Pierce County Pollution Identification and Correction Enhancement Project

Quality Assurance Project Plan

Tacoma-Pierce PIC Award

Contract Number C16903

March 28, 2013

Prepared by:
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Prepared for:
Pollution Identification & Correction (PIC) Team
Tacoma-Pierce County Health Department and
Washington State Department of Health

Public Information

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Approval Sheet

Quality Assurance Project Plan (QAPP) for
Pierce County Pollution Identification and Correction Enhancement Project
Contract Number C16903

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Abstract

The Pierce County Pollution Identification and Correction Enhancement Project is designed to refine and improve the Pierce County Shellfish Partners Program such that the program is more effective at preventing, identifying, and correcting sources of bacterial pollution in the shellfish watersheds of Pierce County. One task of the project, developing the strategic plan, is being conducted by the Shellfish Partners but most of the pollution source identification and correction work is being accomplished by only one of the partners, Tacoma-Pierce County Health Department.

This Monitoring and Quality Assurance/Quality Control Plan has been developed to ensure that data collected as part of the project is of high quality. Water pollution source identification activities include water quality sampling along the shellfish bay shorelines, upland sampling of the larger tributaries, sanitary surveys assessing septic systems, and special investigation sampling. Once a pollution source has been identified, the Septic Repair Facilitator will work with the property owner, and other partner agencies if necessary, to address the problem.

The expected outcomes of the project include:

- More thorough identification of potential causes of contamination to marine waters;
- Improved marine water quality in the shellfish waters monitored by the Washington State Department of Health (DOH);
- Increased capacity to analyze impacts of septic systems or other sources of contamination through data management;
- A comprehensive strategic plan for the Pierce County Shellfish Partners; and,
- Increased quality and effectiveness of septic system inspections by industry professionals.

Problem Definition/Background

Background

This Monitoring and Quality Assurance/Quality Control Plan outlines the data collection and quality assurance (QA) procedures for surface water sample collection, analysis, and reporting for the Pierce County Pollution Identification and Correction Enhancement Project (PIC Project) of the Tacoma-Pierce County Health Department (Health Department). This plan was prepared in accordance with the Washington State Department of Ecology's Guidelines for Preparing Quality Assurance Project Plans (Lombard and Kirchmer, 2004). The goals of this document are as follows:

- To ensure that high quality, verifiable data are collected;
- To ensure cost-effective use of resources; and,
- To ensure that the data are useable by citizens, organizations, state, local and federal agencies, including the Washington State Department of Ecology and the United States Environmental Protection Agency.

Data generated from this project, from the Washington State Department of Health Office of Shellfish Programs (DOH), and from Pierce County Surface Water Management (SWM) will be used to identify problem areas for targeted corrective activities to achieve and maintain good water quality in the shellfish watersheds of Pierce County.

This plan addresses the QA needs associated with sampling and data collection activities to be performed by the Health Department and its representatives. This plan presents objectives, activities, and specific QA procedures designed to assure that scientifically representative data are obtained throughout the project.

The project focuses on the Key Peninsula/Gig Harbor/Islands (KGI) Watershed, which, in turn, is a subbasin of Water Resource Inventory Area 15, the Kitsap Basin. The project area is shown in Figure 1, Map of the Project Area, on Page 27. The watershed lies primarily within unincorporated Pierce County. The watershed is within the usual and accustomed fishing and hunting grounds of the Puyallup, the Nisqually, and the Squaxin Tribes of Indians.

The KGI Watershed covers approximately 158 square miles and is located in the Puget Sound Partnership's South Sound Action Area. The KGI Watershed is bounded on the west by Case Inlet and on the east by Carr Inlet. The Islands included in the project area include: Anderson, Cutts, Fox, Herron, Ketron, and Raft Islands. The area has a mild climate and receives approximately 50 to 55 inches of precipitation each year.

The DOH's website, http://doh.wa.gov/ehp/sf/growreports.htm identifies thirteen commercial shellfish growing areas in Pierce County. All thirteen of these growing areas are within the KGI Watershed. Two (2) of these growing areas, Burley Lagoon and Filucy Bay, are on the DOH "Threatened Areas" list for 2011 due to water quality concerns. There are also numerous recreational shellfish beaches in the KGI Watershed.

A number of the shellfish growing areas, including Minter Bay, have been actively harvested since the 1940s and Burley Lagoon has been actively harvested since 1900. Both Burley Lagoon and Minter Bay have also been impacted by declining water quality at least as far back as the early 1980s (Determan 1985).

This project addresses several key threats summarized in the Puget Sound South Sound Action Agenda by preventing pollution from septic systems, animal waste, and other residential sources:

- Increase in biotoxins, pathogens resulting in loss of private, recreational, commercial and tribal shellfish harvest
- Low levels of dissolved oxygen resulting in fish kills
- Increased stormwater runoff and pollution

The Shellfish Watersheds Program at the Health Department evolved out of successfully implementing more than eight grants from the late 1980s into the early 2000s targeted at improving water quality in specific threatened shellfish growing areas. These grants were generally successful in improving water quality in a shellfish area but water quality frequently declined in the years following completion of the grant. An excellent example of a water quality decline following restoration work is provided by Burley Lagoon, which was downgraded by

DOH in 1981 from Approved to Restricted. Burley Lagoon was upgraded in 1993 following a variety of remedial actions, including a grant project implemented by the Health Department, but was downgraded again in 1999 due to declining water quality (Determan, 2004). This lack of an ongoing, proactive effort led to a partnership initially between SWM, Pierce Conservation District (PCD), and the Health Department to form the Pierce County Shellfish Partners team. This allowed a continuous, proactive approach to improving and protecting water quality in the shellfish watersheds of Pierce County.

To help decrease the repair time for failing septic systems and to lessen the financial hardship on the community, a partnership was developed between the Health Department, SWM, and Pierce County Community Connections to pursue and implement a septic repair grant and loan project. This project began in 2007 and helped in the repair of seventeen failing septic systems, many of which were expensive repairs on difficult marine shoreline properties. The project was so successful that SWM received a larger grant and low interest loan to continue this work and these new monies have to date funded 27 repairs.

The Shellfish Watersheds Program at the Health Department currently receives $199,000 yearly from SWM (collected through a parcel assessment) to support two staff and pay for laboratory costs to analyze approximately 500 water samples for fecal coliform enumeration. These staffers conduct sanitary surveys and shoreline evaluations to identify and prevent water quality threats. Tributaries within the primary shellfish growing areas have been sampled either once or twice each year for the last five years (prior to 2005, only limited sampling was conducted). Approximately 500 samples collected each year have been entered into a database associated with a GIS layer depicting the sampling locations.

Sampling efforts are constrained by a number of factors including tide, beach access, the ever changing nature of the shoreline, rainfall-dependent flows, and the seasonal use of certain properties. A number of tributaries within the primary shellfish growing areas are only accessible on a moderately low or lower tide. Efforts have been made to identify the approximate maximum tide for which a section of shoreline can be evaluated but further work is needed. Most of the tributaries can be sampled at a + 6.0 foot or lower tide. This can present a problem in the winter months, when the lowest tides are during the night or very early in the morning.

Staff are able to access the beach at public access points (such as the Vaughn Bay boat launch) and at locations where property owners have given their permission. To date enough property owners have provided beach access that this hasn't presented a problem. However, if relationships between staff and the community were to sour, beach access could be an issue.

In the past, the identification of particular tributaries has been difficult due to changes in the shoreline (logs, erosion, stream meander) and property changes (new deck, change in house color, etc.). This is less of a concern now that staff use GPS units to help locate tributaries.

A number of tributaries only flow for a short duration during and immediately following a rain storm. Efforts are underway to better track these transitory flows by utilizing the following measures: noting tributaries with no flow during shoreline evaluations, determining what size of rain storm (inches of precipitation in the past 24 hours) that should be targeted for a particular

tributary, and determining the maximum rain storm (inches of precipitation in the past 24 hours) that should be sampled. Staff will be working with SWM to help refine these measures.

A number of properties are second or third homes and are occupied for only a short period of the year, generally some weekends during the summer. For these properties, tributary sampling is not likely to detect a bacterial source unless the residence is being occupied. This is one of the purposes of the summer tributary sampling event, in that many of the recreational properties will be in use during these sampling events.

Problem Statement

The Pierce County Pollution Identification and Correction Enhancement Project is needed to develop a more comprehensive and multi-faceted Shellfish Watersheds Protection Program and a stronger Pierce County Shellfish Partners team to protect and improve water quality in the shellfish waters of Pierce County. This will result in more bacterial sources being identified and corrected; ultimately improving water quality in the shellfish watersheds of Pierce County.

Project/Task Description

This project has the following objectives:

- Enhance shoreline evaluation and sanitary survey work to identify and correct sources of fecal coliform bacteria;
- Enhance monitoring of contractors who engage in septic system Operation and Maintenance Inspections to increase likelihood that problems are detected and addressed;
- Increase capacity to collect and manage data about marine shoreline areas;
- Maintain an ongoing educational element within the Puget Sound Partnership's South Sound Action Area (Key Peninsula, Gig Harbor Peninsula, and Pierce County islands-the KGI Watershed); and,
- Implement a strategic planning effort to identify and address marine water quality priorities and establish and coordinate inspection and correction efforts with other agencies that address marine water quality contamination efforts.

The following tasks will be implemented to meet the goals and objectives for this project.

Task 1. Project Management

Project administration shall consist of, but is not limited to, the following activities: conducting, coordinating and scheduling project activities described in the project task proposal; maintenance of project records; office support; financial administration; quality control; supervision; compliance with the DOH's grant requirements; and the preparation of required scheduled reports to the DOH.

Task 2. Pollution Identification and Correction

The Health Department will conduct shoreline evaluations on Amsterdam Bay, Burley Lagoon, Dutchers Cove, Filucy Bay, Mayo Cove, Minter Bay, Oro Bay, Rocky Bay, Vaughn Bay and the Wauna shoreline to identify and correct sources of pathogens and nutrients. Figure 1 (page 27) shows the general project area and shoreline specific maps are included on pages 52 – 60 in the

Pollution Prevention, Identification & Correction Manual (Appendix E). The shoreline evaluation work will build upon the existing 700 plus monitoring locations that have already been established and 4,800 plus water samples that have been collected to date. All tributaries with a flow greater than one gallon per minute (gpm) in the shellfish bays will be sampled at least yearly for fecal coliform bacteria, water temperature, pH, and conductivity. In addition, flows will be measured or estimated. Flows less than one gpm may be sampled if there is an indication of a water quality issue (sewage odor, unusual coloration, etc.). Tributaries will be resampled if a fecal coliform count is equal to, or greater than, 200 colony forming units (cfu)/100ml. If the resample result is also equal to, or greater than, 200 cfu/100ml, the property will be investigated.

If a failing septic system is suspected, the property will be dye tested. Dye testing standard operating procedures are provided in the Pollution Prevention, Identification & Correction Manual (Appendix E). Property owners will be provided technical assistance if the problem is a failing septic system and the property owner will be directed to a financial assistance program, where appropriate, to expedite repairs. If the high counts of bacteria are due to poor animal keeping practices, the site will be referred to the Pierce Conservation District.

The costs for sampling in 2012 and in 2013 until the end of September will be covered by the current EPA grant and funding from SWM. The proposed project will enable sampling to continue, and possibly expand, in late 2013 and through 2014.

Prior to initiating water quality monitoring activities, a Quality Assurance Project Plan (QAPP) will be developed that meets EPA and Ecology approval (the Health Department is currently conducting sampling under the EPA-approved QAPP for the Pierce County Shellfish Watersheds Project).

Sanitary survey work will be conducted in 2014 on approximately 100 properties along Filucy Bay and Dutchers Cove to assess septic system function. Each homeowner will be asked a series of questions regarding their septic system and the property will be examined for signs of septic system failure. If there is an indication of a problem, the residence will be dye tested to determine if the septic system is failing. If the system is found to be failing, the Health Department will provide technical assistance and assist with finding possible financial assistance to expedite the repair.

The sanitary survey will utilize an approach, developed with prior DOH funding, that includes information and guidance on a variety of household actions to minimize adverse impacts on water quality. This will be accomplished by providing more comprehensive technical assistance during the sanitary surveys, including:

- OSS maintenance
- How homeowners can take increased responsibility of their own OSS
- Natural yard care practices
- Use of “green” or less toxic household chemicals
- Drinking water quality issues
- Proper management of pet and/or agricultural waste

The shoreline evaluation and sanitary survey work will ramp up over a course of months, with most of the work being conducted following completion of the current EPA grant (September 2013).

DOH marine water quality results will be reviewed to evaluate the success of this task. It is anticipated that over the three-year period of this grant, DOH marine water quality results will remain stable and, at some sampling stations, improve. If DOH marine water quality results appear to be declining at one or more stations, further source identification work will be conducted in the vicinity. This will include more frequent tributary sampling and upland sampling, if needed. Approximately 340 water samples will be collected and analyzed for fecal coliform enumeration as part of this project. The majority of this sampling will occur from mid-2013 through 2014.

Task 3. Education and Outreach

Public support is crucial for the efforts of marine water quality improvement. The community needs to have an understanding of the value of environmentally healthy marine shoreline water quality, and the necessity for an active pollution inspection and correction program within the environmentally sensitive areas of the KGI Watershed. Additionally, the Health Department must have an enhanced understanding of the stated needs, interest, and concerns of community members and industry representatives to ensure the successful implementation of project activities.

This task will build upon the efforts of the education process begun with the EPA-funded Pierce County Shellfish Watersheds Project (PO-00J12301-0) and the Pierce County MRA Enhancement Project (funded through a Pathogens grant, application submitted July 29, 2011). One or more media professionals will develop a marketing and education campaign to include: printed materials, informative billboards and web based information, to promote water quality awareness and build community support for contaminant reduction within the KGI Watershed. Information will be presented through a variety of outreach methodologies, including using social marketing tools, to insure that the information is made available to the greatest number of property owners in the KGI Watershed as possible. We will utilize appropriate sections of the Puget Sound Partnership's outreach effort, *Puget Sound Starts Here*, as we implement this task.

A significant portion of the proposed budget is dedicated to Education. Through past efforts at implementing new or enhanced rules/regulations, the Health Department has had to engage in major educational efforts that include homeowners, communities, and local governmental representatives. Many of those efforts have required significant time and staffing on the part of the Health Department to move those changes forward. We anticipate as much or more effort will be required to bring new and enhanced pollution investigation and correction requirements to the KGI Watershed community for this project proposal.

This task will include a pre- and post-activities evaluation component to assess:

- Level of community awareness
- Community attitudes
- Behavior changes

Task 4. Strategic Planning for the PIC Program

The purpose of this task is to dedicate staff time for the development and implementation of a comprehensive and sustainable strategic plan to enhance the Pierce County Shellfish Partners' PIC efforts to reduce contamination in the shellfish growing areas of Pierce County. Elements of that plan will include:

- Identification of appropriate agencies, including, at a minimum, the Health Department, SWM, and PCD, needed to establish a coordinated effort to protect and enhance water quality along marine shorelines;
- Determine the roles and level of effort needed of the Health Department, SWM, and PCD to sufficiently protect water quality in the shellfish watersheds of Pierce County;
- Identify appropriate community citizens and organizations for planning input and feedback;
- Efforts to identify and secure sustainable funding; and,
- Identification and prioritization of short and long term goals.

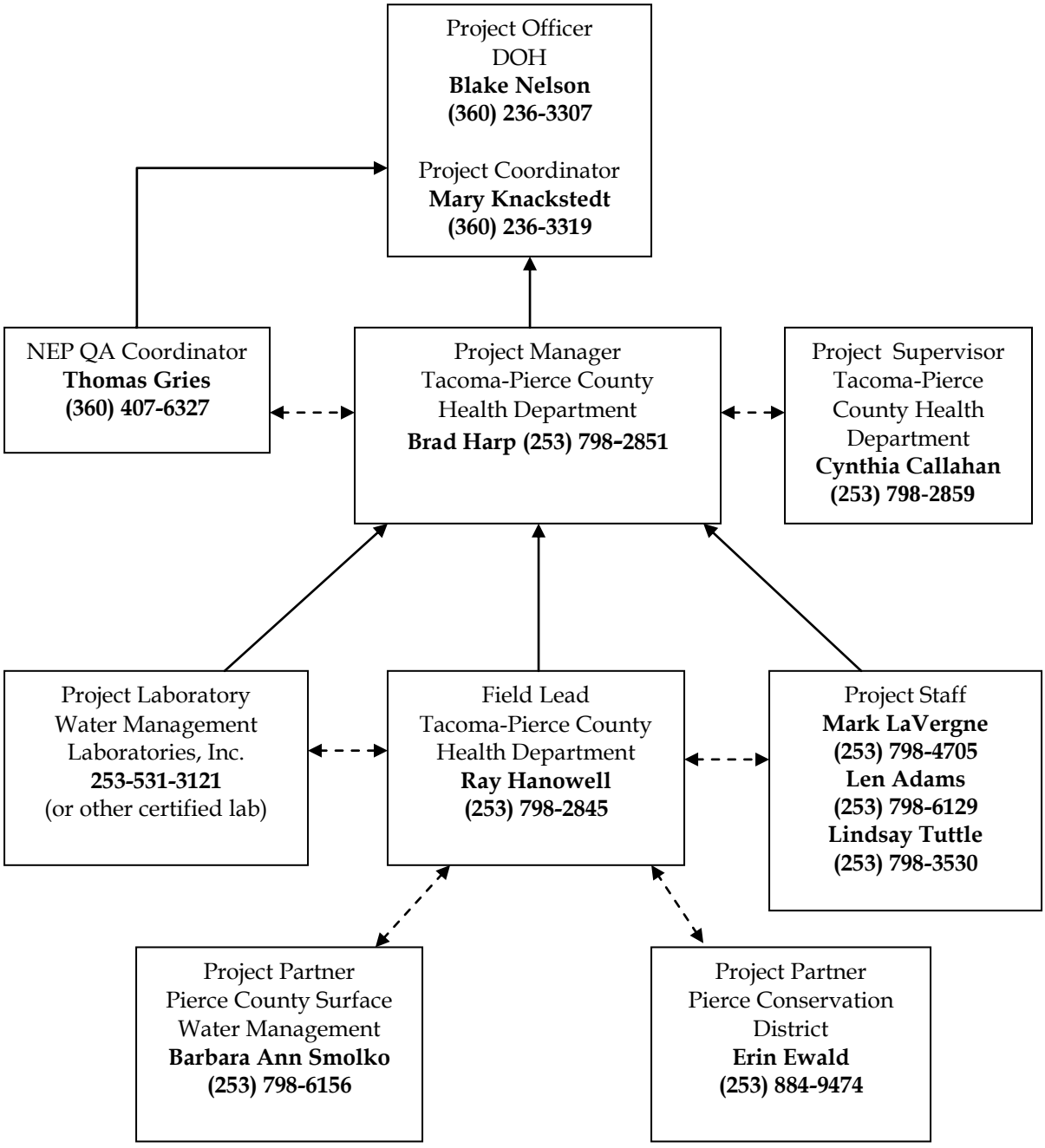
This plan will use as a starting point the Assessment of Pierce County's Shellfish and Water Quality Protection Efforts on Key Peninsula, Technical Memorandum (URS Corporation, 2006). The plan is anticipated to be broader than what is covered in the Technical Memorandum and will identify the necessary program components for other existing programs that have a role in protecting water quality in the shellfish watersheds of Pierce County. For example, the plan is expected to include the Health Department's septic system Operation & Maintenance Program and will identify the program activities needed to sufficiently address the identification and correction of failing septic systems. The plan will also take into consideration the three closure response plans developed for the Rocky Bay, Burley Lagoon, and Filucy Bay Shellfish Protection Districts.

Task 5. Septic System O&M Evaluations and Improvements

The purpose of this task is to begin the process of improving the quality and performance of the contractors who perform septic system inspections for the Operation and Maintenance Program. As septic system professionals begin conducting thorough inspections, they should be identifying most failing septic systems. This should greatly reduce, and possibly eliminate, the need for sanitary surveys by Health Department staff. Activities in this task include:

- Conduct a pre-project evaluation of the quality of O&M inspections, determined through a QA/QC check by the Health Department;
- Conduct an assessment of and training for O&M providers (over a one-to two year timeframe) to include job shadowing, discussion of mandatory inspection steps, and rigorous training. Accompany contractors during their onsite inspections on a random basis to assess their performance and develop methods of improving that performance. Health Department staff will complete at least 30 random inspections of the contractor's performance at onsite locations;
- Provide additional education to the contractor regarding the importance of their role in protecting marine shorelines;
- Post-evaluation of the quality of the O&M inspection determined through a QA/QC check by the Health Department; and,
- Assess need to continue random inspections of contractor efforts.

Task Organization / Schedule



Staff Responsibilities

Brad Harp, Project Manager – Ensures that Project is completed on time and on budget.

Cindy Callahan, Project Supervisor – Ensures that project deliverables are provided to DOH.

Ray Hanowell, Field Lead – Responsible for the day-to-day project activities.

Mark LaVergne – Lead staff for pollution source correction work.

Len Adams – Co-lead staff for educational activities, along with Ji Hae Yi. Also support staff for sanitary surveys, shoreline evaluations and upland sampling.

Lindsay Tuttle – Lead staff for shoreline evaluations, upland sampling, initial data QA review and sanitary surveys.

Barbara Ann Smolko – SWM representative to assist in development of the strategic plan, assist with coordination of educational activities.

Erin Ewald – PCD representative to assist in development of the strategic plan, lead farm planner for PCD in the shellfish areas of Pierce County.

Table 1. Proposed Project Schedule.

Project Tasks	**2012**				**2013**				**2014**			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Project Management												
Reports		R		R		R		R		R		R
Pollution Identification and Correction												
Water Sampling						X	X	X	X	X	X	
Sanitary surveys								X	X	X	X	
Correction Activities						X	X	X	X	X	X	
Outreach and Education												
Develop plan	X	X	X	X	X							
Give presentations			X	X	X	X	X	X	X	X	X	
Attend fairs or events			X	X	X	X	X	X	X	X	X	
Evaluation report											X	X
Strategic Planning												
Develop Strategic Plan		X	X	X	X	X						
Septic O&M QC												
QA/QC Plan for O&M				X	X	X						
Pre-evaluation findings					X	X	X					
Log site inspections					X	X	X	X	X	X		
Post-evaluation											X	X

To view the complete project schedule, please see Appendix A.

Quality Objectives and Criteria for Measurement Data

Data Quality Objectives

The primary data quality objectives for the monitoring task of this project are to collect enough fecal coliform and other environmental data of sufficient quality to identify pollutant sources, where possible measure the effectiveness of corrective activities, and demonstrate water quality improvement after the corrective actions are taken. Consistency in methods of sampling, analysis, data interpretation, and reporting will be a high priority in this investigation.

Data Quality Indicators

For detailed information on measurement quality objectives please refer to the quality control text in the sections on Field Measurement Methods, Analytical Methods, as well as in the PIC Manual (TPCHD, 2013).

Precision is defined as the measure of agreement among repeated measurements of the same property under identical or substantially similar conditions, calculated as either the range or as the standard deviation. It may also be expressed as a percentage of the mean of the measurements, such as relative range or relative standard deviation (coefficient of variation). (EPA/QA G-5)

Precision for samples collected during this project will be determined by the following:

- Collection and analysis of field replicates (not splits) for fecal coliform will be conducted for a minimum of 10% of the samples collected for each monitoring day or event. When possible, replicates will be collected from sites with expected higher densities of fecal coliform in order to determine variability of bacterial density. Investigative monitoring (ie. parcel-specific) will not require replicate sampling;
- Calculation of the percent relative standard deviations (%RSD) of the pooled log transformed fecal coliform results will be made. Results pooled by magnitude will be evaluated allowing the higher percentage %RSDs of low values to be taken into account; and,
- Maintain documentation of ongoing field equipment maintenance and operation.

The total precision for field replicate measurements should not exceed 10% RSD for results at or above 10 times the reporting limit. Precision up to 50% of the RSD for any lower field replicate results, and for the E.coli replicates, is acceptable. At levels close to the method detection limit %RSDs greater than 50% are to be expected and are acceptable. Replicate samples that are "non-detects" shall not be used to measure precision.

Using this methodology, the overall variability will be calculated. Overall variability includes the natural environmental variability of the measured parameter, sampling variability, and lab variability (lab method and lab analyst). The overall variability of the parameter will be taken into consideration in the interpretation of the results.

Bias is considered the consistent deviation of measured values from the true value, caused by systematic errors in a procedure. Bias within the project will be reduced to the extent practicable by the following:

- Strict adherence to the sampling procedures of the project work plan;
- Complete data collection and organization;
- Regular maintenance, inspection, and calibration of field equipment;
- Periodic reviews and evaluations of field sampling procedures; and,
- Analyzing data in an appropriate manner based upon essential considerations, such as temporal variations.

Representativeness of the analytical data is described as an adequate number of samples and monitoring events to determine water quality. Representativeness will be primarily achieved through the following:

- Strict adherence to the specific procedures of the work plan including the selection of correct sample locations and methods;
- Thorough documentation of applicable environmental factors (e.g., weather and tidal conditions, observable changes, etc.); and,
- Entering all applicable environmental information into the water quality database and Excel spreadsheet for use in reporting data collected during the project.

Completeness is defined by Ecology as a measure of the amount of valid data needed to be obtained from a measurement system (Lombard and Kirchmer, 2004). The goal for this project is to correctly collect and analyze a minimum of 95% of the samples for all sites. Problems can occur during sampling, such as flooding or equipment failure, that may require some data to be invalidated.

Comparability to previously collected data will be ensured by utilizing the standard operating procedures (SOPs) previously established and used in previous efforts. These SOPs are described in the Pollution Prevention, Identification & Correction Manual (Appendix E).

Special Training/Certification

There will be no special training or certification required for project personnel above and beyond what is required per the project staff's Environmental Health job classifications. Project personnel have been in their current job positions for at least one year and regularly obtain continuing education training. Current training required for project staff is sufficient to fulfill the objectives and tasks for this project.

Documents and Records

Project personnel will receive the approved QAPP prior to the initiation of project field work. The document will be available in both electronic and hard copy to all project staff. If changes occur to the QAPP, the changes will be communicated to project staff immediately by the Project Manager and/or Project Supervisor. Documentation and record retention for information collected as part of the project is identified in Table 1.

Table 2. Documents and Records.

Project information/documents	Format	Retention schedule
Quality Assurance Project Plan	Hard copy Electronic file located in Grant Project common folder on Health Department network	6 years unless specified by grant contract
Field notebook assigned to each project staff	Spiral bound notebooks with "Rite in the Rain" paper	5 yrs (kept with sample results)
Chain of Custody forms	Hard copies available at Health Department office and at Water Management Laboratories, Inc.	5 yrs (kept with sample results)
Global Positioning System data	GPS electronic data on Health Department network	5 yrs (kept with sample results)
Water quality sample results	Hard copy Electronic data (water quality database, Excel spreadsheet, and GIS layer) on Health Department network, and entered into Ecology's Environmental Information Management system (EIM)	5 yrs Electronic permanent
Sanitary Survey Forms	Hard copy, information in Envision database on Health Department network	Hard copies 5 years, electronic permanent
Semi-annual and Final reports	Hard copy Electronic file located in Grant Project common folder on Health Department network	6 yrs unless specified by grant contract. Potential archival value
Fact Sheets, Press Releases, Presentations and other Educational materials	Hard copy Electronic file located in Grant Project common folder on Health Department network	5 yrs
Water Management Laboratories, Inc. or other contract lab Records of Analysis	Hard copy records kept in office Hard copy records onsite Hard copy records off site archive	Within 6 months Within 3 years Within 7 years

Sampling Process Design

The sampling process design for this project will include shoreline evaluation sampling, sanitary survey or source investigation sampling, and upland tributary sampling when DOH is collecting marine water samples. The SOPs for these sampling efforts, as well as dye testing procedures, are provided in the Pollution Prevention, Identification & Correction Manual (Appendix E).

The shoreline evaluation sampling will be conducted similar to previous sampling efforts under the Shellfish Watersheds Program. Water samples will be collected at the previously identified stations and at any new stations that are identified. In general, flows less than one gpm will not be sampled unless there is some indication of a possible water quality problem.

The shorelines to be monitored, along with the number of existing shoreline and upland sampling stations, include:

- Burley Lagoon — 81 shoreline sampling locations; 12 upland sampling stations
- Filucy Bay — 137 shoreline sampling stations; 12 upland sampling stations
- Oro Bay — 36 shoreline sampling stations
- Rocky Bay — 54 shoreline sampling stations; 3 upland sampling stations
- Minter Bay — 48 shoreline sampling stations; 4 upland sampling stations
- Amsterdam Bay — 15 shoreline sampling stations
- Mayo Cove — 22 shoreline sampling stations
- Dutchers Cove — 47 shoreline sampling stations; 2 upland sampling stations
- Vaughn Bay — 78 shoreline sampling stations; 3 upland sampling stations

Additional shoreline areas may be added if deemed necessary in consultation with SWM, PCD, and DOH. Shoreline evaluations (sampling of all tributaries) will be conducted at least once a year, and preferably twice a year, for each area. Ideally, a dry weather investigation (between May and September) will be conducted as well as a wet weather investigation (between October and April). These sampling events aren't targeted to specific weather conditions but some of the special investigation sampling is targeted to specific weather conditions. Staff are still consulting with SWM to identify the range of storms that should be targeted (the initial approach is to

sample storms between 0.2 and 1.0 inches of rain within the previous 24 hours). The order of the areas evaluated will be selected randomly at the start of each year.

During the shoreline evaluations, water samples will be collected from all flowing discharge points with a flow greater than one gpm, including: streams, stormwater outfalls, yard drains, bulkhead drains, other pipes, ditches, and seeps. Composite samples may be collected if there are multiple small discharges that appear to emanate from one parcel, one source, and/or are close together.

Stream samples will be collected using the following techniques: the collection point is approached from a downstream direction with care being taken not to disturb the bottom sediments; samples will be collected while facing upstream (against the flow) at approximately 15 to 30 cm below the water surface, or at half the depth of the water column (when the depth of the stream is less than twelve inches). For streams of sufficient depth, sample bottles will be filled using the "U" scoop motion to address the fact that bacteria may be concentrated in the surface micro layer. For shallow streams where it is not possible to use a "U" scoop motion, the sample will be collected such that there is the least amount of sediment disturbance as possible. For extremely shallow flows, such that a depression must be dug in the sediment to enable sampling, sufficient time should be allowed for the disturbed sediment to settle prior to collecting the sample. In addition, a comment should be added to the data form noting that this sample required making a depression in the sediment. For additional details on sampling, please see the Pollution Prevention, Identification & Correction Manual in Appendix E.

Water samples for fecal coliform analysis will be collected in sterile 250 ml plastic bottles. Each bottle will be clearly labeled with the location name and/or identification number, collection time, and date. Additionally, information regarding the discharge will be recorded in water resistant field notebooks or on data forms and will include location, drainage, outfall description (if a new site), inspector name(s), water temperature, pH and conductivity (if measured), discharge flow, whether the discharge flow was estimated or measured, and weather conditions. Water temperature, conductivity and pH will be measured with an Oakton meter, PCSTestr 35 utilizing standard operating procedures (see Appendix E). Discharge flow may be measured with a stopwatch and bucket or visually estimated. Notes will also be made to record any unusual odors, warm temperatures, matting, unusual vegetative growth, laundry lint, food waste, other characteristics that can indicate an intermittent sewage or laundry source, animal waste or tracks near the sampling location, unusual color, or if the sample contained some sediment.

Field Measurement Methods

The following parameters will be measured in the field using the SOPs in the PIC Manual available from the Tacoma - Pierce County Health Department (TPCHD, 2013; Appendix E).

Flow:	Estimated by field staff or measured. Shoreline evaluation flows that are measured will use a bucket and stop watch. For the upland sampling where the conditions allow, flows maybe measured using a Swoffer 2100 Current Velocity Meter. Range: 0.1 to 25 feet per second. Resolution: to hundredths of a foot. Accuracy: Possibly to within 1%. However, based upon past field checks at USGS gaging stations, the error range will more likely be plus or minus 10%.
Water Temperature:	Oakton PCSTestr 35. Range: 0 to 50 °C. Resolution: 0.1 degrees Celsius (C), Accuracy: +_0.5 °C.
pH:	Oakton PCSTestr 35. Range: 0.0 to 14.0, Resolution: 0.1, Accuracy: +_0.1
Conductivity:	Oakton PCSTestr 35. Range: 0 to 1999 Microsiemens (uS), Resolution: 1 us, Accuracy: +_ 1% full scale

Any sampling conducted during sanitary surveys or source investigation work will follow the same process as described for the shoreline evaluation sampling except that replicate samples will not be collected. These samples will be collected on an as-needed basis and won't follow a set schedule.

The upland tributary sampling will be conducted on a regular basis, with samples being collected on the same day DOH staff collect marine water samples. The upland sampling stations are described in Appendix B. The upland samples will be collected using the same process as the shoreline evaluation sampling except that a Swoffer 2100 flow meter will be used to measure stream flows at certain locations.

Approximately 340 water samples will be collected and analyzed for fecal coliform enumeration as part of this project. Additional sampling will likely be conducted, using the same methodologies, to provide a more effective pollution source identification effort. The cost for this additional sampling will be covered through funding from SWM for the Health Department's participation in the Pierce County Shellfish Partners work.

Sample Handling and Custody

Water sample handling is the responsibility of project field staff. Staff will collect empty sample bottles from the laboratory prior to sampling. The sample bottles are sterilized by the laboratory and have an expiration date. Following collection of samples in the field, the samples will be kept in a cooler at 10 °C or less, using one or more cold packs, and delivered directly to Water Management Laboratories, Inc. Generally, field staff will call the lab either at the start of the sampling day or immediately upon completion of sample collection to let the lab know how

many samples were collected and what analysis is needed. This allows the lab to begin preparing the correct media for sample analysis.

A Chain of Custody form will be completed by field staff for each sampling event. Included on the form is the identification name or number for each sample, the number of samples, the sampling location, the type of samples, the time and date, sampling staff, the requested analytical method(s), contact information, billing information, and any comments pertinent to the samples. The form is signed and dated, and the time noted, by a field staff person and also by Water Management Laboratories, Inc. staff. The laboratory staff person who signs the form first examines each sample to ensure that the Chain of Custody form correctly captures the necessary information for each sample. A copy of the form is provided to the field staff person who in turn brings it back to the office and gives it to the project lead. A copy of the chain of custody form is included in Appendix B.

Analytical Methods

The water samples will be analyzed for fecal coliform, and in some cases, E. coli enumeration by the contract laboratory, Water Management Laboratories, Inc. Sample analysis will begin no later than 24 hours after sample collection and in most cases will begin within six hours of sample collection. The samples will generally be run for fecal coliform enumeration using the membrane filter method (MF), Standard Methods (SM) 9222D. However, if the sample contains much sediment, the lab will use the multiple-tube fermentation method SM 9221 C or E. If it is suspected that the bacteria may not be from the intestinal tracts of warm blooded animals, the laboratory may also run the samples for E. coli enumeration using EPA 1603 (which is the same method as SM 9213D 3B). The laboratory generally will run multiple dilutions, given that there is such a wide range in fecal coliform counts in surface waters.

The method detection limits for SM 9222D and SM 9213D 3D/EPA 1603 will vary depending on the volume of sample filtered. In most cases, the minimum detection limit is reported as <10 cfu/100ml. This works fine for source identification and correction work since our action level is 200 cfu/100ml. For methods SM 9221C or E the limit of detection is <2 Most Probable Number (MPN) per 100ml. Samples are generally reported out to >16,000 cfu/100ml.

Quality Control

The sampling and analytical quality control checks will utilize the following procedures:

Standard Laboratory Practices performed by Water Management Laboratories, Inc.
Receipt of sample: Sample(s) must arrive at the laboratory within the Standard Method allocated holding time, which for fecal coliform and E. coli is 24 hours. As stated above, most samples will be delivered to the laboratory within six hours of collection. Laboratory staff will note the condition of the samples and check that the chain of custody form information is identical to the information on the labels on the bottles. If everything is in order, the Chain of Custody form is signed, a copy given to the field staff, and the samples are entered into the laboratory system. If there are any irregularities, the samples will be denied and corrective action will be taken, ranging from a request to correct the paperwork to, possibly, collecting replacement samples.

Laboratory Storage of Samples Prior to Analysis: Sample testing will be initiated as soon as possible. Once samples are logged in, they will be hand carried to the laboratory for analysis. Sample analysis will always begin the same day the sample is collected.

Requirements for media, water and reagents: Reagent water is laboratory ultra deionized water and is monitored as required by EPA. In addition to the suitability tests, the laboratory analyzes the water for heavy metals. The conductivity, total residual chlorine and sterility through heterotrophic plate count must be monitored monthly. Commercially packaged media must be dated at receipt, the lot number recorded and the expiration date noted. Laboratory prepared media is dated upon initially being opened. Sterility, pH, and inhibition tests must be run per lot number and recorded in the media and QC logbooks.

Requirements for Sample Containers: Sample containers are pre-cleaned and sterilized by the manufacturer or by the laboratory. To ensure that the sample does not leak in transit, the containers have a watertight screw cap. Sample containers must be tested for sterility, auto fluorescence and measurement per sample to ensure accuracy of sampling and reporting.

Process Quality Control: All aspects of the analytical process are monitored by a scheduled system of quality control checks. For EPA 1603 (E. coli enumeration) ongoing precision and recovery is required every 20 samples or once per week. Glassware, material, and equipment used for analysis all have a specific level of quality to be met and monitored.

According to the Water Management Laboratories, Inc. QA Manual, the types of QC samples include:
Sterility control – to determine the sterility of the procedures
Split sample – determines precision
Viability control– to determine whether the bacteria would be able to grow if present

A bottle blank is not utilized in the filter run since bottles are checked for sterility after autoclaving.

Instrument/Equipment Testing, Inspection and Maintenance

The field equipment to be used for this project includes a sampling wand (for difficult to reach samples), a digital camera, a stop watch, an Oakton PCSTestr 35 multi-parameter field meter, a Garmin GPSmap 62s GPS unit, and, for the upland sampling, a Swoffer 2100 flow meter. The project field staff will be responsible to keep the batteries charged for the digital camera, to check the battery function of the Oakton and Swoffer meters and the Garmin GPS unit, and to calibrate the meters.

Material and instrument preparation is addressed in the Water Management Laboratories, Inc. QA Manual. The specific requirements for each test, as far as media and equipment, will be covered in the SOP for that method. A log is kept for media preparation and quality control information, for instrument QC, and for preventative maintenance.

Instrument/Equipment Calibration and Frequency

The Oakton PCSTestr 35 will be calibrated prior to each sampling event or weekly, if there are multiple sampling events in a one-week period. The instrument will be calibrated in accordance with the manufacturer's instructions. Post performance checks will be performed for pH and conductivity following each sampling event (or weekly if multiple sampling events are conducted within a one-week period) for the purpose of documenting instrument stability after field measurements have been collected. The Swoffer 2100 flow meter does not require calibration per se but it will be checked, by turning the control knob to calibrate and making sure the meter reads 185 (as detailed by the manufacturer), before every measurement.

When the Garmin GPS unit is utilized to identify sampling station locations, the project team will wait at least one minute for the meter to stabilize with a final reading to ensure data reproducibility. Some sampling stations may be delineated via Pierce County's GIS system, Countyview, using the orthophoto layer and the hydro layer.

Laboratory equipment utilized at Water Management Laboratories, Inc. undergoes instrument calibration according to the Water Management QA Manual. This includes:

Sterility control – to determine sterility of the method. This is performed at the beginning and end of the analysis.

Split sample – to determine precision, recalibrate and make sure the procedure has not been contaminated during the analysis. This is done at least every tenth sample.

Internal QC checks – to affirm that laboratory variables and equipment are not contaminating the sample.

Periodic calibration at the laboratory includes: all thermometers are checked on an annual basis with a NIST-traceable reference thermometer. The autoclave is checked monthly with biological indicators to determine if the sterilization cycle is effectively disinfecting all equipment and laboratory liquids. The timer is checked quarterly against a stop watch. The autoclave temperature is checked using a calibrated thermometer and chemical indicator with each load of media.. The incubator and refrigerator temperatures are monitored in the morning and afternoon of each day of use. Balances are calibrated quarterly by the QC Manager. Calibration records are maintained in the QC logbook.

Inspection/Acceptance of Supplies and Consumables

Table 2 lists the field staff equipment and supplies to be used during the project. A designated staff member is responsible for ensuring that adequate supplies are available for all project staff. This person works with the Project Manager to place orders when additional supplies are needed.

Prior to conducting a sampling event, it is the project field staff's responsibility to ensure they have all the supplies needed to complete the collection of samples, perform investigation of sources and/or perform dye testing.

Table 3. Sampling Equipment and Supplies.

Field supplies/ Equipment	Description	Supplier/Vendor	Comments
250 ml sterile plastic water sample bottle	Used to collect water samples for fecal coliform and/or E. coli analysis.	Water Management Laboratories, Inc.	An inventory of about 100 sample bottles are kept at office and in field vehicle.
Garmin GPSmap 62s GPS unit	Used to determine the latitude and longitude of sample sites.		
Swoffer 2100 Flow Meter	Used to measure flows for some upland stream samples.		
Oakton PCSTestr 35 Multi-parameter meter	Used for field measurements of pH, conductivity, and temperature.	Forestry Suppliers	
Sampling wand	Telescoping, used to collect samples	Wands constructed by staff using supplies from local hardware store.	Wands are replaced as needed.
Cooler	Used to store samples until delivered to the contract laboratory. Coolers are filled with cold packs to ensure sample bottles are kept cold.		Coolers and ice Packs purchased as needed at local stores.
Dye tracers	Ready-to-use liquid dye mixtures in 170 ml bottles. Dye tracers include Fluorescein, Rhodamine, and Eosine. Used to dye test septic systems to confirm failing, surfacing, systems (Appendix E)	Ozark Underground Laboratories, Protem Missouri.	Bottles are stored in a designated cabinet separate from other dye test supplies to prevent contamination.
Charcoal samplers	Used during dye tests to "catch" dye. The charcoal used for the samplers are packets of fiberglass screening partially filled with approximately 4.25 grams of activated coconut charcoal.	Charcoal purchased from VWR Scientific, mesh screen purchased from local hardware store.	
Plastic bags	Used for storage of individual control and dye samplers retrieved from site, prior to shipment to the laboratory for analysis.	Purchased from local stores.	
"Rite in the Rain" field notebook.	Used to record sample station information.	J.L.Darling Corporation, Tacoma, WA	

Safety Equipment

Staff are also required to have the following safety equipment/supplies when conducting field work:

- Health Department identification badge – Used to identify staff to property owners. Badges are issued to each inspector.
- Personalized Health Department business card – Each inspector has a business card that can be provided to property owners.
- Cell phone – Inspectors are issued a cell phone for use while conducting Health Department business. There are some areas in the KGI Watershed where cell phone service is not available and this is one reason why most of the project field work is conducted by two inspectors rather than one.
- Disposable nitrile gloves – Used to protect inspectors from pathogenic organisms associated with sewage. Boxes of gloves are kept both at the office and in the field vehicle.
- Hand-wipes and/or hand sanitizer – Used after collecting water samples or handling charcoal packets.

Non-direct Measurements

Additional information that will be utilized for the project include: DOH marine water sampling results, recorded precipitation at several SWM weather stations, and pertinent water quality results collected by Ecology.

DOH routinely collects marine water samples from the shellfish areas for fecal coliform enumeration. These results will be used to help identify possible problem areas where to focus pollution source identification efforts and will also be considered during the evaluation of project success.

The recorded precipitation data will be used to help provide a framework for the fecal coliform results. Through previous projects and work on the Shellfish Watersheds Program, it is obvious that rain conditions can have a huge effect on fecal coliform counts in surface waters. This is especially true for intense rainstorms following an extended dry period. When high fecal coliform counts are recorded, project staff will take into consideration precipitation conditions immediately prior to, and during, the sampling event as staff decide on the appropriate next steps for further investigation or action.

If high bacterial counts are identified through sampling in the shellfish waters of Pierce County by Ecology, project staff may conduct a shoreline evaluation of the area to identify the source(s) of the bacteria.

Data Management

Proper data management is essential for successful completion of this project and for all water quality assessment activities performed by the Tacoma-Pierce County Health Department. This project will include the collection of data and/or information by activity as detailed in Table 3.

Table 4. Data Management by Activity.

Activity	Type of Data or Information	Method of data collection/storage
Shoreline Evaluations	Water sampling results for fecal coliform and/or E. coli, temperature, pH, conductivity, and flow.	Record Sheets or Field book, paper files, Excel spreadsheet, Access database, GIS layer, EIM
Sanitary Survey Sampling/Source Investigation	Water sampling results for fecal coliform and/or E. coli, temperature, pH, conductivity, and flow	Field book, paper files, Excel spreadsheet, Access database, GIS layer, EIM
Upland Sampling (done in conjunction with DOH's marine water sampling)	Water sampling results for fecal coliform, temperature, pH, conductivity, and flow	Record Sheets or Field book, paper files, Excel spreadsheet, Access database, GIS layer, EIM
Sanitary Surveys	Sanitary Survey form	Paper files, Envision database
Mail in survey following sanitary survey visits	survey form	Project files, Excel spreadsheet
Training evaluation forms	Evaluation form collected following workshops	Project files, Excel spreadsheet

All data collected through the project will be stored in paper files at the Health Department and/or electronically, in an Excel spreadsheet, the Surface Water Quality Access database, and/or in the Health Department's main database, Envision.

The temperature, pH, conductivity, and flow measurement results are initially entered onto record sheets or into the field book. The record sheets and field books, when not in use or when full, are kept at the Health Department. These results for the Shoreline Evaluations and Upland sampling will first be reviewed by the Project Lead and then entered into the Surface Water Quality Access database.

The fecal coliform results and E. coli results are first faxed by Water Management Laboratories, Inc. to the Project Lead and are considered initial results. The Project Lead keeps these faxes, along with the chain of custody copy that was provided by lab staff to field staff when the

samples were delivered to the lab. The Project Lead then receives in the mail a paper copy of the final results from the lab. The Project Lead compares the initial results to the final results, the chain of custody sheet that is attached with the final results to the copy originally provided, and reviews the final results to the attached chain of custody. Only after this review are the results entered into the Health Department's Surface Water Quality Access database. Examples of the Access database screen shots are included in Appendix C. The Access database is used to update the GIS layer quarterly so that the results are available geospatially. The paper copy of the results will be stored in a file cabinet that resides in the Surface Water Program area of the Health Department.

The sanitary survey information, including dye test information if a dye test is conducted, is kept in paper files and also entered into the Envision database.

Data will be reviewed prior to entry into an electronic format to ensure that all required data fields have been included, parameters monitored are characteristic of expected results, and laboratory analytical results are characteristic of expected results. When project staff determines the dataset is incomplete or includes uncharacteristic results, the Project Lead or Project Manager will be consulted for a decision regarding the validity of the data. Data may only be excluded with the approval of the Project Lead or Project Manager. Once it is determined that the data are acceptable, staff perform data entry. All data input will have a 100% review after input is complete to assure no transcription errors have occurred. The Surface Water Quality Access database and Envision database are backed-up on a daily basis to minimize the risk of data loss caused by electrical or computer malfunctions.

Computerized information systems are maintained by the Health Department's Information Technology Program and technical assistance is also provided by key individuals in the Environmental Health Division. All environmental data generated by the PIC program under this QAPP will be submitted to Ecology in a format compatible with the agency's EIM system and database.

Assessment and Oversight

It will be the responsibility of the Project Lead, together with the Project Supervisor and Project Manager, to regularly assess that objectives and tasks of the project are being implemented according to this QAPP. In addition to the Project Lead, there are three field staff who are responsible for sample collection and performing field measurements. There are also additional project staff who will be working on other tasks and won't be participating in the field sampling.

Project staff will meet on a regular basis to ensure project activities are being conducted according to the QAPP timeline. These meetings will afford an opportunity to identify potential problems and allow for corrective actions. It is anticipated that staff will meet monthly to ensure that problems are identified early and corrected quickly. If needed, meetings may be held more frequently.

The Project Lead will prepare and submit semi-annual performance reports to DOH in accordance with 40 CFR Part 30.51(d) and 40 CFR Part 31.40, as appropriate. The performance

reports will include brief information on each of the following areas: a comparison of actual accomplishments to the output/outcomes established in the assistance agreement work plan for the period; the reasons for slippages if established outputs/outcomes were not met; and, additional pertinent information including, when appropriate, analysis and information of cost overruns or high unit costs.

The Project Lead will meet with the Project Supervisor and Project Manager monthly to review billing information for the project to ensure that time and activity is commensurate with the budget targets.

Data Assessment and Final Performance Report

The fecal coliform data will be analyzed to determine geometric mean values for each location and arithmetic means will be determined for the field parameters. These data will be compared with DOH shellfish growing standards for fecal coliform bacteria and with the Water Quality Standards for Surface Waters of the State of Washington, Chapter 173-201A WAC. If a single fecal coliform sample equals or exceeds 200 cfu/100ml, a follow up sample will generally be collected. If the follow up sample exceeds 200 cfu/100ml, site investigation work will be conducted to determine if there is a fecal coliform source in the vicinity. The site investigation work may include dye testing a septic system, or, if farm animals are present, the site may be referred to the PCD for further action.

The Project Lead will assess and report on the fecal coliform counts and, if collected, E. coli counts following the completion of corrective actions taken in the project area. This will be done to demonstrate measureable improvements in water quality. Marine water bacteria results collected by DOH will also be reviewed and provided if these results indicate a change in water quality following the completion of corrective source control actions.

The Project Lead will submit the draft final report to DOH within 30 calendar days of the end of the project period (12/31/2014). The final performance report will contain the same information as the periodic reports but will cover the entire project period. The report will include:

- A summary of shoreline evaluation sample results, sanitary survey sample/source control sample results, upland sampling results, and septic effluent sampling results;
- Results from the sanitary surveys, including the number of sites surveyed, a summary of the findings, and follow up survey results;
- Number of failing septic systems identified and corrected; and,
- Number of animal waste problems noted and the number of problems corrected.

Reports to Management

The Project Manager will review the semi-annual performance reports prepared by the Project Lead to stay informed about the activities and findings of the project. The Project Manager will also meet monthly with the Project Lead to review billing and budget information.

Each project staff member completes a bi-weekly time card that is part of the electronic time card reporting system. The time card documents time spent on the project for each staff member over the two week period. The Project Manager reviews and approves the time card, ensuring that project work is being charged correctly.

Data Verification, Validation, and Usability

The goals of this project are to restore and protect water quality of both fresh and marine water in the shellfish watersheds of Pierce County by identifying and correcting sources of fecal pollution.

Data collected from shoreline evaluations, sanitary survey sampling/source identification sampling, and upstream sampling will be analyzed for fecal coliform and, in some situations, E. coli. Field measurements will be made for temperature, pH, conductivity, and flow. These data will be reviewed, verified and reconciled to meet the goals of the project.

Data Review and Verification

Water quality data are reviewed according to procedures stated in the previous Data Management section. Field measurements are reviewed by field staff and then again by the Project Lead when the results are entered into the Access database. Water Management Laboratories, Inc. faxes the initial fecal coliform and/or E. coli results to the Project Lead and then mails a paper copy of the final results with the chain of custody form attached. The Project Lead reviews the final results to the faxed results and compares the chain of custody form attached with the final results to the chain of custody copy that was provided by laboratory staff to the field staff at the time the samples were delivered to the laboratory. The results are only entered into the Excel spreadsheet and Access database after the data review process.

Data Verification

Data verification involves examining all data for errors or omissions, as well as comparing results to measurement quality objectives (e.g., RPD for precision among duplicates). Quality control checks will be conducted after each data set is entered into the Access database. These data are evaluated for completeness and correctness. For example, data are verified to ensure replicates have been entered correctly, the correct value is attributed to the correct constituent, and the sample collection time matches the sampling identification name. The level of detail for performing data review and verification is relatively simple since only a few parameters are being analyzed or measured: fecal coliform, on occasion E. coli, temperature, pH, conductivity, and flow.

Data validation conducted by an independent third party is not applicable for this project due to the low level of complexity of data being generated. Data are collected as described in the Data Generation and Acquisition section.

Reconciliation with User Requirements

The data collected for the project will be descriptive in nature and does not include a statistically based design. The data will be presented in tables and charts, and will show the changes in water quality with the project area for the duration of the project. The Project Manager will systematically review the final data set to identify any limitations on its use relative to project objectives. Possible limitations that may be identified in this review include: inadequate sampling frequency, the number and distribution of samples are not optimal, and the fecal coliform results are too variable.

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Washington State, 2006. Chapter 173-201A of the Washington State Administrative Code (WAC).

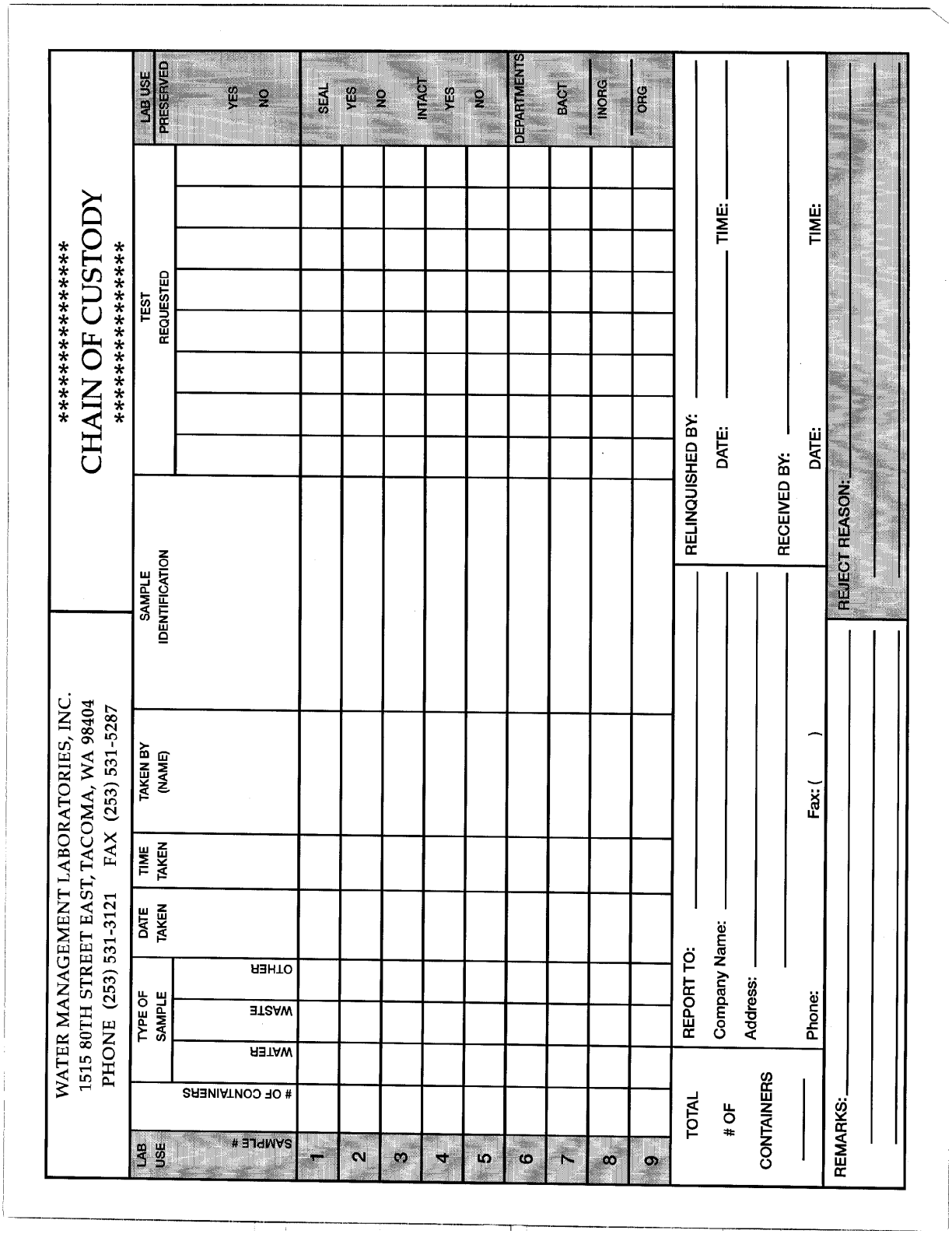
Figure 1. Map of the Project Area

APPENDICES

Appendix A. Project Timeline and Milestones

Project Tasks	2012				2013				2014			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Project Management												
Semi-Annual Reports		R		R		R		R		R		
Final Report												R
Monthly Team Meetings	M	M	M	M	M	M	M	M	M	M	M	M
QAPP – develop and submit to Ecology				X								
QAPP – Ecology review & approval				X								
Pollution Identification and Correction												
Collect approximately 340 water samples					X	X	X	X	X	X	X	
Re-sampling as needed					X	X	X	X	X	X	X	
Conduct approximately 100 sanitary surveys								X	X	X	X	
Dye test as needed					X	X	X	X	X	X	X	
Identify and correct failing septic systems					X	X	X	X	X	X	X	
Identify and correct poor animal keeping practices					X	X	X	X	X	X	X	
Outreach and Education												
Develop Education Plan	X	X	X	X	X							
Give 10 or more presentations			X	X	X	X	X	X	X	X	X	
Attend at least 3 fairs or events			X	X	X	X	X	X	X	X	X	
Develop evaluation report											X	X
Strategic Planning												
Develop a Strategic Plan with Partners		X	X	X	X							
Draft plan developed			X									
Final plan provided to DOH					X							
Enhanced Septic O&M Evaluation												
Local QA/QC Plan for O&M Specialists				X	X	X						
Report of pre-evaluation findings					X	X	X					
Log site inspections and outcomes					X	X	X	X	X	X		
Report of post-evaluation findings											X	X

Appendix B. Chain of Custody Form



WATER MANAGEMENT LABORATORIES, INC.
1515 80TH STREET EAST, TACOMA, WA 98404
PHONE (253) 531-3121 FAX (253) 531-5287

****
CHAIN OF CUSTODY
****

LAB USE	SAMPLE #	# OF CONTAINERS	TYPE OF SAMPLE: WATER	WASTE	OTHER	DATE TAKEN	TIME TAKEN	TAKEN BY (NAME)	SAMPLE IDENTIFICATION	TEST REQUESTED	LAB USE PRESERVED: YES / NO	SEAL: YES / NO	INTACT: YES / NO	DEPARTMENTS: BACT / INORG / ORG
	1													
	2													
	3													
	4													
	5													
	6													
	7													
	8													
	9													

TOTAL # OF CONTAINERS: _____

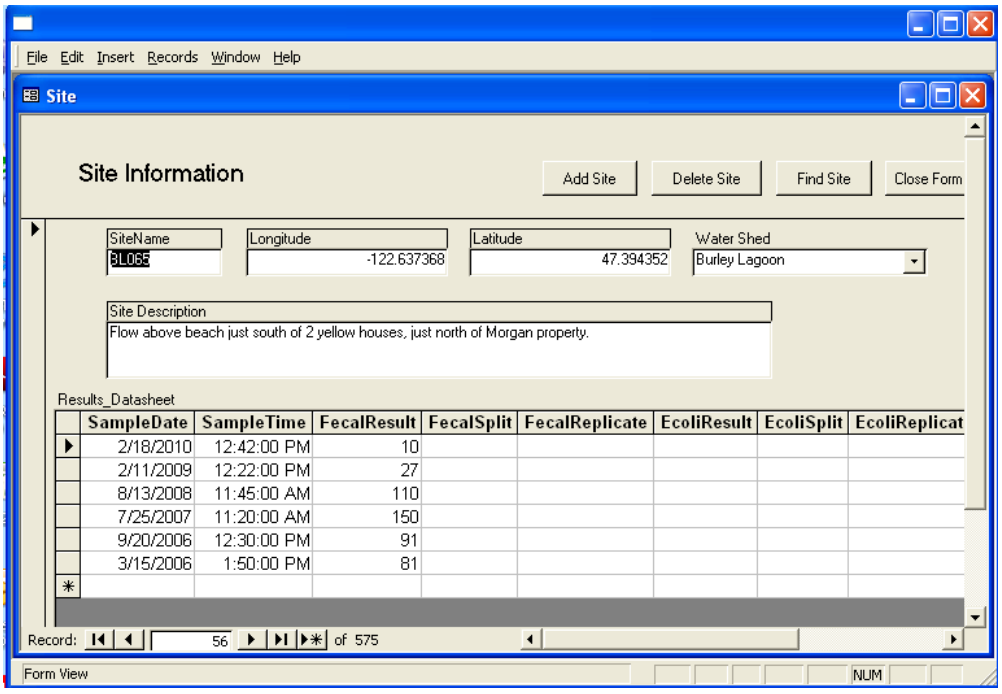
REPORT TO: _____
Company Name: _____
Address: _____
Phone: _____ Fax: ( )

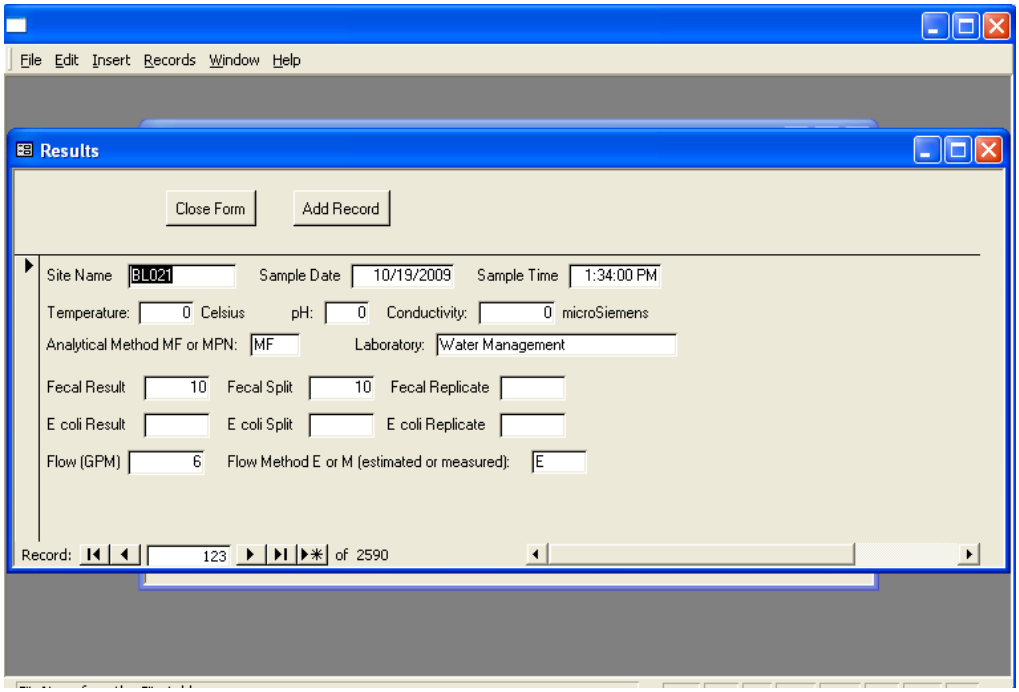
RELINQUISHED BY: _____ DATE: _____ TIME: _____
RECEIVED BY: _____ DATE: _____ TIME: _____

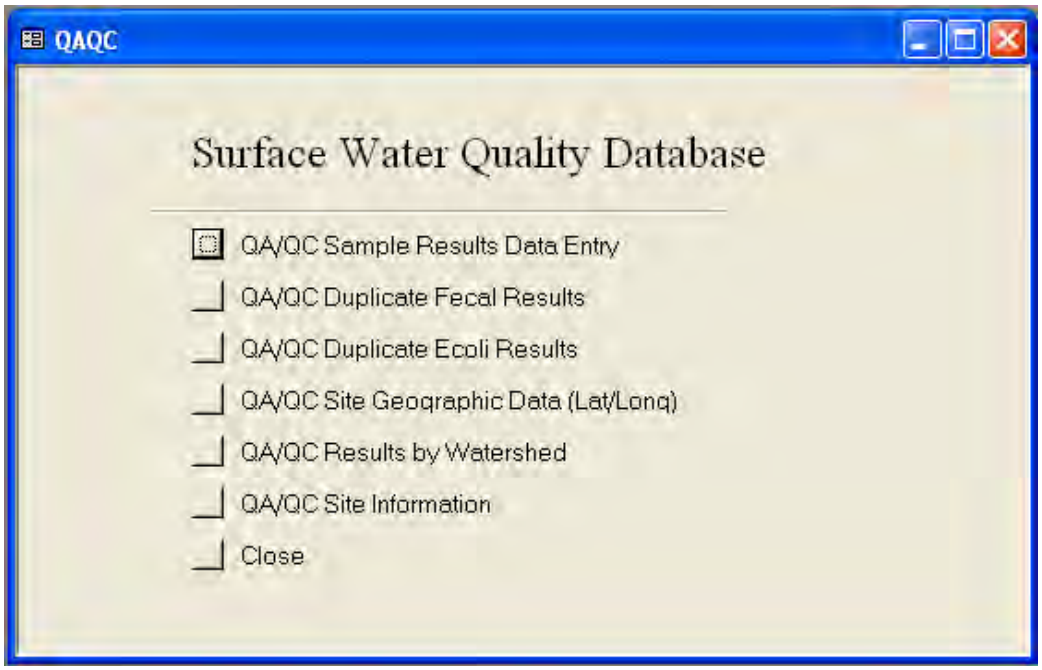
REMARKS: _____

REJECT REASON: _____

Appendix C. Access Database Screen Shots






QAQC
Surface Water Quality Database
QA/QC Sample Results Data Entry
QA/QC Duplicate Fecal Results
QA/QC Duplicate Ecoli Results
QA/QC Site Geographic Data (Lat/Long)
QA/QC Results by Watershed
QA/QC Site Information
Close

Appendix D. Glossary of Abbreviations

cfu	colony forming units
cm	centimeter
°C	degrees Celsius (temperature)
DOH	Washington State Department of Health
Ecology	Department of Ecology
EIM	Ecology's Environmental Information Management system
EPA	Environmental Protection Agency
GIS	Geographic Information System
gpm	gallons per minute
GPS	Global Positioning System
Health Department	Tacoma-Pierce County Health Department
KGI	Key Peninsula/ Gig Harbor/ Islands (Watershed)
MF	membrane filtration
ml	milliliters
MPN	most probable number
O&M	operation and maintenance
OSS	on-site sewage system (septic system)
PCD	Pierce Conservation District
PIC	pollution identification and correction
pH	potential hydrogen ion activity
QA	quality assurance
QAPP	quality assurance project plan
QA/QC	quality assurance/ quality control
QC	quality control
RSD	relative standard deviation
SM	Standard Methods
SOP	standard operating procedure
SWM	Pierce County Surface Water Management
uS	microsiemens
WAC	Washington Administrative Code

Appendix E. PIC Protocol Manual

Available on request.