QUALITY ASSURANCE PROJECT PLAN

For

SKAGIT COUNTY PUBLIC WORKS
CLEAN SAMISH INITIATIVE IMPLEMENTATION
WATER QUALITY MONITORING PROGRAM

EPA PUGET SOUND WATERSHED MANAGEMENT
ASSISTANCE GRANT NO. PO-00J09601-1

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APPROVAL OF QAPP:

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Rick Haley, Co-Manager and QA Manager **Date**
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For Ginna Grepo-Grove 4/2/2012

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INTRODUCTION

The Clean Samish Initiative Implementation Program is Skagit County's project to facilitate cleanup of the fecal coliform pollution problems in the Samish Bay Watershed. This watershed is the subject of a fecal coliform TMDL and more recently, the focus of the Clean Samish Initiative, a cooperative effort of over 20 federal, state, local, and private organizations to address the fecal coliform pollution.

The Clean Samish Initiative Implementation Program is the logical next step in this effort. Skagit County and its partners will conduct focused water quality monitoring, property inspections in areas where the monitoring data indicates pollution sources exist, referral of problem properties to resource agencies for pollution abatement, and extensive public outreach and education activities.

This Quality Assurance Project Plan will address the water quality monitoring aspects of the program. It will govern both Skagit County and Samish Indian Tribe monitoring efforts.

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SCHEDULE

Fecal coliform sampling associated with this project will occur biweekly and during storms from July, 2010 through June, 2013. Sampling commenced before QAPP approval because of the critical nature of the project and delays in QAPP review at EPA.

BACKGROUND AND PROJECT DESCRIPTION

Study Area and Purpose of Program

The Samish Bay Watershed encompasses 140 square miles of mostly lowland farms, fields, and timber country. It has several small, yet distinct, communities, but is largely rural. The Samish River is the main watercourse, rising in Whatcom County between Anderson Mountain and Lyman Hill, flowing south into Skagit County through a narrow valley surrounded by timbered hills, then west through an increasingly broad agricultural valley into Samish Bay. Major tributaries include Thunder, Friday, and Thomas Creeks. Average annual discharge for the Samish River is approximately 240 cfs as measured at the USGS gauge at Highway 99 (RM 10). Watershed activities include rural residences, beef and dairy cattle operations, crop farms, and non-commercial agriculture. Timber management is an important use in the upper watershed. Samish River flow is greatly dependent on recent precipitation – discharge during rainstorms can be as high as several thousand cfs, whereas summer low flow can be 20 cfs or less. There is generally little snowpack in the headwaters. The river responds quickly to rain events, both hydrologically and with bacteria counts. Skagit County and Skagit Conservation District monitoring data indicate a strong relationship between significant rainfall and high fecal coliform counts in the Samish River, which has serious implications for correcting the fecal coliform sources.

There are several independent drainages to Samish Bay, including Oyster and Colony Creeks, Edison Slough, and some agricultural drainage ditches which discharge directly to Samish Bay. Together, these independent drainages comprise approximately 17 percent of the freshwater flow to the bay, while the Samish River makes up the remaining 83 percent (Ecology 2009a).

Samish Bay is home to more than 2300 acres of commercial shellfish beds and 10 commercial growing operations, as well as recreational shellfish opportunities. Commercial shellfish harvest in Samish Bay is a $3 million/year industry (Bill Dewey, Taylor Shellfish). This industry has been subjected to over fifteen mandatory or voluntary closures in the last 20 months due to high bacteria levels in the bay and the Samish River.

This program will comprehensively sample for fecal coliform bacteria in areas of the Samish Bay Watershed where previous sampling has shown elevated bacteria levels. The information will be used to target individual property inspections and educational activities. We will begin with a standard set of sampling locations in the middle reaches of the Samish River and major tributaries, and expand the number and location of sampling locations in response to the data we generate. The initial list of sampling locations can be found in Table 1. Sites in Table 1 with an asterisk are previously existing sites – sampling effort at those sites are counted as part of the County match program but are not charged to the EPA grant funding. The remaining sites form the core of the Pollution Identification and Correction Program funded by this grant.

In addition to the middle reach of the Samish River, our partner organization, the Samish Indian Tribe, will be comprehensively sampling in the Thomas Creek watershed. Thomas Creek is a major tributary to the Samish River at the downstream end of the initial target area, and previous data has shown repeated high fecal coliform counts in Thomas Creek. The four sample locations included here will be added to eight existing Samish Tribe and County sampling sites in the Thomas Creek watershed to comprise a comprehensive sampling effort for Thomas Creek.

Objectives

Target population:	Watercourses in the Samish Bay Watershed
Study boundaries:	Samish Bay Watershed
Goals:	Determine fecal coliform concentrations in Samish Bay Watershed streams and drainage infrastructure as a tool in identifying sources of pollution to Samish Bay.

MONITORING PARAMETERS AND PROCEDURES

Parameters

Fecal coliform will be the primary parameter measured during water quality monitoring associated with this program. Other water quality parameters (e.g. dissolved oxygen, temperature, turbidity, pH) may be monitored in conjunction with the fecal coliform sampling, as governed by Skagit County's previously existing Quality Assurance Project Plan (Skagit County 2003).

Fecal coliform: Fecal coliform is an indicator of fecal pollution from warm-blooded animals in the water. Fecal coliform concentrations will be determined from 150-ml samples obtained from the thalweg of the watercourse in the field and held on ice until submitted to a state-accredited laboratory (Edge Analytical of Burlington, WA or other accredited laboratory) for analysis using the Multiple Tube Fermentation (also known as Most Probable Number or MPN) procedure (Standard Methods SM9221E). Samples will be hand-delivered to the lab within the 8-h holding time limit for this method. MPN is being used for consistency with existing Skagit County and Washington State Office of Shellfish and Water Protection programs. Fecal coliform concentrations will be reported to the nearest 1 colony forming unit per 100 ml.

While fecal coliform loading (as contrasted with concentration) is an important consideration in determining sources of bacteria to the bay, most of the sampling locations in this study are on the mainstem Samish River. A USGS flow monitoring gauge is located on the mainstem Samish River at Highway 99, and the main tributary to the Samish River, Friday Creek, has an Ecology flow monitoring gauge less than a mile upstream from the confluence with the Samish River. These two gauges provide sufficient flow information for this study, and additional flow determinations are not planned at this time.

Table 1. Initial sampling locations for Clean Samish Initiative Implementation Program – Skagit County and Samish Indian Tribe sampling

Site ID	Location	X coordinate	Y coordinate
CAO11*	Samish River at Hwy 9	1301773	587307
CAO32*	Samish River at Thomas Rd	1258078	558708
CAO8*	Swede Cr at Grip Rd	1287964	570311
SAM99	Samish River at Hwy 99	1275993	567410
SAMFS	Samish River at F&S Grade Rd	1286330	569678
SAMGRIP	Samish River at Grip Rd	1287739	570393
SAM1PR	Samish River at 1st Prairie Rd	1287372	571332
SKAR	Skarrup Cr at Double Cr Ln	1283593	575581
SAMDCL	Samish River at 2nd Prairie Rd	1285594	575704
SAMPAR	Samish River above Parsons Cr	1289006	580648
SAM3PR	Samish River at upper Prairie Rd	1301385	581915
PAR	Parsons Creek at mouth	1288985	580750
CAO03*	Thomas Creek at Hwy 99	1275278	560139
CAO04*	Thomas Creek at F&S Grade Rd	1290436	560559
TR1*	Thomas Creek western tributary upstream	1292620	568075
TR2*	Thomas Creek western tributary downstream	1292931	567377
TR3*	Thomas Creek below western tributary	1292977	566711
TC1*	Thomas Creek at Samish Tribe upstream	1288281	562433
TC2*	Thomas Creek at Samish Tribe downstream	1287057	562557
TC3*	Thomas Creek at Delvan Hill Rd	1291738	562526
TC4	Thomas Creek tributary at RR tracks	1293289	566308
TC5	Thomas Creek tributary at Mosier Rd	1298260	565811
TC6	Thomas Creek tributary at Thomas Cr Ln	1294738	568208
WC1	Willard Creek at Garden of Eden Rd	1297029	557421

*Previously existing sites. All other sites are new sites for the grant program.

Sampling procedures

Field trip preparation will take place according to established Skagit County procedures prior to each sampling event. Field trip prep consists of securing necessary expendables such as sample bottles, operations check and calibration of instruments, preparation of labels, field data sheets, chain-of-custody forms, and reservation of a vehicle.

Fecal coliform samples will be obtained following the recommendations of the USGS, "National Field Manual for the Collection of Water Quality Data, TWRI Book 9, Chapter A7, section 7.1 ver 2.0." (2007)
Samples will be obtained from the thalweg of the watercourses and care will be taken with the sampling wand to avoid disturbing bottom sediments or oversampling the surface film.

Sterile technique must be followed. Equipment used for collection of bacterial samples must first be cleaned and then sterilized. Sterile conditions must be maintained during collection, preservation, storage and analysis of indicator bacteria samples. To collect surface water samples sterile wide-mouth bottles with sterile caps, or sterile autoclavable bags must be used. To collect a grab sample:

1. Open a sterile, narrow-mouth borosilicate glass or plastic bottle; grasp the bottle near the base, with hand and arm on the downstream side of the bottle.
2. Without rinsing, plunge the bottle opening downward, below the water surface. Allow the bottle to fill with the opening pointed slightly upward into the current.
3. Remove the bottle with the opening pointed upward toward the water surface and tightly cap it, allowing about 2.5 to 5 cm of headspace (American Public Health Association and others, 1998, p. 9-19; Bordner and Winter, 1978, p. 8).

For turbidity and pH samples, the general sample container used with the wand will be field-rinsed twice thoroughly with stream water immediately before obtaining a sample. Extra general sample containers will be included in the field kit in case of contamination that can't be addressed by field rinsing.

The final sample will then be obtained and homogenized.

Fecal coliform sample bottles will be marked with pre-printed adhesive labels describing the sample site by number and the date. Samples will be held under ice and transported to a certified laboratory by field sampling personnel within the 8-h holding time. A Chain of Custody form will be completed by the field personnel and submitted to the laboratory.

Field duplicates for fecal coliform will be collected at a rate of at least 10%. Duplicates will be obtained from one sterile sample container, homogenized and divided between two sample bottles. Duplicate samples will be labeled with the date and the duplicate number (e.g. "Fecal 1"). The location of the duplicate samples will be recorded on a separate data sheet to avoid bias in the lab analysis.

Other Parameters

Dissolved oxygen and temperature: Dissolved oxygen (DO) and temperature are major factors that determine the type of biological communities that inhabit an aquatic system. Salmonids require high DO levels and low temperatures. DO and temperature will be measured in the thalweg of the watercourse with a YSI Model 85 meter to the nearest 0.1 mg/L (DO) and 0.1 C

(temperature), calibrated and operated per the YSI manual (YSI Incorporated 1998). YSI indicates a DO accuracy of +/- 0.3 mg/L and a temperature accuracy of +/- 0.1 C.

pH: pH will be measured in the field with a Hanna Instruments Model HI8424 pH meter (or the equivalent), calibrated and operated per the Hanna Instruments manual (Hanna Instruments 2011). Samples will be taken from the thalweg of the stream and returned to the vehicle tailgate for pH analysis. Hanna Instruments indicates an accuracy of +/- 0.01 units.

Turbidity: Turbidity will be measured in the field with a Lamotte 2020e turbidimeter, calibrated and operated according to the Lamotte Company manual (Lamotte Company 2007). Lamotte indicates an accuracy of +/- 0.05 ntu or 2% for this meter.

Sampling Frequency

Skagit County will sample each feasible storm event, either on all sites or on a subset as time permits. Storm event sampling will generally include only fecal coliform samples. Skagit County will continue with its biweekly ambient sampling program at the existing sites delineated in Table 1 above. Ambient sampling includes fecal coliform, dissolved oxygen, temperature, turbidity, and pH measurements.

Special Training and Certification

Personnel involved in fecal coliform sampling for this project will be trained in sampling procedures, handling, and data management by Project Co-Manager Rick Haley, who has over 30 years experience in water quality sampling and reporting.

Documents and Records

Project Co-Manager Rick Haley will be responsible for ensuring dissemination of the current QAPP version to project personnel. Email notification and transmission of corrected documents should be sufficient as only a limited number of personnel, working directly with the Co-Manager, will be involved.

Data reports will include the original laboratory data sheet and accompanying laboratory QC sheet, along with the field data sheet containing other field data and field notes. Data summaries and interpretation will be included in quarterly, semi-annual, and annual reports to EPA and in the previously existing biweekly reports to project partners and interested parties. In addition, the data and interpretation will be included in Skagit County's previously existing annual Water Quality Reports.

Data will be maintained in Skagit County's Water Quality Database for the foreseeable future.

QUALITY CONTROL PROCEDURES

Field QC Procedures

Field sampling will use a standard protocol to avoid errors caused by disturbance of the substrate and to ensure representative sampling. Fecal coliform duplicates will be collected at a 10% rate as discussed above.

Laboratory QC Procedures

Laboratory QC procedures will be conducted according to Edge Analytical's standard QC program.

Office QC Procedures

Fecal coliform data obtained from the laboratory will be entered into the Skagit County Water Quality Database. Printouts from the database (QC sheets) will then be checked against the laboratory data sheets to check for data entry errors. Errors will be corrected in the database and noted on the QC sheets.

Corrective Procedures

Corrective procedures will take place as they are warranted. The laboratory will be responsible for implementing corrective actions should problems arise with laboratory analyses. These procedures may involve control charts, recovery charts, and blank analysis charts to locate the source of the problem. The Project Co-Managers will be responsible for corrective actions regarding problems with field data and sample collection. These actions may include additional sample collection, field equipment training, equipment checks, calibration standard verification, and recalibration in the field. Office activities may include correction of the database, meetings with monitoring team members, instrument repair, and revision of procedures.

Data Quality Objectives

The goal of this program is to generate sufficient reliable data to locate areas where fecal coliform pollution is entering watercourses leading to Samish Bay. A secondary data quality goal is to generate data that will allow determination of a stream's status compared to state water quality standards.

Bias

Bias will be minimized by use of standardized procedures by an experienced staff. Samples will be taken and preserved according to written procedures and instruments will be calibrated and operated according to manufacturer's instructions.

Precision

The measurement quality objectives for fecal coliform sampling include 33 percent relative standard deviation (RSD) with a reporting limit of 2 colony-forming units per 100 mL. The

precision goal is taken from the Washington State Department of Ecology's Stream Ambient Water Quality Monitoring Program. Previous Skagit County experience has shown that precision goal to be ambitious, as the current County sampling averages about 40% RSD based on duplicate analysis.

DATA ASSESSMENT PROCEDURES

QA/QC Process

The Project Manager will review laboratory reports and field data and notes to validate laboratory and field techniques, calculate precision, account for bias, and verify completeness. In addition, the reports will be reviewed and summarized annually during the project.

Data Entry and Review

Data will be entered into the Skagit County Monitoring Database directly from the field data sheets. After entry in the database, printouts will be compared with field sheets to detect and correct data entry errors. For analysis, data will be exported to spreadsheets and reviewed to focus on parameters of interest. Trends will also be analyzed using graphical formats and other tools as deemed appropriate. Because all of the field and laboratory analyses are standard procedures and Skagit County personnel have extensive water quality monitoring experience, major problems with quality control are not expected. However, data reports will be reviewed regularly by the Project Manager.

Data acceptability will be judged based on field reports of unusual conditions and laboratory quality control reports. Data with demonstrable problems in collection or laboratory quality control will be rejected. Data with laboratory qualifiers will be flagged but included.

Statistics

Standard summary statistics (mean, standard deviation, geometric mean, etc.) will be computed for fecal coliform and any other parameters measured and included annual reports. Current Skagit County programs use the Seasonal Kendall's Test to detect trends in water quality data, and the data gathered in this program will be included in the larger data sets with previously collected data for trend analysis. Summary statistics and further analysis will be included in any reporting to EPA.

All raw data will be forwarded to EPA for their use and posted on the County's website for use by other interested parties.

PROGRAM ASSESSMENT

Adaptive management will be used to reevaluate fecal coliform sampling strategy on an ongoing basis. Additional sampling locations, including additional tributaries, may be necessary to further delineate pollution sources. Current sampling locations may not be providing suitable information for the cleanup effort. Sampling frequency will also be evaluated on an ongoing basis.

The County will evaluate effectiveness of the sampling program on an ongoing basis and as part of each annual report. Progress in determining pollution sources using the sampling strategy and reducing fecal coliform pollution will be evaluated as part of this process.

The County will keep the EPA Project Manager informed of the assessment process and consult with her before making changes to the program.

REFERENCES

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Washington State Department of Ecology, "Stream Sampling Protocols for the Environmental Monitoring and Trends Section," Publication No. 01-03-036 (2001),

Washington State Department of Ecology, "Quality Assurance Monitoring Plan, Stream Ambient Water Quality Monitoring," Publication No. 03-03-200

YSI Incorporated, "YSI Model 85 Operations Manual," YSI Incorporated, Yellow Springs, Ohio (1998).

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Rationale for pre-QAPP sampling

The water quality sampling associated with this grant is part of an ongoing project to clean up the Samish Bay watershed. Skagit County has been conducting water quality analysis in the Samish Basin since 2000, first on a Centennial grant and then using funding from Skagit County's own Clean Water Program. Skagit County and CSI partners deemed it crucial to continue to collect water quality samples during the QAPP review process, to characterize pollution sources in the watershed. Because of a change in water collection methods delineated in this QAPP, data from samples collected before the QAPP was approved will be flagged as "estimated values" per EPA recommendation.

Draft Figure A-1. Map of Sample Locations for Skagit County Water Quality Monitoring Program