

Pollution, Identification and Correction Program



Photo credit: Karleigh Gomez; Hans Daubenberger extracting water sample at Duckabush River flow wire below Collins Campground.



Final Report 2017

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Photo Credit: Devon Hayes, PGST reservation shellfish opening during sampling event on June 19, 2015



Contents

Acknowledgements..... 1

1 Introduction 4

2 Regulatory Criteria Standards 5

 Non-tribal lands 5

 PGST Tribal Lands..... 6

 Project Administration and Management 6

3 Project Descriptions 7

 Shoreline Surveys..... 7

 MST Literature Review and Study..... 8

 Temporal Investigation 8

 Tryptophan and Optical Brighteners..... 8

 Implementation Summary 9

4 Education and Outreach 9

5 References 10



Photo Credit: Courtney Ewing, Aurora Robles digging clams for the Port Gamble S’Klallam Early Childhood Program Yearly Celebration Clam Bake.



Acronyms and Abbreviations

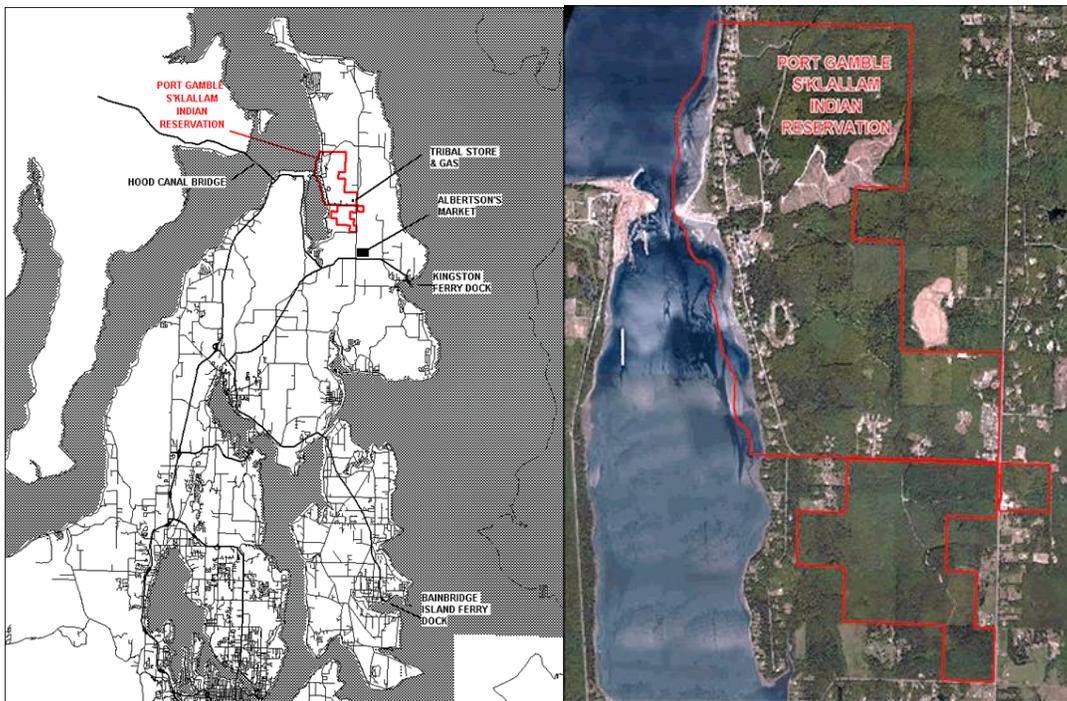
autosampler	Hach Sigma SD 900 Portable Sampler
cfu	colony forming units
CDX	Central Data Exchange
EC	<i>Escherichia coli</i> bacteria
<i>E. coli</i>	<i>Escherichia coli</i> bacteria
Ecology	Washington State Department of Ecology
FC	fecal coliform bacteria
FEATS	Financial and Ecosystem Accounting Tracking System
GIS	Geographic Information System software
GMV	geometric mean value
GPS	Global Positioning System
HCCC	Hood Canal Coordinating Council
HCRPIC	Hood Canal Regional Pollution Identification and Control Program
KPHD	Kitsap Public Health District
MCPH	Mason County Public Health
NPDES	National Pollution Discharge Elimination System (permitting program)
NTR	National Toxics Rule
OSS	onsite sewage system
PGST	Port Gamble S’Klallam Tribe
PIC	Pollution Identification and Correction
PSAMP	Puget Sound Assessment and Monitoring Program
QA	Quality assurance
QAPP	Quality Assurance Project Plan
QC	Quality control
RPD	Relative percent difference
RSD	Relative standard deviation
SOP	Standard Operating Procedure
STORET	USEPA Storage and Retrieval database
TMDL	total maximum daily value
TOD	time of day
Tribe	Port Gamble S’Klallam Tribe
USEPA	U.S. Environmental Protection Agency
WAC	Washington Administrative Code
WDFW	Washington Department of Fish and Wildlife
WDOH	Washington Department of Health
WRIA	Water Resources Inventory Area
WSTMP	Washington State Toxics Monitoring Program
YSI	Yellow Springs Instruments



1 Introduction

The Port Gamble S'Klallam Tribe's reservation is home to more than 1,200 tribal members. Located near the northern end of the Kitsap Peninsula (Figure 1), the reservation lands rise from Admiralty Inlet and Port Gamble Bay. The reservation is mostly forested, contains approximately 2.5 miles of marine shoreline, and receives approximately 20 inches of rain per year. Port Gamble Bay is one of the largest and most productive marine areas open for commercial and recreational shellfish harvest in Kitsap County (see WA DOH shellfish harvest area classification map <https://fortress.wa.gov/doh/eh/maps/biotoxin/biotoxin.html>).

Figure 1. Overview maps of the Kitsap Peninsula and the PGST Reservation



Shellfish and other aquatic organisms along streams and shorelines within the PGST Usual and Accustomed Areas (U&A, Appendix A) have been negatively affected by nutrient and fecal pollution from failing onsite sewage systems (OSS) and other sources. Closure of shellfish beds due to fecal pollution, in particular, has prompted PGST and local governments to develop and implement marine and freshwater monitoring programs.

Pollution Identification and Control (PIC) programs in the Hood Canal region monitor marine and fresh water bodies, mainly for fecal coliform (FC) and/or *Escherichia coli* (EC) bacteria. Some of these programs also measure nutrient concentrations and ancillary environmental parameters such as temperature, salinity, specific conductance, pH, turbidity, and dissolved oxygen.

PGST is a member of the Hood Canal Coordinating Council (HCCC), whose mission is to protect and enhance the environmental and economic health of the Hood Canal and to support the Puget Sound



Action Agenda (PSP, 2014). The HCCC more recently developed the Hood Canal Regional Pollution, Identification and Control Program (HCRPIC) to monitor water quality. PGST serves on the HCRPIC Pilot Guidance Group to provide oversight, guidance and structure for consistent procedures and technical assistance for the HCRPIC program (Banigan, 2015).

PGST’s main role in the HCRPIC program is to research data gaps identified at HCRPIC meetings and during discussions of data submitted by its members. To do this, the PGST developed its own Pollution, Identification, and Correction program. This report describes PIC-related activities that have occurred at freshwater sites, both upland and near marine shorelines, within the reservation and throughout the Hood Canal including Water Resource Inventory Areas (WRIAs) 14-17. The study area and its surroundings are U&A harvest areas of the Port Gamble S’Klallam Tribe protected by the Point-No-Point Treaty of 1855.

Recent HCCC meetings and discussions about data shared by its members, identified issues that needed to be addressed by literature reviews or conducting “gap” analyses related to identifying sources of *E. coli* or fecal coliform bacteria.

This report and appendices describe PGST’s PIC program development including wet and dry season sampling, literature reviews, a microbial source tracking (MST) study, and a temporal sampling investigation.

2 Regulatory Criteria Standards

Non-tribal lands

Washington State delegates the responsibility for identifying and correcting nonpoint pollution to local governments (KPHD, 2014a/b). The regulatory authorities in the Hood Canal region include Jefferson County Public Health (JCPH), Kitsap Public Health District (KPHD), and Mason County Public Health and Human Services (MCPH). These jurisdictions are given flexibility to implement water quality protection programs, e.g., PIC programs, using different tools. For example, these regulatory authorities may choose to measure EC, FC and/or nutrients as indicators of fecal pollution. FC is still a common analysis, but federal guidance suggests EC (a species of FC bacteria specific to humans and other warm-blooded animals) and enterococci are better indicators of health risk from water contact (USEPA, 2012).

Staff from local governments compared PIC monitoring results to current Washington State water quality standards to determine appropriate response actions. HCRPIC guidance and regional agreements



Photo Credit: Katy Davis, Hans Daubenberger taking water sample at the marine sample stations outside the Duckabush River Estuary.



state that Hood Canal drainages with FC exceeding 200 colony forming units (cfu) per 100 milliliters (mL) or EC exceeding 100 cfu/100 mL, must be sampled at least two additional times for confirmation. The Geometric Mean Value (GMV) of the three (or more) sample results is then calculated. If the GMV for FC exceeds 500 cfu/100mL or 320 cfu/100mL for EC, further investigation is required.

PGST Tribal Lands

The Port Gamble S'Klallam Tribe is responsible for identifying and correcting nonpoint pollution on tribal



Photo Credit: Courtney Ewing, Therron Sullivan digs cockles at Point Julia for Port Gamble S'Klallam Early Childhood Program's Yearly Celebration Clam Bake.

lands. To this end, PGST collects and analyzes water samples from the reservation for EC concentrations. Collection and analysis methods are comparable to those used by other Hood Canal Regional PIC programs (Banigan, 2015). PGST staff compared its EC results to Tribal Water Quality Standards adopted to afford stringent levels of protection within the reservation (PGST, 2002):

Waters designated for recreational and cultural use shall not contain concentrations of EC bacteria exceeding a 30-day GMV of 126 cfu / 100 mL (based on a minimum of 5 samples).

Water designated for shellfish and crustacean spawning, rearing, and harvesting shall not contain FC levels exceeding a GMV of 14 cfu / 100 mL and no more than 10 percent of the samples used to calculate the GMV shall contain 43 cfu / 100 mL.

Project Administration and Management

PGST Natural Resources staff was primarily responsible for managing and implementing the PGST PIC program. PGST prepared and submitted necessary documentation for planning and reporting, submitted semi-annual reports to the USEPA Puget Sound Financial and Ecosystem Tracking System (FEATS), and facilitated data reporting to USEPA's STorage and RETrieval (STORET) website through the tribe's network node.

PGST administrated the PIC Program on the reservation and worked closely with Kitsap County Public Health District (KPHD) to plan and conduct Shoreline Surveys in the wet and dry seasons, as well as respond to elevated bacteria levels. PGST coordinated contracts with Spectra Laboratories – Kitsap, LLC for sample analysis and an environmental contractor for assistance with sampling and other program needs.

PGST led planning for regional gap studies based on available pollution trend analyses. PGST worked with county staff to prioritize sample locations for the temporal investigation, MST study, and the optical brightener and tryptophan evaluation.



3 Project Descriptions

The Port Gamble S'Klallam Tribe (PGST) has traditionally harvested shellfish for commercial, subsistence, and ceremonial purposes within areas that are currently prohibited and unclassified for harvest by State and Federal programs. PGST developed coordinated strategies to improve local PIC programs' ability to effectively protect shellfish beds within the tribal U&A harvest areas in Port Gamble Bay and the northern Hood Canal region. The following actions are the result of this undertaking.

Shoreline Surveys

PGST PIC Program conducted wet and dry season shoreline surveys on the PGST reservation in 2015. The wet season survey was conducted on February 24 and the dry season survey on September 25. KPHD was a critical partner for the shoreline surveys and provided valuable support to PGST personnel and contractors throughout the planning, field work, laboratory coordination, sample results review. PGST reservation shoreline survey results filled a lingering data gap in water quality records and allowed KPHD to assess and account for all shorelines in Kitsap County.

The wet season shoreline survey results led to one hotspot confirmation. PGST coordinated with KPHD on response. KPHD and PGST staff led a home visit and dye test in April 2015. The results of this dye test were negative, meaning the source of pollution remained unconfirmed, and subsequent monitoring results showed that water quality improved. Dry season shoreline survey bacteria results yielded no hotspot confirmation and required no investigation (See Appendix B).

A second hotspot investigation was initiated in response to a sewer overflow on the PGST reservation sewer system. PGST determined the source of the spill to be near Bud Purser Lane and began sampling streams in the vicinity. PGST worked with KPHD to confirm the hotspot and began a dye testing strategy for the neighborhood. As part of this ongoing investigation, PGST deployed charcoal filters in the impacted stream to test background conditions. After this, PGST deployed new charcoal filters and conducted dye tests in the lowest elevation houses. After the first dye test period, new charcoal filters were deployed and dye tests conducted on a new set of houses at the next higher elevation in the neighborhood. PGST then continued weekly sampling and coordinated with US Health and Human Services (USHHS). PGST closed the associated beach to shellfish harvest to protect tribal members until water quality improves sufficiently. As of March 2017, correcting this pollution source on the reservation is an ongoing effort.



Photo Credit: Devon Hayes, Due to elevated levels of FC and EC detected in Bud Purser Lane stream this popular shellfish harvest location was forced to close.



MST Literature Review and Study

To date, water quality monitoring and management practices have relied heavily on fecal indicator bacteria (FIB), including *Escherichia coli* and *Enterococcus*, which have low pathogenic potential but abundant presence in sewage and feces. FIB are therefore suggestive of pathogen presence. However, conventional indicators cannot discern between human and animal sources because FIB are present in the feces of most mammals and birds. It is important to distinguish between human and animal derived fecal pollution because of the heightened health risks associated with human sewage and the different remediation strategies for mitigating contamination from sewage versus surface runoff carrying animal waste. PGST conducted a literature review of published methods which have been used to identify microbial sources (see Appendix C). This resulted in the development of a DNA-based microbial source tracking study utilizing PCR and high throughput sequencing. Results of the microbial source tracking study are expected to be available Spring 2017.

Temporal Investigation

PGST coordinated sample collection of EC over a 24-hour period, to test for temporal variation in sample results. PGST collected water samples using a Hach Sigma SD 900 Portable Sampler (autosampler) which collected one sample per hour during the 24-hour sampling periods. Variability in results between samples was enough to warrant a second test, to determine the range of variability between split and replicate samples. A second collection period was coordinated with personnel collecting samples by hand four times a day over 72 hours.

Temporal studies were conducted on the PGST Reservation, and in Jefferson County at Irondale Creek and the Duckabush River. A time of day study was planned at Lofall Creek in Kitsap County during the wet season of 2015-2016 however was eventually canceled after excessive rainfall. Results showed that EC levels did vary significantly with time of day, beyond the variability found between split and replicate samples.

PGST recommends that future projects looking to utilize an autosampler should consider a model which can be easily dismantled and autoclaved. Additionally, unless the autosampler is going to be deployed regularly at a set location with proper infrastructure to house the equipment, using personnel to collect samples by hand is likely the more practical approach. For detailed methods and results of the temporal investigation, see Appendix D.

Tryptophan and Optical Brighteners

PGST used a Turner Designs Cyclops 7 Submersible Fluorometer with tryptophan and optical brightener sensors to determine if *in situ* measurements of tryptophan and optical brighteners are a useful proxy for identifying EC hotspots. Results showed no correlation between optical brighteners and EC at the three temporal investigation sites where the fluorometer was deployed. At one of the three sites, there was a weak correlation between EC and tryptophan (See Appendix D).



Implementation Summary

Table 1: Number of samples analyzed at each survey site

Shellfish Growing Area & County	Site	PGST Shoreline Survey	24-Hour EC Sampling	72-Hour EC Sampling	DNA	Total EC and FC
Port Gamble Bay, Kitsap	PGST Reservation	70	17	99	1	120
Port Townsend, Jefferson	Irondale Creek	-	14	-	1	16
Hood Canal 2, Kitsap	Lofall Creek	-	-	-	2	14
Hood Canal 3, Jefferson	Dosewallips River	-	-	-	8	14
Hood Canal 3 Jefferson	Duckabush River	-	-	104	12	122
Totals		70	31	203	24	286

4 Education and Outreach

Attending Puget Sound PIC workshops and regional meetings was valuable to PGST Natural Resources personnel to understand the broad program opportunities and educational options available. PGST maintained records of meeting agendas and notes in the Tribe's project files. With the understanding gained from these networking opportunities, PGST was able to consider the best ways to reach its audience.

PGST identified two priority audiences, tribal members, and regional policy-makers. To engage with these audiences, PGST developed its own outreach materials. This encouraged PGST to increase its field documentation, associated training and photographs of relevant field activities in U&A areas with actual PGST tribal members and personnel. PGST prepared outreach materials for social media, such as the PGST website and Facebook page. The materials are PowerPoint slides that stand alone to introduce PGST PIC priorities. Additionally, PGST created two PowerPoint presentations that are tailored to the tribal members and policy-makers.

PGST and KPHD conducted outreach and education with property owners and onlookers during field sampling events. Natural Resources Department staff offered presentations to college and grade school students on the reservation. The newly strengthened relationship with KPHD provided excellent networking opportunities for engaging with local policy-makers.



5 References

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