

# **Hood Canal Regional Pollution Identification and Correction *Monitoring Plan***



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## **Introduction**

Hood Canal is a natural, glacier-carved fjord more than 60 miles long, which forms the westernmost waterway and margin of the Puget Sound basin. It begins in the north in Admiralty Inlet between Tala Point and Foulweather Bluff and extends southwesterly about 45 miles to the Great Bend at Annas Bay. From there its “hook” extends northeasterly 15 miles to its head at the Union River estuary near Belfair (HCCC, 2012).

The canal has great cultural, economic, and recreational value to Washington state residents and tribes. A significant portion of the western Hood Canal upland watershed is located within the Olympic National Park and Olympic Forest. Marine resources include many boat docks, several marinas, with popular shrimp and crab events and commercial and recreation clam and oyster harvesting. Several state parks are located in the area. Local tribes rely on Hood Canal as their usual and accustomed treaty rights area.

Water quality is critical to protecting and enhancing human and ecological health, as well as critical shellfish and finfish resources. In a watershed with approximately 25,000 onsite sewage systems (OSS), many in close proximity to water bodies, PIC and other water quality programs have been essential to maintain and protect water quality. The programs will continue to be vital for the health of Hood Canal.

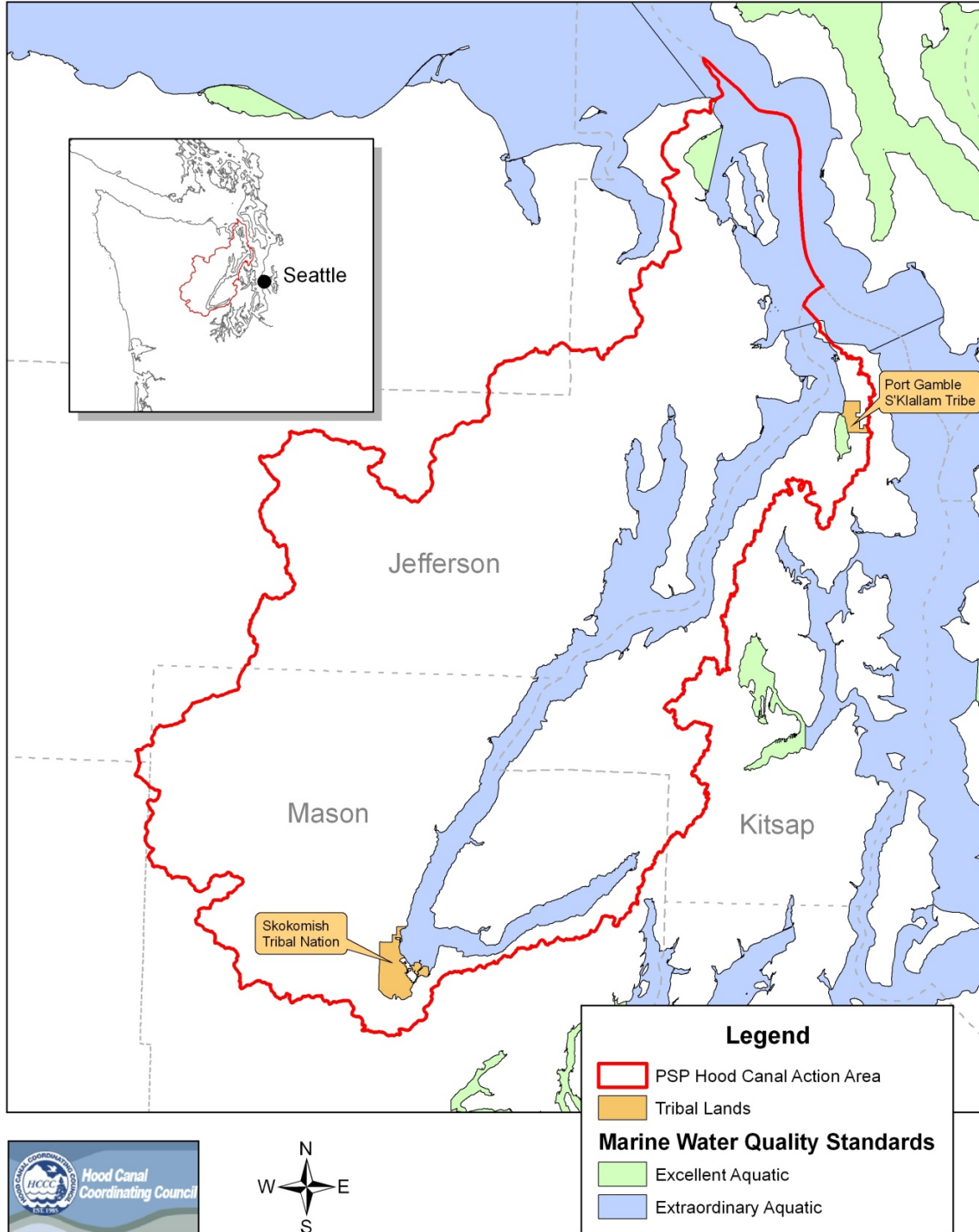
Recently, Hood Canal dissolved oxygen concentrations have improved. This may be the result of regional efforts to limit nitrogen inputs from sources including OSS, fertilizers, agricultural runoff.

Hood Canal was identified as a particularly important and vulnerable part of Puget Sound and designated as an Aquatic Rehabilitation Zone by Revised Code of Washington (RCW) 90.88 (Herrera, June 23, 2010). It is also designated as a shoreline of Statewide Significance by RCW 90.58.030. Mason County and Jefferson County Local Management Plans designated Hood Canal as a Marine Recovery Area.

The Hood Canal Coordinating Council (HCCC) was granted National Estuary Program funding to develop a regional Hood Canal Pollution Identification and Correction (HCPIC) program to enable efficient, prioritized, and coordinated responses by Hood Canal jurisdictions. This monitoring plan was developed through the project to provide a regional water quality assessment that will help identify water quality problem areas and rank them for implementation. The geographic scope of the HCPIC program is the Hood Canal Action Area.

Figure 1: Puget Sound Partnership's Hood Canal Action Area

## Hood Canal Action Area



This Monitoring Plan details background water quality and resource information, existing monitoring activities, proposed monitoring activities with rationale, and discusses other tools needed for identifying water quality problem areas, and recommendations. The plan is organized by monitoring type: marine water monitoring, fresh water monitoring, and shoreline surveys.

## **Background**

### **Marine Water Monitoring**

Washington State is the leading producer of farmed shellfish in the nation. This commercial product is shipped around the world. In addition, miles of Puget Sound shoreline and Washington coastal beaches attract hundreds of thousands of recreational harvesters every year. Monitoring water quality for shellfish consumption is essential to maintaining public health.

Clams, mussels, oysters, and other bivalve shellfish are filter feeders and can accumulate and concentrate toxins and disease-causing organisms that are harmful to humans. Because of this, it is important that the public be protected from consuming shellfish located near actual and potential sources of pollution.

Washington State Department of Health (WSDOH) is responsible for evaluating commercial shellfish growing areas to determine if shellfish are safe to eat. They monitor more than 100 shellfish growing areas throughout Puget Sound and along the coast.

WSDOH classifies shellfish growing areas based on ambient monitoring of marine water quality and evaluation of potential fecal pollution sources to protect public health. Commercial shellfish growing areas in Washington State are classified as *Approved*, *Conditionally Approved*, *Restricted*, or *Prohibited*. These classifications have specific standards that are derived from the National Shellfish Sanitation Program Guide for the Control of Molluscan Shellfish (Chapter IV, 2009 Revision).

WSDOH prepares an annual report for every growing area summarizing the previous year's data and the area's classification status. They evaluate commercial shellfish growing areas to make sure they still meet their classification status by analyzing water sample data collected in the previous year and assessing potential pollution sources. The evaluation is summarized in a brief report for each area.

In addition to the individual growing area reports, WSDOH prepares Early Warning System (EWS) Summary Reports for each county. The EWS Summary identifies specific locations (water sample stations) for each growing area in the county where water quality is "threatened" or "of concern".

- "Threatened" areas could soon be downgraded in classification because water quality is close to failing the standard, or because existing pollution sources may impact public health
- Areas "of concern" still meet the standard for their current classification, but the water quality is declining

### **Fresh Water Monitoring**

In June 2010, an Inventory of Stream and River Monitoring Efforts in Hood Canal was prepared for WRIA 16/14B Planning Unit, by Herrera Environmental Consultants and Aspect Consulting (Herrera, July 2010). A significant finding was that the number of local, state, tribal and federal entities involved in monitoring Hood Canal more than doubled since a 2003 study. This has resulted in a substantial increase in the amount of data collected. Most of this has been fecal coliform (FC) bacteria in an effort to reduce the public health threat from fecal pollution hotspots. The majority of monitoring implemented over the last decade has been short-term monitoring on selected streams due to funding sources.

WRIA 16/14B also contracted with Herrera Environmental Consultants to develop a comprehensive, long-term monitoring strategy for streams that flow into Hood Canal. The purpose of the strategy was to provide a comprehensive evaluation of the status of Hood Canal freshwater streams, and track trends in water quality over time. The strategy resulted in River and Stream Water Quality Monitoring Plan for the Hood Canal Watershed (Herrera, July 2010).

The WRIA 16/14B monitoring plan selected an approach that combines continuous, routine, seasonally-focused monitoring with a rotating sub-basin strategy. This approach reduces costs by limiting monitoring to only the highest priority streams in the watershed and to time periods of the greatest interest. Eleven highest priority streams were identified for Tier 1 routine monitoring.

The strategy divided the Hood Canal basin into four sub-regions, identifying eight prioritized Tier 2 monitoring stations per sub-region, each of which to be monitored for a full year on a 5-year rotating cycle. It recommended monitoring for lab parameters: FC, total phosphorous, soluble reactive phosphorus, total suspended solids, total nitrogen, nitrate+nitrite-nitrogen (NO<sub>2</sub>+NO<sub>3</sub>), ultimate biochemical oxygen demand; and field parameters: temperature, pH, dissolved oxygen, turbidity, conductivity, and flow.

In 2003, WRIA 17 contracted with Golder Associates to develop the Quilcene Watershed (WRIA 17) Water Quality Monitoring Plan for the northern portion of the Hood Canal

Action Area (June 30, 2003). Most water quality problems in the watershed are related to elevated temperature and FC. (Golder, June 30, 2003)

These monitoring plans provide thoughtful and comprehensive frameworks that can inform a phased regional approach as funding is available. The intent is to develop a long-term evaluation of ambient fresh water monitoring in order to prioritize pollution identification and correction activities, and to track seasonal variability and long-term trends.

Kitsap Health has found ambient fresh water monitoring to be a very effective approach to identify and fairly rank fecal pollution problem areas for correction. Kitsap's stormwater utility funded county-wide ambient trend monitoring in February 1996. The monitoring is key to Kitsap Health's ability to protect water quality in the county. Kitsap Health staff sample FC monthly at 115 county stream stations, 23 swimming beaches on 17 lakes, and 61 receiving marine stations. They evaluate monitoring data and produce an annual status report for the community. Areas that do not meet state water quality standards for FC are the basis of PIC Work List development. The data is also used to evaluate PIC program effectiveness.

### **Shoreline Survey**

A shoreline survey is the inventory and bacterial (potentially nitrogen) assessment of all flowing fresh water discharges to the project area shoreline. Dry season events, May 1 through Sept 30, can identify problems in areas where stormwater masks FC sources or where residences are only occupied in the summer. Wet season assessments, Oct. 1 through April 30, can identify OSS failures caused by high seasonal groundwater and surface water drainage issues. Wet weather conditions, or precipitation events, are met when water is flowing off parcels and stormwater is flowing in roadside ditches or storm systems.

During the shoreline survey, water samples are collected from all flowing discharge points including streams, storm water outfalls, yard drains, bulkhead drains, pipes, drainage ditches, seeps and sheet flow. Composite samples are collected if there are multiple small discharges that appear to emanate from one parcel or source and/or are close together.

Samples are collected at low tide to target the discharge of fresh groundwater versus the drainage of residual marine water. Detailed field notes, photographs and global positioning system waypoints are collected in support of samples. Confirmation samples are collected in drainages with bacterial results above a threshold. Jefferson Public Health (Jefferson Health) uses 200 FC/100ml and 100 EC/100ml. Kitsap Health used 200 FC/100ml. and 160 EC/100 ml. until 2013, when they moved to 500 FC/100ml and 406 EC/100ml. When initial sample exceed the threshold, Jefferson and Kitsap



collect two additional confirmation samples within 30 days (or as soon as practicable due to tide conditions). If the geometric mean of these samples exceeds the threshold, an investigation is conducted to identify fecal pollution sources and implement corrective actions. Mason Public Health (Mason Health) dye tests and collects one confirmation sample.

The investigation begins with researching drainage patterns in the immediate area. Beginning at the discharge, the drainage is broken into segments that bracket potential fecal sources like OSS and animal waste. Sampling FC or E. Coli (EC) sampling three times, beginning at the outfall segment assesses which segments are fecal pollution hotspots. OSS research is conducted to prioritize properties with no OSS records, non-conforming or concern conditions, and substandard maintenance reports. Property surveys are conducted and dye tests are used when necessary to eliminate properties as fecal sources, working upstream from the discharge.

Table 1 presents a summary of shoreline surveys conducted by Hood Canal jurisdictions between 2005 and 2011.

**Table 1: Shoreline Surveys 2005-2011**

County	Shoreline Miles	Confirmed Hotspots	OSS Failures Found
Jefferson	75.0*	29	10
Kitsap	48.0*	50	24
Mason	44.4 26.4*	37	9
TOTAL	193.8	116	43

\*wet and dry season

More than 193 miles of shoreline were surveyed by Hood Canal jurisdictions between 2005 and 2011; most were visited twice (during wet and dry seasons). Forty-three OSS were found to be failing and impacting the Hood Canal shoreline.

### Sanitary Survey

WSDOH’s commercial growing area classification process is called a “sanitary survey” and consists of three parts: a shoreline survey, a marine water quality evaluation, and a meteorological and hydrographic evaluation. The purpose of a sanitary survey is to ensure that an area complies with its classification, to modify the classification when needed, and to notify the responsible agencies when contamination sources are identified. Monitoring data and reports resulting from these studies are shared with tribes, local governments and state agencies. Annual reports are available online at

<http://www.doh.wa.gov/CommunityandEnvironment/Shellfish/GrowingAreas/AnnualReports.aspx>.

WSDOH conducts sanitary surveys of shellfish growing areas every 8-12 years. The sanitary survey is a growing area evaluation involving:

- A shoreline survey, which identifies pollution sources that may impact water quality and evaluates sewage treatment plants, OSS, animal farms, drainage ways, and wildlife;
- Marine water sampling to determine FC bacteria levels in the marine water; and
- Analysis of how weather conditions, tides, currents, and other factors may affect the distribution of any pollutants in the area. (WSDOH, accessed April 30, 2013)

### **Purpose and Objectives**

The purpose of the Hood Canal Regional PIC Monitoring Plan is to determine essential long-term monitoring needs in order to develop and maintain water quality assessments of and water quality trends for major Hood Canal fresh waters and receiving marine waters. This information will be used to proactively rank areas for PIC activities. This plan describes current monitoring efforts and proposes additional monitoring that will facilitate prioritized implementation of the regional HCPIC program.

The major goal of the regional program is to restore and protect Hood Canal water quality by correcting sources of fecal pollution that impact shellfish growing areas and pose a threat to public health. This goal makes bacterial pollution monitoring data, associated with human health and shellfish bed approval, a priority. This involves development and implementation of an ongoing bacterial monitoring and investigation program. The program will identify and correct fecal pollution sources to protect and improve shellfish growing areas and recreational opportunities. The anticipated outcomes of the project include water quality improvements and protection of human health. That will result in the protection of harvestable shellfish growing areas and safe recreational opportunities.

An additional goal of the program is to restore and protect Hood Canal habitat and promote salmon recovery. This goal makes inorganic nitrogen, in association with eutrophication and dissolved oxygen and temperature, a priority. At a minimum, this involves monitoring for ammonium, nitrate+nitrite-nitrogen, salinity, and temperature. The program will work to correct activities that discharge nutrients or cause temperature increases that are detrimental to the riparian habitats of Hood Canal.

Although there are many other very important water quality parameters that could be looked at, this plan focuses on pathogens and nutrients in order to develop a solid monitoring foundation that can be built upon as funding allows.

In summary, the Hood Canal Regional Pollution Identification and Correction Monitoring Plan (Monitoring Plan) objectives are to:

- Work with local jurisdictions to develop a regional PIC for the Hood Canal watershed;
- Provide coordinated water pollution investigation and cleanup work;
- Identify waterbodies 303(d) listed for fecal coliform (FC) and address anthropogenic sources of pathogens and nitrogen;
- Work to enhance and protect habitat associated with riparian areas;
- Work with local jurisdictions on coordinated regulatory oversight and policy development;
- Coordinate with Hood Canal jurisdictions to correct OSS and solid waste violations under applicable local codes;
- Educate residents about actions they can take to protect and restore Hood Canal water quality and habitat.

## **Methods**

### **Washington State Water Quality Standards**

The Washington State Department of Ecology (Ecology) establishes surface water quality standards in Chapter 173-201A Washington Administrative Code (WAC). Surface waters in the Hood Canal Action Area are designated in the WAC as either Primary or Extraordinary Primary waters. Applicable surface water quality standards are summarized in **Table 2**.

**Table 2: Washington State Surface Water Quality Standards and Related Criteria**

Parameter	Freshwater Standard		Marine Water Standard	
	Extraordinary Primary	Primary	Extraordinary Primary	Primary
Fecal Coliform Bacteria (FC)	Part 1: $\leq 50$ FC/100 mL (geomean).  Part 2: Not more than 10% of all samples obtained for calculating a geomean $> 100$ FC/100 mL.	Part 1: $\leq 100$ FC/100 mL (geomean).  Part 2: Not more than 10% of all samples obtained for calculating a geomean $> 200$ FC/100 mL.	Part 1: $\leq 14$ FC/100 mL (geomean).  Part 2: Not more than 10% of all samples obtained for calculating a geomean $> 43$ FC/100 mL.	Part 1: $\leq 14$ FC/100 mL (geomean).  Part 2: Not more than 10% of all samples obtained for calculating a geomean $> 43$ FC/100 mL.
E. Coli Bacteria	$\leq 126$ organisms/100 mL (geomean) <sup>1</sup>		None	None

<sup>1</sup> U.S. EPA criterion (U.S. EPA 1986A).

### **Stratified Random Sampling Strategy**

A *stratified random sampling* strategy is used to determine current conditions and track long-term water quality trends. Random sampling is often used in water quality sampling because some parameters are known to vary by the time of day, season, precipitation levels and duration, or other factor(s). The advantages of a stratified random sampling strategy include (MacDonald, 1991):

- Improves sampling efficiency;
- Provides separate data (i.e., data collected during different times, seasons, and weather conditions) on each stratum (or matrix); and
- Enhances the sensitivity of future statistical tests by separating the variability among the strata (e.g., station locations, surrounding land uses, etc.) from variability within the strata (e.g., season, time of day, tide cycle, precipitation conditions, etc.).

A stratified random sampling approach is employed by both the WSDOH Shellfish Program in their classification of commercial and recreational shellfish areas, and Ecology's Environmental Investigations and Laboratory Services Program for their

ambient marine water monitoring for the Puget Sound Ambient Monitoring Program (PSAMP).

Ambient monitoring data collected using a stratified random sampling approach can be used to:

- Compare areas and rank for remediation needs;
- Show annual, seasonal, and rainfall related variability, changing water quality conditions, and emerging problems or improvements; and
- Show changes and differences in water quality between offshore and nearshore sampling locations, and between urbanized and rural lands.

Drawbacks of stratified random sampling include duration, population error, and poor accuracy and precision stemming from unrecognized trends or cycles in the population.

### **Marine Water Monitoring**

#### Existing Monitoring Data

WSDOH ambient marine monitoring identifies water quality problems in Washington marine waters and informs protection and restoration work.

There are eighteen shellfish growing areas in the Hood Canal Action Area: Hood Canal 1-9, Annas Bay, Quilcene Bay, Dabob Bay, Port Gamble, Mats Mats Bay, Oak Bay, Mystery Bay, Kilisut Harbor, and Port Townsend. WSDOH samples these areas for FC, temperature, salinity and tidal condition six times each year. Shellfish beds are classified based on fecal sample results as specified by the National Shellfish Sanitation Program.

WSDOH's most recent annual growing area review for Hood Canal watersheds assessed water quality data collected through December 31, 2012. Overall, marine water quality is very good in the eighteen Hood Canal growing areas with most of the stations meeting the *Approved* standard for shellfish harvest.

The following table shows the WSDOH Hood Canal growing area shellfish bed classification changes between 2005 and 2011 (WSDOH, September 2012). The net result is 180 acres upgraded from *Prohibited* to *Approved*, 70 acres upgraded from *Restricted* to *Approved*, and 40 acres from *Prohibited* to *Conditionally Approved*.

**Table 3: 2005-2012 Hood Canal Shellfish Bed Classification Changes and Status**

<b>Growing Area</b>	<b>Downgrade</b>	<b>Upgrade</b>	<b>Status</b>
Annas Bay	2005 - 300 acres from <i>Approved</i> to <i>Prohibited</i>	2009 - 300 acres from <i>Prohibited</i> to <i>Approved</i>	2010 - 108 days closure due to flooding 2011 - 69 days closure due to flooding
Hood Canal 1	2009 - one acre from <i>Approved</i> to <i>Prohibited</i>	No Change	2010 - 5 days closure due to flooding 2011 - 7 days closure due to flooding
Hood Canal 3		2010 - 70 acres from <i>Restricted</i> to <i>Approved</i>	2013 - Water quality concern
Hood Canal 5		2007 - 22 acres from <i>Prohibited</i> to <i>Approved</i>	
Hood Canal 6		2006 - 70 acres from <i>Prohibited</i> to <i>Approved</i>	2013 - Threatened
		2006 - 40 acres from <i>Prohibited</i> to <i>Conditionally Approved</i>	
Hood Canal 7		No Change	2010 - 5 days closure due to excessive rainfall 2011 - 7 days closure due to excessive rainfall
Hood Canal 8		No Change	2010 - 7 days closure due to excessive rainfall 2011 - 7 days closure due to excessive rainfall
Hood Canal 9		2006 - 55 acres from <i>Prohibited</i> to <i>Approved</i>	2010 - 7 days closure due to excessive rainfall 2011 - 7 days closure due to excessive rainfall
<b>Growing Area</b>	<b>Downgrade</b>	<b>Upgrade</b>	<b>Status</b>
Mystery Bay	2009 - 44 acres from <i>Approved</i> to <i>Conditionally Approved</i>	2010 - 44 acres from <i>Conditionally Approved</i> to <i>Approved</i>	

Port Gamble		2008 - 33 acres from <i>Prohibited to Approved</i>	
Quilcene Bay		No Change	2010 - 7 days closure due to flooding 2011 - 15 days closure due to improper waste disposal
		<b>INCREASE</b>	
<b>NET CHANGE</b>		<b>180 acres from <i>Prohibited to Approved</i></b>	
		<b>70 acres from <i>Restricted to Approved</i></b>	
		<b>40 acres from <i>Prohibited to Conditionally Approved</i></b>	

WSDOH has ongoing and robust marine water monitoring, shoreline survey, and sanitary survey programs in Hood Canal and Puget Sound. The Hood Canal Regional PIC program intends to utilize this marine water data in conjunction with “areas of concern” based on OSS GIS mapping clusters of old and unpermitted OSS to prioritize PIC work.

### **Fresh Water Monitoring**

#### Existing Monitoring Data

The following table summarizes fresh water FC data collected in Hood Canal by water year (October through September) between 2005 and 2011. The list was based on the 11 Tier 1 monitoring stations identified in the WRIA 16/14B monitoring plan and four high priority monitoring stations identified in the WRIA 17 monitoring plan. The jurisdictions added monitoring stations in areas with water quality and shellfish concerns, some of which are Tier 2 monitoring stations from the monitoring plan.

Ecology monitoring data from Hood Canal was also added.

([http://www.ecy.wa.gov/programs/eap/fw\\_riv/rv\\_main.html#4](http://www.ecy.wa.gov/programs/eap/fw_riv/rv_main.html#4)). Nitrogen data and other parameters have been collected at some stations, but are not inventoried here.

**Table 4: 2005 - 2011 Fresh Water Quality Summary (HCCC, 2013)**

Hood Canal Coordinating Council  
Hood Canal Regional Pollution Identification and Correction  
Monitoring Plan

Waterbody		WY2011 FC GMV	Meets WY2011 WQ Standard?	2005-2011 FC GMV
Big Anderson Creek (BA01)	Tier 2	20	<b>Failed Part 2</b>	14
Big Beef Creek (BB01)	Tier 1	22	Yes	12
Big Bend Creek (I-73)	Tier 1	39	<b>Failed Part 2</b>	40 <sup>1</sup>
Big Quilcene River	High Priority	No Data		2010 GMV 3.29
Chimacum Creek (CH/0.1)	High Priority	2011-12 GMV 76	<b>2010 Failed both parts</b>	2009-10 GMV 61
Dewatto River (33)	Tier 1	No Data		7 <sup>2</sup>
Donovan Creek (DV/0.0)	Jefferson	2012 GMV 412 EC	<b>2010 Failed Part 2</b>	2010 GMV @ DV/0.4 42
Duckabush River (DUC/0.0)	Tier 1	2011-12 GMV 4	Yes	2007-10 GMV < 7 EC
Duckabush River nr Brinnon	Ecology	1	Yes	2
Gamble Creek (PG01)	Tier 1	31	Yes	21
Hamma Hamma River @ Lena Creek Camp	Ecology	1	Yes	No Data
Jorsted Creek (17)	Tier 1	No Data		10 <sup>3</sup>
Jump Off Joe Creek (JJ01)	Tier 2	41	<b>Failed Part 2</b>	34
Kinman Creek (KN01)	Tier 2	119	<b>Failed both parts</b>	53
Leland Creek	Jefferson	No Data		
Little Anderson Creek (LA02)	Tier 2	11	Yes	10
Little Quilcene River	High Priority	No Data		
Seabeck Creek (SB01)	Tier 2	12	Yes	11



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Waterbody		WY2011 FC GMV	Meets WY2011 WQ Standard?	2005-2011 FC GMV
Skokomish River @ Hwy 106 @ HWY 101 Bridge @ Nally Slough @ Bobby Allens (Long term monthly monitoring by the Skokomish Tribe for multiple parameters - data summary from HWY 106)	Tier 1	21	<b>Failed Part 2</b>	14
Skokomish River @ Hwy 101 Bridge	Ecology	3	Yes	6
Stavis Creek (SV01)	Tier 2	18	Yes	14
Tahuya River (35)	Tier 1	No Data		10 <sup>4</sup>
Tarboo Creek (TB/0.0)	High Priority	2012 GMV 334.2 EC	<b>2010 Failed Part 2</b>	2009-10 GMV @ TB0.9 17 2007 Ecology 74
Trail's End Creek	Tier 1	24	<b>Failed Part 2</b>	30 <sup>5</sup>
Union River (40)	Tier 1	No Data		32 <sup>6</sup>

<sup>1</sup> 14 Samples collected between 8/10/10 and 9/6/11

<sup>2</sup> 24 Samples collected between 11/15/04 and 6/26/07

<sup>3</sup> 20 Samples collected between 10/5/04 and 11/13/06

<sup>4</sup> 28 Samples collected between 11/1/04 and 6/26/07

<sup>5</sup> 14 Samples collected between 8/11/10 and 9/6/11

<sup>6</sup> 17 Samples collected between 11/1/04 and 3/21/06

Jefferson Health monitors three lakes monthly for cyanobacteria, dissolved oxygen, temperature, and conductivity at the swimming beach and nitrogen and phosphorus at the lake center. They would like to monitor for bacteria. Kitsap Health monitors lake public swimming beaches for EC at least once monthly between May and September based on beach usage. Several years ago, Mason Health subcontracted with Mason Conservation District to monitor lakes for EC monthly between Memorial Day and Labor Day for educational purposes. They would like to resume monitoring for bacteria.

### **Monitoring Data Management**

Data management is essential to water quality assessment activities. The Hood Canal Regional PIC program will utilize monitoring data to prioritize and rank areas for PIC activities and to report to the public.

Currently the five Hood Canal jurisdictions utilize different data management systems. The common systems are EIM, where data collected through Ecology grants is managed, and STORET, where data collected through EPA grants is managed.

The regional PIC program will need to determine which data management systems will allow the regional team to easily manage data and to utilize it to identify hotspots, confirm corrections and report to the public. The team will need to determine which group will coordinate all data management activities in order to provide a consistent data repository.

## **Proposed Monitoring Plan**

### **Marine Water Monitoring**

WSDOH Shellfish Program classifies commercial shellfish beds based on FC sample results as specified by the National Shellfish Sanitation Program. They monitor Hood Canal marine waters for FC, temperature, salinity, and tidal conditions six times each year through the Puget Sound shellfish and water protection program.

The WSDOH ambient monitoring program is a stratified random sampling approach. The program is ongoing and the dataset is robust. The WSDOH marine water data will be a useful resource for the Hood Canal Regional PIC team. Other useful resources include 303(d) listings and BEACH enterococcus monitoring.

### **Fresh Water Monitoring**

The majority of fresh water monitoring implemented in Hood Canal over the last decade has been short-term monitoring on selected streams due to funding sources. (Herrera, June 2010). Although Hood Canal monitoring more than doubled between 2003 and 2010, only eleven of the twenty-five fresh water stream stations monitored had FC data for the entire 2005-2011 assessment period as seen in Table 1.

Existing data does not allow a robust comparison of Hood Canal fresh water quality. Ambient fresh water monitoring data for all of the Hood Canal Action Area is essential to identify and rank fresh water problem areas. PIC activities are then targeted to ranked problem areas to protect and restore water quality in Hood Canal. Until a robust fresh water monitoring program can be implemented, OSS GIS data clusters of old or unpermitted OSS and marine monitoring data will be utilized to identify “areas of concern”.

A stratified random sampling strategy will provide the necessary comprehensive approach in order to gain a representative assessment of the location and magnitude of water quality problems in the Hood Canal watershed and to allow ranking of problem areas for PIC work.

This assessment recommends that ambient freshwater stream monitoring be implemented monthly at the proposed stream monitoring stations listed as needing ongoing monitoring in Table 4. The list was developed based on the WRIA 16/14B and WRIA 17 monitoring plans. (Herrera, June 23, 2010; Golder, June 30, 2003). Local jurisdictions may add additional upland monitoring stations on a rotating basis in order to proactively assess upland water quality.

Monitoring will begin with FC and/or E. coli, temperature, pH, dissolved oxygen and conductivity. A stratified random sampling strategy will provide the necessary comprehensive approach in order to gain a representative assessment of the location and magnitude of water quality problems in the Hood Canal watershed and to allow ranking of problem areas for PIC work.

Nutrient monitoring and pilot nitrogen studies will be added as the Hood Canal Aquatic Rehabilitation Technical Advisory Committee, working on dissolved oxygen issues in Hood Canal, determines next steps based on available science and the March 2013 publication “Review and Synthesis of Available Information to Estimate Human Impacts to Dissolved Oxygen in Hood Canal (Ecology, March 2013). They are currently in the process of making recommendations for needed nutrient monitoring. Targeted nutrient studies in Hood Canal between 2005 and 2011 provided important information in identifying shoreline nutrient contributions and additional studies may be conducted to address gaps or provide follow up.

**Table 4: Proposed Stream Monitoring Plan**

<b>Waterbody</b>	<b>Jurisdiction</b>	<b>Priority</b>	<b>Ongoing Ambient Monitoring</b>
Big Anderson Creek	Kitsap	Tier 2	Kitsap
Big Beef Creek	Kitsap	Tier 1	Kitsap
Big Bend Creek	Mason	Tier 1	Needed
Big Quilcene River	Jefferson	Tier 1	Ecology
Chimacum Creek	Jefferson	Tier 1	Needed
Dewatto River	Mason	Tier 1	Needed
Donovan Creek	Jefferson	Tier 1	Needed
Dosewallips River	Jefferson	Tier 2	Needed
Duckabush River	Mason	Tier 1	Needed

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Duckabush River nr Brinnon	Mason	Ecology	Ecology
East Chimacum Creek	Jefferson	Tier 1	Needed
Finch Creek	Mason	Local concern	Needed
Gamble Creek	Kitsap	Tier 1	Kitsap
Hamma Hamma River @ Lena Creek Camp	Mason	Ecology	Ecology
Jorsted Creek	Mason	Tier 1	Needed
Jump Off Joe Creek	Kitsap	Tier 2	Kitsap
Kinman Creek	Kitsap	Tier 2	Kitsap
Leland Creek	Jefferson	Tier 1	Needed
Little Anderson Creek	Kitsap	Tier 2	Kitsap
Little Quilcene River	Jefferson	Tier 1	Needed
Ludlow Creek	Jefferson	Tier 1	Needed
Martha John Creek	Kitsap	Local concern	Kitsap
Naylor's Creek	Jefferson	Tier 1	Needed
Putansuu Creek	Jefferson	Tier 1	Needed
Seabeck Creek	Kitsap	Tier 2	Kitsap
Shine Creek	Jefferson	Tier 1	Needed
Skokomish River @ Hwy 106	Skokomish/Mason		
@ HWY 101 Bridge	Skokomish/Mason		
@ Bobby Allens	Skokomish/Mason	Tier 1	Skokomish Tribe
Skokomish River @ Hwy 101 Bridge	Skokomish/Mason	Ecology	Skokomish Tribe/Ecology
Snow Creek	Jefferson	Tier 1	Needed
Stavis Creek	Kitsap	Tier 2	Kitsap
Tahuya River	Kitsap	Tier 1	Kitsap
Tarboo Creek	Jefferson	Jefferson	Needed
Trail's End Creek	Mason	Tier 1	Needed
Union River	Mason/Kitsap	Tier 1	Kitsap

This assessment recommends that lake monitoring be conducted monthly between May and October at the proposed lakes listed in Table 5. The list was compiled by the Hood Canal Action Area jurisdictions based on beach usage and water quality threats. Lake

monitoring parameters of interest at the swimming beaches include cyanobacteria and EC. Parameters of interest at the lake center include dissolved oxygen, temperature, pH, EC, chlorophyll A or secci disk, phosphorus and nitrogen.

**Table 5: Proposed Lake Monitoring Plan**

<b>Lake</b>	<b>Jurisdiction Location</b>	<b>Reason for Inclusion</b>	<b>Ongoing Ambient Monitoring</b>
Anderson Lake	Jefferson	toxic algae	Needed*
Gibbs Lake	Jefferson	toxic algae	Needed*
Lake Leland	Jefferson	toxic algae	Needed*
Lake Symington	Kitsap	data available	Kitsap
Lake Tahuya	Kitsap	data available	Kitsap
Mission Lake	Kitsap	data available	Kitsap
Panther Lake	Kitsap	data available	Kitsap
Tiger Lake	Kitsap	data available	Kitsap
Aldrich Lake	Mason	local priority #6	Needed*
Collins Lake	Mason	local priority #5	Needed*
Devereaux Lake	Mason	local priority #2	Needed*
Erdman Lake	Mason	local priority #4	Needed*
Haven Lake	Mason	local priority #3	Needed*
Lake Cushman	Mason	local priority #1	Needed*
Reservoir behind Cushman and Kokanee Dams	Skokomish Tribe	Water quality concerns	Needed*

\*Bacteria monitoring needed

**Shoreline Survey and Sanitary Survey Assessment**

WSDOH prepares an annual growing area review and conducts a sanitary survey and pollution source report for each growing area on a rotating basis. They utilize this data to reclassify shellfish growing areas as needed. WSDOH also keeps track of and establishes closure zones for confirmed fecal sources in the correction process.

PIC shoreline surveys, inventory and bacterial assessment of flowing discharges, are the key approach for identifying and correcting bacterial pollution problems. Nearly 200

miles of Hood Canal shoreline were surveyed by Hood Canal jurisdictions between 2005 and 2011. Most of this shoreline was surveyed twice, once during the dry weather season and once during the wet season.

This assessment recommends that Hood Canal jurisdictions coordinate with WSDOH to enhance the marine shoreline survey program in Hood Canal to conduct a shoreline survey or a sanitary survey in shellfish growing areas approximately every five years. A proposed schedule follows and will be amended as clusters or “areas of concern” are identified through the HCPIC OSS GIS mapping project update. Further assessment is planned to determine where additional nutrient monitoring should be considered in shoreline survey work.

**Table 6: Hood Canal Action Area Sanitary Survey and Proposed Shoreline Survey Schedule**

Growing Area	Jurisdiction	Last WSDOH Sanitary Survey	Hood Canal Regional Shoreline Survey	Next WSDOH Sanitary Survey
Annas Bay	Mason	2012	2017	2021
Dabob Bay	Jefferson	2010	2016	2020
Hood Canal 1	Jefferson, Kitsap	2003	2018	In Progress
Hood Canal 2	Jefferson, Kitsap	2009	2016	2020
Hood Canal 3	Jefferson	2006	2014	2017
Hood Canal 4	Jefferson, Kitsap, Mason	2005	2020	2015
Hood Canal 5	Kitsap, Mason	2002	2018	In Progress
Hood Canal 6	Mason	2005	2020	2015
Hood Canal 7	Mason	2005	2020	2015
Hood Canal 8	Mason	2005	2019	2015
Hood Canal 9	Mason	2011	2016	2021
Kilisut Harbor	Jefferson	2009	2017	2019
Mats Mat Bay	Jefferson	2013	2018	
Mystery Bay	Jefferson	2009	2017	2019
Oak Bay	Jefferson	2005	2020	2015
Port Gamble Bay	Kitsap	2004	2019	2014
Port Townsend	Jefferson	2007	2013	2017
Quilcene Bay	Jefferson	2007		2017

The additional shoreline surveys are targeted to clean up closed shellfish growing areas and to protect open growing areas on a rotating basis. Jurisdictions surveys will include the following elements:

- Conduct shoreline monitoring of discharges in shellfish growing areas to find fecal “hot spots,” identify sources and correct them;
- Conduct shoreline monitoring during dry and wet weather conditions;
- Collect 1-2 confirmation samples when the initial sample is 200 FC/100ml, 100EC/100ml or greater;
- Investigate potential fecal pollution sources identified in WSDOH sanitary surveys;
- Segment and investigate shoreline “hotspot” drainages when the geomean of the confirmation samples is 500 FC/100ml; 320EC/100ml or greater. Conduct OSS surveys and investigations to find and correct fecal sources impacting commercial and recreational shellfish growing areas and swimming beaches;
- Collect samples and conduct property surveys according to the Hood Canal Regional Pollution Source Identification and Correction Guidance Document;
- Share monitoring data and survey results with WSDOH; and
- Provide data and information to the public and all other stakeholders.

### **Monitoring Plan Summary**

This Hood Canal regional monitoring plan recommends multiple elements:

- Utilize WSDOH marine water data to find and rank shoreline water quality problem areas.
- A fresh water ambient monitoring program will collect FC and temperature data at the locations found in Table 4. This data will be utilized to find and rank upland water quality problem areas. Pilot nutrient studies will be conducted based on the Hood Canal Aquatic Rehabilitation TAC’s need assessment.
- A shoreline survey element is the most effective way to address fecal pollution discharges to the shoreline. Fresh water monitoring can be added as funding permits to develop data about upland discharges.

Data management is an important element of monitoring and pollution identification and correction activities. The Hood Canal regional PIC team is in the process of looking at data management options and will develop a standard operating procedure for the regional PIC guidance document.

### **Other Needs**

The Hood Canal Action Area jurisdictions will need additional funding to accomplish the tasks specified in this monitoring plan. This funding will need to be ongoing to

adequately assess and prioritize areas for PIC work, and to implement PIC identification, correction, and follow-up work. Currently most water quality work in the five jurisdictions is funded through short-term grants. These grants require significant resources to research, obtain, and manage. The current trend has been smaller grant amounts with increased administrative tasks and costs.

### **Other Tools**

Non-point pollution resulting from landowner practices can be best addressed through community engagement, outreach, and education. The Hood Canal Water Education Network (HCWEN) has been very active in the Hood Canal region for more than a decade finding innovative ways of engaging the public to protect water quality. HCWEN is comprised of local agencies in the Hood Canal region including: WSU Extension, UW SeaGrant, local health departments, local public works, local conservation districts and non-profit groups such as the Hood Canal Coordinating Council and Hood Canal Salmon Enhancement Group. HCWEN provides a network for members, coordinates regional outreach messaging, and facilitates implementation of grant-funded outreach projects. HCWEN is one of the Puget Sound Partnership's Education, Communication and Outreach Networks (ECO Nets), twelve regional networks of professionals working to help save Puget Sound.

Successful education and outreach programs prevent pollution by developing approaches that result in measurable adoption of specific behaviors. The social marketing process uses marketing principles and techniques to influence public behaviors. This process has been effectively used to protect and improve Puget Sound.

The idea is to develop a regional outreach campaign that incorporates motivators and addresses barriers for priority audiences to make selected behavior changes. A pilot outreach campaign is then conducted in the region and measures adoption of the selected behaviors.

Workshops are educational tools that have been useful in this region and have included information about:

- Preventing bacterial and nutrient pollution
- How to protect your septic system investment
- Natural cleaning products
- Natural yard care
- Conservation District free technical assistance
- Mud Management Workshops
- Rain Gardens and other natural stormwater systems
- Shellfish Workshops
- Water conservation



- Distribution of sink screens, water conservation kits, or natural cleaning products
- Distribution of OSS Homeowner's manuals, pet waste brochures, conservation district brochures

### **Future Proposals**

The Hood Canal regional team has proposed the following future project ideas:

- **Citizen Monitoring:** Volunteer monitoring programs can be an effective way to collect water samples and educate the public about local water quality. A well organized, energetic, and personable volunteer coordinator is the key to an effective citizen monitoring program.
- **Water Quality Tow:** The Port Gamble S'Klallam Tribal Nation has water quality equipment that can be towed behind a boat. The team may design a pilot project to collect needed data in Hood Canal.

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