

Quality Assurance Project Plan

BEACH Program

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BEACH Program

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May 24, 2004

Indicator Bacteria Monitoring at Marine Public Bathing Beaches

Approvals

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- Kieth Dublanica, Skokomish Tribe

Abstract

This is a Quality Assurance Project Plan for the Washington State Beach Environmental Assessment, Communication and Health (BEACH) Program. This Program will support a marine recreational beach monitoring and notification program in Clallam, Grays Harbor, Island, Jefferson, King, Kitsap, Mason, Pacific, Pierce, San Juan, Skagit, Snohomish, Thurston, and Whatcom Counties. The Program will determine the concentrations of the bacteria enterococci along with the options of fecal coliforms and/or *E-coli* in samples of water taken from the swimming areas of specified recreational beaches. Public notification will take place when sample results are above EPA's recommended threshold limits.

Project Organization and Responsibilities

Name	Responsibilities	Qualifications
Lynn Schneider BEACH Program Coordinator	Monitoring program supervisor Program management WA Department of Ecology and Health	BS Chemistry Over 10 years experience with water quality sampling and analysis
Gary Fraser Recreational Water Health Specialist	Technical support Assists in collaboration between WA Dept of Health, Ecology and Local Health Jurisdictions WA Department of Health	MS Microbiology Over 32 years experience with environmental health management
Bill Jolly Environmental Program Management	State Parks and Recreation Commission Liaison	Over 35 years' experience with natural resources policy and management at field and administrative levels
Val Streeter Marine Monitoring Lead Clallam County	Monitoring Program Lead Water Quality Planner Clallam County	MS Environmental Science Over 10 years in environmental monitoring and assessment
Doug George Marine Monitoring Lead Grays Harbor County	Monitoring Program Lead Grays Harbor County	BS Bacteriology and Public Health Over 30 years environmental health and water monitoring programs
Kathleen Parvin Marine Monitoring Lead Island County	Monitoring Program Lead Island County	BA Entomology and Botany Over 13 years experience with environmental health and water monitoring programs
Eileen Hennessy Marine Monitoring Lead, King County	Monitoring Program Lead King County	BS in Bacteriology and Public Health Over 17 years environmental health and water monitoring programs
Shawn Ultican Marine monitoring lead Bremerton-Kitsap County Health District	Monitoring Program Lead Bremerton-Kitsap County Health District	BA Biology Over 7 years expience with environmental health and water monitoring programs
Debbie Riley Environmental Health Director Mason County	Monitoring Program Lead Mason County	Public Health Over 20 years environmental health and water monitoring programs
Bryan Harrison Pacific County	Monitoring Program Lead Pacific County	Public Health Over 10 years environmental health and water monitoring programs
Ray Hanowell Environmental Health Director, Pierce County	Monitoring Program Lead Pierce County	BS Fisheries Over 18 years environmental health and water monitoring programs

Name	Responsibilities	Qualifications
Andy Ross Marine Monitoring Lead Skagit County	Monitoring Program Lead Skagit County	BS Fisheries Over 18 years environmental health and water monitoring programs
Sue Davis Marine Monitoring Lead Thurston County	Monitoring Program Lead Thurston County	BS in Environmental Resource Management Over 21 years experience with environmental health and water monitoring programs
Keith Dublanica Marine Monitoring Lead Skokomish Tribe	Monitoring Program Lead Skokomish Tribe	BS Environmental Studies Over 9 years in Natural Resource Management
Paul Chudek Marine Monitoring Lead Whatcom County	Monitoring Program Lead Whatcom County	BS Biology Over 32 years experience with environmental health management
Jessica Archer BEACH Program Database Coordinator	Data Management	BS Marine Science / GIS 2 Years experience in data management and marine environmental monitoring
Anne Duffy WA State Department of Health	Web Site Design	BS Marine Science Over 3 years environmental data management and marine environment monitoring

Schedule

The following table provides a schedule of the primary activities for the BEACH Program.

Task	Date
Ecology QAPP preparation, review and approval	May 2004
Indicator bacteria collection	Weekly May - September 15 or Biweekly for year round beaches
Data entry/validation	Weekly
Data evaluation	Weekly
Data reporting to Health	Weekly
Data reporting to EPA	January of each year
Program summary and evaluation	October of each year

Background

Washington's Beach Environmental Assessment, Communication, and Health (BEACH) Program is a statewide marine recreational beach water quality monitoring program. An inter-agency committee has developed the Program; see Table 1 for list of BEACH Committee members. Development of Washington's BEACH Program is occurring in response to the BEACH Act. The BEACH Act amended the US Clean Water Act in 2000. It gave the United States Environmental Protection Agency (US EPA) the authority to offer funds to states to develop and implement marine recreational beach monitoring and public notification programs.

The Washington State Department of Ecology (Ecology) applied for and received a grant from EPA in December 2001 to develop and implement Washington State's component of the BEACH Act. The BEACH Committee was convened during the spring of 2002 to begin planning Washington State's BEACH Program. The committee used a workgroup format and committee meetings to develop the guidelines as outlined in EPA's *National Beach Guidance and Required Performance Criteria for Grants* (USEPA, 2002).

The BEACH Program's goal is to reduce the risk of disease to users of Washington's marine recreational beaches. The Program was developed to support microbiological monitoring and an efficient communication system that will notify the public of potential exposure to disease-causing microorganisms. Monitoring will take place at beaches that have an average of more than five users per day during the recreational season and have a potential for fecal pollution. Monitoring and notification of coastal marine water quality will provide information to the public regarding the relationship between water quality and human health and safety.

Human activities including sewer treatment plants, failing septic systems, improper handling of boat waste, combined sewer outfalls, agricultural activities, and animal waste have the potential of carrying disease-causing microorganisms. As a result, microbial contaminants may be a risk to the public in Washington's coastal waters. Washington's coastal beaches are popular

recreational locations for tourists. The economy of coastal cities and towns is dependent on the tourism industry.

Prior to the implementation of Washington State’s BEACH Program, only two counties, Island and Kitsap had marine recreational beach monitoring and notification programs. Two counties, King and Skagit monitored marine recreational beaches but did not have notification procedures incorporated into their programs. Pierce County monitors the marine recreational beaches periodically to determine if an ongoing monitoring program is needed. The other nine counties did not monitor marine recreational beaches for bacteria. Prior to the BEACH Program, Washington State did not have uniform standardization of sampling methods or analysis. Consequently, the Surfrider Foundation and the National Resource Defense Council have classified Washington State as “Beach Bums”. This classification has the potential to negatively influence the recreational use of coastal beaches thereby causing adverse impacts to coastal cities and towns.

As a result of the negative media reports and to ensure the public’s safety, Ecology applied for and received a BEACH Act grant from USEPA. Implementation of the BEACH Program, as outlined in the draft BEACH Program Guidance (Schneider, 2002) began as a Pilot Project in 2003. Five Counties, Grays Harbor, Island, Kitsap, Pierce, and Skagit Counties conducted weekly monitoring. The 2003 Beach Program Pilot Project was evaluated and recommendations were incorporated into the finalized version of the Beach Program Guidance (Schneider, 2004). The continued implementation of Washington State’s BEACH Program is dependent on US Congress appropriating further funding for the BEACH Act.

Table 1. BEACH Committee

Name	Title	Agency/Organization
Jessica Archer	Ecology	Ecology
Sarah Brace	Science Liason Lead	Puget Sound Action Team
Toba Derrick	Natural Resources	Natural Resources
Jim Eychaner	Interagency for Outdoor Recreation	Interagency for Outdoor Recreation
Gary Fraser	Recreational Water Health Specialist	Health
Bill Jolly	Parks and Recreation	Parks and Recreation
Andrew Kolosseus	Water Quality Standards	Ecology
Ian Miller	Surfrider Foundation	Surfrider Foundation
Jan Newton	Ecology	Ecology
Arville Ohlde	City of Edmonds	City of Edmonds
Kevin Ranker	Regional Lead	Surfrider Foundation
Lynn Schneider	Beach Program Coordinator	Ecology
Brad Sele	Fish and Wildlife	Fish and Wildlife
Kim Stark	King County	King County
Shawn Ultican	Bremerton-Kitsap County Health Dist.	Bremerton-Kitsap County Health Dist.
Kim Zabel-Lincoln	Recreational Shellfish Lead	Health

Project Objectives

This Quality Assurance Project Plan is developed for the BEACH Program in order to implement a federally standardized sampling, analysis, and notification program. This Program has been designed by state, county, and local agencies in conjunction with public input. It will give the users of the program and the citizens of the state a fully implemented-wide state marine recreational beach monitoring and notification program.

To accomplish the goals of this Program, water samples will be collected by state employees, Local Health Jurisdictions (LHJs), Tribal staff, or trained volunteers and state accredited laboratories will determine the concentrations of enterococci along with fecal coliform and/or *E-coli*. Sample collectors will also measure ancillary water and environmental conditions when possible (e.g. temperature and rainfall) and help to determine useful information desired for further implementation.

The objectives of the BEACH Program are to:

1. Monitor popular marine recreation swimming beaches located near potential fecal pollution sources for bacteria to reduce the risk of disease to users of Washington State's waters.
2. Identify and document the existing condition of specified marine recreational swimming beaches [Appendix A].
3. Identify background levels in bacteriological water quality and environmental conditions.

Project Description

Marine public beaches available for public use have been assessed for water contact recreational activities and the number of people using the water. 776 beaches were evaluated for potential pollution from fecal sources, the number of users of the beach, and the water contact duration and extent of use. The evaluation process ranked the beaches by numerical priority. 72 beaches were picked from that list to be monitored in the 2004 recreational season. The list will be reviewed each year for completeness and reprioritized based on sampling results, new information, and public input. This Program will determine the concentrations of the bacteria enterococci in samples of water taken from the swimming areas of specified recreational beaches [Appendix A]. When results are above threshold levels, resamples will be collected and determined for enterococci along with fecal coliforms or *E-coli*.

LHJs and Tribes have the necessary training and equipment to conduct monitoring or supervise volunteers to conduct monitoring. State personnel will be used for back up when county and volunteer sample collectors are not available. Each beach will be sampled weekly or biweekly for beaches that have high use year round.

Water samples will be submitted to laboratories and tested for enterococci [only laboratories accredited for determining enterococcus by Washington State will be used]. Resamples will be tested for fecal coliform or *E-coli*. All laboratories must be accredited by Washington State for the the indicator determinations. Laboratory results will be sent via e-mail or fax from the lab

and entered into the BEACH Program Database by the BEACH Program Coordinator or the BEACH Program Database Coordinator. Public notification of beach status will be made available via the Department of Health's (Health) Recreational Beach Web site. Ecology will submit data to USEPA via CDX by January 31, 2005.

The intent of the BEACH Program is to offer rapid and accurate assessment of beach water quality conditions through routine monitoring of coastal marine recreational waters and to determine if levels of the indicator bacteria, enterococci, exceed the single sample maximum and geometric mean water quality criteria established by EPA's *Ambient Water Quality Criteria for Bacteria-1986* (USEPA, 1986). Failure to meet this criterion will result in issuance of an "Advisory". A "Warning" shall be issued when a single sample of enterococci results exceed the single sample maximum of 276 enterococci bacteria colonies per 100 milliliters. Monitoring coastal marine waters for these bacterial indicators will help determine if the waters are suitable for recreational use by Washington residents and tourists.

Project Communication

The BEACH Program is a collaborative effort between Ecology, Health, and LHJs requiring effective communication. Regular and frequent communication between all parties will occur through phone calls, e-mails, and site visits. The BEACH Program Coordinator will be the link between all parties and will have official work stations in both Ecology and Health's Headquarters.

The lead investigator shall:

1. Meet with the BEACH Program Coordinator monthly to track progress and determine compliance with grant requirements.

The BEACH Program Coordinator shall:

1. Meet with the lead investigator monthly.
2. By e-mail, discuss general analytical needs and QAPP requirements with the LHJs.
3. Support the posting and notification process as necessary.
4. Verify field results and validate laboratory data.
5. Report and verify resample procedures for sample results above threshold limits.

LHJ and Tribal staff shall:

1. Communicate with BEACH Program Coordinator via e-mail and telephone as necessary.
2. Report fecal pollution events to BEACH Coordinator via telephone or e-mail within two hours.
3. Train volunteers and evaluate quality of volunteer-collected data if applicable.

The QA officer shall:

1. Review and approve the Quality Assurance Project Plan.
2. Review and confirm QC problems presented by the BEACH Program Coordinator and recommend solutions.

Specified laboratories shall:

1. By e-mail, inform the BEACH Program Coordinator of any difficulties in meeting QAPP requirements.
2. Report results of analysis by e-mail as soon as possible or within four hours of completion.
3. By phone, inform the BEACH Program Coordinator of lost samples, failure of one or more QC requirements, or the need for a resample.

Measurement Quality Objectives

Table 2 outlines the Data Quality Objectives (DQOs) for the variables measured in this Program. Accuracy of the laboratory determinations will be assured through the laboratory procedures of the various accredited labs. Accuracy has been demonstrated and assured in the State Accreditation process.

Standard protocols for data and sample collection will be followed throughout the study to limit sources of bias. Sources of bias from sampling procedures and sample handling will be minimized by adherence to standard operating procedures.

Table 2. Data Quality Objectives

Parameter	Reporting Units	Reporting Limit	Relative Percent Difference (RPD)
Enterococci	1	2 cfu	50%
Fecal coliforms	1	2 cfu	50%
E-coli	1	2 cfu	50%
Water temperature	°C	+/- 0.5 ° C	30%
Turbidity	NTU	0.5 NTU	10 %

Study Design

Used as a tool to evaluate the risk of waterborne illness to bathers in highly used recreational marine waters of Washington State identified personnel will conduct or manage weekly water, or biweekly for year round beaches, sampling for indicator bacteria at specified marine recreational beach sites [Appendix A].

Samples will be collected in knee-deep water from three sample locations across the bathing area; if there is a freshwater/stormwater discharge in the bathing area, sampling should occur near the discharge. Additional samples will be collected every 200 yards up to a maximum of 600 yards from the discharge. Individual sample locations will be geo-referenced using a GPS unit and the locations stored in the BEACH Program database. Water sampling will begin the last week of May and continue weekly through September 15 or year round for the limited number of year round beaches.

Water samples will be collected by LHJ staff, Tribal Staff, or volunteers managed by LHJs or Tribes, or state personnel when county and volunteers are not available. Samples will be delivered to laboratories ideally within six hours. Samples will be analyzed for indicator bacteria, which are not disease causing pathogens, but can indicate the presence of fecal contamination.

Ancillary water and environmental conditions can influence bacterial levels. Sample collectors will measure water temperature, turbidity, and other environmental conditions when feasible; however, these are not required elements of this Program, and are not a part of this QAPP. LHJs or Tribes should maintain their own sampling QA and metadata for these variables. This information will be used to determine useful information desired for further implementation.

Field Procedures

The Standard Operating Procedures (SOPs) for field sampling are described as “Step-by-Step Procedures” below, including specific facilities, equipment, materials and methods, and QA/QC procedures. The proper collection, preservation and storage of beach water samples are necessary to reduce errors in analysis. Three samples per beach will be collected across the bathing beach, including one near a freshwater inflow, if present and adjacent to the bathing beach. A random duplicate sample will be collected once per week per county.

Marine water samples are susceptible to rapid increases or death of microorganisms and hence will be held for the shortest time possible to minimize change. Steps for the preservation and transit of collected water samples will be followed precisely, or the sample will not be analyzed and another sample will be collected. Bacteriological samples must be iced or refrigerated at a temperature of 1-4° Celsius (C) and stored in insulated containers to assure proper maintenance of sample temperature during transit to the laboratory. Samples will be delivered only to laboratories approved by Ecology.

Step-by-Step Procedures

The protocol for sampling was derived from the procedures outlined in the EPA’s *Microbiological Methods for Monitoring the Environment: Water and Wastes* (EPA, 1978).

1. Identify sampling site on the label and field log book before collecting the sample.
2. Wade into roughly 2.5 feet of water.
3. Fill a water bottle at each of the three sample sites by wading into knee deep water, unscrewing the cap and inserting the bottle and cap into the water at a 45 degree angle (with the bottle opening facing down). Turn the bottle upright a few inches below the surface and allow it to fill. Remove the cap and bottle from the water and pour off enough water to leave an air space. Cap the bottle. If possible, use a wand to avoid collecting disturbed sediment.
4. Place labeled sample bottle in cooler.
5. Deliver to laboratory within six hours of sample collection.

Samples must be examined as soon as possible after collection so that the holding time limit will not exceed six hours between collection and initiation of sample determination. Samples will be delivered only to laboratories *accredited* by Washington State.

Design Assumptions

Samples will be collected weekly, or biweekly for year round beaches, for all beaches selected for the monitoring and notification program. In order to allow time for the resampling of poor results before the next sampling period, field personnel will be encouraged to collect the samples on Monday or Tuesday of the sampling period and collect any re-samples later in the week. LHJ staff, Tribal personnel or volunteers will document rainfall and tidal information to explain sample collection difficulties (for example: the current was too strong to safely enter the water). If the sample cannot be collected according to the plan, due to holidays or inclement weather, then personnel will collect the sample as soon as possible to ensure that any re-samples can be conducted before the next sampling period. If the situation does not allow for sampling in the required time frame, LHJ staff, Tribal personnel or volunteers must contact the BEACH Coordinator within the sampling period in question. Laboratories will be required to have the ability to handle weekly samples and to report results to the BEACH Coordinator in a timely manner.

Sample Custody Procedure

Chain of Custody (COC) procedures are to be followed whenever samples are collected, transferred, stored, or analyzed. Specific laboratory COCs are outlined in the required QA manuals developed for Ecology *accredited* laboratories. LHJ staff or volunteers will follow the sampling protocol developed and will directly deliver samples to the laboratory for analysis. When the samples are at the laboratory, LHJ staff, volunteers and laboratory staff will complete any COC records required by each laboratory. Specific laboratory COCs are outlined in the required QA manuals developed for Ecology *accredited* laboratories.

Laboratory Procedures

Indicator	Method	Reference
Fecal Coliform		
Fecal Coliform by Multiple Tube Fermentation (MTF) m-EC	SM 9221 C, E	APHA, 1998
Fecal Coliform by Membrane Filtration (MF) m-EC	SM 9222 D	APHA, 1998
Enterococci		
Enterococci by Membrane Filtration (MF) Using mEI or me	SM 9230 C SM 9213 D	APHA, 1998 APHA, 1998
Enterococci by Quant-Tray	Enterolert	EPA, 2001
E – Coli		
Most Probable Number	LTB EC-MUG	APHA, 1998
Most Probable Number	9221B	APHA, 1998
Membrane Filtration (MF)	SM 9221 C, E(2) 9213 B, D	APHA, 1998

Decision Criteria

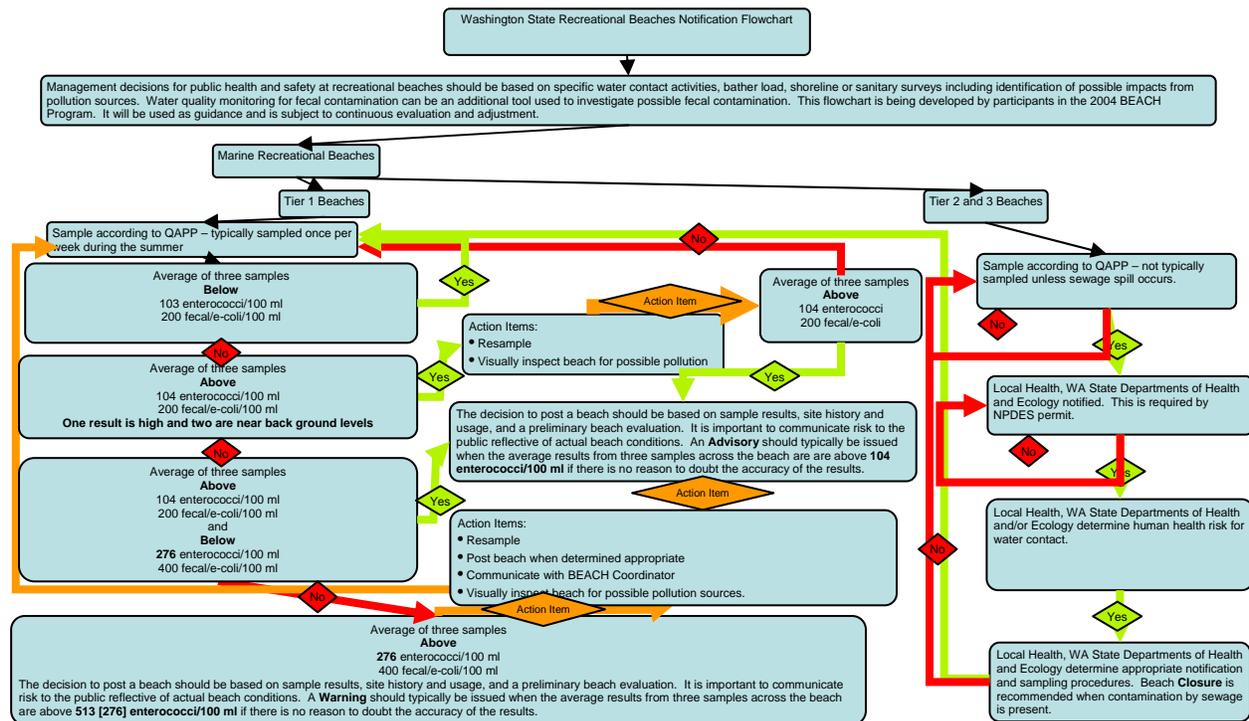
Closure action or other emergency action may only be taken by the local health officer under RCW 70.05.070, Local health Officer - Powers and Duties.

WAC 246-260-180 Bathing beaches. No bathing beach shall be maintained or operated when such water is determined by the health officer to be so polluted or subject to pollution as to constitute a menace to health if used for bathing. Where bathhouse and toilet facilities are provided for use of bathers they shall be constructed, maintained and operated in a sanitary manner approved by the health officer.

The BEACH Program's decision criteria are based on EPA's ambient water quality criteria (EPA, 1986) for two reasons:

1. Enterococci have a better correlation between indicator levels and illness rates than fecal coliform.
2. Washington State's marine Bacteria Indicator Water Quality Standards protect for the consumption of shellfish. Protection from human illness due to primary marine water contact is not mentioned in Washington State's Water Quality Standards. Closing a beach or advising against water contact based on a single sample of 41 fecal coliform colonies/100mL or having a geometric mean of 14 fecal coliform colonies/100mL could result in excessive advisories. A financial hardship on local communities could result from unnecessary and excessive postings. Public confidence in the Beach Program could also drop resulting in a human health hazard due to future postings being ignored.

The decision to post an “Advisory” or “Warning” will be based on the Beach Program Notification Flowchart:



To make the necessary decision, data must be indicative of water quality conditions to adequately assess sanitary conditions of the beach. Due to inherent uncertainty involved with sampling and analytical determination of bacteria levels, decisions will be made when there is no reason to doubt the accuracy of the sample.

Quality Control Procedures

Field Quality Control

The BEACH Coordinator will accompany field-sampling crews on several occasions throughout the sampling season to ensure samples are collected at the correct location and according to the SOP. Each county will collect duplicate water samples at one station each week to assess variation associated with field replicates and laboratory analysis. Duplicate measurements will also be taken at the QC station.

State Accreditation Status

All testing, inspection, and maintenance of laboratory equipment will be conducted as prescribed by laboratory QC manuals. The QA procedures for the laboratories were reviewed and maintained through Washington State Accreditation status.

Data Reduction and Management Procedures

Laboratory data reduction and validation will be conducted by the laboratory analyzing the samples in accordance with methods requirements and standard operating procedure of the laboratory. The BEACH Coordinator or BEACH Data Coordinator will assess the data for completeness and data entry errors and will enter the data into an Microsoft Access© database. Any discrepancies will result in the notification of LHJ representatives and the laboratory.

Reports

Data will be reported to the BEACH Coordinator via e-mail by the LHJ staff, Tribal personnel or volunteers and the analysing laboratory.

Ecology will report data from the BEACH Program to EPA via CDX/STORET by January 31 of each year.

Data Verification and Validation

Data will be verified by the LHJ laboratory then faxed or e-mailed to the BEACH Program Coordinator.

The BEACH Program Coordinator will validate the results then transfer them to a Microsoft Access© database. Further validation will occur to ensure:

- 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,
- Accuracy meets program objectives, and
- The protocols outlined in this QAPP were followed.

Data Quality Assessment

After the data has been validated, to make decisions regarding the risk of disease to users of Washington's marine recreational beaches:

- Data will be reviewed within 24 hours of determination, resample decisions will be made when sample results are above threshold limits as outlined in the Decision Criteria section.
- Resample data will be reviewed and compared to threshold limits, when sample results remain above threshold limits outlined in the Decision Criteria section, public notification, further investigation, and a recommendation to the LHJ to conduct a shoreline survey will occur.
- Application of statistical tests will occur to evaluate and ensure determinations remain below the specified geometric means.
- Verify the assumptions of the statistical tests.
- Draw conclusions from the data.
- Data will be reviewed and recommendations made for BEACH Program improvements in October of each year.

References

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- U.S. Environmental Protection Agency. 2002. *National Beach Guidance and Required Performance Criteria for Grants*. EPA-823-B-02-004, Office of Water, Washington, DC.

Appendix A

<p>Clallam Cline Spit County Park Hollywood Beach Salt Creek Recreation Area County Park (CRESCENT BEACH)</p>	<p>Grays Harbor Westhaven State Park, South Jetty Westhaven State Park, Halfmoon Bay Westport - The Groins Chance a La Mer / Ocean Shores Main Entrance</p>
<p>Island Oak Harbor City Beach Park Oak Harbor Lagoon Fort Ebey State Park Freeland County Park/Holmes Harbor</p>	<p>Jefferson Camp Parsons Boy Scout Camp Fort Worden State Park</p>
<p>King Alki Beach Park South West Alki Beach Carkeek park Discovery Park Golden Gardens Park Lincoln Park Lowman Beach Redondo County Park Richey Viewpoint Richmond Beach County Park Saltwater State Park Seacrest Park Seahurst County Park</p>	<p>Kitsap Arness County Park Blake Island State Park - Tillicum Village Eagle Harbor Waterfront Park Evergreen Park Harper County Park Illahee State Park Indianola Dock Kitsap Memorial State Park Lions Park Oyster Plant Park Pomeroy Park - Manchester Beach Scenic Beach State Park Silverdale County Park Camp Indianola</p>
<p>Mason Belfair State Park Twanoh State Park Potlatch State Park Lilliwaup State Park</p>	<p>Snohomish Edmonds Underwater Park Jetty Island Howarth Park Kayak Point county Park Marine Beach South / Edmonds Picnic Point County Park</p>
<p>Pierce Dash Point County Park Dash Point State Park Penrose Point State Park Owen Beach - Point Defiance Ruston Way Waterfront Park Sunnyside Beach Park Titlow Beach Park Wauna, Beach 35</p>	<p>Whatcom Birch Bay State Park Birch Bay Near Terrell Creek Maple Beach</p>

Skagit

Bayview State Park

Dewey Beach

North Beach - Guemes Island

Seafarer Park

Samish Island Recreation Area

March Point Public Access

Thurston

Burfoot County Park

Priest Point Park

Tolmie State Park

Swantown Marina