beaches are visited by thousands of people each year and beach water is subject to contamination from sources such as storm sewers, wastewater treatment discharges, combined sewer overflows, agricultural runoff, wildlife wastes and adverse weather. This contaminated water is a potential cause of gastrointestinal illness and other diseases. While the BEACH Act provides funds to monitor microbial contamination at 127 monitoring sites in Wisconsin, the Program has not had additional funds to investigate the sources of microbial contamination. Sanitary surveys will be conducted at beaches with impaired water quality (as defined by Wisconsin's 303d list) in Wisconsin, to investigate the possible sources of microbial contamination and begin the process of planning for mitigation of these microbial contamination sources.

2. Project/Task Descriptions

The overall objective of this project is to investigate sources of microbial contamination by conducting sanitary surveys of beaches with impaired water quality (as defined by Wisconsin's 303d list) on Lake Superior and Lake Michigan.

Other program objectives include:

a) Beach Assessment and Identifying Possible Sources of Contamination
b) Sampling Design, Methods Assessment and Procedures
c) Monitoring Report Submission
d) Begin Development of Beach Forecasting Models
e) Develop complete redesigns of eight beaches using data gathered from this project and develop complete engineering plans for the local municipality.

3. Overall Project/Task Descriptions

Program Objective (a) – Beach Assessment and Identifying Possible Sources of Contamination

To determine potential microbial pollution sources, the U.S. EPA Annual Sanitary Survey Pilot Protocol will be used to assess beaches with impaired water quality (as defined by Wisconsin's 303d list) along Lake Superior and Lake Michigan. These beaches have been selected for the sanitary survey based on geographic location, frequent advisories and closures over the past four beach sampling seasons, and recent reconstruction. A comprehensive assessment of each beach will be conducted. Both the routine On-Site Surveys and Annual Comprehensive Survey will be performed at each beach. The routine On-site Survey, to be completed at the time of sample collection, can be found at: http://www.epa.gov/waterscience/beaches/sanitarysurvey/pdf/survey-routine.pdf. The Annual Sanitary Survey, a comprehensive survey to be performed annually for a beach, can be found at http://www.epa.gov/waterscience/beaches/sanitarysurvey/pdf/survey-annual.pdf.

The routine on-site sanitary survey will be conducted when water sampling occurs at each of the beaches. Approximately 100-200 samples will be taken at each beach inclusive of identified probable sources of microbial contamination (storm water outfalls, river mouths, runoff from nearby parking lots, etc). This project will be in addition to samples collected for Wisconsin's BEACH Monitoring and Notification Program. This effort will yield >10,000 samples to characterize pathogen sources in this phase of the project, and allow for a quantifiable measure of the significance of each source on the overall beach water quality.

In addition to water samples, beach water movement (currents) and depth profiles at each location will be evaluated as part of this project. The beach substrate will be characterized at each location in terms of its chemical and physical composition.

Program Objective (b) - Sampling Design, Methods Assessment & Procedures

To assure consistency in collecting samples for analysis, the following procedures will be used:

- Specific sites will be designated as potential contamination sources. Samples will be collected exclusively at these sites for the duration of the sampling period.
- Sample bottles will be prepared and provided by the laboratories charged with conducting bacteria analyses.

See Appendix A for Wisconsin's Beach Monitoring Sampling Protocol, which will be used for water quality sampling for the sanitary surveys.

The data will be verified through a systematic process to determine if the data has been collected in accordance with specifications resulting in compliance with established standards and the QAPP, e.g. precision, accuracy, consistency, and completeness. The department will assess whether the data quality objectives of this project have been met. Once the data have been confirmed to meet the standards, they will be systematically examined to determine their technical usability with respect to the planned objectives. The data will be assessed to determine whether they are of the right type, quality, and quantity to support the intended use.

Program Objective (c) - Monitoring Report Submission

Monitoring data will be updated daily, in a timely manner, for viewing by the public, EPA, and other agencies in a similar fashion as currently employed using the Beach Health Website. A final report will be completed for the project identifying outcomes and possible mitigation strategies.

Program Objective (d) - Begin Development of Beach Forecasting Models

Beach sanitary survey data and monitoring data will be organized, entered on-line daily, and evaluated to begin development of, or refine existing, forecasting models during the summers of 2010 and 2011, at beaches in Racine, Milwaukee, and Door County, WI. In conjunction with the WDNR, this effort will be used to test the predictive abilities of the US EPA's public domain nowcast model building software, Virtual Beach. This software allows the user to manipulate and choose variables that will be included in the predictive model, and thus create individualized predictive models specific to local beaches. The readily available routine, daily survey information (rainfall, wave height, wind speed and direction, cloud cover, bird counts, *Cladophora* prevalence,

water turbidity, etc.) will be used for these beaches a minimum of five days per week and may extend over weekends, to ensure that the model can be used to forecast *E. coli* concentrations that will occur when maximum bather activity is expected, in each of two swimming seasons. The sanitary survey data along with the monitoring data may be plugged into the Virtual Beach software and *E. coli* concentrations in beach water will either be nowcast (0-12 hours post data collection) or forecast (24-48 hours post data collection). Actual *E. coli* concentrations and the predicted values will be compared to determine the predictive ability of each model. Currently, Door County and South Milwaukee issue pre-emptive beach closures, based on "significant" rainfall events occurring in the county. When the actual *E. coli* concentrations were examined on days when pre-emptive closures were instituted in 2006, this "predictive model system" proved to be correct in only about 20% of cases. The Virtual Beach model has been shown to be significantly better than this at the test beach (Huntington Beach, Ohio). This is an opportunity to test Virtual Beach software in settings both similar to and unlike the relatively urban Huntington Beach.

Program Objective (e) - Develop complete redesigns of eight beaches using data gathered from this project and develop complete engineering plans for the local municipality.

Once all the data has been collected it will be used to develop engineering plans for eight beaches. These plans will include draft designs to be reviewed with the appropriate beach managers and municipal personel, as well as public meetings (at the discretion of the local municipality), in preparation of final engineered plans to mitigate the discovered sources of fecal pollution at the beach. The final plans will be construction ready documents.

4. Schedule

Data collection for this project will run concurrently with Wisconsin's BEACH Act Monitoring and Notification Program. Wisconsin's beach season for public coastal beaches is approximately 15 weeks in length (Memorial Day Weekend through Labor Day Weekend). Sample collection may, and laboratory analysis will, continue after the beach season. A final report will be available by the end of calendar year in 2010, 2011, and 2012.

The estimated schedule for completing beach sanitary survey activities per calendar year are as follows with each year following a similar schedule:

Date of Activity	**Project Activities**
March & April 2010	Meet with county collaborators
May 2010	Research sites and their unique characteristics. Identify any resources available such and county or state data that may be available. Conduct a site visit to each of the test sites prior to the start of the beach season. Begin preliminary sampling at sites in late May 2010. Meet with collaborators as needed to discuss results and gather input from each community involved in the project.
June 2010	Complete Sanitary Survey of each site using the forms and procedures developed during the EPA pilot program. Identify possible sources of contamination at each location. Start beach season sampling prior to Memorial Day. Meet with collaborators as needed to discuss results and gather input from each community involved in the project.

June, July, August 2010	Continue sampling and assess potential sources using methodologies described above. Conclude sampling on approximately Labor Day. Meet with collaborators as needed to discuss results and gather input from each community involved in the project. Genetic information for *E.coli* will be available in the late summer, identifying sources of microbial pollution.
September 2010	Conclude sampling and any laboratory work that is in progress. Meet with collaborators as needed to discuss results and gather input from each community involved in the project.
October 2010	Conduct data analysis and conclude any work that remains from the summer sampling season. Meet with collaborators as needed to discuss results and gather input from each community involved in the project.
December, November 2010 and months leading up to next beach sampling season	Complete and submit interim progress or Final Report to the USEPA and/or other appropriate agencies. Hold local community meetings in all locations that are interested. Answer questions of the public and allow public comment on the results of the project. Discuss redesigns in 2012.

5. Personnel, Special Equipment or Supplies

Personnel: BEACH Act Coordinator will serve as a liaison between the U.S. EPA and the local public health departments. This person is responsible for contractual agreements for funding, data evaluation, organizing meetings and report writing. No special equipment will need to be ordered for the beach sanitary surveys project.

6. Special Training Requirements or Certifications

State Registered Sanitarians, Public Health Officials and Interns under supervision of Sanitarians and/or City Parks personnel will be trained in filling out the Sanitary Survey form developed for this project.

In addition, samples will be collected by State Registered Sanitarians, Public Health Officials, and Interns under the direction of Sanitarians and/or City Parks personnel trained on proper field sampling technique. Sample analyses will be performed by certified laboratory personnel, trained and experienced in current laboratory procedures for bacteria analysis. Laboratories certified by the Wisconsin Department of Agriculture Trade and Consumer Protection will perform all testing. Sample result evaluation and analysis, notification of results to project participants and the public, as well as any accompanying recommendations, are under the direct supervision of the Project Coordinator. Training is ongoing and documented.

7. Documentation and Records

Contractors for the Beach Sanitary Surveys, will follow the approved QAPP for the WI Beach Program as well as all elements found in this QAPP. Records generated during the project include:

- Documentation regarding agreements, contracts, and expectations.

- An annual comprehensive report to be prepared for submission to the Water Division Administrator, the Director of the Bureau of Watershed Management and the USEPA Administrator.

Storage, access to, and final disposition of all records are subject to the requirements of the State of Wisconsin.

a) Field Records

The Great Lakes Beaches Routine On-Site Survey and the Annual Sanitary Survey Form will be completed by field staff. All field information will be recorded on individual sanitary forms for each beach (Appendix B). If possible, EPA suggests printing Routine On-Site Sanitary Survey forms on waterproof paper. It is suggested also, that forms are filled out in pencil to avoid losing data that has been recorded. All possible sources of contamination will be geo-located and mapped. Hard copies of each file and other relevant field data, including notebooks, maps, drawings, photographs, and communication records will be stored by the health departments collecting the data. At the end of the project, all sanitary survey forms and files will be stored at the WDNR central office.

b) Laboratory Records

Laboratory data forms are to be completed initially by the sample collector at the time the sample is collected; followed by the laboratory sample receipt person and analyst when the sample is received, tested, and results are determined. The laboratory data form allows collection of information including, but not limited to, the name of beach, body of water, sampling point, date/time of collection, water and weather conditions, as well as name of laboratory, dates and times of testing, and final results. The laboratory data form serves as a Chain-of-Custody record for each sample collected and analyzed. The laboratory maintains control of other relevant laboratory records including logs, bench sheets, and raw analytical and QA/QC data. Data collected will be stored and available at www.wibeaches.us.

c) Standard Operating Procedures

A Sampling Protocol Requirements Page has been created to accompany all local health department grants (See Appendix A). Participants in the sanitary survey are required to comply with sampling requirements in order to receive contractual funding.

d) Constructing an Annual Survey Report

The Annual Survey Report Outline is a standard format for compiling a report to assess a beach and the surrounding watershed for potential sources of microbial contamination that impact the water quality of a beach (Draft Great Lakes Beach Sanitary Survey Guidance, Appendix B). This report format will allow for consistency among Great Lakes beach managers for sharing beach pollution source information on beaches.

B. DATA QUALITY OBJECTIVES

1. The Decision

a) Determine possible sources of microbial contamination through sanitary surveys.

2. Inputs to the Decisions

Sanitary surveys will be conducted on selected beaches located on Lake Superior and Lake Michigan. The annual survey includes:

a) Basic Information (Beach Name, Town City, Name of Waterbody)
b) Land Use Description in Watershed (Current Land Use, Erosion Measurements, Bounding Structures, Beach Materials, Comments/Observations)
c) Conditions (Beach Dimensions, Slope, Water Level)
d) Sampling Location
e) Bather Load
f) Beach Cleaning/Grooming Techniques
g) Sampling (Invasives, Algal Blooms, Wildlife and Domesticated Animals, Samples Collected, Water Quality)
h) Modeling
i) Advisories/Closures
j) Potential Pollutant Sources
k) Description of Sanitary Facilities
l) Description of Other Beach Facilities

The routine on-site sanitary survey will include the following parameters:

a) General Beach Conditions (Air Temperature, Rainfall, Weather Conditions)
b) Water Quality (Water Temperature, Odor, Turbidity, Algae)
c) Bather Load (# and Recreational Activities)
d) Potential Pollution Sources (Discharges, Floatables, Debris/Litter, Algae, Wildlife and Domesticated Animals)

3. Study Boundaries

Beach sanitary surveys, water sampling evaluations and assessments are to be conducted on twenty selected public coastal beaches located along Lake Michigan and Lake Superior.

4. Action Levels

a) Samples with *E.coli* levels exceeding 235 MPN or CFU/100 mL at potential microbial contamination sources will be used to indicate whether the source is contributing to beach advisories and closures.
b) Sanitary surveys will provide information to help facilitate mitigation plans for cleaning up microbial contamination sources at these beaches.

C. MEASUREMENT/DATA ACQUISITION

1. Process Design

Objective (a) – Beach Assessment and Identifying Possible Sources of Contamination

a) Beach Sanitary Surveys - Each beach will be evaluated using the US EPA Draft Sanitary Survey Form. The Annual Survey form will be filled out by an intern in the beginning of the beach season with input from local partner agencies. While collecting beach water quality samples, and samples at potential sources of contamination, the On-Site Routine Sanitary Survey Form from EPA will be used.

The sanitary survey forms will include all parameters mentioned above in the Data Quality Objective Inputs (B2).

Environmental Conditions - The following WEB sites, in addition to local weather stations, can be used to view real-time and historical weather conditions, wind speed & direction, water temperature and wave height:

- http://www.aos.wisc.edu/~sco/
- http://www.coastwatch.msu.edu/twomichigans.html
- http://www.ndbc.noaa.gov\station_page.phtml?station=45007

b) Geo-locational data - All potential contamination sources at each of the beaches will be identified and located via the use of GPS and GIS technologies. All available Digital OrthoPhotos and Digital Raster Graphics will be viewed to see if outfalls are outlined clearly and can be digitized on screen using ArcView 3.2. Coordinates will be collected using a Trimble ProXR GPS unit or equivalent GPS unit. The Trimble ProXR GPS unit collects locational data in the Wisconsin Transverse Mercator (WTM) format with sub-meter accuracy. The data will be stored in the datalogger and downloaded into the computer using the Pathfinder software. Once a beach polygon layer has been created, it will be used to create a second layer by converting the polygons to polylines. The line layer will be edited so that a single line represents the length/location of each outfall. Attributes such as beach name and measured length will be tied to each line feature. A map of each beach participating will be developed indicating the adjacent coastal recreation waters, points of access by the public, length of beach, as well as any known potential sources of microbial pollution.

Quality Control

Geo-locational data: The TSC1 datalogger acts as the controlling software by communicating with the GPS receiver to set specific GPS parameters required for optimal accuracy. Data validity is determined by the number of satellites. If there are too few satellites, a warning tone sounds to identify the data. The same validity checks are built into the Pathfinder software. Any data collected by too few satellites was identified and eliminated through this software.

Objective (b) - Assessment procedures to identify sources of microbial contamination

Assessment Procedures for Identifying Short-term Increases

Frequent, regular sampling is required to identify short-term increases in pathogens and increases due to weather events. Beach monitoring efforts at potential sources of microbial contamination may help pinpoint when microbial contamination is occurring due to weather events. Existing monitoring data along with new data will be evaluated. The additional information collected during sanitary surveys can be used along with the monitoring data to aid in identifying short-term pathogen increases and increases due to storm events.

The usefulness of the data on beach conditions, beach uses, and environmental conditions that drive beach process must be evaluated to find significant or logical relationships of the driving mechanisms. Hopefully, parameter relationships will become apparent from the statistical analysis of the data. This information may be used for predictive modeling in the future. This circular process of valid sampling, statistical analysis and modeling beach conditions will hopefully improve our understanding of pathogen exposure at beaches and lead to a predictive model(s) that forewarns of impending health hazards.

Collaboration and Exchange of Information

The challenge at hand demands a collective effort and through this effort a collective solution. The sanitary survey effort will include communicating and sharing of information with universities, colleges, US EPA, USGS, other states, regional planning groups, counties, cities and other municipalities and interest groups. This will be done through individual contact, conferences and special meetings and/or site visits.

Final Report

This study will include a final report and the attendance of special meetings and conferences by the principal investigators to share the results of the beach sanitary survey project. The final report will include results of the sanitary surveys, a statistical analysis of water quality samples collected at the beaches, as well as any additional suggestions on monitoring for hazards and minimizing microbial contamination to the beaches.

2. Sampling Method Requirements

All sampling is required to follow these general rules:

a. Samples will be collected in containers approved by the Wisconsin Department of Agriculture Trade and Consumer Protection (WDATCP) laboratory certification program.

b. Extreme care needs to be taken to avoid contaminating the sample and sample container.
- Do not remove bottle covering and closure until just prior to obtaining each sample.
- Do not touch the inside of the sample container.
- Do not rinse the sample container.
- Do not put caps on the ground while sampling.
- Do not transport the samples with other environmental samples.

c. Adhering to sample preservation and holding time limits is critical to the production of valid data.
- Samples should be labeled, iced or refrigerated at 1 - 4 degrees C immediately after collection and during transit to the lab. Samples will be immediately placed on wet ice and placed in a cooler for transport to the laboratory.

- Care should be taken to ensure that sample bottles are not totally immersed in water from melted ice during transit or storage.

- Samples should arrive in the laboratory no later than 24 hours after collection. Whenever possible samples should arrive at the lab on the day of collection, preferably before 2 p.m.

d. The sampler will complete the laboratory data form noting time, date, and location of sample collection.

e. Samples will be analyzed on the day of collection whenever possible and holding times may not exceed 24 hours.

3. Sample Handling and Custody Requirements

The laboratory data form will serve as a Chain-of-Custody record for each sample collected and analyzed. In keeping with laboratory requirements (Standard Methods), all samples must be sealed, chilled, and transported from the sample point to the laboratory for analysis within twenty-four hours after sampling. Sample collectors will have exclusive custody of any sample from the time of collection until the sample is deposited with the laboratory. The laboratory will assume custody of each sample it receives and is responsible for forwarding all sample analysis results to the Project Manager within twenty-four hours to forty-eight hours of receiving the sample.

4. Analytical Requirements

All analyses shall be performed in laboratories certified by the Wisconsin Department of Agriculture and Consumer Protection for microbiological analysis of *E.coli* in water. Table

1 lists all the current EPA approved analytical methods or microbiological analysis of *E. coli*.

Table 2 - EPA Approved Analytical Methods

Indicator	*Type of Analyses Performed*	*Method Number*
E. coli	❑ Membrane Filter Fecal Coliform Test (MFFCC) with Nutrient Agar	Standard Methods 9222(D) and Standard Methods 9222(G)
	❑ Membrane Filter (MF)	Standard Methods 9213(B)
	❑ MPN - Enzyme Substrate Test - Colilert™	Standard Methods 9223(B)

5. Quality Control Requirements

A number of quality control checks are required to ensure the quality of the generated data. All laboratory staff will adhere to current and generally accepted practices for safe handling, testing of samples, and chain of custody measures.

(a) Precision

Precision is a measure of the degree to which two or more measurements are in agreement. Field precision is estimated through the collection and measurement of two samples at the same sampling site at approximately 10 percent of the sites. The precision of laboratory analyses is estimated by analyzing two or more aliquots of the same water sample. This data quality indicator is obtained from two duplicate samples by calculating the relative percent difference (RPD) as follows:

$$RPD = \frac{|C_1 - C_2|}{(C_1 - C_2)/2} \times 100$$

Where C_1 is the first of the two values and C_2 is the second value. Because of the heterogeneity of populations of bacteria in surface waters, an RPD of less than or equal to 50 percent between field duplicates for microbiological analyses might be considered acceptable. When multiple replicates are analyzed, precision of the test will be expressed in terms of standard deviation and the ability to detect the target organism. Analysts should be able to duplicate bacterial colony counts on the same membrane within 5 percent and the counts of other analysts within 10 percent; otherwise, procedures should be reviewed and corrective action implemented.

(b) Accuracy

Accuracy is determined through the use of field blanks and through the adherence to all sampling handling and holding times. Because accuracy is the measurement of the degree of agreement between and observed value and an accepted reference value or a true value, and the true values of environmental physiochemical and biological characteristic cannot be known, accuracy is assessed by the use of a surrogate. To estimate the densities of bacteria,

use of samples prepared from known quantities of freeze-dried and cultured bacteria as a surrogate can result in 97.9 percent recovery of the bacteria from water samples. Based on the mTEC medium, bias was determined to be 2 percent of the true value. This information is helpful in establishing the most appropriate methods to be followed.

(c) Representativeness

In the sample design, care is taken to determine if the area of sample collection is typical and representative of each area of concern.

6. Data Management

Wisconsin DNR contracts with the USGS to maintain a database capable of storing all pertinent information about each participating beach. The data is stored in an accessible form usable to the local decision-makers. A system of quality control checks is performed to assure that all data is accurately entered into any data storage system. All data are analyzed statistically immediately upon completion of tests so that beach advisory decisions can be made quickly. Additionally, all beach data are reported electronically in an acceptable form for reporting to USEPA. Appropriate user instructions and system documentation have been developed and made available to all staff using the database system.

D. ASSESSMENT/OVERSIGHT

The effectiveness of the monitoring program will be assessed at regular intervals through the use of technical systems audits, performance evaluations, and audits of data quality to verify that sampling and analysis are performed in accordance with the established QC procedures and that all operational aspects of the program are acceptable. This Project will identify specific assessment methods and procedures for project documentation as well as collection, preservation, and storage of water samples. The laboratory is responsible for the compliance regarding the analytical aspects of the Project.

The QA program will include procedures for identifying and defining a problem, assigning responsibility for investigating the problem, determining the cause of the problem, assigning responsibility for implementing corrective action, and assigning responsibility for determining the effectiveness of the corrective action and verifying that the corrective action has eliminated the problems.

E. RECONCILIATION WITH DATA OBJECTIVES

Sample records, chain of custody records, and sample tracking records will be reviewed to verify that all the samples collected were analyzed so the data set will be complete. Data entries and analyses will also be verified. The input of large quantities of historical data will be spot checked to detect potential data entry errors. Calculations will be reviewed by rechecking the computations, reviewing the assumptions used and checking the input data against the original sources to be sure transcription errors have not occurred.

Once the data have been confirmed to meet standards, a report that provides an assessment of the usability of the data, a summary of sample results, and a summary of QC and QA results will be prepared. The report will discuss any discrepancies between the Data Quality Objectives (DQOs) and the data collected and any effects such discrepancies might have on the ability to meet the DQOs.

APPENDIX A –SAMPLING PROTOCOL

Sampling Protocol for E.coli at Wisconsin's Beaches

To assure consistency in collecting samples for analysis, the following procedures will be used:

1) Specific sites will be designated for collecting samples during the bathing season. Samples will be collected exclusively at these sites for the duration of the sampling period.
2) Sample bottles will be prepared and provided by the laboratories charged with conducting bacteria analyses.

General Rules of Sampling

- Take extreme care to avoid contaminating the sample and sample container.
- Do not remove bottle covering and closure until just prior to obtaining each sample.
- Do not touch the inside of the sample container.
- Do not rinse the sample container.
- Do not put caps on the ground while sampling.
- Do not transport the samples with other environmental samples.
- Adhering to sample preservation and holding time limits is critical to the production of valid data.
- Samples should be labeled, iced or refrigerated at 1 - 4 degrees C immediately after collection and during transit to the lab.
- Care should be taken to ensure that sample bottles are not totally immersed in water during transit or storage.
- Samples should arrive in the lab no later than 24 hours after collection. Whenever possible samples should arrive at the lab on the day of collection, preferably before 2 p.m.
- The sampler will complete the laboratory data form noting time, date, and location of sample collection, current weather conditions (including wind direction and velocity), water temperature, clarity, wave height and any abnormal water conditions.

Sampling Method

(1) Carefully move to the first sampling location. Water should be approximately knee deep (24 – 30 inches). While wading slowly in the water, try to avoid kicking up bottom sediment at the sampling site.
(2) Open a sampling bottle and grasp it at the base with one hand and plunge the bottle mouth downward into the water to avoid introducing surface scum.
(3) The sampling depth should approximately 6 to 12 inches below the surface of the water.
(4) Position the mouth of the bottle into the current away from your hand. If the water body is static, an artificial current can be created by moving the bottle horizontally with the direction of the bottle pointed away from you.
(5) Tip the bottle slightly upward to allow air to exit and the bottle to fill.
(6) Make sure the bottle is completely filled before removing it from the water.
(7) Remove the bottle from the water body and pour out a small portion to allow an air space of 2 cm for proper mixing of the sample before analyses.
(8) Tightly close the cap and label the bottle.
(9) Store sample in a cooler filled with ice or suitable cold packs immediately.

Analytical Methods
All sample analyses shall be conducted by State certified labs using one of the following EPA approved methods:

Most probable number (MPN) tests for E. coli:
- LTB EC-MUG (Standard Methods 9221B.1/9221F)
- ONPG-MUG (Standard Methods 9223B, AOAC 991.15, Colilert, Colilert-18, and Autoanalysis Colilert)

Membrane filter tests for E. coli:
- MEndo, LES-Endo, or mFC followed by transfer to NA-MUG media (Standard Methods 9222B/9222G or 9222D/9222G)
- MI Agar, M-ColiBlue24 Broth

APPENDIX B- FORMS FOR SANITARY SURVEYS

Please see the following attached:
-On-Site Routine Sanitary Survey Document
-Annual Sanitary Survey Document

GREAT LAKES BEACHES ROUTINE ON-SITE SANITARY SURVEY

Name of Beach:	Date and Time of Survey:
Beach ID:	Surveyor Name(s):
Sampling Station(s)/ID:	Surveyor Affiliation:
STORET Organizational ID:	

PART I – GENERAL BEACH CONDITIONS

Air Temperature: _____ °C or °F | Wind: Speed (mph) _____ Direction (e.g., E or 90°) _____ (From which direction the wind is coming)

Rainfall: ☐ <24 hours ☐ <48 hours ☐ <72 ☐ >72 hours since last rain event and _____ inches **or** _____ cm rainfall measured

Rain Intensity: ☐ Misting ☐ Light Rain ☐ Steady Rain ☐ Heavy Rain ☐ Other

Weather Conditions:

Sky Condition	☐ Sunny	☐ Mostly Sunny	☐ Partly Sunny	☐ Mostly Cloudy	☐ Cloudy
Amount of cloud coverage	No Clouds	1/8 to 2/8	3/8 to 1/2	5/8 to 7/8	Total Coverage

Wave Intensity: ☐ Calm ☐ Normal ☐ Rough Wave Height: _____ ft ☐ Estimated or ☐ Actual

Longshore current speed and direction (cm/sec, S or 180°): _____

Comments/Observations

PART II – WATER QUALITY

Bacteria Samples Collected (list samples collected from beach water and potential pollution sources, if applicable—see Part IV)

Sample Point	Sample #	Parameter (*E. coli*, enterococci, etc.)	Comments:

Water Temperature: _____ °C or °F Change in Color? ☐ yes ☐ no If yes, describe _____

Odor: ☐ None ☐ Septic ☐ Algae ☐ Sulfur ☐ Other _____

Turbidity: ☐ Clear ☐ Slightly Turbid ☐ Turbid ☐ Opaque or NTU:

Comments/Observations

PART III – BATHER LOAD

Total number of people in the water: _____ Total number of people out of the water: _____

Total number of people at the beach: _____

List of Activities Seen (optional):

Type of Activity				
Number of People				

Comments/Observations

GREAT LAKES BEACHES ROUTINE ON-SITE SANITARY SURVEY (continued)

PART IV – POTENTIAL POLLUTION SOURCES

Sources of Discharge:

Type	River(s)	Pond(s)	Wetland(s)	Outfall(s)	Other (specify):
Name(s) of Source(s)					
Amount (H, M, L)					
Flow Rate (M/sec)					
Volume					
Characteristics					

Did you collect any bacteria samples from the sources listed in the table above? ☐ yes ☐ no

If "Yes", did you list the samples in the table in Part II, Water Quality? ☐ yes ☐ no

Floatables present: ☐ yes ☐ no Please circle the following floatables if found:

Type	Street litter	Food-related litter	Medical items	Sewage-related	Building materials	Fishing related	Household waste	Other:
Example	Cigarette filters	Food packing, beverage containers	Syringes	Condoms, tampons	Pieces of wood, siding	Fishing line, nets, lures	Household trash, plastic bags	

Amount of Beach Debris/Litter on Beach: ☐ None ☐ Low (1-20%) ☐ Moderate (21-50%) ☐ High (>50%)

Type of Debris/Litter Found (please circle)

Type	Street litter	Food-related litter	Medical items	Sewage-related	Building materials	Fishing related	Household waste	Tar	Oil/ Grease	Other:
Example	Cigarette filters	Food packing, beverage containers	Syringes	Condoms, tampons	Pieces of wood, siding	Fishing line, nets, lures	Household trash, plastic bags	Tar balls	Oil slick	

Amount of Algae in Nearshore Water: ☐ None ☐ Low (1-20%) ☐ Moderate (21-50%) ☐ High (>50%)

Amount of Algae on Beach: ☐ None ☐ Low (1-20%) ☐ Moderate (21-50%) ☐ High (>50%)

Circle the types of algae found

Type	Periphyton	Globular	Free floating	Other
Description	Attached to rocks, stringy	Blobs of floating materials	No obvious mass of materials	Please describe

Circle the color of algae found

Light green	Bright green	Dark green	Yellow	Brown	Other

Presence of Wildlife and Domestic Animals

Type	Geese	Gulls	Dogs	Other (specify)
Number				

List the number of each species of bird found dead on the beach

Type	Common loons	Herring gulls	Ring-billed gulls	Double crested cormorants	Long-tailed ducks	White-winged scoter	Horned grebes	Red-necked grebes	Other
Number found dead									

Number of dead fish found on the beach: _____

Comments/Observations (continue on back if necessary):

GREAT LAKES BEACH ANNUAL SANITARY SURVEY

1. BASIC INFORMATION

Name of Beach:	Date(s) of Survey:
Beach ID:	Name of Waterbody:
Town/City/County/State:	Number of Routine Surveys Used:
Sampling Station(s)/ID:	Name(s) of Surveyor(s):
STORET Organizational ID:	Surveyor Affiliation:

2. DESCRIPTION OF LAND USE IN WATERSHED

Current Land Use in Watershed

Type	Residential	Industrial	Commercial	Agricultural	Other (specify):
Percentage					

Development	Describe
% undeveloped	
% developed	

How was land use measured:

Waterbody Uses: ☐ Boating ☐ Fishing ☐ Surfing ☐ Windsurfing ☐ Diving ☐ Other (specify)

Are maps of the beach area attached? ☐ yes ☐ no Are maps of the watershed attached? ☐ yes ☐ no

List maps and their sources:

Does the detailed map include locations of:

Sample Points	☐ yes	☐ no	(explain):
Hydrometric Network	☐ yes	☐ no	(explain):
Pollutant Sources	☐ yes	☐ no	(explain):
Boat Traffic	☐ yes	☐ no	(explain):
Marinas	☐ yes	☐ no	(explain):
Boat dockage	☐ yes	☐ no	(explain):
Fishing	☐ yes	☐ no	(explain):
Bathing/Swimming	☐ yes	☐ no	(explain):
Bounding Structures:			
Jetty	☐ yes	☐ no	(explain):
Groin	☐ yes	☐ no	(explain):
Seawall	☐ yes	☐ no	(explain):
Other	☐ yes	☐ no	(explain):
Sanitary Facilities	☐ yes	☐ no	(explain):
Restaurants/Bars	☐ yes	☐ no	(explain):
Playground	☐ yes	☐ no	(explain):
Parking Lot(s)	☐ yes	☐ no	(explain):
Other	☐ yes	☐ no	(explain):

Erosion/Accretion Measurements

High Watermark Location Identification	Fixed Object Description (e.g., tree, building)	Distance from Fixed Object to High Watermark	Feet or Meters?	Distance between High Watermark Locations	Feet or Meters?
A				A↔B:	
B				B↔C:	
C				C↔D:	
D (optional)				D↔E:	
E (optional)					

GREAT LAKES BEACH ANNUAL SANITARY SURVEY (continued)

Bounding Structures

Bounding Structure	Number	Description or Comment
Jetty		
Groin		
Seawall		
Natural formation		
Other (specify):		
Other (specify):		

Beach Materials/Sediments:

☐ Sandy ☐ Mucky ☐ Rocky ☐ Other:

Or, Beach Materials/Sediments Lab Analysis (attach diagram or photographs of plot locations)

Name of Lab Used:	
Date of Sample Collection:	

Plot ID	Mean Grain Size Diameter	Uniformity Coefficient	Description of Plot Location:
Average			

Describe the results and conclusion of the sediment analysis and potential effects of the sediment distribution at this beach:

Photographs Taken in the Beach Area or Surrounding Watershed

Image Number	Date/Time	File Name	Description of Photograph (Include Pictures of High Watermark Locations and Corresponding Fixed Objects)

Habitat around beach:

☐ Dunes ☐ Wetlands ☐ River/stream ☐ Forest ☐ Park ☐ Protected Habitat or Reserve

☐ Other:

3. WEATHER CONDITIONS

Examine the weather data collected over the prior beach season(s) along with bacteria sampling results.
Do the bacteria concentrations at this beach appear to correlate with any of the following?

Rainfall	☐ yes	☐ no	(explain):
Air Temperature	☐ yes	☐ no	(explain):
Water Temperature	☐ yes	☐ no	(explain):
Cloud Cover	☐ yes	☐ no	(explain):
Wind Speed	☐ yes	☐ no	(explain):
Wind Direction	☐ yes	☐ no	(explain):
Longshore Current	☐ yes	☐ no	(explain):
Wave Height or Intensity	☐ yes	☐ no	(explain):
Other Weather	☐ yes	☐ no	(explain):

GREAT LAKES BEACH ANNUAL SANITARY SURVEY (continued)

Have any statistical analyses been done to calculate the degree of correlation? ☐ yes ☐ no

Describe any analyses done, and any trends or correlations found (add lines if needed to describe in detail):

Average air temperature during beach season: ° C or ° F	Average water temperature during beach season: ° C or °F

Average wind speed and direction during beach season (e.g., E or 90° at 15 mph):

Typical weather conditions: ☐ Sunny ☐ Mostly Sunny ☐ Partly Cloudy ☐ Mostly Cloudy ☐ Overcast ☐ Rainy

Rainfall total for the beach season (in):	Average rainfall for all beach seasons (in):

Does rainfall intensity correlate with bacteria sample results? ☐ yes ☐ no Describe:

Number of significant rain events:	What constitutes "significant?" (e.g., 1 inch or more rain)

Additional Comments/Observations:

4. PHYSICAL BEACH CONDITIONS

Beach length or dimensions (indicate Z1, Z2, and Z3 on a map)

Length (m):		Width (average, in m):
Width Z1 (m):	Width Z2 (m):	Width Z3 (m):
Local water level variation: feet inches	Hydrographic influences (e.g., seiches):	

Characterize any longshore or nearshore currents and their potential effects based on bacteria sampling results

Approximate beach slope at swim area: _____ %

Description and date of last beach rehabilitation (example: new sand, nourishment, dredging, etc., physical structures will be described in Sections 12 and 13):

Comments/Observations:

5. BATHER LOAD (# OF BEACH USERS)

Is bather load measured? ☐ yes ☐ no

If yes, describe how beachgoer numbers are calculated (i.e., turnstile, counting at noon, photographs):

GREAT LAKES BEACH ANNUAL SANITARY SURVEY (continued)

Beach Use

Beachgoer Category	Number of People Per Day Using the Beach					
	Peak Use for the Season (Daily Use)	Seasonal Average (Daily Use)	Holiday Average (Daily Use)	Weekend Average (Daily Use)	Weekday Average (Daily Use)	Off-Season Average if applicable (Daily Use)
Total people in the water						
Total people out of the water						
Total people at the beach						
Breakdown of Activities (if activities were broken down on the Routine-Onsite Sanitary Survey, summarize them here)						
Activity 1:						
Activity 2:						
Activity 3:						
Activity 4:						
Activity 5:						
Activity 6:						
Frequency of measurements (e.g., daily, weekly, monthly)						

Examine bather load data along with sampling results for the past beach season(s). Look at each sampling point. Does bather load appear to correlate with bacteria concentrations at any of these sampling points? Does the amount of people in the water or out of the water correlate with bacteria concentrations? Has a statistical analysis been done? Describe:

Comments/Observations:

6. BEACH CLEANING

Beach cleaning frequency during season:

Description of cleanup activities

	Leveling of Sand	Trimming or Removing Vegetation	Removing Debris	Removing Trash	Construction and Maintenance of a Temporary Pathway Directly to Open Water	Other (specify):
Check activities that were done						
Equipment used (if applicable)						

How often are floatables found at the beach? ☐ Never ☐ Sometimes ☐ Frequently ☐ Very frequently

Known sources of floatables:

Types of floatables found ☐ Street litter ☐ Food-related litter ☐ Medical items ☐ Sewage-related ☐ Building materials ☐ Fishing related ☐ Household waste ☐ Other:

How often is beach debris/litter found on the beach? ☐ Never ☐ Sometimes ☐ Frequently ☐ Very frequently

Known sources of debris:

GREAT LAKES BEACH ANNUAL SANITARY SURVEY (continued)

Type of Debris/Litter Found

☐ Street litter ☐ Food-related litter ☐ Medical items ☐ Sewage-related ☐ Building materials
☐ Fishing related ☐ Household waste ☐ Tar ☐ Oil/ Grease ☐ Other:

Comments/Observations:

7. INFORMATION ON SAMPLING LOCATION

Description of Sample Points (include beach water and potential pollution sources)

Sample Point Name/ID	Location	Description	Sample Frequency	Time of Day of Sample Collection

Description of hydrometric network [note that this is a network of monitoring stations that collect data such as rainfall and stream flow]

Comments/Observations:

8. WATER QUALITY SAMPLING

Name of laboratory: _____ Distance to laboratory: _____ miles

Is there a sampling and analysis plan? ☐ yes ☐ no Is it adequate? ☐ yes ☐ no (explain):

Are the sampling staff properly trained on sampling techniques, equipment maintenance, and calibration procedures? ☐ yes ☐ no

Biological Survey Results:

Were invasive/nonnative species present? ☐ yes ☐ no (describe): _____

Have algae blooms been observed during the beach season? (If so, specify duration and algae species) _____

Percent of beach season where algae was present in significant amounts in the nearshore water: ☐ None ☐ Low (1–20%)
☐ Moderate (21–50%) ☐ High (> 50%)

Percent of beach season where algae was present in significant amounts on the beach: ☐ None ☐ Low (1–20%)
☐ Moderate (21–50%) ☐ High (> 50%)

List types of algae found: _____

Colors of algae most commonly found: _____

List any infectious snails that were found: _____

List any dangerous aquatic organisms that were found: _____

GREAT LAKES BEACH ANNUAL SANITARY SURVEY (continued)

Presence of Wildlife and Domestic Animals

Type	Degree of Presence (Low, Mod, High)	Does the Presence Appear to Correlate with Bacteria Results? (Yes, No, Don't Know)	Describe Further (include whether fecal droppings are seen and are a problem)
Geese			
Gulls			
Dogs			
Other (specify):			
Other (specify):			
Other (specify):			

Was a significant number of dead birds found on the beach during beach season? ☐ yes ☐ no
Describe types and numbers found and possible causes: _____

Was a significant number of dead fish found on the beach during the beach season? ☐ yes ☐ no
Describe numbers found and possible causes: _____

Bacteria Samples Collected

Do you test for *Escherichia coli*? ☐ yes ☐ no Analytical Method Used: _____
Do you test for *Enterococcus*? ☐ yes ☐ no Analytical Method Used: _____
Do you test for fecal coliform? ☐ yes ☐ no Analytical Method Used: _____
List any additional bacteria tested and associated analytical methods: _____
Do you composite any bacteria samples? ☐ yes ☐ no If yes, explain: _____

How do this past season's bacteria results compare to that of previous years'? _____

Do the bacteria results correlate to other parameters, such as water quality, weather, flow, bather load, algae, or wildlife? ☐ yes ☐ no Describe in detail analyses that were performed on the data (add additional lines as needed).

Water Quality (check all that are measured regularly)

Temperature	pH	Rainfall	Turbidity	Conductivity	Other

How does the water quality data compare to data from previous years? _____

Do any data correlate with bacteria sample results? ☐ yes ☐ no If yes, explain: _____

GREAT LAKES BEACH ANNUAL SANITARY SURVEY (continued)

Were there any unusual results, such as extremely high or low values detected, or unusual trends? ☐ yes ☐ no If yes, explain what was found and any potential causes: _____

Are water quality annual trend data attached? ☐ yes ☐ no

Comments/Observations:

9. MODELING

Are models being used? ☐ yes ☐ no

If yes, list types of models being used and a brief description of the models:

Comments/Observations:

10. ADVISORIES/CLOSINGS

List any advisories and closings that occurred, whether bacteria levels were high, and any possible reasons for advisory or closing or high bacteria level, such as stormwater runoff, sewage spill, or wildlife on the beach.

Advisory or Closing (specify one)	Start and End Dates	Length of Advisory or Closing (Days)	Did Bacteria Concentrations Exceed GM or SSM Criteria?	Reason for Advisory or Closing or Possible Contributing Factors

Total number of closings issued: _____ Total number of days under an advisory: _____

Total number of advisories issued: _____ Total number of days beach was closed: _____

Comments/Observations:

GREAT LAKES BEACH ANNUAL SANITARY SURVEY (continued)

11. POTENTIAL POLLUTION SOURCES

Type of Source	Level of Concern (H, M, L, or NA)	Latitude*	Longitude*	Describe how this source might contribute to beach pollution and frequency of contribution
Wastewater discharges				
Sewage overflows				
Septic systems				
Subsurface sewage disposal				
Stormwater outfalls				
Natural outfalls				
CAFOs or AFOs				
Wildlife				
Agriculture runoff				
Urban runoff, industrial waste				
Marinas, harbors				
Mooring boats				
Domestic animals				
Unsewered areas				
Erosion-prone areas				
Landfills, open dumps				
Groundwater seepage				
Bathhouse leakage				
Drains and pipes nearby				
Stream or wetland drainage				
Vacant areas				
Other (specify):				
Other (specify):				
Other (specify):				

*If latitude and longitude are unknown, show the location on the detailed map and describe in the Comments/Observations section below.

Have potential pollution sources identified above been included on the detailed map? ☐ yes ☐ no (explain):

Did you collect bacteria samples from any potential pollution sources, such as streams or outfalls? ☐ yes ☐ no (explain):

If yes, describe any analyses performed and a summary of the results:

Are there any discharge reports available for dischargers in the watershed? ☐ yes ☐ no If yes, attach report or pertinent sections and summarize here:

GREAT LAKES BEACH ANNUAL SANITARY SURVEY (continued)

Have any sources been remediated, or have steps been taken to remediate sources? ☐ yes ☐ no (explain):

Comments/Observations:

12. DESCRIPTION OF SANITARY FACILITIES

Bathhouses: Total number of bathhouses at the beach:

Number or ID	Location	Condition (Good, Fair, or Poor)	Distance from Waterline (feet)	Frequency of Cleaning (Daily, Weekly, Monthly)

Describe further. Include number of toilets, showers, sinks, etc., and whether these facilities are adequate to support beach use.

Litterbins: Total number of litterbins at the beach:

Number or ID	Location	Condition (Good, Fair, or Poor)	Distance from Waterline (feet)	Frequency of Emptying (Daily, Weekly, Monthly)

Describe further. Include whether number and location of litterbins is adequate to support beach use.

13. DESCRIPTION OF OTHER FACILITIES

List facilities in the beach area, such as restaurants, bars, playgrounds, parking lots, and dog parks.

Facility Name/Type	Location	Condition (Good, Fair, or Poor)	Distance from Beach (feet)	How might this facility contribute to water quality problems?

Comments/Observations: