

Quality Assurance Project Plan

Lake Bacteria Sampling Project

by
Maggie Bell-McKinnon

Environmental Monitoring & Trends Section (EMTS)
Environmental Assessment Program
Washington State Department of Ecology
Olympia, Washington 98504-7710

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303 (d) listings addressed in this study:

NA

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WA-09-9160, WA-12-9010, WA-12-9085, WA-10-9280, WA-12-9070, WA-11-9010

Approvals

Approved by:

Maggie Bell-McKinnon, Principal Investigator, Environmental
Monitoring and Trends Section

July 29, 2003

Date

Approved by:

Rob Plotnikoff, Unit Supervisor, Freshwater Monitoring Unit

August 4, 2003

Date

Approved by:

Ken Dzinbal, Section Manager, Environmental Monitoring and
Trends Section

August 5, 2003

Date

Approved by:

Stuart Magoon, Director, Manchester Environmental Laboratory

July 30, 2003

Date

Approved by:

Cliff Kirchmer, Ecology Quality Assurance Officer

July 30, 2003

Date

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Abstract

This project has been designed to assist local health agencies by providing them with monthly sampling results for bacteria presence (specifically *E. coli* and fecal coliform) at publicly used lakes. Currently there are no state regulations specifically written for swimming beach safety. However, the local health jurisdiction's responsibility to protect public health should necessitate that swimming areas be monitored to ensure the safety of the public. Due to growing financial constraints, this sampling can be increasingly difficult to do.

Specific objectives of the program include:

- Collect samples and have a laboratory determine the concentration of *E. coli* and fecal coliform in water samples from total of ten swimming beach areas in two counties.
- Determine the pH, electrical conductivity and temperature of a sample taken from each swimming beach area.
- Compare results with the Washington State Water Quality Standards and any established county water quality standards for waters within their jurisdiction.
- Notify the local health jurisdiction and any other identified interested parties of the results.
- Integrate the results into the newly established Ecology BEACH (Beach Environmental Assessment, Communication and Health) Program public notification system.

Organization and Schedule

The following are the roles of people involved in the study:

Maggie Bell-McKinnon, Department of Ecology EA Program, (360) 407-6124

- Responsible for project management, field sampling, data compilation, data analysis, and periodic evaluation reports.

Other Department of Ecology EA Program staff as needed

- Responsible for field sampling.

This is an ongoing project and will have a schedule of monthly sampling at each chosen location beginning in June and running through September each year. The collected data will be shared with the local health district/department, and other interested parties, which serve the area where the sampling takes place. The following is the project timetable:

Reconnaissance: Starting in March 2003, King County and Pierce County health districts/ departments were contacted to determine which lakes, within their jurisdiction, are of interest to them with regard to human health concerns and contact with bacteria, specifically *E. coli*. Based on this information, the following lakes were chosen:

King County - Steele, Angle, Pine, Wilderness and Meridian

Pierce County - American, Wapato, Tapps, Spanaway and Alder

Field Activities: Starting in June 2003, staff from the Department of Ecology EA Program will begin bacteria sampling. The King County lakes will be sampled on the following days: 6/23, 7/21, 8/18 and 9/29. The Pierce County lakes will be sampled on the following days: 6/30, 7/25, 8/25 and 9/22.

Data Entry: As data are collected, they will be compiled and entered into a spreadsheet for analysis.

Reporting: Periodic reports will be prepared as needed to evaluate the adequacy of field data for use by Ecology in conducting water quality assessments.

Background and Problem Statement

This project has been designed to assist local health agencies by providing them with monthly sampling results for bacteria presence (specifically *E. coli*) at publicly used lakes. Currently there are no state regulations specifically written for swimming beach safety. However, the local health jurisdiction's responsibility to protect public health should necessitate that swimming areas be monitored to ensure the safety of the public. Due to growing financial constraints, this sampling can be increasingly difficult to do.

In addition, the Department of Ecology has recently begun a program, called BEACH (Beach Environmental Assessment, Communication and Health), which will sample for bacteria near marine beaches. The BEACH Program is being developed as a response to the BEACH Act which was passed by the US Congress in 2000. The Act amends the Clean Water Act by authorizing the US Environmental Protection Agency (EPA) to appropriate funds to states for the development of monitoring and notification programs which will provide a more uniform system for protecting the users of marine waters.

In the spring of 2002, Ecology received a grant from EPA to develop a marine beach monitoring and notification program for the State of Washington. The BEACH Program is a result of that grant and a collaborative effort among the Departments of Ecology and Health together with other state, county, and local agencies and volunteer organizations.

By expanding the effort of the BEACH program to freshwater environments, Ecology will help to protect more citizens of Washington State.

Project Description

Goals

Determine the concentration of the bacteria *E. coli* in samples of water taken from the swimming areas of ten lakes in Western Washington.

Objectives

1. Collect samples and have a laboratory determine the concentration of *E. coli* in water samples from ten swimming beach areas.
2. Determine the pH, electrical conductivity, and temperature of a sample taken from each swimming beach area.
3. Compare results with the Washington State Water Quality Standards and any established county water quality standards for waters within their jurisdiction.
4. Notify the local health jurisdiction and any other identified interested parties of the results.
5. Integrate the results into the BEACH Program public notification system.

Data Quality Objectives

The laboratory's data quality objectives are documented in the Manchester Environmental Laboratory (MEL) Lab Users Manual (MEL, 2002).

Bias

There are no specific levels of bias defined for the data to be obtained in this project. Adherence with established protocols will eliminate most sources of bias (Lombard et al, 2001).

Precision

The percent relative standard deviation (%RSD), will be used to assess data quality. The level of precision for this project is <25% RSD (logtransformed data).

Field Measurement Quality Objectives

Parameter	Accuracy	Precision	Required Reporting Limit
<i>E. coli</i>	N/A	25% RSD (log transformed)	1 cfu/100ml
pH	0.1 standard unit	N/A	N/A
Electrical conductivity	10 microSiemens/cm	N/A	N/A
Temperature	0.5 °C	N/A	N/A

Sampling Design

Representativeness

Water sampling will consist of a near surface measurement (approximately six inches below the water surface) in an area where the lake water depth is approximately three feet. At each swimming beach, a total of five samples for each sampling event will be taken in order to characterize the bacterial environment as accurately as possible. In addition, pH, conductivity and water temperature will be measured at each swimming beach location.

The time of day when measurements are taken will be determined by the logistics of sampling all the station locations planned for that day. No attempt will be made to sample a particular location at the same time for repeat visits; although the lakes will be visited in the same order during each sampling event.

Comparability

All samples will be collected on a Monday or Tuesday in order to capture changing water quality conditions after a weekend of recreational use.

The target population is limited to five lakes in each of two counties during the months of June through September.

Field Procedures

Field sampling and measurement protocols will follow those listed in "Sampling Protocols for River and Stream Water Quality Monitoring" (Ward et al. 2001).

Bacteria grab samples will be collected directly into pre-cleaned containers supplied by the laboratory and described in MEL (2002). A second sampling container will be filled with a water sample; pH and conductivity measurements will be done on the water from the second container. Temperature will be measured directly in the lake.

If a dock is present at the swimming area, the sampling stations will be visited on a clockwise basis. Otherwise, the sampling will begin on the left side of the swimming area and move from left to right in order to lessen the disturbance of sediments and the possible contamination of the water sample. Samples will be collected from an area of the lake that is approximately three feet in depth. The actual water sample will be collected at approximately six inches below the surface of the water.

When all the samples have been collected, they will be labeled, transferred to a cooler and kept at 4 degrees Centigrade until they are picked up for delivery to the laboratory. All samples will be received at the laboratory no later than 24 hours after collection.

Laboratory Procedures

Laboratory analyses will be performed in accordance with MEL protocols (2002). MEL will use the method EPA 1105 for the bacteria analysis.

Calibration and Quality Control

Total variation for field sampling and analytical variation will be assessed by collecting replicate bacteria samples in addition to lab duplicates and comparing those data to data quality objectives. Bacteria samples tend to have a high % RSD compared to other water quality analyses. Total variation for field sampling and laboratory analysis of bacteria samples will be assessed by collecting replicates for approximately 20% of samples. Precision up to 25% relative standard deviation (RSD) log transformed will be considered acceptable.

For the parameters of pH and electrical conductivity, both meters will be pre- and postcalibrated in accordance with manufacturer's instructions. For each sampling event, pre- and postcalibration checks with standards will evaluate field measurement accuracy. For temperature, the thermometer will be calibrated against a NIST thermometer.

Data Management Procedures

As data are collected, they will be compiled and entered into a spreadsheet for analysis.

Data Review, Verification, and Validation

Once the measurement results have been recorded into the spreadsheet, they will be examined to ensure that:

- The data are consistent, correct, and complete according to the data recording sheets filled out in the field.
- Any qualifiers with the data are identified.
- The protocols specified in the Freshwater Ambient Water Quality Monitoring Final Quality Assurance Project Plan (Ehinger, 1996) were followed.

Data Quality Assessment

After the data have been validated, the following steps will be conducted to assess the data quality:

- Review the data quality objectives and the sampling design
- Conduct a preliminary data review
- Apply the statistical tests to be evaluated
- Verify the assumptions of the statistical tests
- Draw conclusions from the data

References

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