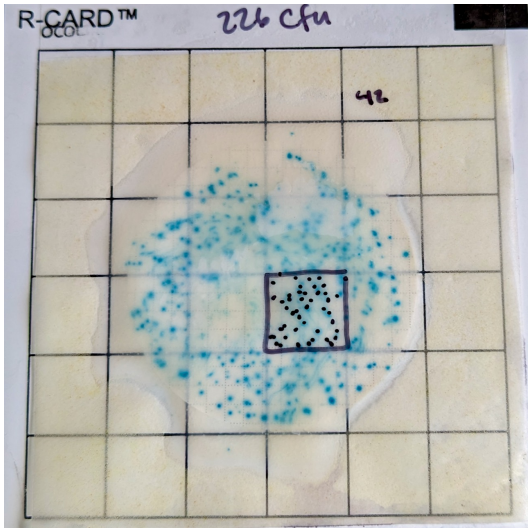
Salish Sea Stormwater Monitoring Program

Five Year Summary 2021 - 2025









September 2026

FRIENDS of the Salish Sea

RE SOURCES

Land Acknowledgement

We live and work on the ancestral homelands of the Coast Salish Peoples who have lived in the region from time immemorial. We acknowledge the Tribes' treaty rights, as well as our responsibility to uphold them, and we are grateful for the Tribes' enduring care and protection of the lands and waterways.

Authors

Zoe Fry, Program Manager, RE Sources. zoef@re-sources.org
Kirsten McDade, North Sound Waterkeeper, RE Sources. kirstenm@re-sources.org
Shannon Valderas, Stormwater Project Manager, Friends of Salish Sea. stormwater@friendsofsalishsea.org
Chris Wood, Stormwater Project Data Manager, Friends of Salish Sea. woodc@umich.edu

About Friends of the Salish Sea

Friends of the Salish Sea (formerly Friends of Skagit Beaches) was established in 2008. Our goal is to protect our marine shorelines, waterways, and natural lands through education, community science, and stewardship projects. We strive to increase public awareness and take action to protect the health of the Salish Sea and surrounding watersheds in order to protect all wildlife including the endangered Southern Resident Killer Whales, native salmon and oyster species, and forage fish.

Organization website: https://friendsofsalishsea.org
Link to the report: https://friendsofsalishsea.org/2025_5yr_summary_report
Link to the raw data: https://friendsofsalishsea.org/2025-5-year_summary_report-raw_data

About RE Sources

Founded in 1982, RE Sources is a nonprofit organization working to protect the environment and communities of the central Salish Sea region and our climate. We catalyze community action to build a lasting legacy for all of us — clean water, protected shorelines, an end to dangerous fossil fuel projects, and recovery for orcas and salmon.

Organization website: https://www.re-sources.org
Link to the Report: www.re-sources.org/5-year-stormwater-summary
Link to the raw dataset: www.re-sources.org/5-year-stormwater-summary

Table of Contents

Abstract **10**
Introduction **11**
Methods **14**
Results & Discussion **21**
Program Wide **22**
Bellingham 33
Bennett Ave Outfall 35
Broadway St Outfall 37
C St Outfall 38
Cedar St Outfall 40
Cornwall Ave Outfall 42
Olive St Outfall 44
Little Squalicum Creek 46
Padden Creek 47
Squalicum Creek 49
Whatcom Creek 51
Anacortes 53
Outfall B03-1001 57
Outfall B04-1002 59
Outfall G05-1003 61
Outfall G05-1002 63
Outfall G06-1001 65
Outfall G07-1002 67
Outfall G07-1001 69
Outfall G11-1001 72
Outfall G12-1001 74
Outfall G17-1001 76
Outfall G18-1001 78
Outfall G19-1001 80
Outfall G21-1001 82
Outfall G21-1005 83
Outfall F18-1001 85
Outfall F01-1001 87
Outfall F03-1001 91

Outfall F05-1001 94
Outfall F06-1001 96
Outfall F08-Culvert 97
Outfall F09-1002 99
Outfall F09-1004 100
Outfall F14-1002 103
Outfall F14-1003 105
Outfall F14-1004 106
Outfall F14-1005 108
Outfall F14-1006 108
Outfall F15-1002 110
Outfall F15-1006 112
Outfall F15-1007 114
Outfall F15-1008 116
Outfall SR20-05 118
Outfall F15-1009 121
Outfall F15-1010 124
Outfall SR20-02 126
Outfall F17-1002 129
Outfall P02-1001 131
Outfall S01-1001 134
Oak Harbor 136
Outfall FID726 138
Outfall FID3641 140
Outfall FID1681 142
Outfall FID2971 144
Outfall PID334,169 146
Outfall FID3024 148
Everett 149
Outfall EVE-10 151
Outfall EVE-11 152
Outfall EVE-13 154
Outfall EVE-14 155
Pigeon Creek #2 156
Glenwood Creek 157

Glenhaven Creek....159
Edgewater Creek....160
Mukilteo....162
Outfall OF041....164
Outfall OF059....165
Outfall OF256)....167
Outfall OF228....168
Big Gulch....169
Brewery Creek....170
Smuggler's Gulch....172
Japanese Gulch....173
Edmonds....175
Outfall CV665....177
Outfall CV664....178
Outfall CV663....179
Outfall CV2309....181
Hindley Creek-CV761....182
Hindley & Shell Creeks....183
Shellabarger Creek....184
Shell Creek....185
Perrinville Creek-CV399....187
Perrinville Creek-Talbott Road....188
Shoreline....190
Outfall OF864....192
Outfall OF1158....194
Blue Heron Creek....196
Storm Creek....197
Poulsbo....198
Outfall OF3703 PB02....200
Outfall OF3702 PB01....202
Outfall OF3604....203
Conclusions....204
Acknowledgements....211
References....212
Appendices....218

Appendix A: Salish Sea Stormwater Monitoring Program Monitoring Locations..... 219
Appendix B: Salish Sea Stormwater Monitoring Program Methods..... 224
Appendix B.1: Site and Safety Survey Worksheet..... 225
Appendix B.2: Field Procedures..... 226
Appendix B.3: Field Datasheet..... 233
Appendix B.4: Color, Odor and Visual Indicators Worksheet..... 235
Appendix B.5: Photo Monitoring Datasheet..... 236
Appendix B.6: Lab Procedures..... 237
Appendix B.7: Lab Datasheet..... 242
Appendix C: Bellingham Stream Background Turbidity Calculations..... 244

List of Tables

Table 1. Cities in the Salish Sea Stormwater Monitoring Program, the year monitoring started, and the number of locations monitored..... 15

Table 2. Criteria used to determine the flow rate category at a monitoring site.....16

Table 3. Index for rating the severity of color, odor and other visual observations.....17

Table 4. Stormwater pollution thresholds and water quality standards used to trigger notifications sent to stormwater managers.....19

Table 5. Turbidity water quality standards used to determine exceedances.....20

Table 6. Water quality health rating categories based on the percentage of samples that exceeded stormwater thresholds or water quality standards at a monitoring site.....20

Table 7. Combined percentage of stormwater threshold or water quality standard exceedances for dissolved oxygen, pH, turbidity, and E. coli from 2021 to 2025 with overall water quality health rating..... 22

Table 8a. Total percentage of outfall samples that exceeded stormwater thresholds by city and parameter for 2021 to 2025.....25

Table 8b. Total percentage of creek site samples that exceeded water quality standards by city and parameter for 2021 to 2025.....26

Table 9. Total number of Salish Sea Stormwater Monitoring outfall or creek sites with a given water quality health rating by parameter.....28

Table 10. Trends in water quality as demonstrated by changes in exceedance rates (%) and extremum (Extm) over time.....30

Table 11. PFAS detected in a background (low suds) sample of Outfall F03-1001 stormwater on April 17, 2026.....93

List of Figures

Figure 1. Locations of the eight cities included in the Salish Sea Stormwater Monitoring Project....14
Figure 2. Bellingham - Salish Sea Stormwater Monitoring Program sites with overall water quality health ratings....33
Figure 3. Anacortes - Salish Sea Stormwater Monitoring Program sites with overall water quality health ratings....53
Figure 4. Anacortes, Northwest Fidalgo Island - Salish Sea Stormwater Monitoring Program sites with overall water quality health ratings....56
Figure 5. Anacortes, Guemes Channel and Fidalgo Bay/Cap Sante Marina - Salish Sea Stormwater Monitoring Program sites with overall water quality health ratings....71
Figure 6. Paint spill flowing to Outfall F01-1001 storm drain....89
Figure 7. Anacortes, North Fidalgo Bay - Salish Sea Stormwater Monitoring Program sites with overall water quality health ratings....90
Figure 8. Excessive foam observed at Outfall F03-1001 on December 12, 2025....92
Figure 9. Milky looking discharge from Outfall F05-1001 on October 6, 2022....95
Figure 10. Anacortes, South Fidalgo Bay - Salish Sea Stormwater Monitoring Program sites with overall water quality health ratings....102
Figure 11. Anacortes, Southeast Fidalgo Bay, Padilla Bay and Similk Bay - Salish Sea Stormwater Monitoring Program sites with overall water quality health ratings....128
Figure 12. Select stormwater threshold exceedances in the vicinity of Anacortes stormwater Outfall P02-1001 from 2022-2025....132
Figure 13. Dense iron bacteria slime growths in roadside ditch upstream of Anacortes Outfall P02-1001 on February 14, 2025....133
Figure 14. Oak Harbor - Salish Sea Stormwater Monitoring Program sites with overall water quality health ratings....136
Figure 15. Everett - Salish Sea Stormwater Monitoring Program sites with overall water quality health ratings....150
Figure 16. Mukilteo - Salish Sea Stormwater Monitoring Program sites with overall water quality health ratings....162
Figure 17. Edmonds - Salish Sea Stormwater Monitoring Program sites with overall water quality health ratings....176
Figure 18: Shoreline - Salish Sea Stormwater Monitoring Program sites with overall water quality health ratings....190
Figure 19. Poulsbo - Salish Sea Stormwater Monitoring Program sites with overall water quality health ratings....198
Figure 20. Paint spill flowing into a storm drain that was reported by program volunteers and

promptly cleaned up by the City of Anacortes stormwater staff..... 205
Figure 21. Mean fecal coliform (FC) concentrations in stormwater by land use.....208

Abstract

Stormwater is the largest source of pollution to the Salish Sea, yet Washington's Phase II Municipal Stormwater Permits do not require permit holders to monitor the water quality of local discharges. To address this gap, two nonprofit organizations began a community science stormwater monitoring program in Bellingham and Anacortes in 2021. The program has since expanded to include Oak Harbor, Mukilteo, Everett, Edmonds, Shoreline, and Poulsbo. This report summarizes five years of data collected by over 90 trained volunteers at 88 sites (68 stormwater outfalls and 20 urban creek sites) across these eight Salish Sea communities. Monthly monitoring included water temperature, dissolved oxygen, conductivity, salinity, pH, turbidity, and *Escherichia coli (E. coli)* fecal bacteria, along with observational assessments of flow rate, color, odor, and other visual indicators. Each site received an overall water quality health rating of Good, Watch, or Threat based on the frequency of exceedances of stormwater thresholds (outfalls) or water quality standards (streams). Six sites were rated Good, 47 Watch, and 35 Threat. *E. coli* was the parameter with the most frequent exceedance rate in five of eight cities, followed by dissolved oxygen and temperature. Elevated conductivity was largely attributable to tidal seawater influence rather than pollution. Monitoring results directly informed several successful pollution source investigations in partnership with stormwater managers, including illicit sewage connections and spills. These findings demonstrate that pollution continues to enter the Salish Sea via stormwater even where permit requirements are met and that without site specific monitoring these pollution sources will continue undetected. The Salish Sea Stormwater Monitoring Program is a successful example of a low-cost, volunteer-based monitoring model that can generate data that supports pollution source tracing, leads to corrective actions, and measurably reduces stormwater pollution while also providing a meaningful opportunity for community engagement.

Introduction

Stormwater is the single largest source of pollution to the Salish Sea and is one of the biggest threats to this ecosystem (Ecology and King County, 2011). When rain or snow hits hard surfaces such as roofs, roads, and lawns the water picks up pollution and carries it to storm drains and pipes and eventually into the nearest waterway with little to no treatment. Many of these pollutants resist breaking down and can remain in the environment for decades and even bioaccumulate and magnify within organisms. No aquatic organisms are immune to stormwater pollution but larger, longer lived species such as the iconic Chinook salmon and orca whale are more susceptible to the accumulation of harmful pollutants and are failing to thrive because of it (Hardy et al., 2017)). One pollutant in stormwater, the chemical 6PPDQ found in tire dust, is lethal to coho salmon in very small amounts.

Stormwater pollution also contaminates common seafood that humans harvest and eat such as crab, mussels, and seaweed (Hardy et al. 2017, Hahn et al. 2022, James et al. 2020). This poses a significant health hazard to subsistence communities including the Coast Salish, who consume larger quantities of food from the Salish Sea than other groups. Current data suggests that the amount of pollution in aquatic organisms is not dramatically improving despite various cleanups and preventative measures (Hardy et al., 2017).

In Washington State, stormwater is regulated by the Department of Ecology (Ecology) through Municipal Stormwater Permits. There is a Phase I permit for large cities like Seattle and Tacoma and a Phase II permit for cities that are smaller but have more than 10,000 people. Additionally, the Phase II permit has a version for the west side of the Cascade Range (Shook, 2024) and one for the east side. The fourth type of Municipal Stormwater Permit is issued to Washington State Department of Transportation (WSDOT).

There are 119 Phase II stormwater permit holders in Washington State and 18 of those discharge directly into the Salish Sea. Phase II permits contain thresholds for different pollutants that when exceeded trigger a requirement for stormwater managers to identify and eliminate the sources (Shook, 2024). Phase II permits allow municipalities to choose from 3 options to fulfill the monitoring requirement. A major shortcoming of this system is that it is less expensive for a Phase II city to choose one of the two options which involve paying into the Stormwater Action Monitoring (SAM) fund, which supports regional status and trends studies or effectiveness and source identification studies, rather than choosing the option to monitor their own local stormwater quality (Shook, 2024)). Stormwater is managed using best management

practices — a suite of technologies and maintenance systems such as street sweeping, sediment removal, and visual inspections — but not monitoring.

To fill this knowledge gap, in 2020, two nonprofit organizations, Friends of the Salish Sea (FOSS, formerly Friends of Skagit Beaches) and RE Sources, started a community science monitoring program in their respective communities: Anacortes and Bellingham. The program design and methods were primarily developed from the *Illicit Connection and Illicit Discharge Field Screening and Source Tracing Guidance Manual* (Herrera Environmental Consultants & Aspect Consulting, 2020) with input from the Anacortes Stormwater Manager, the Department of Ecology's Head Municipal Stormwater Permit Planner, the Stormwater Action Monitoring Collaborative, the Samish Tribe, and the Bellingham Stormwater Team.

Six other communities have since joined the program - Oak Harbor, Everett, Mukilteo, Edmonds, Shoreline and Poulsbo - that is now referred to as the Salish Sea Stormwater Monitoring Project. Currently, 68 municipal outfalls and 20 urban creeks are monitored each month by over 90 trained volunteers. Other sites have been monitored but not on a regular enough basis to include in this report (see Appendix A). The hope is to expand the program when resources allow to include all Phase II permitted cities that discharge directly into the Salish Sea.

The goal is to provide inexpensive high quality data to stormwater managers while also engaging communities by providing training, volunteer opportunities, and education about local stormwater. Ultimately the goal is to find and clean up sources of stormwater pollution. Regular monitoring helps to pinpoint illicit (illegal) discharges and other sources of pollution. When pollution is detected, a report is sent to the stormwater manager who is responsible for evaluating the data using field investigations, historical trends, watershed characteristics, and the ICID manual to determine whether source tracing or further action is warranted. The volunteer teams work to develop a positive relationship with the stormwater managers and assist with investigative upstream sampling when requested.

The Salish Sea Stormwater Monitoring Program is completely dependent on the dedicated local community volunteers who are trained to conduct sampling. As volunteers, community members become educated about their local environment, learn how to be a part of the solution, develop empathy, and become change makers themselves. Their time and commitment reduce the overall cost of the program making it fiscally viable. The program is also dependent on the generosity of numerous grant programs to cover the remaining costs - materials, supplies and project management.

This report presents the results of five years of data collection and rated the overall water quality of each monitoring site as Good, Watch, or Threat. Six outfalls were rated as Good meaning they exceeded stormwater thresholds less than 10% of the time over the five years. Forty-seven sites, 39 outfalls and eight creeks, were rated as Watch, meaning they exceeded stormwater thresholds or water quality standards 10 to 30% of the time. Thirty-five sites, 23 outfalls and 12 creeks, were rated as Threat because they exceeded stormwater thresholds or water quality standards more than 30% of the time over the study period.

The fecal coliform bacteria, *Escherichia coli* (*E. coli*), was the most common threshold exceedance for five out of the eight cities sampled. Dissolved oxygen and temperature were the second and third most common threshold exceedances though generally at lower rates. Conductivity appears as a frequent exceedance, but many of the stormwater outfalls are exposed to marine water twice a day at high tide. Salt water has a high conductivity and therefore, these are not considered to be true water quality exceedances.

Methods

Sampling locations in the Phase II cities were selected based on municipal stormwater maps, field reconnaissance, safety concerns, and public access. The primary focus was on municipal stormwater outfalls. A few of the outfalls were later found to be private outfalls but have remained in the study. Urban freshwater creeks that were receiving waters for municipal stormwater outfalls were also included. Sites were surveyed monthly by a team of trained local volunteers. Usually, the sites were monitored where the outfall or stream enters the Salish Sea. Occasionally, due to safety or accessibility issues, monitoring occurred upstream.

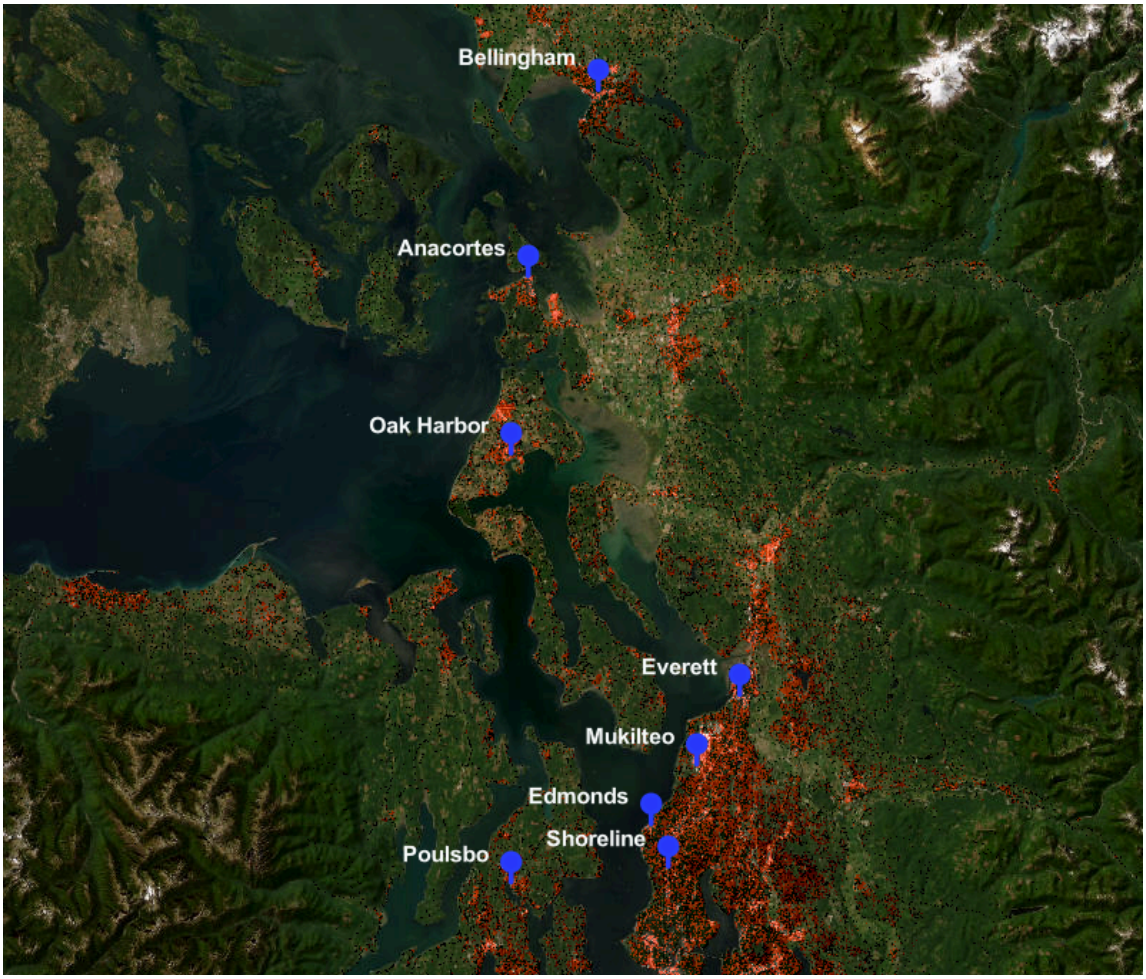


Figure 1. Locations of the eight cities included in the Salish Sea Stormwater Monitoring Project. Impervious, or hard surfaces, are indicated by pink and red shading.

A total of 177 different sites, 136 stormwater outfalls and 41 creek sites, in eight cities have been monitored over the past five years (Figure 1; Appendix A). Monitoring began in Bellingham and Anacortes and eventually expanded to six additional cities. The number of locations monitored in each city varied due to the number of stormwater outfalls present and ability to access them safely from public property (Table 1). A subset of the total sites monitored were deemed to have sufficient data to include in this summary report - 68 stormwater outfalls and 20 freshwater creek sites. There were many municipal stormwater outfalls that were not monitored due to a lack of resources, both monetary and volunteer interest. Some of these locations do not have sufficient detail to be included in this report. However, they are listed in Appendix A to allow interested parties to request the available data. Locations discussed in detail in this report are highlighted in Appendix A.

Table 1. Cities in the Salish Sea Stormwater Monitoring Program, the year monitoring started, and the number of locations monitored.

City	Year Monitoring Began	Number of Stormwater Outfalls Monitored*	Number of Creek Sites Monitored
Bellingham	2020	10	4
Anacortes	2020	77	0
Oak Harbor	2022	6	0
Edmonds	2022	15	11
Mukilteo	2022	14	16
Everett	2023	8	6
Shoreline	2023	2	4
Poulsbo	2024	4	0

*Includes a small number of manholes and catch basins sampled in source investigations.

Each monthly survey had several components: collection of basic environmental data, observations of flow rate, color, odor and other visuals; monitoring for water temperature, dissolved oxygen (DO), specific conductivity (SPC), salinity, and pH; and individual grab samples for turbidity monitoring and *Escherichia coli* (*E. coli)* analysis. The data collected, equipment used, and procedures followed were chosen to create a program that would provide reliable

high quality data using relatively simple and low cost methods that directly relate to the requirements of Phase II stormwater permits. Monthly monitoring dates and times were determined by volunteers based on tide tables, availability of shared equipment, and personal schedules. The complete field and laboratory methods including example datasheets are included in Appendix B. Additional information and important points regarding the methods are discussed below.

Basic Environmental Data: Current weather, past 24-hour rainfall, tide level and air temperature were recorded. Observations on the rate of flow were based on easily measured criteria separating flow into three broad categories (Table 2).

Table 2. Criteria used to determine the flow rate category at a monitoring site.

Flow Rate	Stormwater Outfall	Stream
None	No flow/stagnant pooled water	Stream bed is dry
Trickle	Filled 16 oz. cup in 2 minutes	Lots of exposed rocks/sediment
Moderate	Between tickle and high	Between trickle and high
High	Filled 16 oz. cup in 1 second	Flow close to high water mark

Water Quality Monitoring: A hand held ProQuatro YSI meter was used in the field to determine the water temperature, dissolved oxygen, SPC, salinity and pH of the stormwater. Turbidity was determined using an AMTAST turbidity meter.

Observational Parameters: Based on past observations at a site, volunteers objectively assessed if the flow rate appeared to be lower, higher, or normal compared to what they would expect to see given the previous 24-hour rainfall. An unexpectedly high flow could signal the presence of an illicit discharge. Conversely, no flow, or unusually low flow, might be a symptom of a blockage or break in the stormwater system.

The water sample and immediate downstream area of the outfall or creek were observed for color, odor and other visual indicators. A severity index was used to rate observations on a scale of 0 to 3 (Table 3) and a short description of the observation was recorded. The Color, Odor and Visual Indicators Worksheet (Appendix B.3.) provided additional information to guide volunteers on how to rate and describe what was observed. Sometimes, in cases of unusual visual observations, photo monitoring was conducted (Appendix B.4.)

Table 3. Index for rating the severity of color, odor and other visual observations.

Color Severity Scale		Odor Severity Scale		Visual Severity Scale	
0	None	0	None	0	None
1	Faint - faint color in sample	1	Faint - odor barely noticeable	1	Few/slight
2	Moderate - color clearly visible in sample	2	Moderate - odor easily detected	2	Moderate
3	Intense - color clearly visible in outfall flow or creek	3	Strong - odor noticeable several feet away	3	Excessive/severe

Bacteria Analysis: Initial bacteria tests in Bellingham were run using Coliscan EasyGel. In 2022, bacteria testing expanded to all cities and was conducted using the R-CARD, a rapid bioassay developed by Roth Biosciences. Both methods measure the presence of *E. coli* in water samples and were inexpensive and reproducible. The R-CARD, however, was easier to use and to interpret results. It also produced substantially less waste. Over the time period of this study, the volume of water tested changed from 100 ml siphoned through a filter which was placed on the R-CARD, to three ml pipetted directly onto an R-CARD. All results were normalized to colony forming units (cfu) per 100ml for comparability to stormwater thresholds and water quality standards (WQS). The R-CARD method was also being used as a monitoring tool by several agencies including the Whatcom Conservation District (LoGiudici & May, 2024) and the King County Water Quality Compliance Unit (King County Stormwater Services, 2023).

Quality Assurance and Quality Control Program: Field and lab methods included several components to ensure that data collected and reported was accurate and reproducible. This included the use of sterile lab techniques, routine instrument calibration for the YSI and turbidity meters, duplicate YSI monitoring at select sites, a duplicate sample for turbidity and bacteria monitoring from one randomly selected site per survey, and a sterile water negative bacteria control for each survey.

Results were entered by volunteers using an online data entry portal. All results entered were reviewed by an experienced stormwater database manager using original field datasheets for reference.

Volunteer Training: Initial training in each participating city included an overview of the program and demonstrations of the instruments and methods in a group setting followed by field and lab demonstrations. As new volunteers came aboard, training included joining or shadowing an existing team or training with a regional coordinator. Regional coordinators were in contact with volunteers to clarify methods, provide procedure updates, trouble shoot instrument breakdowns and provide general support.

Thresholds and Notifications: The most important aspect of the program was notifying local municipal stormwater managers when results suggested the presence of an illicit discharge, or other source of stormwater pollution. The goal was to provide data that would allow the managers to conduct follow-up investigations to identify and eliminate pollution sources.

In order to assess water quality and determine when to notify stormwater managers, a combination of stormwater thresholds taken directly from the Phase II stormwater permit and Ecology WQS, were used (Table 4). These thresholds and standards were designed to protect public health (full body contact recreation) and aquatic life, including endangered Pacific salmon species.

Local municipal stormwater managers were notified when monitoring results exceeded the thresholds and standards for dissolved oxygen, pH, turbidity and *E. coli* shown in Table 4. Conductivity and temperature were handled differently. While there is a stormwater threshold for conductivity, a large number of outfalls that were monitored were partially or fully inundated with seawater during high tide. Conductivity levels exceeding the stormwater threshold were only included in notifications if they were clearly not attributable to seawater.

The published stormwater threshold for temperature which triggers further investigation and sampling is “Above ambient air temperature” (Herrera Environmental Consultants & Aspect Consulting 2020). This threshold was exceeded so frequently that when developing the stormwater monitoring program, in consultation with the Anacortes stormwater manager, an alternative threshold for triggering a notification was agreed upon: outfall temperature > ambient air temperature + 3 ^{o}C. The reason for adding the +3 ^{o}C was to restrict notifications for temperature to the most extreme situations. However, it has been observed that during cold weather monitoring, the presence of groundwater in some stormwater outfalls causes even the higher threshold to be exceeded due to natural conditions. Due to these factors, notifications based on temperature, where natural causes could be ruled out, were rare.

Table 4. Stormwater pollution thresholds and water quality standards used to trigger notifications sent to stormwater managers.

Parameter	Outfall Thresholds*	Freshwater Stream WQS Core Summer Habitat**	Freshwater Stream WQS Spawning, Rearing and Migration**
Flow	> expected	NA	
Temperature °C	> air +3***	>16	>17.5
Dissolved Oxygen mg/l	<6	<10	
pH	<5 or >9	<6.5 or >8.5	
SPC uS/cm	>500	>500****	
Turbidity ntu	>50	Background < 50: > back + 5; Background > 50: > back + 10%	
E. coli cfu/100ml	>320	>320	>320
Color	Any unnatural color	Any unnatural color	
Odor	Any odor	Any odor	
Visual	Any unnatural phenomena	Any unnatural phenomena	

*(Herrera Environmental Consultants & Aspect Consulting, 2020)
**(Washington State Department of Ecology, 2024)
***Modified stormwater threshold
****(City of Bellingham, 2015)

The WQS for turbidity in freshwater streams is site specific and allows a given increase over background turbidity levels. Background turbidity data was available for Bellingham (City of Bellingham, 2015) and Everett (City of Everett, 2022) streams and was used to calculate site specific turbidity water quality standards (Table 5). For the remaining streams, an average of the background turbidity levels for the Bellingham streams 10.19 ntu, was used. Appendix C provides the detailed calculations of site specific WQS for Bellingham streams.

Notifications of exceedances to local municipal stormwater managers have improved regarding consistency and timeliness over the project history. Notifications in recent years were emailed one to five days after the results were available and often included additional reports including all monitoring previously performed at the site in question. In addition, monthly summary reports with all new data are emailed to managers at the end of each month.

An additional mechanism, the Environmental Reporting Tracking System (ERTS) monitored by Ecology, was used periodically by volunteers or staff to report very serious signs of pollution such as fossil fuel sheens, unusually high flow events and extreme bacteria levels in areas where people recreate.

Table 5. Turbidity water quality standards used to determine exceedances.

City	Creek	WQS for Turbidity (ntu)
Bellingham	Little Squalicum Creek	7.25
Bellingham	Squalicum Creek	14.29
Bellingham	Whatcom Creek	7.35
Bellingham	Padden Creek	11.87
Everett	Pigeon Creek #2	13.8
Everett	Edgewater Creek	11.2
Everett	Glenhaven Creek	12.0
Everett	Glenwood Creek	14.5
All other creeks		10.19

Water Quality Health Ratings and Trends: In order to assess the water quality at each location a rating system based on the percentage of samples that exceeded stormwater thresholds or water quality standards was developed. Each parameter and observation was given a health rating based on the percentage of exceedances over the entire study period (Table 6).

Table 6. Water quality health rating categories based on the percentage of samples that exceeded stormwater thresholds or water quality standards at a monitoring site.

Exceedance Frequency	Water Quality Health Rating	
	Parameters	Observations
≤ 10%	Good	Good
10% < x < 30%	Watch	Watch
≥ 30 %	Threat	Threat

In cases of observations that ranked Threat based on the percentage of exceedances, the health rating was upgraded to Watch if there was a known natural source. The most common cases this applied to was amber-like color in outfalls with wetlands or stormwater retention basins upstream. If an illicit discharge source had been identified and corrected and subsequent

sampling showed lower percentages of exceedances, the health rating for the specific parameter was upgraded from Threat to Watch or Watch to Good. When a health rating was upgraded due to site specific conditions, it was footnoted in the site summary.

The color codes shown in Table 6 were used in site summary tables presented in the Results & Discussion section and on maps. A choice was made to use a different color scale, grey scale, for observations to help distinguish them from the more objective parameters monitored.

In addition to a water quality health rating for each parameter and observation, an overall water quality health rating was assigned to each site. Recognizing the subjectivity of observations, for most sites the overall health rating was the worst individual health rating given for temperature, dissolved oxygen, pH, conductivity, turbidity, or *E. coli*. For example, if dissolved oxygen was rated Threat, the overall water quality health rating was rated Threat. An exception was made for one group of stormwater outfalls in Anacortes near HWY 20 (F15-1007, F15-1010, SR20-01, SR20-02 and SR20-05) where observations reflected severe pollution with no natural sources. For these outfalls, overall health ratings of Threat were given based on observations.

For data analysis, results were compiled by year for each monitoring site. Comparing the yearly percentage of exceedances over time allowed for a crude assessment of water quality trends to be made for each parameter and observation. If the rate or magnitude of exceedances clearly showed a trend it was noted as improving (↑), worsening(↓) or no change (⟷). For most parameters the trend was unclear or inconsistent (↑↓).

Results & Discussion

Program Wide

The majority of the 68 stormwater outfalls and 20 freshwater creek sites monitored from 2021-2025 had overall water quality health ratings in the Watch category (Table 7). This included 39 outfalls and eight creek sites. Only six outfalls, and no creeks, were found to have overall water quality ratings of Good. The remaining 23 outfalls and 12 creek sites had health ratings of Threat.

Table 7. Combined percentage of stormwater threshold or water quality standard exceedances for dissolved oxygen, pH, turbidity, and E. coli from 2021 to 2025 with overall water quality health rating.

Monitoring Site	Combined Percent Exceedances for DO, pH, Turbidity & *E. coli**	Overall Water Quality Health Rating
Bellingham - Outfalls		
Broadway St	7%	Watch
C St	13%	Threat
Cornwall Ave	20%	Threat
Cedar St	7%	Watch
Olive St	12%	Threat
Bennett Ave	18%	Threat
Bellingham - Creeks		
Little Squalicum Creek	16%	Watch
Squalicum Creek	15%	Watch
Whatcom Creek	12%	Watch
Padden Creek	24%	Threat
Anacortes - Outfalls		
B03-1001	3%	Watch
B04-1002	0%	Watch
F01-1001	12%	Threat
F03-1001	1%	Watch
F05-1001	7%	Watch
F06-1001	1%	Watch
F08-Culvert	23%	Threat
F09-1002	1%	Watch
F09-1004	2%	Good

Monitoring Site	Combined Percent Exceedances for DO, pH, Turbidity & *E. coli**	Overall Water Quality Health Rating
F14-1002	2%	Good
F14-1003	0%	Good
F14-1004	3%	Watch
F14-1005	3%	Watch
F14-1006	1%	Watch
F15-1002	3%	Watch
F15-1006	2%	Watch
F15-1007	5%	Threat
F15-1008	10%	Watch
F15-1009	14%	Threat
F15-1010	5%	Threat
F17-1002	7%	Watch
F18-1001	24%	Threat
G05-1002	4%	Watch
G05-1003	3%	Watch
G06-1001	2%	Watch
G07-1001	4%	Watch
G07-1002	13%	Threat
G11-1001	5%	Watch
G12-1001	4%	Watch
G17-1001	9%	Watch
G18-1001	13%	Threat
G19-1001	15%	Threat
G21-1001	16%	Threat
G21-1005	0%	Good
P02-1001	5%	Threat
S01-1001	4%	Watch
SR20-01	4%	Threat
SR20-02	3%	Threat
SR20-05	4%	Threat
Oak Harbor - Outfalls		
PID334, 169	9%	Watch
FID726	10%	Watch
FID3641	7%	Watch
FID3024	5%	Watch

Monitoring Site	Combined Percent Exceedances for DO, pH, Turbidity & *E. coli**	Overall Water Quality Health Rating
FID2971	16%	Threat
FID1681	6%	Watch
Everett - Outfalls		
EVE-14	3%	Watch
EVE-13	0%	Good
EVE-11	4%	Watch
EVE-10	9%	Watch
Everett - Creeks		
Pigeon Creek #2	29%	Threat
Glenwood Creek	20%	Threat
Glenhaven Creek	15%	Watch
Edgewater Creek	21%	Watch
Mukilteo - Outfalls		
OF041	9%	Watch
OF059	9%	Threat
OF256	4%	Watch
OF228	6%	Watch
Mukilteo - Creeks		
Smuggler's Gulch	18%	Threat
Big Gulch	23%	Threat
Brewery Creek	30%	Threat
Japanese Gulch	16%	Watch
Edmonds - Outfalls		
CV665	5%	Watch
CV664	10%	Threat
CV663	5%	Watch
CV2309	4%	Watch
Edmonds - Creeks		
Hindley Creek-CV761	29%	Threat
Hindley & Shell Creeks	10%	Watch
Shellabarger Creek	33%	Threat
Shell Creek	19%	Threat
Perrinville Creek-CV399	10%	Threat
Perrinville Creek-Talbott Rd	13%	Watch

Monitoring Site	Combined Percent Exceedances for DO, pH, Turbidity & *E. coli**	Overall Water Quality Health Rating
Shoreline - Outfalls		
OF864	9%	Threat
OF1158	0%	Good
Shoreline - Creeks		
Storm Creek	16%	Threat
Blue Heron Creek	27%	Threat
Poulsbo - Outfalls		
OF3703 PB02	4%	Watch
OF3702 PB01	0%	Watch
OF3604	7%	Threat

*These percentages are different then those used to rate overall water quality health of a site.

There was a large variation between the parameters measured when looking at total exceedance rates by city for both stormwater outfalls (Table 8a) and creeks (Table 8b). In Table 8a the extremely high exceedance rates for conductivity are a reflection of stormwater outfalls being inundated with seawater during high tides rather than a pollution problem. Excluding conductivity, *E. coli* were the predominant stormwater pollutant exceeding thresholds in six of the eight cities monitored. In Everett, the most prominent problem in stormwater was low

Table 8a. Total percentage of outfall samples that exceeded stormwater thresholds by city and parameter for 2021 to 2025.

Parameter	Bellingham	Anacortes	Oak Harbor	Everett	Mukilteo	Edmonds	Shoreline	Poulsbo
# Sites Sampled	6	39	6	4	4	4	2	3
Water Temp °C	23%	14%	21%	5%	10%	12%	0%	6%
Dissolved Oxygen mg/l	10%	2%	9%	13%	5%	1%	0%	0%
pH	0%	1%	0%	0%	0%	0%	0%	0%
Conductivity uS/cm	43%*	24%*	71%*	76%*	46%*	74%*	3%*	46%*
Turbidity ntu	3%	3%	1%	0%	4%	5%	0%	8%
E. coli cfu/100 mL	31%	20%	26%	8%	19%	21%	8%	5%

* includes data for outfalls inundated with saltwater during high tides.

dissolved oxygen and in Poulsbo it was high turbidity. Elevated water temperatures had the second highest rate of stormwater threshold exceedances for six of the eight cities. The exceptions were Everett and Poulsbo both with *E. coli* levels having the second highest rate of exceedance.

Table 8b presents the rates at which creek samples exceeded water quality standard by city and parameter. For the five cities conducting creek monitoring, the primary concern was low dissolved oxygen levels which violated water quality standards at rates of 23 to 44%. Only in Mukilteo did a different parameter (turbidity) have the highest exceedance rate. When looking at parameters with the second highest rate of exceedances they varied across the cities: *E. coli* (Bellingham and Edmonds), turbidity (Everett and Shoreline), and conductivity (Mukilteo).

Table 8b. Total percentage of creek site samples that exceeded water quality standards by city and parameter for 2021 to 2025.

Parameter	Bellingham	Everett	Mukilteo	Edmonds	Shoreline
# Sites Sampled	4	4	4	6	2
Water Temp °C	15%	0%	0%	0%	0%
Dissolved Oxygen mg/l	28%	36%	23%	44%	42%
pH	6%	4%	10%	3%	6%
Conductivity uS/cm	17%	0%	26%	0%	0%
Turbidity ntu	13%	29%	30%	5%	12%
E. coli cfu/100 mL	18%	13%	29%	31%	9%

Bacteria

E. coli exceedances can stem from a number of natural and anthropogenic sources. Natural sources include waste from the cornucopia of wildlife present in shoreline cities. In Anacortes, one volunteer team had to be careful to check an outfall for river otters before sampling. Normally the wildlife are not in the outfall, but sea birds, deer, and other species are spending time in wetlands and stormwater catch basins or roosting on buildings. In Mulkilteo, cleaning of a popular garage roof bird roosting site resulted in a significant lowering of bacteria levels in Outfall OF059.

Notifications of elevated *E. coli* levels have resulted in the identification of illicit discharges to the stormwater systems by municipal stormwater staff in multiple cities. In the initial month of being added to the program, *E. coli* monitoring in Anacortes resulted in the discovery of a

residence with an illicit sanitary sewage connection to the stormwater system which was subsequently corrected (Outfall F09-1004). Another source of sewage entering stormwater systems discovered in multiple locations was illegal RV residence including in driveways or backyards, and at group sites.

The high rate of pet ownership makes dog waste a common source of stormwater pollution. When present in dense concentrations, it has been identified as the source of some of the high *E. coli* levels reported. Increasing public education campaigns encouraging owners to pick up pet waste is the primary option for trying to reduce impacts.

High levels of *E. coli* are a health risk to humans recreating in bodies of water and can also negatively impact aquatic life. Some stormwater outfalls discharge directly to popular shoreline recreation areas where the possibility of human exposure is high. When initial source investigations are unable to find anything, stormwater managers can use eDNA (environmental DNA) testing to help direct further investigations. This type of testing is expensive and, due to limited resources, is not commonly used, but eDNA testing is a useful tool to distinguish between human or animal sources and between some common domestic animals and wildlife.

Following notification of high bacteria levels in Brewery Creek, Mukilteo stormwater staff used eDNA testing to help identify sources. In one case, the eDNA results confirmed that elevated bacteria levels were coming from a human source. Investigations revealed the presence of a leaking sewer line that ran right over the top of the creek. The line was from a commercial property that was found to have an oil trap that had not been properly maintained . In another incident, eDNA testing found the bacteria to be not of human origin. Source investigations found the cause to be pet waste on a creek side property that the owner was neglecting to clean up. The City talked to the dog owner and increased their general education and outreach on the importance of picking up pet waste.

Dissolved Oxygen

Low dissolved oxygen levels were much more prevalent in creek samples than in outfall samples (Table 9). A total of 11 stormwater outfalls, 16%, rated water quality health ratings of Watch (eight) or Threat (three) for low dissolved oxygen levels across the eight cities. All of the creek sites fell into one of these two water quality categories based on dissolved oxygen: Watch - 12 sites or Threat - eight sites. Protected as designated salmonid waters, the dissolved oxygen water quality standard for all of the creek sites was 10 mg/l. Dissolved oxygen levels are dependent on water temperature. However, most of the streams monitored met water quality

standards for water temperature, except during summers when air temperatures were high and creek levels low.

Table 9. Total number of Salish Sea Stormwater Monitoring outfall or creek sites with a given water quality health rating by parameter.

Parameter	Stormwater Outfalls				Creek Sites			
	Health Rating			NA or Tidal	Health Rating			NA or Tidal
	Good	Watch	Threat		Good	Watch	Threat	
Water Temperature	27	38	3	0	16	4	0	0
DIssolved Oxygen	57	8	3	0	0	12	8	0
pH	68	0	0	0	16	4	0	0
SPC	26	4	2	36	17	1	0	2
Turbidity	59	8	1	0	8	9	3	0
E. coli	18	32	13	5	5	11	4	0
Flow	35	19	6	8				
Color	11	31	24	2	4	12	4	0
Odor	49	12	5	2	19	1	0	0
Visual	44	16	6	2	11	7	2	0
Overall Health Rating	6	39	23		0	8	12	

Water Temperature

In most samples, the freshwater creeks met water quality standards for water temperature while frequently outfall samples did not meet even the modified stormwater threshold of air temperature + 3°C. As noted in the Methods, the reason for adding the +3 °C to the stormwater threshold was to restrict notifications based on temperature to the most extreme situations. With this modification, it was not expected that exceedances would occur so frequently. Due to the desire to not cry wolf unnecessarily and the difficulty in ruling out natural causes like the presence of groundwater, notifications to stormwater managers based on temperature were rare.

Turbidity and pH

Turbidity and pH levels presented less of a concern in stormwater than the parameters previously discussed. The percentage of samples exceeding the stormwater thresholds was low for all of the cities samples ranging from 0 to 8% for turbidity and 0 to 1% for pH (Table 8a). Though when threshold exceedances occurred, the data was very helpful in identifying sources.

In the streams sampled, the rate of pH exceedances was low ranging from 3 to 10% while the rate of exceedances for turbidity had a wider variation ranging from 5 to 30% (Table 8b). For the 20 stream sites monitored, eight had water quality health ratings of Good for turbidity, nine sites rated as Watch and three sites rated as Threat (Table 9). High turbidity can have a negative impact on aquatic life, particularly salmon species, by reducing visibility or in extreme cases, clogging gills (City of Bellingham, 2015). It should be noted here that for 12 of the stream sites, the water quality standard for identifying exceedances, 10.19 ntu, was based on an estimated background turbidity rather than site specific data as called for.

Observations

The subjective nature of the observational parameters (flow rate, color, odor and other visual indicators) along with possible presence of natural sources did present a challenge in interpreting the results. However, well trained observers experienced with the background characteristics of their sites, were able to discern changes. And in some cases, the presence of a problem was obvious. Observations have led to the identification of several pollution incidents and have been helpful in directing source identification activities. For example, unusual colors identified paint spills affecting Anacortes Outfalls F01-1001 and F05-1001. Color and observations of unusual microbial/bacterial growths have identified problems at Bellingham's Broadway and C Street outfalls. Unusual flow rate changes at Edmonds Outfall CV664 led to an ongoing investigation of possible sewer system failure. A combination of brown color, foul odor and foam along with high *E. coli* levels at their Olive Street Outfall, alerted the City of Bellingham to a sewage waste issue that was remediated.

Trends

Using a simple measure of consistent directional changes in exceedance rates and extremum over time, a few obvious trends in water quality were identified (Table 10).

Table 10. Trends in water quality as demonstrated by changes in exceedance rates (%) and extremum (Extm) over time. Notes: ↑ improving, ↓ worsening; units - E. coli cfu/100 ml, dissolved oxygen mg/l, turbidity ntu; the remaining 73 sites showed no trends.

Outfall ID#	Parameter ↑ or ↓	2022 % Extm	2023 % Extm	2024 % Extm	2025 % Extm	Comments
Bellingham						
Broadway St	*E. coli* ↓	25% 1,900	0% 320	20% 2,764	42% 2,580	Cause unknown
C St	Dissolved Oxygen ↑	17% 4.87	0% 6.7	0% 7.07	0% 6.79	Cause unknown
Cedar St	Turbidity ↓	NA	0% 22.7	0% 36.7	8% 109.4	Cause unknown
Cornwall Ave	Turbidity ↑	NA	17% 63.8	10% 603	0% 21.6	Cause unknown
Little Squalicum Creek	Dissolved Oxygen ↓	0% 10.07	33% 7.42	25% 9.84	42% 6.93	Cause unknown
Little Squalicum Creek	Turbidity ↑	NA	50% 10.48	0% 3.55	0% 3.56	Cause unknown
Padden Creek	Turbidity ↓	NA	0% 6.06	10% 30.6	25% 41	Cause unknown
Anacortes						
F01-1001	*E. coli* ↓	NA	33% 546	54% 2,131	55% 42,291	Source found in 2025 & remediated
F09-1004	*E. coli* ↑	100% 1,481	0% 254	0% 33	9% 533	Source found in 2022 & remediated
S01-1001	*E. coli* ↓	NA	0% 201	28% 2,730	29% 3,263	Suspected source identified in 2025

Outfall ID#	Parameter ↑ or ↓	2022 % Extm	2023 % Extm	2024 % Extm	2025 % Extm	Comments
Oak Harbor						
FID3641	*E. coli* ↓	0 % 71	0% 63	28% 3,696	45% 3,263	Suspected natural source, investigation ongoing
FID1681	*E. coli* ↓	0% 63	0% 140	28% 1,365	28% 2,231	Suspected natural source, investigation ongoing
FID2971	*E. coli* ↓	0% 167	0% 64	45% 2,564	50% 47,319	Source investigation ongoing
FID2971	Dissolved Oxygen↑	50% 3 mg/l	44% 2.9 mg/l	29% 4.9 mg/l	9% 5.9 mg/l	Cause unknown
PID334, 169	*E. coli* ↓	NA	0% 280	14% 533	80% 26,678	Source investigation ongoing
Mukilteo						
Japanese Gulch	*E. coli* ↓	0% 83	0% 75	0% 233	22% 2,631	Cause unknown
Edmonds						
CV664	*E. coli* ↓	0% 63	6% 585	46% 4,325	67% 2,464	Suspected source, investigation ongoing

Most of the trends that were observed were for *E. coli*. In two cases, sources were identified and remediated and subsequent monitoring has shown sharp declines in levels, Outfalls F01-1001 and F09-1004. For another two cases, CV664 and S01-1001, suspected sources have been identified but further investigation and remediation activities are ongoing. In two cases, natural wetlands have been identified as possible sources and investigation is ongoing. In three unresolved cases with high *E. coli* levels, source investigations by city stormwater staff continue - Broadway St; FID2971; and PID334,169. Interestingly, Outfall FID2971, over the same period, showed improved water quality with respect to dissolved oxygen concentrations. In the case of Japanese Gulch, while the overall trend appears to be an increase in *E. coli* concentrations and

an increase in the rate of exceedances, over the four year monitoring period there have only been two exceedances and the overall water quality rating for *E. coli* is Good.

Bellingham

Bellingham, WA is the northernmost city in the Salish Sea Stormwater Monitoring Program and has a current population of about 100,000. The City is roughly 31 square miles and it is estimated that 40-70% is impervious surface. Bellingham curves along eastern Bellingham Bay, and is surrounded by hills and mountains, including the Chuckanuts and Galbraith.

The Salish Sea Stormwater Monitoring Program started in 2020 with just two cities being monitored, Bellingham and Anacortes. There are six outfalls and four urban creeks that Bellingham has monitored (Figure 2).

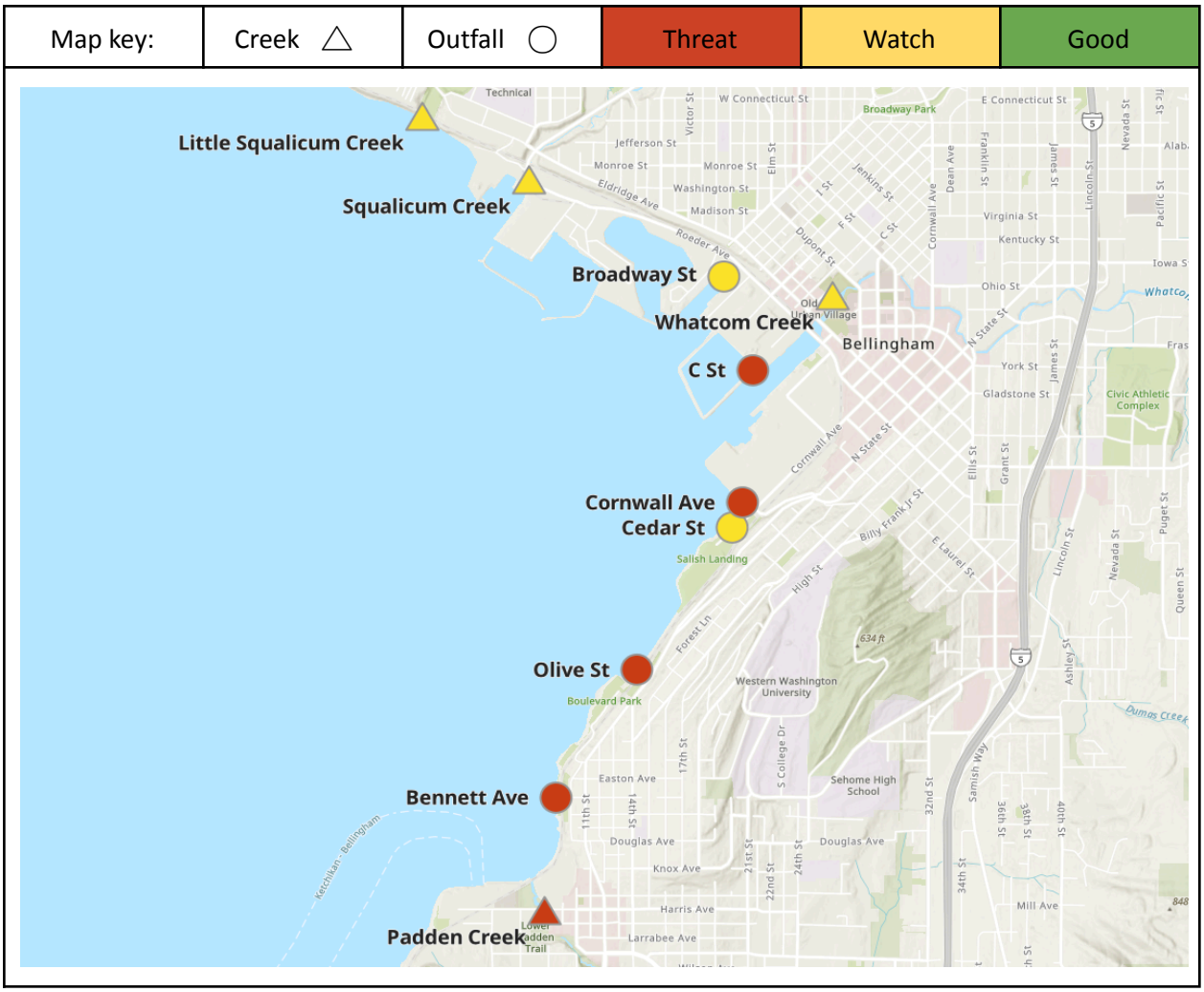


Figure 2. Bellingham - Salish Sea Stormwater Monitoring Program sites with overall water quality health ratings.

Of the six outfalls monitored, four have been assigned overall water quality health ratings of Threat, while two have been assigned overall health ratings of Watch. Exceedances in *E. coli* thresholds were a common problem for the Bellingham outfalls. Three of the four creeks in Bellingham have been assigned an overall health rating of Watch, with one creek, Padden, being assigned an overall water quality health rating of Threat. Exceedances of water quality standards for dissolved oxygen is a common issue for Bellingham creeks, all of which are protected as salmon rearing habitat.

Additionally, all four creeks monitored in Bellingham are listed as impaired on Washington State's 303(d) list, for not regularly meeting water quality standards. Little Squalicum Creek is considered impaired for copper exceedances (ID #78228; Washington State Department of Ecology, n.d.), while Squalicum Creek, Whatcom Creek, and Padden Creek are all considered impaired for fecal coliform, dissolved oxygen, and temperature (ID# 39153, 39034, and 14011; Washington State Department of Ecology, n.d.). Additionally, inner Bellingham Bay has 44 impairments ranging from bacteria to heavy metals (Washington State Department of Ecology, n.d.). Bellingham has its share of polluted waterbodies.

For stormwater outfalls, the parameter with the most exceedances was *E. coli*. Bennett Ave Outfall had elevated levels of bacteria seasonally, with counts of *E. coli* reaching into the 10,000+ cfu/100 ml in the summer months. In Spring of 2025, the team of volunteers who monitor Olive St Outfall observed dark brown foaming water gushing from the outfall that smelled like poop and yielded a bacteria count of 8,258 cfu/100 ml. The City of Bellingham's stormwater manager was alerted and follow-up sampling was conducted by City personnel. eDNA testing was performed and traces of human waste and wastewater treatment plant influent were detected. City personnel eventually discovered an issue in the pipe system with an old sanitary sewer catch basin where warm still water was pooling. This issue was addressed and *E. coli* levels were observed to decline.

A more detailed account of each outfall and creek monitored in Bellingham follows.

Bellingham Site Summary - Bennett Ave Outfall (48.72640, -122.50620)



Water Quality Health Rating Key		
Exceedance Frequency	Parameter	Observation
≤ 10%	Good	Good
10% < x < 30%	Watch	Watch
≥ 30 %	Threat	Threat

Trend Key			
Improving	Worsening	Inconsistent	Stable
↑	↓	↑↓	↔

Stormwater threshold exceedances, extremum, health ratings, and water quality trends for select parameters at Bennett Ave Outfall.

Summary 2021-2025							
Parameter	Outfall Thresholds*	Sample #	Exceedances		Health Rating	Extremum	Trend
			#	%			
Water Temp °C	> Air +3**	59	14	24	Watch	18.3	↑↓
DO mg/l	<6	54	0	0	Good	6.33	↔
pH	<5 or >9	59	0	0	Good	6.35-8.54	↔
SPC uS/cm	>500	58	7	12	Tidal	2,443	NA
Turbidity ntu	>50	28	0	0	Good	20	↔
E. coli cfu/100ml	>320	59	35	59	Threat	20,480	↔
Observation							
Flow	> Expected	20	0	0	Good	normal	↔
Color 1-3	Any unnatural color	59	7	12	Watch	1	↓
Odor 1-3	Any odor	59	1	2	Good	1	↔
Visual 1-3	Any unnatural phenom	59	5	8	Good	1	↑↓
Overall Health Rating: Threat							

*(Herrera Environmental Consultants & Aspect Consulting 2020)

**modified stormwater threshold, see Methods

With overall water quality health rated a Threat, Bennett Ave Outfall had warm temperatures and frequent bacteria exceedances. Over the course of five years, 59% of the samples had high bacteria counts with over 30% found to have three to 15x the stormwater threshold. Bennett Ave Outfall is in close proximity to Taylor Dock where people swim throughout the year. Because of the frequent bacteria exceedances, high spikes, and the high potential for public exposure, this area has been added to the statewide Beach Environmental Assessment, Communication & Health (BEACH) monitoring program. The BEACH program monitors the safety of saltwater

swimming beaches from Memorial Day to Labor Day and is co-led by Ecology and the Department of Health. During BEACH monitoring in 2025, there was only one bacteria exceedance and it occurred at the mouth of Bennett St Outfall. The level of *Enterococci sp.* detected was 246 cfu/100ml on August 6th.

Bellingham Site Summary - Broadway St Outfall (48.75570, -122.49230)



Water Quality Health Rating Key		
Exceedance Frequency	Parameter	Observation
≤ 10%	Good	Good
10% < x < 30%	Watch	Watch
≥ 30 %	Threat	Threat

Trend Key			
Improving	Worsening	Inconsistent	Stable
↑	↓	↑↓	↔

Stormwater threshold exceedances, extremum, health ratings, and water quality trends for select parameters at Broadway St Outfall.

Summary 2021-2025							
Parameter	Outfall Thresholds*	Sample #	Exceedances		Health Rating	Extremum	Trend
			#	%			
Water Temp °C	> Air +3**	59	12	20	Watch	18.6	↓
DO mg/l	<6	55	0	0	Good	7.0	↔
pH	<5 or >9	59	1	2	Good	4.8-8.4	↔
SPC uS/cm	>500	59	3	5	Good	789	↔
Turbidity ntu	>50	28	1	4	Good	376	↔
E. coli cfu/100ml	>320	57	11	19	Watch	2,764	↓
Observation							
Flow	> Expected	19	1	5	Good	Higher	↔
Color 1-3	Any unnatural color	59	33	56	Threat	3	↓
Odor 1-3	Any odor	59	23	39	Threat	3	↓
Visual 1-3	Ch Wat	59	22	37	Threat	3	↓
Overall Health Rating: Watch							

*(Herrera Environmental Consultants & Aspect Consulting 2020)

**modified stormwater threshold, see Methods

Broadway St Outfall drains mostly residential areas and had worsened water quality since monitoring began in late 2020. The outfall had an overall water quality health rating of Watch due to high bacteria levels and high water temperatures. The rate of stormwater threshold exceedances for *E. coli* increased each year showing a clear downward trend in water quality. The Broadway St Outfall had a chronic yellow hue, sulfur odor, white microbial mat, and diatoms growing at the outfall which are all potential indicators of poor water quality. This outfall discharges into the I & J Waterway which is a Washington State Model Toxics Cleanup Site (Washington State Department of Ecology, n.d.).

Bellingham Site Summary - C St Outfall (48.75040, -122.48990)



Water Quality Health Rating Key		
Exceedance Frequency	Parameter	Observation
≤ 10%	Good	Good
10% < x < 30%	Watch	Watch
≥ 30 %	Threat	Threat

Trend Key			
Improving	Worsening	Inconsistent	Stable
↑	↓	↑↓	↔

Stormwater threshold exceedances, extremum, health ratings, and water quality trends for select parameters at C St Outfall.

Summary 2021-2025							
Parameter	Outfall Thresholds*	Sample #	Exceedances		Health Rating	Extremum	Trend
			#	%			
Water Temp °C	> Air +3**	60	13	22	Watch	21.2	↓
DO mg/l	<6	56	5	9	Good	4.53	↑
pH	<5 or >9	60	0	0	Good	5.36-8.35	↔
SPC uS/cm	>500	60	52	87	Tidal	42,510	NA
Turbidity ntu	>50	28	0	0	Good	21.3	↔
E. coli cfu/100ml	>320	58	20	34	Threat	144,895	↑↓
Observation							
Flow	> Expected	21	1	5	Good	Higher	↔
Color 1-3	Any unnatural color	60	40	67	Threat	3	↓
Odor 1-3	Any odor	60	38	63	Threat	3	↓
Visual 1-3	Any unnatural phenom	60	47	78	Threat	3	↓
Overall Health Rating: Threat							

*(Herrera Environmental Consultants & Aspect Consulting 2020)

**modified stormwater threshold, see Methods

C St Outfall continued to be rated one of the most polluted stormwater outfalls with an overall water quality health rating of Threat. *E. coli* levels have fluctuated between a 25% and a 60% threshold exceedance rate. *E. coli* levels were at their worst in summer of 2024 with a maximum of 144,895 cfu/100 mL. In 2025, the highest *E. coli* level recorded was 18,781 cfu/100 mL, a decline from the previous year but still nearly 60x the human health based recreation threshold. The City of Bellingham performed *E. coli* sampling and source tracing twice in the C St outfall drainage in 2022 in response to high bacteria levels at the outfall. The City was unable to

determine any point source, and the City stated their sampling indicated the high bacteria levels were due to an accumulation of non-point source bacterial inputs. In addition, dissolved oxygen levels and water temperatures have worsened over the monitoring period. Observations also reflect poor water quality with reports of a chronic yellow hue, sulfur and fossil fuel odors, oil sheens, and the presence of a white microbial mat. Research suggests that some bacteria species found in microbial mats may be growing in response to polluted water, potentially sewage (Kaksonen, 2025).

Bellingham Site Summary - Cedar St Outfall (48.74160, -122.49160)



Water Quality Health Rating Key		
Exceedance Frequency	Parameter	Observation
≤ 10%	Good	Good
10% < x < 30%	Watch	Watch
≥ 30 %	Threat	Threat

Trend Key			
Improving	Worsening	Inconsistent	Stable
↑	↓	↑↓	↔

Stormwater threshold exceedances, extremum, health ratings, and water quality trends for select parameters at Cedar St Outfall.

Summary 2021-2025							
Parameter	Outfall Thresholds*	Sample #	Exceedances		Health Rating	Extremum	Trend
			#	%			
Water Temp °C	> Air +3**	59	15	25	Watch	19.1	↑
DO mg/l	<6	54	0	0	Good	6.29	↔
pH	<5 or >9	58	0	0	Good	6.65-8.49	↔
SPC uS/cm	>500	59	33	56	Tidal	1,361	NA
Turbidity ntu	>50	29	1	3	Good	109.4	↓
E. coli cfu/100ml	>320	58	12	21	Watch	4,300	↑↓
Observation							
Flow	> Expected	20	0	0	Good	Higher	↔
Color 1-3	Any unnatural color	59	34	58	Threat	2	↓
Odor 1-3	Any odor	59	10	17	Watch	2	↑↓
Visual 1-3	Any unnatural phenom	59	9	15	Watch	3	↓
Overall Health Rating: Watch							

*(Herrera Environmental Consultants & Aspect Consulting 2020)

**modified stormwater threshold, see Methods

Cedar St Outfall frequently had a yellow, brown hue and showed a trend of increasing water temperatures and *E. coli* exceedances over the past five years. It had an overall water quality health rating of Watch. The stormwater drains mostly from residential and commercial areas, but the stormwater conduit also passes under the RG Haley toxic clean-up site. This contaminated site is scheduled to be cleaned up and converted into a public park (Salish Landing) over the next few years. Construction on the park began in November of 2025.

Sampling has paused as of January 2026 due to construction. Additional pre- and post-cleanup testing may help identify where the contaminants are coming from.

Bellingham Site Summary - Cornwall Ave Outfall (48.74300, -122.49070)



Water Quality Health Rating Key		
Exceedance Frequency	Parameter	Observation
≤ 10%	Good	Good
10% < x < 30%	Watch	Watch
≥ 30 %	Threat	Threat

Trend Key			
Improving	Worsening	Inconsistent	Stable
↑	↓	↑↓	↔

Stormwater threshold exceedances, extremum, health ratings, and water quality trends for select parameters at Cornwall Ave Outfall.

Summary 2021-2025							
Parameter	Outfall Thresholds*	Sample #	Exceedances		Health Rating	Extremum	Trend
			#	%			
Water Temp °C	> Air +3**	58	16	28	Watch	20.7	↑↓
DO mg/l	<6	54	29	54	Threat	3.81	↔
pH	<5 or >9	56	0	0	Good	5.65-7.48	↔
SPC uS/cm	>500	57	56	98	Tidal	27,846	NA
Turbidity ntu	>50	28	2	7	Good	603	↑
E. coli cfu/100ml	>320	57	8	14	Watch	2,250	↑↓
Observation							
Flow	> Expected	20	0	0	Good	Normal	↔
Color 1-3	Any unnatural color	58	23	40	Threat	2	↓
Odor 1-3	Any odor	58	1	2	Good	1	↔
Visual 1-3	Any unnatural phenom	58	5	9	Good	1	↑↓
Overall Health Rating: Threat							

*(Herrera Environmental Consultants & Aspect Consulting 2020)

**modified stormwater threshold, see Methods

Cornwall Ave Outfall is rated a Threat for overall water quality health and suffers from hypoxic - water that has a low concentration of dissolved oxygen - flows more than 50% of the time. *E. coli* has become an increasing problem at this outfall in terms of number of exceedances per year and number of colonies found per sample. Cornwall Ave Outfall had a chronic yellow hue and there have been observances of a white microbial mat. Cornwall Outfall flows under the RG Haley toxic cleanup site which is scheduled to be cleaned up and converted into a public park (Salish Landing) over the next few years. Construction on the park began in November of 2025.

Sampling has paused as of January 2026 due to construction. Additional pre- and post-clean-up testing may help identify where the contaminants are coming from.

Bellingham Site Summary - Olive St Outfall (48.73360, -122.49950)



Water Quality Health Rating Key		
Exceedance Frequency	Parameter	Observation
≤ 10%	Good	Good
10% < x < 30%	Watch	Watch
≥ 30 %	Threat	Threat

Trend Key			
Improving	Worsening	Inconsistent	Stable
↑	↓	↑↓	↔

Stormwater threshold exceedances, extremum, health ratings, and water quality trends for select parameters at Olive St Outfall.

Summary 2021-2025							
Parameter	Outfall Thresholds*	Sample #	Exceedances		Health Rating	Extremum	Trend
			#	%			
Water Temp °C	> Air +3**	59	11	19	Watch	20.9	↑↓
DO mg/l	<6	54	0	0	Good	6.55	↔
pH	<5 or >9	58	0	0	Good	6.37-8.3	↔
SPC uS/cm	>500	59	0	0	Good	454.4	↔
Turbidity ntu	>50	29	1	3	Good	107.8	↔
E. coli cfu/100ml	>320	58	23	40	Threat	8,258	↔
Observation							
Flow	> Expected	19	1	5	Good	Higher	↔
Color 1-3	Any unnatural color	59	6	10	Watch	3	↓
Odor 1-3	Any odor	59	3	5	Good	3	↓
Visual 1-3	Any unnatural phenom	59	4	7	Good	3	↓
Overall Health Rating: Threat							

*(Herrera Environmental Consultants & Aspect Consulting 2020)

**modified stormwater threshold, see Methods

Olive St Outfall had an overall water quality health rating of Threat with bacteria levels exceeding the stormwater threshold at a rate of 40% during the five year monitoring period. Its close proximity to a small pocket beach at the northern end of Boulevard Park where people and dogs swim regularly presents a high public exposure risk. The water had a consistent yellow to dark brown color. In May of 2025, volunteers observed water gushing from the outfall that was foaming, dark brown, smelled like poop, and yielded a bacteria count of 8,258 cfu/100 ml. The City's stormwater manager was alerted and follow-up sampling was conducted by City personnel. eDNA testing was run on the collected samples, and traces of human waste and

wastewater treatment plant influent were detected. City staff thoroughly cleaned out an area that had collected stagnant, warm water and after this maintenance, the bacteria levels declined. In the summer of 2026, however, *E. coli* levels spiked once again. It is unknown if this is a new source or not.

Bellingham Site Summary - Little Squalicum Creek (48.76470, -122.51730)



Water Quality Health Rating Key		
Exceedance Frequency	Parameter	Observation
≤ 10%	Good	Good
10% < x < 30%	Watch	Watch
≥ 30 %	Threat	Threat

Trend Key			
Improving	Worsening	Inconsistent	Stable
↑	↓	↑↓	↔

Water quality standard exceedances, extremum, health ratings, and water quality trends for select parameters at Little Squalicum Creek.

Summary 2022-2025							
Parameter	Water Quality Standard Spawn/Rear/Migration*	Sample #	Exceedances		Health Rating	Extremum	Trend
			#	%			
Water Temp °C	>17.5	36	0	0	Good	16.2	↔
DO mg/l	<10	34	10	29	Watch	6.93	↓
pH	<6.5 or >8.5	36	2	6	Good	5.92-7.82	↔
SPC uS/cm	>500**	35	0	0	Good	474	↔
Turbidity ntu	7.25	23	2	9	Good	10.48	↑
E. coli cfu/100ml	>320	36	6	17	Watch	42,257	↑↓
Observation							
Color 1-3	Any unnatural color	35	13	37	Threat	1	↔
Odor 1-3	Any odor	36	1	3	Good	1	↔
Visual 1-3	Any unnatural phenom	35	11	31	Threat	1	↔
Overall Health Rating: Watch							

*(Washington Department of Ecology, 2024)

**(City of Bellingham, 2015)

Little Squalicum Creek runs through an off leash dog park and receives much of its flow from stormwater. It had an overall water quality rating of Watch due to high *E. coli* levels and in the warm, summer months, low dissolved oxygen. Over four years of monitoring, *E. coli* exceedances have consistently occurred, but the number of bacteria exceedances and *E. coli* levels spiked in 2025. Thirty three percent of bacteria samples in 2025 exceeded the *E. coli* water quality standard with a high of 42,257 cfu/100 ml. The water at Little Squalicum Creek was chronically observed to be a yellow color with foam present.

Bellingham Site Summary - Padden Creek (48.72010, -122.50720)



Water Quality Health Rating Key		
Exceedance Frequency	Parameter	Observation
≤ 10%	Good	Good
10% < x < 30%	Watch	Watch
≥ 30 %	Threat	Threat

Trend Key			
Improving	Worsening	Inconsistent	Stable
↑	↓	↑↓	↔

Water quality standard exceedances, extremum, health ratings, and water quality trends for select parameters at Padden Creek.

Summary 2021-2025							
Parameter	Water Quality Standard Core Summer Habitat*	Sample #	Exceedances		Health Rating	Extremum	Trend
			#	%			
Water Temp °C	>16	45	8	18	Watch	19.3	↑↓
DO mg/l	<10	43	17	40	Threat	7.69	↔
pH	<6.5 or >8.5	43	3	7	Good	5.89-8.45	↔
SPC uS/cm	>500**	44	14	32	Tidal	3,983	NA
Turbidity ntu	>11.87	28	4	14	Watch	41	↓
E. coli cfu/100ml	>320	45	14	31	Threat	3,463	↑↓
Observation							
Color 1-3	Any unnatural color	45	35	78	Threat	3	↔
Odor 1-3	Any odor	45	1	2	Good	1	↔
Visual 1-3	Any unnatural phenom	45	6	13	Watch	1	↑
Overall Health Rating: Threat							

*(Washington Department of Ecology, 2024)

**(City of Bellingham, 2015)

Rated a Threat, Padden Creek had issues surrounding regular exceedances in *E. coli*, conductivity, and dissolved oxygen. Over the five years of monitoring, there have been an observed light yellow color which could be due to natural tannins. Padden Creek also experienced low dissolved oxygen levels during the summer months which is unhealthy for salmonids. Not once, but twice in summer of 2025 hundreds of gallons of diesel were spilled into Padden Creek just upstream of the monitoring site. WA Ecology responders deployed sorbent pads and placed oil booms at the mouth of the creek. Ecology and the Lummi Nation

are surveying the creek for impacts. The spill resulted in at least seven aquatic life deaths. The site will now undergo long term monitoring.

Bellingham Site Summary - Squalicum Creek (48.76110, -122.50850)



Water Quality Health Rating Key		
Exceedance Frequency	Parameter	Observation
≤ 10%	Good	Good
10% < x < 30%	Watch	Watch
≥ 30 %	Threat	Threat

Trend Key			
Improving	Worsening	Inconsistent	Stable
↑	↓	↑↓	↔

Water quality standard exceedances, extremum, health ratings, and water quality trends for select parameters at Squalicum Creek.

Summary 2021-2025							
Parameter	Water Quality Standard Spawn/Rear/Migration*	Sample #	Exceedances		Health Rating	Extremum	Trend
			#	%			
Water Temp °C	>17.5	59	6	10	Watch	18.2	↑↓
DO mg/l	<10	54	12	22	Watch	7.7	↑↓
pH	<6.5 or >8.5	59	3	5	Good	6.42-8.72	↔
SPC uS/cm	>500**	59	17	29	Watch	7,005	↑↓
Turbidity ntu	>14.29	24	5	21	Watch	59	↔
E. coli cfu/100ml	>320	58	9	16	Watch	3,840	↑↓
Observation							
Color 1-3	Any unnatural color	58	47	81	Threat	3	↔
Odor 1-3	Any odor	59	1	2	Good	1	↔
Visual 1-3	Any unnatural phenom	58	33	57	Threat	2	↔
Overall Health Rating: Watch							

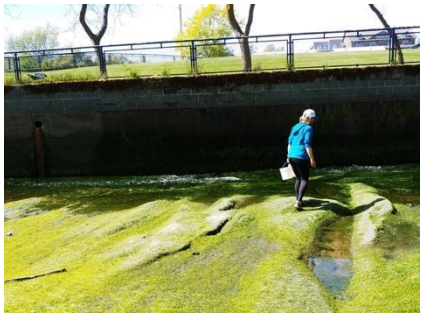
*(Washington Department of Ecology, 2024)

**(City of Bellingham, 2015)

Rated a Watch, Squalicum Creek had struggled to meet water quality standards over its five year monitoring period. It had a chronic yellow hue, *E. coli* exceedances, and usually had foam on its surface. The creek gets too hot to support salmonids in the summer months. Clumps of white foam are often observed floating on the surface of Squalicum Creek. This creek faces a triple threat — it is fed from water that comes from industrial parks, agricultural lands, and heavily built out commercial and residential parcels. Re Sources conducted PFAS testing in 2025 and detected high levels of these chemicals in the upper reaches, for the third year in a row. White, artificial, sticky looking foam, have been documented in Squalicum Creek at Cornwall Park.

These foam characteristics are in congruence with PFAS related foam forming on surface water. Testing from Ecology has demonstrated that Squalicum Creek continued to have high levels of total PFAS concentration in 2025. Further action is in the works to have signage, or more extensive remediation, put in place to combat this PFAS issue at Squalicum Creek.

Bellingham Site Summary - Whatcom Creek (48.75460, -122.48330)



Water Quality Health Rating Key		
Exceedance Frequency	Parameter	Observation
≤ 10%	Good	Good
10% < x < 30%	Watch	Watch
≥ 30 %	Threat	Threat

Trend Key			
Improving	Worsening	Inconsistent	Stable
↑	↓	↑↓	↔

Water quality standard exceedances, extremum, health ratings, and water quality trends for select parameters at Whatcom Creek.

Summary 2021-2025							
Parameter	Water Quality Standard Core Summer Habitat*	Sample #	Exceedances		Health Rating	Extremum	Trend
			#	%			
Water Temp °C	>16	59	16	27	Watch	20.6	↔
DO mg/l	<10	54	12	22	Watch	7.39	↑↓
pH	<6.5 or >8.5	58	3	5	Good	5.88-8.81	↔
SPC uS/cm	>500**	59	3	5	Good	15724	↔
Turbidity ntu	7.35	26	2	8	Good	11.46	↑
E. coli cfu/100ml	>320	59	7	12	Watch	3760	↑
Observation							
Color 1-3	Any unnatural color	59	15	25	Watch	1	↓
Odor 1-3	Any odor	59	4	7	Good	1	↑↓
Visual 1-3	Any unnatural phenom	59	7	12	Watch	1	↓
Overall Health Rating: Watch							

*(Washington Department of Ecology, 2024)

**(City of Bellingham, 2015)

Whatcom Creek starts at Lake Whatcom and flows through industrial parks, commercial and residential areas, as well as some public parks and restored riparian areas. Water temperatures too warm during the summer months to support salmonids was the main reason it had an overall water quality health rating of Watch. For two of the past five years, Whatcom Creek has shown more observational exceedances - yellow hues, floaters, and odors.

Bellingham Copper Study

Copper contamination in urban waterways poses a significant threat to aquatic ecosystems, particularly for salmonids whose olfactory systems are sensitive to even trace concentrations. This study monitored copper levels at ten sites across Bellingham, Washington, four urban creeks and six stormwater outfalls, in 2025 to assess whether copper concentrations exceeded Washington's Aquatic Life Criteria for freshwater - chronic threshold of 0.0018 ppm (Toxic Substances, WAC 173-201A-240, 2024). Water samples were collected monthly by stormwater volunteers and analyzed using a YSI 9800 Photometer measuring free, total, and chelated copper via colorimetry.

Results showed that every sample collected exceeded the freshwater chronic threshold, though no sample exceeded the human health criteria of 1.3 ppm. Outfalls generally exhibited higher average total copper concentrations than urban creeks, likely due to lower dilution rates. Cornwall Street Outfall had the highest average total copper concentration among outfalls (0.634 ppm) and Padden Creek had the highest among creeks (0.502 ppm).

A seasonal trend was observed, with lower copper concentrations during dry summer months. Padden Creek showed a notable correlation between rainfall and copper concentration spikes, suggesting stormwater as a primary copper source. The proximity of Cornwall outfall to a toxic cleanup site (GP West) may contribute to its consistently elevated readings. Given the possibility of naturally elevated background copper levels in Whatcom County, site-specific water quality criteria using the Biotic Ligand Model are recommended for more accurate assessment (U.S. Environmental Protection Agency [EPA], 2025). Continued monitoring and implementation of copper-reduction strategies are advised to protect salmon populations in Bellingham's urban watersheds.

Anacortes

The city of Anacortes is located on the north end of Fidalgo Island covering ~15.5 square miles with a population of 17,637 based on the 2020 census. One third of the city is protected undeveloped forestlands. The majority of the remaining area is moderately dense residential neighborhoods. There is one commercial corridor, part of which takes travelers to the San Juan Ferry terminal resulting in more traffic than the population would suggest. Active marine industry, including ship building and seafood processing, occupies a significant portion of the shoreline along with numerous marinas. Fidalgo Bay, located along southeastern Anacortes is a state designated aquatic reserve due, in part, to its habitat for forage fish.

The Salish Sea Stormwater Monitoring Program started in Anacortes and Bellingham in 2020. Anacortes is unique in having a very large number of stormwater outfalls. About half of the outfalls, 39, have been monitored. Of these, four had overall water quality health ratings of Good, 21 were rated as Watch and 14 were rated as Threat (Table 7 and Figure 3).

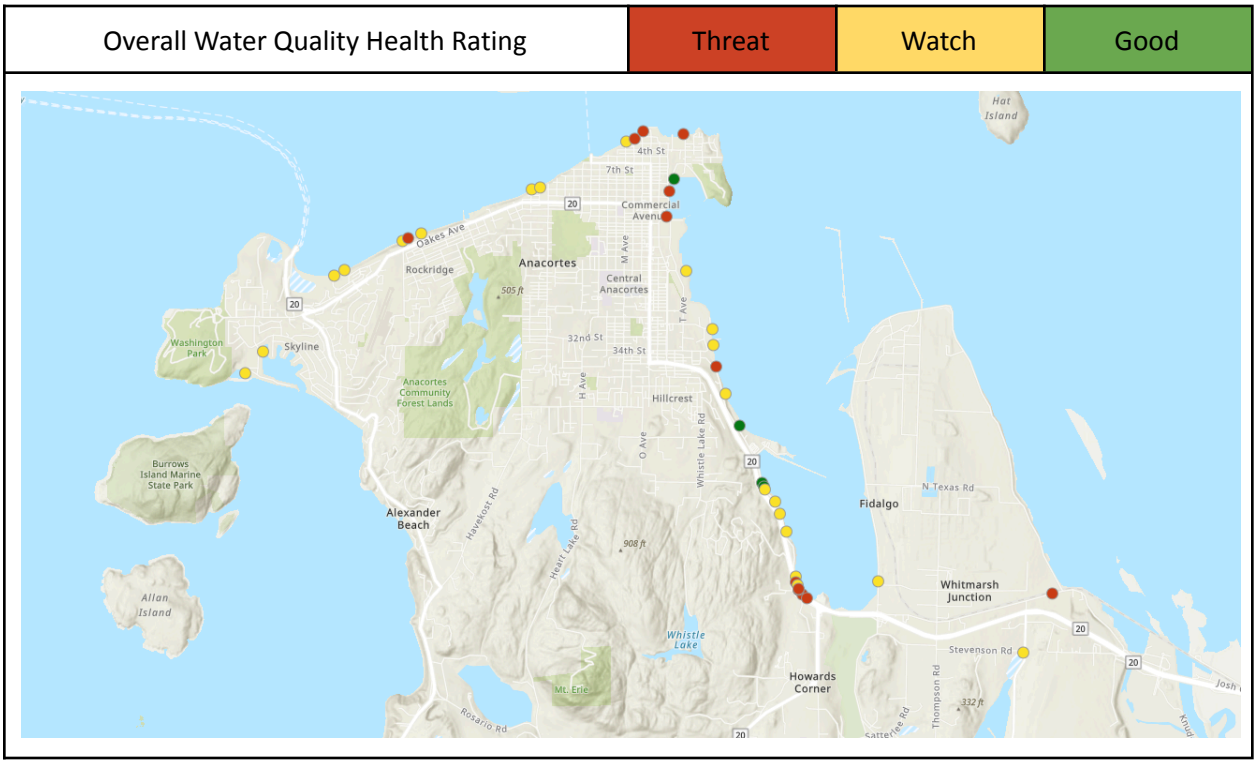


Figure 3. Anacortes - Salish Sea Stormwater Monitoring Program sites with overall water quality health ratings.

The most frequent parameter of concern for the outfalls rated as Threat were unusual observations at seven outfalls, followed by elevated *E. coli* levels at six outfalls, high water temperature at three outfalls, low dissolved oxygen at two outfalls and high conductivity at two outfalls. (Note: these add up to more than 14 because an outfall can have multiple parameters with a threat rating).

Observations were not generally considered in the overall water quality health rating unless they were chronic and severe and natural causes did not appear to be the cause. Five of the outfalls with Threat ratings (F15-1007, F15-1010, SR20-10, SR20-02, SR20-05) received stormwater runoff from HWY 20 and all had similar reports of grey-black color and deposits of black goo on the saltmarsh below the outfalls in Fidalgo Bay. Given the major concerns surrounding the toxic tire compound 6PPDQ, and Fidalgo Bay's status as an aquatic reserve, these sites should be considered a high priority for follow-up monitoring for 6PPDQ.

Two additional outfalls had water quality health ratings of Threat due to observations, but also for an additional parameter. Outfall P02-1001 had high conductivity ratings and observations of orange color due to iron bacterial slime growths in an upstream ditch. The site summary for this outfall goes into detail about the history of contamination sources which included a waste oil recovery facility and an empty lot used as an illegal dump site for barrels of petroleum products. The waste oil recovery facility has completed all compliance measures required by Ecology and is no longer considered a source. However, even though the barrels have been removed, the ditch along the dump site had seasonal very dense growths of iron bacterial slime suggesting an ongoing source. Additional investigation is needed to determine if the remaining source is naturally occurring iron deposits or contaminated soils.

The last of the seven outfalls that received a health rating of Threat was Outfall G19-1001 due to high *E. coli* levels, high water temperature and reports of rusty or milky coloration. The health rating for *E. coli* was upgraded to Watch after a source was identified, corrected and the levels dropped below the stormwater threshold. High water temperature remains a concern and it is unclear if the unusual colors will be addressed by the control measures taken.

The majority of the stormwater outfalls monitored, 59%, exceeded the modified stormwater threshold for water temperature (> air temperature + 3°C) at a rate earning them a water quality health rating of Watch (21 outfalls) or Threat (14 outfalls). Two factors complicate the interpretation of water temperature exceedances. First, many of the outfalls contain contributions of groundwater that, with an approximate temperature of 11°C (EPA, 2012), may contribute to threshold exceedances when surveys are conducted during cold weather.

Secondly, many stormwater outfalls in Anacortes are inundated with seawater during high tide which clearly, based on conductivity measurements, is captured in catch basins and later combines with stormwater during rain events and is then discharged.

Program-wide, only six stormwater outfalls had overall water quality health ratings of Good and four of these were in Anacortes: F09-1004, F14-1002, F14-1003 and G21-1005.

What follows are detailed data summaries for each of the Anacortes stormwater outfalls that were monitored. Due to the large number of outfalls, they are presented in several sections based on location.

Anacortes - Northwest Fidalgo Island Outfalls

Overall Water Quality Health Rating	Threat	Watch	Good

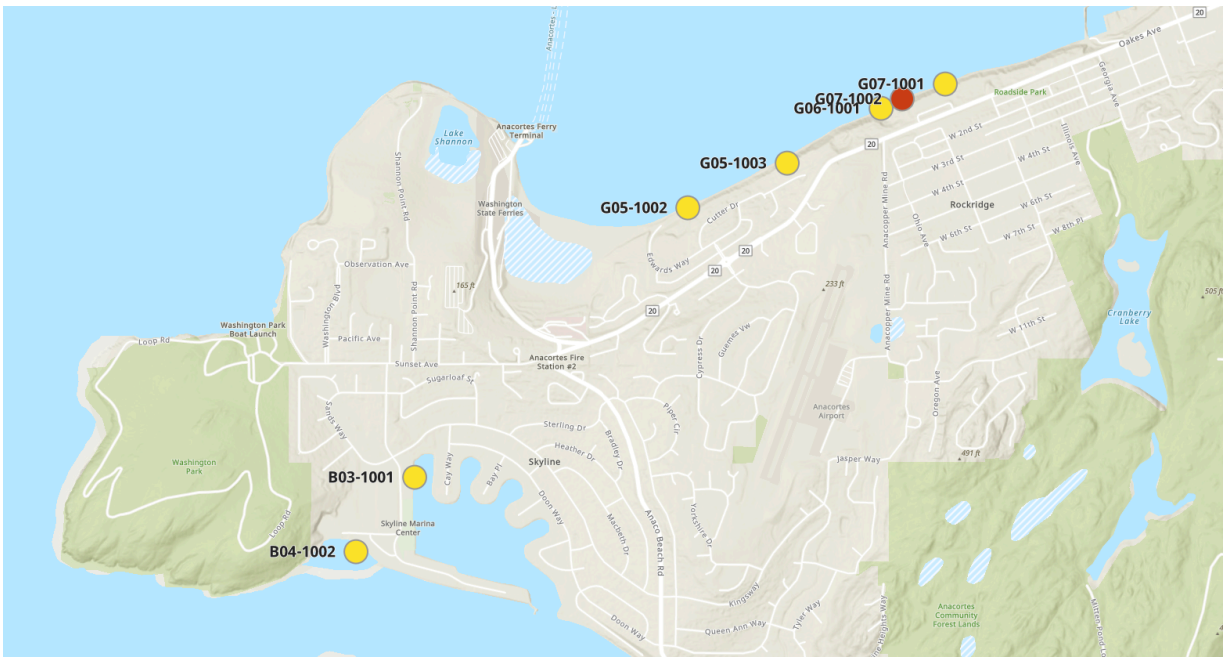


Figure 4. Anacortes, Northwest Fidalgo Island - Salish Sea Stormwater Monitoring Program sites with overall water quality health ratings.

Anacortes Site Summary - Outfall B03-1001 (48.49470,-122.68370)



Water Quality Health Rating Key		
Exceedance Frequency	Parameter	Observation
≤ 10%	Good	Good
10% < x < 30%	Watch	Watch
≥ 30 %	Threat	Threat

Trend Key			
Improving	Worsening	Inconsistent	Stable
↑	↓	↑↓	↔

Stormwater threshold exceedances, extremum, health ratings, and water quality trends for select parameters at Outfall B03-1001.

Summary 2021-2025							
Parameter	Outfall Thresholds*	Sample #	Exceedances		Health Rating	Extremum	Trend
			#	%			
Water Temp °C	> Air +3**	36	8	22	Watch	19.1	↑↓
DO mg/l	<6	36	0	0	Good	6.5	↔
pH	<5 or >9	37	1	3	Good	4.4-7.95	↔
SPC uS/cm	>500	37	15	40	Tidal	8,356	NA
Turbidity ntu	>50	35	0	0	Good	42.7	↔
E. coli cfu/100ml	>320	25	3	12	Watch	2,897	↑↓
Observation							
Flow	> Expected	13	3	23	Watch	Higher	NA
Color 1-3	Any unnatural color	16	9	56***	Watch	3	NA
Odor 1-3	Any odor	16	0	0	Good	0	NA
Visual 1-3	Any unnatural phenom	16	0	0	Good	0	NA
Overall Health Rating: Watch							

*(Herrera Environmental Consultants & Aspect Consulting 2020)

**modified stormwater threshold, see Methods

***health rating upgraded to Watch due to presence of natural source - wetland

Outfall B03-1001 drains 70.4 acres of mostly high density residential acres then discharges into Skyline Marina. The stormwater was periodically a light to dark tan/amber/rust color likely caused by input from an eight acre wetland located in the most upstream part of the drainage area. The overall health rating was Watch based on the presence of periodic high levels of *E. coli.* In both 2023 and 2024, sampling after significant rain events (0.28 - 0.37”), high levels of *E. coli* were present. Follow-up sampling two days later in 2023 showed levels much reduced while

in 2024 *E. coli* levels remained elevated when re-sampled two days later. Subsequently, 14 additional monthly samples have been below the stormwater threshold for *E. coli*.

Anacortes Site Summary - Outfall B04-1002 (48.49200,-122.68689)



Water Quality Health Rating Key		
Exceedance Frequency	Parameter	Observation
≤ 10%	Good	Good
10% < x < 30%	Watch	Watch
≥ 30 %	Threat	Threat

Trend Key			
Improving	Worsening	Inconsistent	Stable
↑	↓	↑↓	↔

Stormwater threshold exceedances, extremum, health ratings, and water quality trends for select parameters at Outfall B04-1002.

Summary 2021-2025							
Parameter	Outfall Thresholds*	Sample #	Exceedances		Health Rating	Extremum	Trend
			#	%			
Water Temp °C	> Air +3**	8	2	25	Watch	14.4	NA
DO mg/l	<6	8	0	0	Good	7.08	NA
pH	<5 or >9	8	0	0	Good	7.14-7.52	NA
SPC uS/cm	>500	8	7	88	Tidal	35,602	NA
Turbidity ntu	>50	8	0	0	Good	7.19	NA
E. coli cfu/100ml	>320	5	0	0	Good	133	NA
Observation							
Flow	> Expected	5	0	0	Good	Normal	NA
Color 1-3	Any unnatural color	5	0	0	Good	0	NA
Odor 1-3	Any odor	5	0	0	Good	0	NA
Visual 1-3	Any unnatural phenom	5	0	0	Good	0	NA
Overall Health Rating: Watch							

*(Herrera Environmental Consultants & Aspect Consulting 2020)

**modified stormwater threshold, see Methods

Outfall B04-1002 discharges to a public beach in Burrows Bay and drains 127 acres of which 44 acres is an undeveloped area of Washington Park. Land use in the remainder of the drainage basin is about two-thirds residential and one-third light industrial. The outfall is under water most of the time requiring a 0.7’ tide to access. Based on limited data collected in 2021 and 2025, Outfall B04-1002 had an overall health rating of Watch based on high water temperatures. This outfall was monitored initially for a year and then dropped due to the lack of

daytime low tides in the winter months. Monitoring was restarted in 2025 in order to obtain more data.

Anacortes Site Summary - Outfall G05-1003 (48.50390, -122.67059)



Water Quality Health Rating Key		
Exceedance Frequency	Parameter	Observation
≤ 10%	Good	Good
10% < x < 30%	Watch	Watch
≥ 30 %	Threat	Threat

Trend Key			
Improving	Worsening	Inconsistent	Stable
↑	↓	↑↓	↔

Stormwater threshold exceedances, extremum, health ratings, and water quality trends for select parameters at Outfall G05-1003.

Summary 2021-2025							
Parameter	Outfall Thresholds*	Sample #	Exceedances		Health Rating	Extremum	Trend
			#	%			
Water Temp °C	> Air +3**	44	9	20	Watch	19	↑↓
DO mg/l	<6	44	0	0	Good	6.9	↔
pH	<5 or >9	44	0	0	Good	5.4-7.6	↔
SPC uS/cm	>500	44	0	0	Good	380.5	↔
Turbidity ntu	>50	42	0	0	Good	38	↔
E. coli cfu/100ml	>320	31	5	16	Watch	1,798	↑↓
Observation							
Flow	> Expected	16	1	6	Good	Higher	NA
Color 1-3	Any unnatural color	22	21	95***	Watch	3	↔
Odor 1-3	Any odor	21	0	0	Good	0	↔
Visual 1-3	Any unnatural phenom	21	0	0	Good	0	↔
Overall Health Rating: Watch							

*(Herrera Environmental Consultants & Aspect Consulting 2020)

**modified stormwater threshold, see Methods

***health rating upgraded to Watch due to presence of natural source - wetland

The next five stormwater outfalls, all discharge between the Guemes Channel and the State Ferry Terminal along the mile long Guemes Channel Trail. Working from West to East the first, Outfall G05-1003, drains 117 acres of a densely developed suburban area with several stormwater detention basins and natural wetlands. The potential for human exposure is high at this outfall due to the location near a ferry terminal and a shoreline trail.

The overall health rating of Watch was based on *E. coli* level exceedances in one to two samples each year from 2023 thru 2025 with no trend over time apparent. The City's initial source identification work included smoke and dye testing in some homes and did not find evidence of an illicit sewer hookup. The City sampled again the following summer, 2024, to determine if bacteria levels showed a seasonal pattern with inconclusive results. In 2025, one of nine samples exceeded the stormwater threshold with an *E. coli* level of 1133 cfu/100 ml.

Color observations were recorded in 95% of the samples, however they were upgraded to a Watch health rating. These reports of light yellow/brown color were likely due to vegetative decay in the stormwater detention basins and wetlands in the drainage area.

Anacortes Site Summary - Outfall G05-1002 (48.50450,-122.66870)



Water Quality Health Rating Key		
Exceedance Frequency	Parameter	Observation
≤ 10%	Good	Good
10% < x < 30%	Watch	Watch
≥ 30 %	Threat	Threat

Trend Key			
Improving	Worsening	Inconsistent	Stable
↑	↓	↑↓	↔

Stormwater threshold exceedances, extremum, health ratings, and water quality trends for select parameters at Outfall G05-1002.

Summary 2021-2025							
Parameter	Outfall Thresholds*	Sample #	Exceedances		Health Rating	Extremum	Trend
			#	%			
Water Temp °C	> Air +3**	42	10	24	Watch	17	↑↓
DO mg/l	<6	42	0	0	Good	7.46	↔
pH	<5 or >9	42	0	0	Good	6.23-8.4	↔
SPC uS/cm	>500	42	5	12	Tidal	3,872	NA
Turbidity ntu	>50	40	0	0	Good	20.4	↔
E. coli cfu/100ml	>320	27	6	22	Watch	1,865	NA
Observation							
Flow	> Expected	15	3	20	Watch	Higher	NA
Color 1-3	Any unnatural color	19	8	42	Threat	1	↔
Odor 1-3	Any odor	19	1	5	Good	1	↔
Visual 1-3	Any unnatural phenom	19	0	0	Good	0	↔
Health Rating: Watch							

*(Herrera Environmental Consultants & Aspect Consulting 2020)

**modified stormwater threshold, see Methods

Outfall G05-1002 drains 22 acres of dense suburban development and discharges west of the Guemes Channel. The overall health rating of Watch is based on *E. coli* levels. The maximum level detected was 1,865 cfu/100 ml in 2023 with no apparent trend over the three years of bacteria data collection. During their follow-up investigations, the City found a private sewer pump station that was failing and worked with the County health department and the home owners association on getting that repaired. Frequent color observations of light yellow/brown

were rated as Threat. There are no apparent wetlands or retention basins in the drainage to explain the observed color.

Anacortes Site Summary - Outfall G06-1001 (48.50809,-122.65811)



Water Quality Health Rating Key		
Exceedance Frequency	Parameter	Observation
≤ 10%	Good	Good
10% < x < 30%	Watch	Watch
≥ 30 %	Threat	Threat

Trend Key			
Improving	Worsening	Inconsistent	Stable
↑	↓	↑↓	↔

Stormwater threshold exceedances, extremum, health ratings, and water quality trends for select parameters at Outfall G06-1001.

Summary 2021-2025							
Parameter	Outfall Thresholds*	Sample #	Exceedances		Health Rating	Extremum	Trend
			#	%			
Water Temp °C	> Air +3**	43	1	2	Good	14.6	↔
DO mg/l	<6	43	0	0	Good	7	↔
pH	<5 or >9	43	0	0	Good	5.8-7.9	↔
SPC uS/cm	>500	43	0	0	Tidal	446	NA
Turbidity ntu	>50	40	0	0	Good	27.4	↔
E. coli cfu/100ml	>320	28	3	11	Watch	3,863	↔
Observation							
Flow	> Expected	17	1	6	Good	Higher	NA
Color 1-3	Any unnatural color	22	14	64***	Watch	2	↔
Odor 1-3	Any odor	21	0	0	Good	0	↔
Visual 1-3	Any unnatural phenom	21	0	0	Good	0	↔
Overall Health Rating: Watch							

*(Herrera Environmental Consultants & Aspect Consulting 2020)

**modified stormwater threshold, see Methods

***health rating upgraded to Watch due to presence of natural source - wetland

The 33 acre drainage area of Outfall G06-1001 is suburban development with several small stormwater detention ponds and natural wetlands. It discharges west of the Guemes Channel. While the overall health rating for Outfall G06-1001 is Watch based on *E. coli*, the water quality of this outfall is one of the best in the City. The *E. coli* exceedance rate was just slightly above the Good cutoff consisting of one one instance in three of the four years sampled. Since the

frequent observations of light brown/yellow color is likely due to vegetative decay occurring in the detention ponds and wetlands, the health rating for color was upgraded to Watch.

Anacortes Site Summary - Outfall G07-1002 (48.50845,-122.65696)



Water Quality Health Rating Key		
Exceedance Frequency	Parameter	Observation
≤ 10%	Good	Good
10% < x < 30%	Watch	Watch
≥ 30 %	Threat	Threat

Trend Key			
Improving	Worsening	Inconsistent	Stable
↑	↓	↑↓	↔

Stormwater threshold exceedances, extremum, health ratings, and water quality trends for select parameters at Outfall G07-1002.

Summary 2024-2025							
Parameter	Outfall Thresholds*	Sample #	Exceedances		Health Rating	Extremum	Trend
			#	%			
Water Temp °C	> Air +3**	10	0	0	Good	16.1	NA
DO mg/l	<6	10	0	0	Good	9.18	NA
pH	<5 or >9	10	0	0	Good	6.7-7.9	NA
SPC uS/cm	>500	10	2	20	Tidal	3,044	NA
Turbidity ntu	>50	9	0	0	Good	46.4	NA
E. coli cfu/100ml	>320	10	5	50	Threat	11,954	NA
Observation							
Flow	> Expected	9	1	11	Watch	Higher	NA
Color 1-3	Any unnatural color	10	2	20	Watch	1	NA
Odor 1-3	Any odor	10	1	10	Good	1	NA
Visual 1-3	Any unnatural phenom	10	0	0	Good	0	NA
Overall Health Rating: Threat							

*(Herrera Environmental Consultants & Aspect Consulting 2020)

**modified stormwater threshold, see Methods

Outfall G07-1002 has a drainage area of 1944 acres of suburban development and discharges west of the Guemes Channel. Based on data collected beginning in October 2024, the overall health rating for this outfall was Threat based on routine exceedances of the stormwater threshold with a maximum *E. coli* of 11,954 cfu/100ml in May 2025. The City's follow-up sampling did not detect elevated bacteria levels. While conducting maintenance work on

stormwater detention ponds in the area, nesting geese and goslings were observed suggesting one natural source of bacteria.

During one survey, the stormwater was observed to be gray with a turbidity of 46.4 ntu. This turbidity was higher than most of the stormwater samples we have monitored programwide but was below the stormwater threshold. Observations during another survey included a green color and grass odor.

Anacortes Site Summary - Outfall G07-1001 (48.50900,-122.65460)





Water Quality Health Rating Key		
Exceedance Frequency	Parameter	Observation
≤ 10%	Good	Good
10% < x < 30%	Watch	Watch
≥ 30 %	Threat	Threat

Trend Key			
Improving	Worsening	Inconsistent	Stable
↑	↓	↑↓	↔

Stormwater threshold exceedances, extremum, health ratings, and water quality trends for select parameters at Outfall G07-1001.

Summary 2021-2025							
Parameter	Outfall Thresholds*	Sample #	Exceedances		Health Rating	Extremum	Trend
			#	%			
Water Temp °C	> Air +3**	44	6	14	Watch	19.8	↑
DO mg/l	<6	45	0	0	Good	8	↔
pH	<5 or >9	45	0	0	Good	5.44-8.4	↔
SPC uS/cm	>500	45	23	51	Tidal	686	NA
Turbidity ntu	>50	44	1	2	Good	68.2	↔
E. coli cfu/100ml	>320	28	5	18	Watch	6,593	↔
Observation							
Flow	> Expected	11	0	0	Good	Normal	NA
Color 1-3	Any unnatural color	16	13	81	Threat	2	NA
Odor 1-3	Any odor	16	0	0	Good	0	NA
Visual 1-3	Any unnatural phenom	16	2	13	Watch	1	NA
Overall Health Rating: Watch							

*(Herrera Environmental Consultants & Aspect Consulting 2020)

**modified stormwater threshold, see Methods

Outfall G07-1001 has a small six acre drainage area with about a dozen homes and a green space buffer along the water. It discharges to the west of the Guemes Channel. The outfall's overall health rating of Watch was based primarily on *E. coli* exceedances. The highest level of *E. coli,* 6,595 cfu/ 100 ml, was recorded in January 2024. The flow rate for this sample was a trickle. In 2025, one third of the samples exceeded the stormwater threshold with values

ranging from 333 to 667 cfu/100 ml. Colors were frequently present and described as faint green, green/brown, buff, light tan/beige. The source of the colors is unknown.

Anacortes - Guemes Channel and Fidalgo Bay/Cap Sante Marina Outfalls

Overall Water Quality Health Rating	Threat	Watch	Good

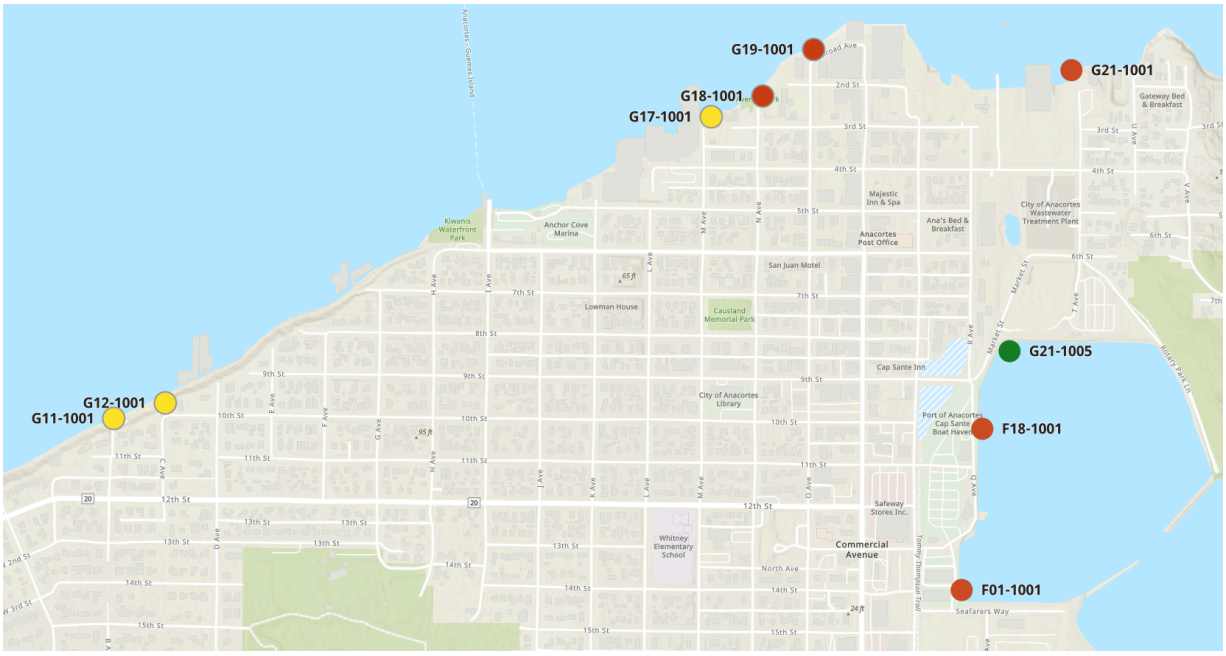


Figure 5. Anacortes, Guemes Channel and Fidalgo Bay/Cap Sante Marina - Salish Sea Stormwater Monitoring Program sites with overall water quality health ratings.

Anacortes Site Summary - Outfall G11-1001 (48.51430,-122.63440)



Water Quality Health Rating Key		
Exceedance Frequency	Parameter	Observation
≤ 10%	Good	Good
10% < x < 30%	Watch	Watch
≥ 30 %	Threat	Threat

Trend Key			
Improving	Worsening	Inconsistent	Stable
↑	↓	↑↓	↔

Stormwater threshold exceedances, extremum, health ratings, and water quality trends for select parameters at Outfall G11-1001.

Summary 2023-2025							
Parameter	Outfall Thresholds*	Sample #	Exceedances		Health Rating	Extremum	Trend
			#	%			
Water Temp °C	> Air +3**	14	0	0	Good	15.8	↔
DO mg/l	<6	15	0	0	Good	8.31	↔
pH	<5 or >9	15	0	0	Good	7-8.38	↔
SPC uS/cm	>500	15	0	0	Good	459	↔
Turbidity ntu	>50	15	0	0	Good	21.2	↔
E. coli cfu/100ml	>320	16	3	19	Watch	2,930	↑↓
Observation							
Flow	> Expected	8	1	13	Watch	Higher	NA
Color 1-3	Any unnatural color	11	8	73***	Watch	3	↔
Odor 1-3	Any odor	11	5	45***	Watch	2	↔
Visual 1-3	Any unnatural phenom	11	0	0	Good	0	↔
Overall Health Rating: Watch							

*(Herrera Environmental Consultants & Aspect Consulting 2020)

**modified stormwater threshold, see Methods

***health rating upgraded to Watch due to presence of natural source - forestland

Outfall G11-1001 drains an area of 180 acres of suburban development of which about 25 acres are grass playing fields. It discharges to the Guemes Channel at the end of B Avenue. Monitoring at this outfall started in 2023. The overall health rating was Watch based on *E. coli* levels. The most recent exceedance was for one of eight samples collected in 2025 with 1000 cfu/100ml in June.

A range of colors have been frequently observed including yellow, yellow-brown, tan, weak tea and green tea. These may be due to plant decay in several stormwater retention ponds in the drainage area so the health rating was upgraded to Watch. Odors reported include metallic, rusty, ammonia, seafood and urine. The iron outfall pipe is corroded and rusty which explains some of the odors. A nearby seafood sales business might be the source of the seafood odor though it is on the shoreline and does not contribute stormwater to outfall. Based on these possible odor sources the health rating was upgraded to Watch.

Anacortes Site Summary - Outfall G12-1001 (48.51460,-122.63290)





Key		
Exceedance Frequency	Parameter	Observation
≤ 10%	Good	Good
10% < x < 30%	Watch	Watch
≥ 30 %	Threat	Threat

Trend			
Improving	Worsening	Inconsistent	Stable
↑	↓	↑↓	↔

Stormwater threshold exceedances, extremum, health ratings, and water quality trends for select parameters at Outfall G12-1001.

Summary 2021-2024							
Parameter	Outfall Thresholds*	Sample #	Exceedances		Health Rating	Extremum	Trend
			#	%			
Water Temp °C	> Air +3**	19	3	16	Watch	15.1	↔
DO mg/l	<6	19	0	0	Good	7.2	↔
pH	<5 or >9	19	0	0	Good	5.71-7.6	↔
SPC uS/cm	>500	19	0	0	Good	363.8	↔
Turbidity ntu	>50	19	0	0	Good	31.7	↔
E. coli cfu/100ml	>320	11	3	27	Watch	633	↔
Observation							
Flow	> Expected	3	0	0	Good	Normal	NA
Color 1-3	Any unnatural color	5	3	60	Threat	1	NA
Odor 1-3	Any odor	5	0	0	Good	0	NA
Visual 1-3	Any unnatural phenom	5	0	0	Good	0	NA
Overall Health Rating: Watch							

*(Herrera Environmental Consultants & Aspect Consulting 2020)

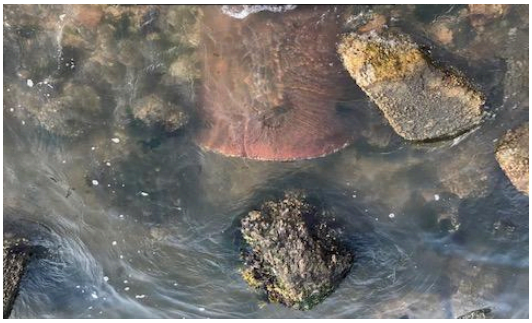
**modified stormwater threshold, see Methods

Outfall G12-1001 has a small drainage area of 11 acres of a residential area and discharges to the Guemes Channel at the end of C Avenue. The outfall was initially sampled at the end of the pipe. Early in 2023, new riprap was placed over the outfall pipe making it inaccessible and the monitoring location was moved just upstream about 30 meters to the first upstream catch basin. The overall health rating was Watch based on *E. coli*. The most recent exceedances were April 2024. A sample collected on April 25th had 566 cfu/100ml and a confirmation sample

collected on April 27th had 633 cfu/100ml. The outfall was visited nine times in 2025 but was never flowing. The color observations that resulted in a Threat rating were for three of five samples in 2024 reported to be light tan or brown.

Note: one of the three reported exceedances was for *Entero*. It was for a sample collected when our procedure was to sample 100 ml of stormwater. When bacteria was present in high numbers, it was sometimes difficult to count individual colonies. The *E. coli* R-CARD for this sample was full of colonies but was smeared and faded so counting individual colonies was not possible. During this time period, we were also testing for *Entero*. The *Entero* R-CARD for this sample was full of colonies and they were distinct, allowing for an estimate of individual colonies. Our experience monitoring for both bacteria, suggests that using *Entero* R-CARD results was a reasonable estimate for *E. coli* levels.

Anacortes Site Summary - Outfall G17-1001 (48.52010,-122.61700)



Water Quality Health Rating Key		
Exceedance Frequency	Parameter	Observation
≤ 10%	Good	Good
10% < x < 30%	Watch	Watch
≥ 30 %	Threat	Threat

Trend Key			
Improving	Worsening	Inconsistent	Stable
↑	↓	↑↓	↔

Stormwater threshold exceedances, extremum, health ratings, and water quality trends for select parameters at Outfall G17-1001.

Summary 2021-2025							
Parameter	Outfall Thresholds*	Sample #	Exceedances		Health Rating	Extremum	Trend
			#	%			
Water Temp °C	> Air +3**	12	0	0	Good	15.3	NA
DO mg/l	<6	12	2	17	Watch	2.86	NA
pH	<5 or >9	12	0	0	Good	6.83-7.4	NA
SPC uS/cm	>500	12	11	92	Tidal	19,038	NA
Turbidity ntu	>50	11	0	0	Good	30.2	NA
E. coli cfu/100ml	>320	9	2	22	Watch	2,654	NA
Observation							
Flow	> Expected	8	0	0	Good	Normal	NA
Color 1-3	Any unnatural color	11	2	18	Watch	1	NA
Odor 1-3	Any odor	11	4	36	Threat	3	NA
Visual 1-3	Any unnatural phenom	11	1	9	Good	1	NA
Overall Health Rating: Watch							

*(Herrera Environmental Consultants & Aspect Consulting 2020)

**modified stormwater threshold, see Methods

Outfall G17-1001 has a drainage area of 88 acres of mostly residential neighborhoods, a school, library and play fields. It discharges to the Guemes Channel in a shoreline marine industrial area. In 2021 the outfall was visited only once and in 2022/23 it was not visited at all. Sampling restarted in 2024. The overall health rating was Watch due to *E. coli* and dissolved oxygen. *E. coli* levels exceeded the stormwater threshold two times in 2025. The bacteria level was 2,654 cfu/100ml in April with a moderate flow rate and 733 cfu/100ml in May with a low flow rate.

Low dissolved oxygen values were found in October 2024, 4.65 mg/l, and July 2025, 2.86 mg/l. It has been rare for the stormwater outfalls we monitor to have dissolved oxygen levels this low. During both of these samples the outfall had a low flow, and the 2025 sample was light grey in color with a foul indescribable odor. Four of the five samples collected in 2025, all with low flow, were reported to have strong odors described as seaweed, sulfur or foul. It is possible that the flow is a combination of stormwater and seawater slowly draining from a catch basin. However, there are many outfalls that are inundated with sea water and reports of these types of odors and color are rare. No evidence was identified during the City's follow-up observations to indicate an illicit discharge.

Anacortes Site Summary - Outfall G18-1001 (48.52050,-122.61550)



Water Quality Health Rating Key		
Exceedance Frequency	Parameter	Observation
≤ 10%	Good	Good
10% < x < 30%	Watch	Watch
≥ 30 %	Threat	Threat

Trend Key			
Improving	Worsening	Inconsistent	Stable
↑	↓	↑↓	↔

Stormwater threshold exceedances, extremum, health ratings, and water quality trends for select parameters at Outfall G18-1001.

Summary 2021-2025							
Parameter	Outfall Thresholds*	Sample #	Exceedances		Health Rating	Extremum	Trend
			#	%			
Water Temp °C	> Air +3**	11	2	18	Watch	16.9	NA
DO mg/l	<6	11	0	0	Good	6.16	NA
pH	<5 or >9	11	0	0	Good	5.46-7.05	NA
SPC uS/cm	>500	11	0	0	Good	256.7	NA
Turbidity ntu	>50	10	1	10	Good	60.5	NA
E. coli cfu/100ml	>320	7	4	57	Threat	7,126	NA
Observation							
Flow	> Expected	3	1	33	NA	Higher	NA
Color 1-3	Any unnatural color	6	5	83	Threat	1	NA
Odor 1-3	Any odor	6	2	33	Threat	1	NA
Visual 1-3	Any unnatural phenom	6	0	0	Good	0	NA
Overall Health Rating: Threat							

*(Herrera Environmental Consultants & Aspect Consulting 2020)

**modified stormwater threshold, see Methods

The drainage area for Outfall G18-1001 is 11 acres of mostly residential neighborhood with 20% shoreline marine industry where it discharges to the Guemes Channel. The outfall was visited a total of 39 times and had flow present 12 times. The overall health rating was Threat primarily due to *E. coli* but also unnatural colors (grey or yellow) and odors (sulfur or metallic). The number of samples was small but the rate of E.coli exceedances was high, 57%. The poor

stormwater quality is concerning due to the unusual combination of parameters and observations having threshold exceedances.

Anacortes Site Summary - Outfall G19-1001 (48.52140, -122.61400)



Water Quality Health Rating Key		
Exceedance Frequency	Parameter	Observation
≤ 10%	Good	Good
10% < x < 30%	Watch	Watch
≥ 30 %	Threat	Threat

Trend Key			
Improving	Worsening	Inconsistent	Stable
↑	↓	↑↓	↔

Stormwater threshold exceedances, extremum, health ratings, and water quality trends for select parameters at Outfall G19-1001.

Summary 2021-2025							
Parameter	Outfall Thresholds*	Sample #	Exceedances		Health Rating	Extremum	Trend
			#	%			
Water Temp °C	> Air +3**	28	10	36	Threat	18	↑↓
DO mg/l	<6	29	1	3	Good	5.24	↔
pH	<5 or >9	29	0	0	Good	5.59-7.6	↔
SPC uS/cm	>500	29	20	69	Tidal	43,882	NA
Turbidity ntu	>50	28	3	11	Watch	181.9	↑↓
E. coli cfu/100ml	>320	24	12	50***	Watch	4,562	↑↓
Observation							
Flow	> Expected	14	2	14	Watch	Higher	NA
Color 1-3	Any unnatural color	15	7	47	Threat	1	NA
Odor 1-3	Any odor	15	0	0	Good	0	NA
Visual 1-3	Any unnatural phenom	15	0	0	Good	0	NA
Overall Health Rating: Threat							

*(Herrera Environmental Consultants & Aspect Consulting 2020)

**modified stormwater threshold, see Methods

***health rating upgraded to Watch due to source identification and control

The drainage area for Outfall G19-1001 is 27 acres of mostly residential neighborhood with 20% marine industry on the shoreline where it discharges to the Guemes Channel at the end of O Avenue. Half (50%) of the *E. coli* samples from Outfall G19-1001 have exceeded the stormwater threshold. The likelihood of finding *E. coli* at this outfall was so high, 90%, that it became the go

to outfall to sample whenever we were evaluating our bacteria procedures. The health rating for *E. coli* was upgraded to Watch due to the source identification and control measures taken. However, the overall water quality health rating for Outfall G19-1001 remains Threat due to high temperatures and, to a lesser extent, high turbidity, low dissolved oxygen, and frequent unusual colors - grey, tan, rusty or milky. And due to the uncertainty that the fish waste problem has been permanently solved.

The source of the bacteria was identified by City staff in July 2025. A truck was seen leaving the area with fish processing waste spilling from the vehicle onto the road. The discharge included fish remains and fish processing wastewater which entered the stormwater system. It was the second occurrence observed in the same week involving the same vehicle. A seafood processor had been storing leftover fish and crab waste in bins on site. When the bins were full, they were hauled away. But both the bins and the trucks leaked during handling and transport. This runoff had been entering the storm system and likely contributing to the high bacteria levels.

An August 2025 stormwater sample still had high *E. coli* levels, 3,663 cfu/100ml. Since then an additional three samples in 2025 and three early 2026 samples did not exceed the threshold suggesting the problem has been corrected for now.

Anacortes Site Summary - Outfall G21-1001 (48.52100, -122.60650)



Key		
Exceedance Frequency	Parameter	Observation
≤ 10%	Good	Good
10% < x < 30%	Watch	Watch
≥ 30 %	Threat	Threat

Trend			
Improving	Worsening	Inconsistent	Stable
↑	↓	↑↓	↔

Stormwater threshold exceedances, extremum, health ratings, and water quality trends for select parameters at Outfall G21-1001.

Summary 2021-2025							
Parameter	Outfall Thresholds*	Sample #	Exceedances		Health Rating	Extremum	Trend
			#	%			
Water Temp °C	> Air +3**	8	0	0	Good	14.1	NA
DO mg/l	<6	8	0	0	Good	7.5	NA
pH	<5 or >9	8	0	0	Good	6.36-7.32	NA
SPC uS/cm	>500	8	8	100	Tidal	37,119	NA
Turbidity ntu	>50	10	2	20	Watch	73.9	NA
E. coli cfu/100ml	>320	6	3	50	Threat	5,395	NA
Observation							
Flow	> Expected	4	0	0	Good	Normal	NA
Color 1-3	Any unnatural color	5	3	60	Threat	2	NA
Odor 1-3	Any odor	5	2	40	Threat	2	NA
Visual 1-3	Any unnatural phenom	5	1	20	Watch	2	NA
Overall Health Rating: Threat							

*(Herrera Environmental Consultants & Aspect Consulting 2020)

**modified stormwater threshold, see Methods

Outfall G21-1001 drains an area of 23 acres, about 50% residential with the rest municipal/ commercial development discharging to the Guemes Channel. Only a few samples have been collected from this outfall each year. However, it has been included because of the poor water quality observed. The overall health rating was Threat due to *E. coli*, turbidity, oil sheen, unusual colors (murky-brown, milky-cloudy), and odors (oil, sulfur, petroleum).

Anacortes Site Summary - Outfall G21-1005 (48.51560, -122.60830)



Key		
Exceedance Frequency	Parameter	Observation
≤ 10%	Good	Good
10% < x < 30%	Watch	Watch
≥ 30 %	Threat	Threat

Trend			
Improving	Worsening	Inconsistent	Stable
↑	↓	↑↓	↔

Stormwater threshold exceedances, extremum, health ratings, and water quality trends for select parameters at Outfall G21-1005.

Summary 2021-2025							
Parameter	Outfall Thresholds*	Sample #	Exceedances		Health Rating	Extremum	Trend
			#	%			
Water Temp °C	> Air +3**	7	0	0	Good	14.7	NA
DO mg/l	<6	7	0	0	Good	6.6	NA
pH	<5 or >9	7	0	0	Good	5.88-7.02	NA
SPC uS/cm	>500	7	4	57	Tidal	5,925	NA
Turbidity ntu	>50	8	0	0	Good	13.71	NA
E. coli cfu/100ml	>320	6	0	0	Good	266	NA
Observation							
Flow	> Expected	3	2	67	Threat	Higher	NA
Color 1-3	Any unnatural color	5	3	60	Threat	2	NA
Odor 1-3	Any odor	5	0	0	Good	1	NA
Visual 1-3	Any unnatural phenom	5	0	0	Good	1	NA
Overall Health Rating: Good							

*(Herrera Environmental Consultants & Aspect Consulting 2020)

**modified stormwater threshold, see Methods

The drainage area for Outfall G21-1005 is small with mostly (~95%) impervious surfaces with a recreational vehicle camping area, roadways, and sidewalks. It discharges to the northwest corner of Cap Sante Marina. With such a small drainage area, Outfall G21-1005 is often dry. It was visited 28 times during the study period and was sampled 9 times. When it did flow after rain events, the color of the stormwater was described as greenish-brown, yellow-brown and

yellow-green in three of five samples in 2025. The flow has occasionally been reported as higher than expected based on prior rainfall. The overall health rating for Outfall G21-1005 was Good.

Anacortes Site Summary - Outfall F18-1001 (48.51410,-122.60910)



Water Quality Health Rating Key		
Exceedance Frequency	Parameter	Observation
≤ 10%	Good	Good
10% < x < 30%	Watch	Watch
≥ 30 %	Threat	Threat

Trend Key			
Improving	Worsening	Inconsistent	Stable
↑	↓	↑↓	↔

Stormwater threshold exceedances, extremum, health ratings, and water quality trends for select parameters at Outfall F18-1001.

Summary 2021-2024							
Parameter	Outfall Thresholds*	Sample #	Exceedances		Health Rating	Extremum	Trend
			#	%			
Water Temp °C	> Air +3**	7	2	29	Watch	16	NA
DO mg/l	<6	7	4	57	Threat	5	NA
pH	<5 or >9	7	0	0	Good	6.89-7.33	NA
SPC uS/cm	>500	7	7	100	Tidal	27,239	NA
Turbidity ntu	>50	7	0	0	Good	41.1	NA
E. coli cfu/100ml	>320	4	2	50	Threat	833	NA
Observation							
Flow	> Expected	1	0	0	Good	Normal	NA
Color 1-3	Any unnatural color	2	1	50	Threat	1	NA
Odor 1-3	Any odor	2	0	0.00	Good	0	NA
Visual 1-3	Any unnatural phenom	2	0	0.00	Good	0	NA
Overall Health Rating: Threat							

*(Herrera Environmental Consultants & Aspect Consulting 2020)

**modified stormwater threshold, see Methods

Outfall F18-1001 drains 14 acres of the downtown Anacortes business district before discharging to Cap Sante Marina. The drainage area contains a dog park and undeveloped parking areas to be developed in the near future. The overall health rating, based on limited sampling, was Threat due to low D.O., *E. coli* and a brown/rusty color. The stormwater infrastructure in this basin is known to have a breakage which may contribute to the colors seen. Currently, the outfall is no longer accessible having been covered with riprap sometime

after September 2024. If a new outfall is accessible after construction, then monitoring will resume.

Anacortes Site Summary - Outfall F01-1001 (48.51100, -122.60970)



Water Quality Health Rating Key		
Exceedance Frequency	Parameter	Observation
≤ 10%	Good	Good
10% < x < 30%	Watch	Watch
≥ 30 %	Threat	Threat

Trend Key			
Improving	Worsening	Inconsistent	Stable
↑	↓	↑↓	↔

Stormwater threshold exceedances, extremum, health ratings, and water quality trends for select parameters at Outfall F01-1001.

Summary 2021-2025							
Parameter	Outfall Thresholds*	Sample #	Exceedances		Health Rating	Extremum	Trend
			#	%			
Water Temp °C	> Air +3**	27	3	11	Watch	18.6	↑↓
DO mg/l	<6	28	0	0	Good	7.25	↔
pH	<5 or >9	28	0	0	Good	6.5-8.21	↔
SPC uS/cm	>500	28	24	86	Tidal	2,861	NA
Turbidity ntu	>50	29	0	0	Good	36.6	↔
E. coli cfu/100ml	>320	26	13	50	Threat	42,291	↓
Observation							
Flow	> Expected	14	1	7	Good	Higher	↔
Color 1-3	Any unnatural color	18	2	11	Watch	1	NA
Odor 1-3	Any odor	17	0	0	Good	0	NA
Visual 1-3	Any unnatural phenom	16	1	6	Good	1	NA
Overall Health Rating: Threat							

*(Herrera Environmental Consultants & Aspect Consulting 2020)

**modified stormwater threshold, see Methods

Outfall F01-1001 drains 210 acres of mostly residential areas with commercial businesses and light industrial making up about 35% of the basin. The outfall discharges into the southwest corner of Cap Sante Marina. Half of the 26 samples analyzed from outfall F01-1001 exceeded the stormwater threshold for *E. coli* resulting in an overall health rating of Threat. In addition,

both the percentage of exceedances and the levels of *E. coli* increased during the period monitored, 2021 to 2025. This outfall had one of the highest counts of *E. coli* we have seen, an estimated 42,291 cfu/100 ml in August 2025. It should be noted that, post actions taken by the City (discussed below), the *E. coli* levels in 2026 have dropped considerably but do continue to exceed the stormwater threshold.

Follow-up fecal coliform sampling by the City of Anacortes at four manholes and six catch basins upstream of the F01-1001 outfall was conducted in April 2025 after our sample the previous month showed 1698 cfu/100 ml *E. coli* present. The results for fecal coliform samples were above the stormwater threshold for fecal coliform of 200 cfu/100 ml (Ecology, 2020) in two of the four lines feeding outfall F01-1001. Additional upstream sampling by the City of these two lines showed one of five samples exceeding the threshold with 218 cfu/100 ml fecal coliform.

On July 7, 2025 the City filed a pollution incident report with Ecology (ERTS #740067) based on reports from a citizen who witnessed a trail of sewage draining from a motor home parked in a driveway. The trail of sewage continued to a stormwater drain that feeds Outfall F01-1001. Three days later, a sample we collected had an estimated 9,490 cfu/100 ml *E. coli*. The following month, in a sample we collected on August 7, 2025, the *E. coli* measured ~42,291 cfu/100ml.

The Anacortes Municipal Code restricts residential vehicles living on private property to no more than nine months per year and requires sewage be properly contained and disposed of. The City notified the property owners multiple times requesting that the residential vehicle living on the property cease and the sewage be cleaned up.

In early results for 2026, the *E. coli* threshold was exceeded in three of four samples ranging from 1,132 to 3,062 cfu/100 ml suggesting there is still a source, but the levels have significantly declined from the peak in the summer of 2025. Because of the known sewage contamination, the City is planning a complete cleaning of the stormwater conveyance system tributary to Outfall F01-1001 hoping to remove any remaining sources which may be contributing to the recent high bacteria levels.

In an unrelated incident, volunteers came upon an orange paint spill in January 2025 (Figure 6). Paint store employees watched as paint ran down an alley into a storm drain that connects to

Outfall F01-1001. Volunteers immediately reported the incident to the Anacortes Spill Hotline. Within five minutes, stormwater staff were on site, blocked the flow, ran a street sweeper to clean the alley, and checked stormwater vaults downstream from the spill.



Figure 6. Paint spill flowing to Outfall F01-1001 storm drain.

Anacortes - North Fidalgo Bay Outfalls

Overall Water Quality Health Rating	Threat	Watch	Good

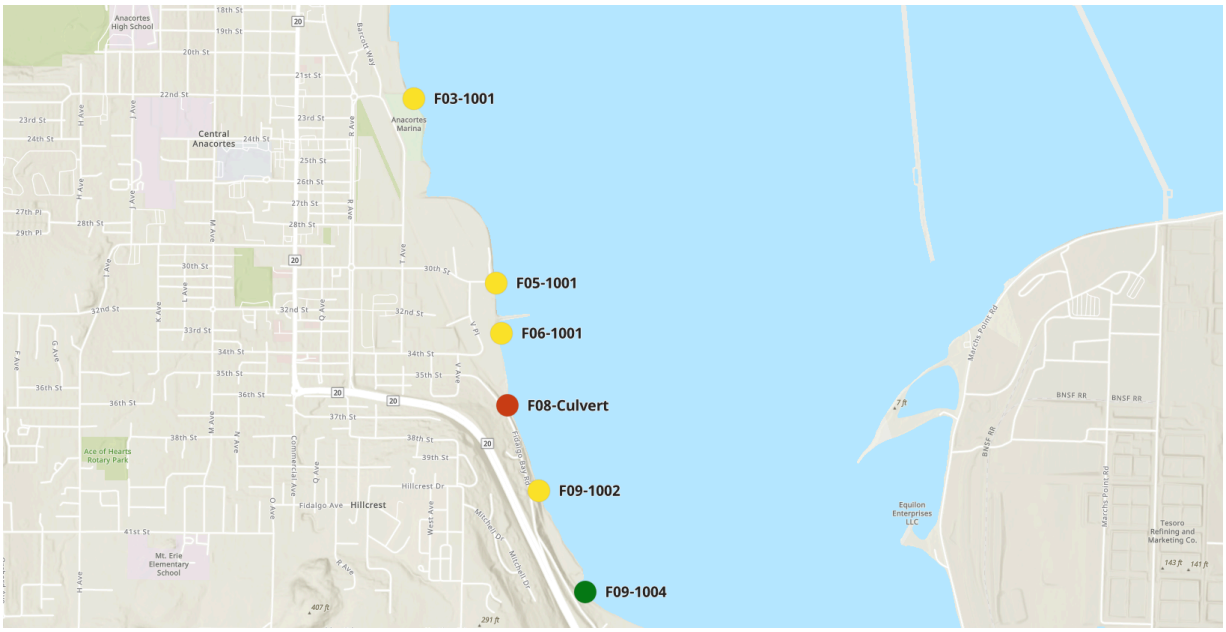


Figure 7. Anacortes, North Fidalgo Bay - Salish Sea Stormwater Monitoring Program sites with overall water quality health ratings.

Anacortes Site Summary - Outfall F03-1001 (48.50440,-122.60599)



Water Quality Health Rating Key		
Exceedance Frequency	Parameter	Observation
≤ 10%	Good	Good
10% < x < 30%	Watch	Watch
≥ 30 %	Threat	Threat

Trend Key			
Improving	Worsening	Inconsistent	Stable
↑	↓	↑↓	↔

Stormwater threshold exceedances, extremum, health ratings, and water quality trends for select parameters at Outfall F03-1001.

Summary 2021-2025							
Parameter	Outfall Thresholds*	Sample #	Exceedances		Health Rating	Extremum	Trend
			#	%			
Water Temp °C	> Air +3**	41	3	7	Good	18.8	↔
DO mg/l	<6	40	0	0	Good	8.43	↔
pH	<5 or >9	41	0	0	Good	6.3-8.15	↔
SPC uS/cm	>500	41	1	2	Good	1,210	↔
Turbidity ntu	>50	40	0	0	Good	27.6	↔
E. coli cfu/100ml	>320	28	1	4	Good	1,132	↔
Observation							
Flow	> Expected	15	3	20	Watch	Higher	↔
Color 1-3	Any unnatural color	22	5	22	Watch	2	NA
Odor 1-3	Any odor	22	0	0	Good	0	NA
Visual 1-3	Any unnatural phenom	22	6	27	Watch	3	NA
Overall Health Rating: Watch***							

*(Herrera Environmental Consultants & Aspect Consulting 2020)

**modified stormwater threshold, see Methods

***overall health rating was based on observations

The 375 acre drainage basin for F03-1001 spans from the 32nd Street Swamp on the edge of the Anacortes Forestlands over to Fidalgo Bay where it discharges at the north end of Anacortes Marina. Land use is mostly residential with about 20% commercial/businesses/hospital, 10% schools/play fields, and 10% parks/undeveloped land. The swamp drains into Beaver Brook which eventually joins the stormwater system and discharges from F03-1001.

While the water quality parameters measured put the overall health rating of the stormwater into the Good category, observations suggest the outfall has water quality issues that need to be watched. The concerning observation was a periodic presence of excessive white foam usually occurring in the winter months.



Figure 8. Excessive foam observed at Outfall F03-1001 on December 12, 2025.

Excessive foam was reported to the City of Anacortes in November 2024 after a sampling event. The stormwater manager replied that the same thing happened a year earlier in December 2023 and they had filed a pollution incidence report with Ecology (ERTS #727277). Follow-up source tracing by the City failed to find a cause and they, with Ecology agreeing, decided it was likely due to natural sources.

The amount of foam present is unusual compared to all other sites we monitor program wide. A potential source of contamination is the City's old landfill, closed in 2006, and located next to the 32nd Street Swamp which drains to Outfall F03-1001. The landfill was used for the disposal of wood, concrete, asphalt, yard waste, street sweepings and other materials. As part of a recent proposal to use the space as a bike park, Ecology revisited the landfill, conducted

sampling and placed the landfill on the Contaminated Sites list. Ecology found exposed garbage and petroleum contamination at the site. As a result of the listing, the City will be conducting additional sampling.

One potential contaminant known to cause foam is the group of compounds called PFAS - human-made chemicals used for decades in numerous products, including non-stick cookware, fast food wrappers, stain-resistant sprays and firefighting foam (WDNR, 2026). To help with source identification, a sample of the outfall was collected in April 2026 by volunteers using a Cyclopure Water Test KIt Pro and sent for PFAS analysis. Unusual suds were not observed, so this was considered a background sample. Of 55 PFAS tested for, 8 PFAS were detected in the sample with a total concentration of 17.5 parts per trillion (ppt, Table 11). This is considered a low level of PFAS and it will be compared to a future sample collected when excessive suds appear.

Table 11. PFAS detected in a background (low suds) sample of Outfall F03-1001 stormwater on April 17, 2026.

Compound	Abbreviation	Concentration ppt
Perfluorooctanoic Acid	PFOA	3.3
Perfluorooctane Sulfonic Acid	PFOS	3.1
Perfluorohexane Sulfonic Acid	PFHxS	1.3
Perfluorobutane Sulfonic Acid	PFBS	3.2
Perfluorobutanoic Acid	PFBA	1.8
Perfluoropentanoic Acid	PFPeA	1.5
Perfluorohexanoic Acid	PFHxA	2.1
Perfluoroheptanoic Acid	PFHpA	1.2
Total PFAS		17.5

Anacortes Site Summary - Outfall F05-1001 (48.49740,-122.60129)



Water Quality Health Rating Key		
Exceedance Frequency	Parameter	Observation
≤ 10%	Good	Good
10% < x < 30%	Watch	Watch
≥ 30 %	Threat	Threat

Trend Key			
Improving	Worsening	Inconsistent	Stable
↑	↓	↑↓	↔

Stormwater threshold exceedances, extremum, health ratings, and water quality trends for select parameters at Outfall F05-1001.

Summary 2021-2025							
Parameter	Outfall Thresholds*	Sample #	Exceedances		Health Rating	Extremum	Trend
			#	%			
Water Temp °C	> Air +3**	49	8	16	Watch	18.9	↑
DO mg/l	<6	48	0	0	Good	8.24	↔
pH	<5 or >9	50	0	0	Good	5.57-7.93	↔
SPC uS/cm	>500	50	9	18	Tidal	3,402	NA
Turbidity ntu	>50	49	3	6	Good	97.6	↔
E. coli cfu/100ml	>320	35	10	29	Watch	8,125	↑↓
Observation							
Flow	> Expected	19	4	21	Watch	Higher	↔
Color 1-3	Any unnatural color	22	2	9	Good	1	NA
Odor 1-3	Any odor	21	0	0	Good	0	NA
Visual 1-3	Any unnatural phenom	21	5	24	Watch	2	NA
Overall Health Rating: Watch							

*(Herrera Environmental Consultants & Aspect Consulting 2020)

**modified stormwater threshold, see Methods

This outfall along Fidalgo Bay at Fidalgo Marina drains a small basin of 13 acres consisting of marine industrial buildings with the remaining area made up of almost 100% impervious surfaces. Due to high bacteria concentrations, primarily in 2024, Outfall F05-1001 has an overall health rating of Watch. The stormwater was also found to be cloudy and occasionally turbid in 2024. There has been an obvious river otter latrine in the small grassy area above the outfall since sampling began and has appeared to have been used continuously since then. Volunteers

have disturbed otters in the outfall during some site visits. The high bacteria levels are assumed to be a result of the otters presence. In the most recent year of sampling there were no elevated bacteria samples.

In 2022, the outfall was observed to have a milky white color with no apparent odor. The City was notified immediately. Their follow-up investigation identified the source - a business that pressure washed their roof in preparation for a new roof. Part of the roof was painted white. Under City code exterior building washing is permitted as long as detergents are not used, which they were not in this case. The company was asked to contact the City ahead of time in the future if they do a washdown like this so they could work with them to minimize the impact to the storm system.



Figure 9. Milky looking discharge from Outfall F05-1001 on October 6, 2022.

Anacortes Site Summary - Outfall F06-1001 (48.49550,-122.60100)



Water Quality Health Rating Key		
Exceedance Frequency	Parameter	Observation
≤ 10%	Good	Good
10% < x < 30%	Watch	Watch
≥ 30 %	Threat	Threat

Trend Key			
Improving	Worsening	Inconsistent	Stable
↑	↓	↑↓	↔

Stormwater threshold exceedances, extremum, health ratings, and water quality trends for select parameters at Outfall F06-1001.

Summary 2022-2025							
Parameter	Outfall Thresholds*	Sample #	Exceedances		Health Rating	Extremum	Trend
			#	%			
Water Temp °C	> Air +3**	21	3	14	Watch	17.6	↑↓
DO mg/l	<6	21	0	0	Good	7.25	↔
pH	<5 or >9	21	0	0	Good	6.28-8.1	↔
SPC uS/cm	>500	21	12	57	Tidal	2,125	NA
Turbidity ntu	>50	20	0	0	Good	25	↔
E. coli cfu/100ml	>320	19	1	5	Good	400	↔
Observation							
Flow	> Expected	7	2	29	Watch	Higher	NA
Color 1-3	Any unnatural color	12	1	8	Good	1	NA
Odor 1-3	Any odor	12	2	17	Watch	1	NA
Visual 1-3	Any unnatural phenom	12	0	0	Good	0	NA
Overall Health Rating: Watch							

*(Herrera Environmental Consultants & Aspect Consulting 2020)

**modified stormwater threshold, see Methods

Outfall F06-1001 drains a small basin of 12 acres, consisting of marine industrial buildings with the remaining area made up of almost 100% impervious surfaces and discharges into Fidalgo Bay. The monitoring results give this outfall an overall health rating of Watch due to elevated water temperature. The sole exceedance for *E. coli,* 400 cfu/100ml, was for a trickle flowing from pooled stormwater below the outfall in 2025 and a few reports of tan color and iron odor may be due to the rusty pipe.

Anacortes Site Summary - Outfall F08-Culvert (48.49278,-122.60063)



Water Quality Health Rating Key		
Exceedance Frequency	Parameter	Observation
≤ 10%	Good	Good
10% < x < 30%	Watch	Watch
≥ 30 %	Threat	Threat

Trend Key			
Improving	Worsening	Inconsistent	Stable
↑	↓	↑↓	↔

Stormwater threshold exceedances, extremum, health ratings, and water quality trends for select parameters at F08-Culvert.

Summary 2024-2025							
Parameter	Outfall Thresholds*	Sample #	Exceedances		Health Rating	Extremum	Trend
			#	%			
Water Temp °C	> Air +3**	5	1	20	Watch	13.3	NA
DO mg/l	<6	5	0	0	Good	9.95	NA
pH	<5 or >9	5	0	0	Good	7.4-8.3	NA
SPC uS/cm	>500	5	3	60	Threat	595	NA
Turbidity ntu	>50	4	0	0	Good	12.3	NA
E. coli cfu/100ml	>320	8	5	63	Threat	5,494	NA
Observation							
Flow	> Expected	6	0	0	Good	Normal	NA
Color 1-3	Any unnatural color	6	3	50	Threat	1	NA
Odor 1-3	Any odor	6	0	0	Good	0	NA
Visual 1-3	Any unnatural phenom	6	1	16	Watch	1	NA
Overall Health Rating: Threat							

*(Herrera Environmental Consultants & Aspect Consulting 2020)

**modified stormwater threshold, see Methods

This un-named culvert was discovered to be flowing during a visit to Outfall F08-1001 which is located just to the south. The drainage basin is very small, 8.5 acres, consisting of 50% residential and 50% undeveloped forest. The results of the initial sampling were high for *E. coli*, so it was added to the monthly monitoring list. Its overall health rating of Threat was due to the high levels of bacteria and elevated conductivity. In addition, the stormwater has been observed to be yellow/green/brown in color.

During a later sampling event in May 2025, the homeowner across the street shared that he or his parents had lived in the home since the 1960s and he knew the path of water that flowed to the outfall. He said the water flows past the wood chips he purchased that were treated with manure fertilizer. This could be a source of the elevated bacteria levels.

Anacortes Site Summary - Outfall F09-1002 (48.48954,-122.59884)



Water Quality Health Rating Key		
Exceedance Frequency	Parameter	Observation
≤ 10%	Good	Good
10% < x < 30%	Watch	Watch
≥ 30 %	Threat	Threat

Trend Key			
Improving	Worsening	Inconsistent	Stable
↑	↓	↑↓	↔

Stormwater threshold exceedances, extremum, health ratings, and water quality trends for select parameters at Outfall F09-1002.

Summary 2021-2025							
Parameter	Outfall Thresholds*	Sample #	Exceedances		Health Rating	Extremum	Trend
			#	%			
Water Temp °C	> Air +3**	34	6	18	Watch	16.1	↑↓
DO mg/l	<6	32	0	0	Good	6.31	↔
pH	<5 or >9	34	0	0	Good	6.32-8.05	↔
SPC uS/cm	>500	34	3	9	Good	552.7	↔
Turbidity ntu	>50	33	0	0	Good	19.34	↔
E. coli cfu/100ml	>320	18	1	6	Good	677	↔
Observation							
Flow	> Expected	7	1	14	Watch	Higher	NA
Color 1-3	Any unnatural color	11	1	9	Good	1	↔
Odor 1-3	Any odor	11	0	0	Good	0	↔
Visual 1-3	Any unnatural phenom	11	0	0	Good	0	↔
Overall Health Rating: Watch							

*(Herrera Environmental Consultants & Aspect Consulting 2020)

**modified stormwater threshold, see Methods

Outfall F09-1002 is one of four outfalls that drain 26 acres that border US Highway 20 to the west and Fidalgo Bay to the east. The drainage area includes a portion of Fidalgo Bay Road and a paved shoreline trail. The land between Fidalgo Bay Road and the trail is a steep forested bank. Outfall F09-1002 has an overall water quality health rating of Watch due to high water temperatures.

Anacortes Site Summary - Outfall F09-1004 (48.48570, -122.59620)



Water Quality Health Rating Key		
Exceedance Frequency	Parameter	Observation
≤ 10%	Good	Good
10% < x < 30%	Watch	Watch
≥ 30 %	Threat	Threat

Trend Key			
Improving	Worsening	Inconsistent	Stable
↑	↓	↑↓	↔

Stormwater threshold exceedances, extremum, health ratings, and water quality trends for select parameters at Outfall F09-1004.

Summary 2021-2025							
Parameter	Outfall Thresholds*	Sample #	Exceedances		Health Rating	Extremum	Trend
			#	%			
Water Temp °C	> Air +3**	38	3	8	Good	17.9	↔
DO mg/l	<6	38	0	0	Good	7.45	↔
pH	<5 or >9	38	0	0	Good	5.7-8.24	↔
SPC uS/cm	>500	38	1	3	Good	823	↔
Turbidity ntu	>50	36	0	0	Good	32.9	↔
E. coli cfu/100ml	>320	26	3	12***	Good	1,489	↑
Observation							
Flow	> Expected	11	4	36	Threat	Higher	NA
Color 1-3	Any unnatural color	17	0	0	Good	0	↔
Odor 1-3	Any odor	17	2	11	Watch	1	↔
Visual 1-3	Any unnatural phenom	17	0	0	Good	0	↔
Overall Health Rating: Good							

*(Herrera Environmental Consultants & Aspect Consulting 2020)

**modified stormwater threshold, see Methods

*** health rating upgraded to Good due to source identification and control

Outfall F09-1004 is another one of four outfalls that drain ~26 acres running between US Highway 20 to the west and the Tommy Thompson Trail to the east. This outfall receives additional drainage from a forested area on the west side of Highway 20 which enters via conduits running under Highway 20 and Fidalgo Bay Road then cascades down the hillside under the trail into Outfall F09-1004 and Fidalgo Bay. The overall health rating for Outfall

F09-1004 fell into the Watch category based on high *E. coli* levels in 2022. The overall water quality health rating was upgraded to Good based on source identification and control measures implemented.

After notification of high *E. coli* levels in 2022, the City's follow-up sampling confirmed the high bacteria counts. Through additional sampling they tracked the high bacteria counts up the storm system into a neighborhood. Smoke and dye testing revealed a residence with an illicit sanitary sewer connection. Since the City worked with the homeowner to have the problem corrected, bacteria levels have declined significantly with one exceedance of 533 cfu/100ml in 2025.

Observations of metallic odors were reported and the expected flow rate was reported as greater than expected on a regular basis.

Anacortes - South Fidalgo Bay Outfalls

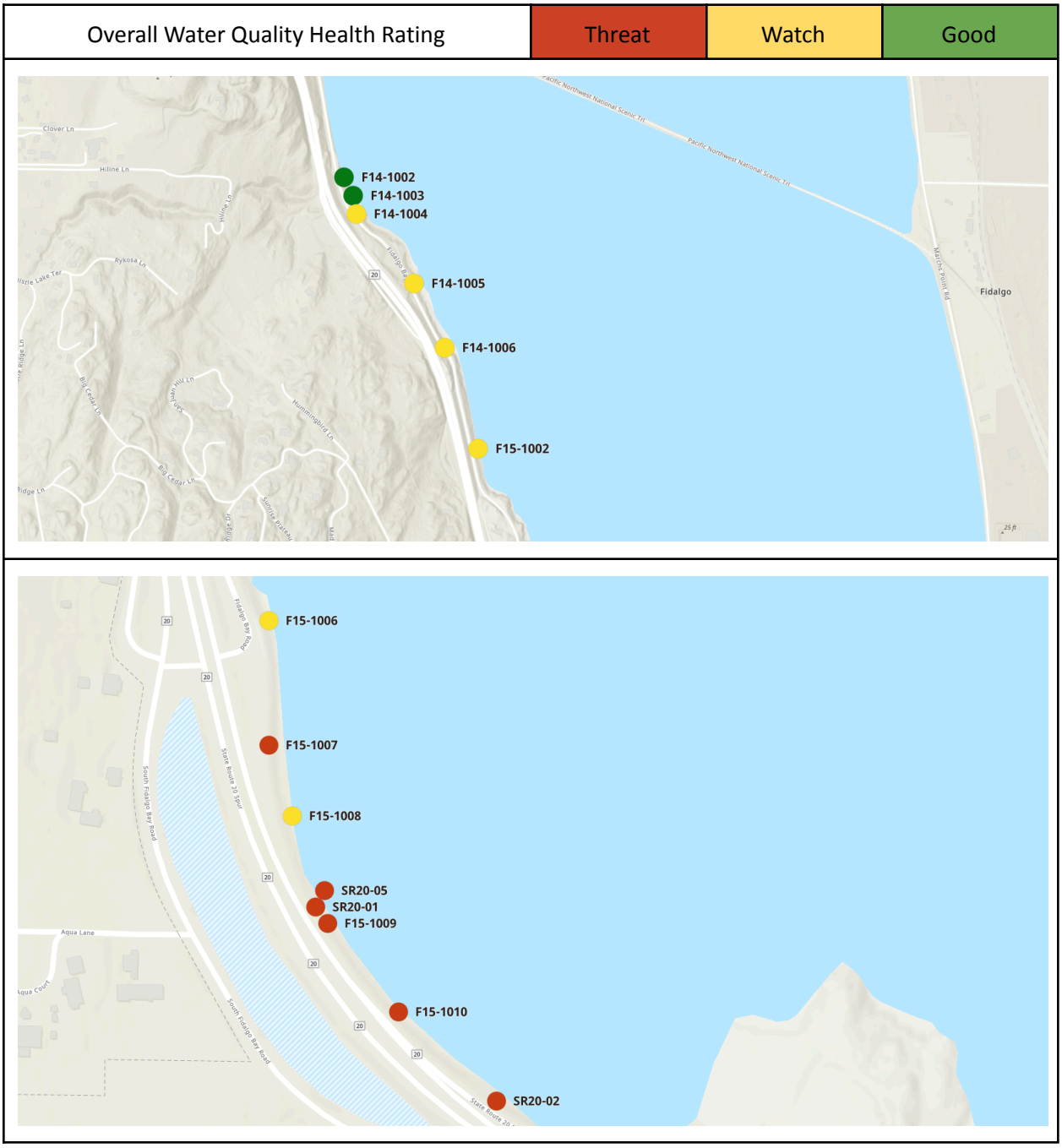


Figure 10. Anacortes, South Fidalgo Bay - Salish Sea Stormwater Monitoring Program sites with overall water quality health ratings. Note: the scale for the two maps are not the same.

Anacortes Site Summary - Outfall F14-1002 (48.47870,-122.59210)



Water Quality Health Rating Key		
Exceedance Frequency	Parameter	Observation
≤ 10%	Good	Good
10% < x < 30%	Watch	Watch
≥ 30 %	Threat	Threat

Trend Key			
Improving	Worsening	Inconsistent	Stable
↑	↓	↑↓	↔

Stormwater threshold exceedances, extremum, health ratings, and water quality trends for select parameters at Outfall F14-1002.

Summary 2021-2025							
Parameter	Outfall Thresholds*	Sample #	Exceedances		Health Rating	Extremum	5 Year Trend
			#	%			
Water Temp °C	> Air +3**	28	2	7	Good	18.2	↔
DO mg/l	<6	27	0	0	Good	6.4	↔
pH	<5 or >9	27	0	0	Good	6.25-8.36	↔
SPC uS/cm	>500	27	2	7	Good	708	↔
Turbidity ntu	>50	28	2	7	Good	66.8	↑↓
E. coli cfu/100ml	>320	12	0	0	Good	266	↔
Observation							
Flow	> Expected	3	0	0	Good	Normal	↔
Color 1-3	Any unnatural color	7	4	57***	Watch	2	NA
Odor 1-3	Any odor	7	0	0	Good	0	NA
Visual 1-3	Any unnatural phenom	7	0	0	Good	0	NA
Overall Health Rating: Good							

*(Herrera Environmental Consultants & Aspect Consulting 2020)

**modified stormwater threshold, see Methods

***health rating upgraded to Watch due to presence of natural source - forestland

A series of six outfalls drain a basin of ~200 acres of mostly undeveloped forestlands and a scattering of about three dozen residences. Highway 20 and Fidalgo Bay Road run along the east side of the drainage basin. Outfall F14-1002 is the northern most of the five that we monitor which all discharge into Fidalgo Bay. Outfall F14-1002 has an overall water quality health rating of Good, one of only six outfalls program-wide to do so.

The only concern is color which is often a light yellow/brown. Four of the five outfalls monitored in this drainage basin have a high percentage of samples reported to have similar color. There is no obvious wetland in the drainage but maybe the heavily forested nature of the area results in the stormwater coming into contact with decaying vegetation which would explain the colors seen. The health rating for color was upgraded to Watch due to the presence of likely natural sources.

Anacortes Site Summary - Outfall F14-1003 (48.47830,-122.59180)



Water Quality Health Rating Key		
Exceedance Frequency	Parameter	Observation
≤ 10%	Good	Good
10% < x < 30%	Watch	Watch
≥ 30 %	Threat	Threat

Trend Key			
Improving	Worsening	Inconsistent	Stable
↑	↓	↑↓	↔

Stormwater threshold exceedances, extremum, health ratings, and water quality trends for select parameters at Outfall F14-1003.

Summary 2021-2025							
Parameter	Outfall Thresholds*	Sample #	Exceedances		Health Rating	Extremum	Trend
			#	%			
Water Temp °C	> Air +3**	21	1	5	Good	18	↔
DO mg/l	<6	21	0	0	Good	6.6	↔
pH	<5 or >9	21	0	0	Good	6.45-8	↔
SPC uS/cm	>500	21	1	5	Good	510.1	↔
Turbidity ntu	>50	20	0	0	Good	17.5	↔
E. coli cfu/100ml	>320	6	0	0	Good	33	↔
Observation							
Flow	> Expected	5	0	0	Good	Normal	NA
Color 1-3	Any unnatural color	5	3	60***	Watch	1	NA
Odor 1-3	Any odor	5	0	0	Good	0	NA
Visual 1-3	Any unnatural phenom	5	0	0	Good	0	NA
Overall Health Rating: Good							

*(Herrera Environmental Consultants & Aspect Consulting 2020)

**modified stormwater threshold, see Methods

***health rating upgraded to Watch due to presence of natural source - forestland

Outfall F14-1003 is the next outfall, from north to south, draining the 200 acres of Basin F14 which is heavily forested. Like the previous outfall, F14-1003 has an overall health rating of Good, one of only six outfalls program-wide. Colors of light yellow to amber were frequently reported, however the health rating for color was upgraded to Watch due to the presence of likely natural sources.

Anacortes Site Summary - Outfall F14-1004 (48.47790,-122.59170)



Water Quality Water Quality Health Rating Key		
Exceedance Frequency	Parameter	Observation
≤ 10%	Good	Good
10% < x < 30%	Watch	Watch
≥ 30 %	Threat	Threat

Trend Key			
Improving	Worsening	Inconsistent	Stable
↑	↓	↑↓	↔

Stormwater threshold exceedances, extremum, health ratings, and water quality trends for select parameters at Outfall F14-1004.

Summary 2021-2025							
Parameter	Outfall Thresholds*	Sample #	Exceedances		Health Rating	Extremum	Trend
			#	%			
Water Temp °C	> Air +3**	30	4	13	Watch	16.5	↑
DO mg/l	<6	30	0	0	Good	7.19	↔
pH	<5 or >9	30	2	7	Good	3.81-8.09	↑↓
SPC uS/cm	>500	30	2	7	Good	537	↑↓
Turbidity ntu	>50	30	0	0	Good	38.7	↔
E. coli cfu/100ml	>320	16	1	6	Good	466	↔
Observation							
Flow	> Expected	6	0	0	Good	Normal	NA
Color 1-3	Any unnatural color	11	4	36***	Watch	1	↔
Odor 1-3	Any odor	11	1	9	Good	1	↔
Visual 1-3	Any unnatural phenom	11	1	9	Good	1	↔
Overall Health Rating: Watch							

*(Herrera Environmental Consultants & Aspect Consulting 2020)

**modified stormwater threshold, see Methods

***health rating upgraded to Watch due to presence of natural source - forestland

Draining basin F14 and discharging into Fidalgo Bay just south of Outfall F14-1003 is Outfall F14-1004. The outfall had a similar light tan/yellow color, but had a lower pH and more temperature exceedances than the other four outfalls in this basin, resulting in a lower overall health rating of Watch. The lowest pH recorded was 3.81 for a 2025 sample. If the low flow rate

for this sample, a trickle, enhanced the influence of decaying vegetation that could explain the higher acidity.

Anacortes Site Summary - Outfall F14-1005 (48.47640,-122.58980)



Water Quality Health Rating Key		
Exceedance Frequency	Parameter	Observation
≤ 10%	Good	Good
10% < x < 30%	Watch	Watch
≥ 30 %	Threat	Threat

Trend Key			
Improving	Worsening	Inconsistent	Stable
↑	↓	↑↓	↔

Stormwater threshold exceedances, extremum, health ratings, and water quality trends for select parameters at Outfall F14-1005.

Summary 2021-2025							
Parameter	Outfall Thresholds*	Sample #	Exceedances		Health Rating	Extremum	Trend
			#	%			
Water Temp °C	> Air +3**	11	2	18	Watch	12.9	↔
DO mg/l	<6	11	0	0	Good	8.47	↔
pH	<5 or >9	11	0	0	Good	6.35-7.5	↔
SPC uS/cm	>500	11	0	0	Good	467.7	↔
Turbidity ntu	>50	11	0	0	Good	40.1	↔
E. coli cfu/100ml	>320	6	1	17	Watch	566	↔
Observation							
Flow	> Expected	6	0	0	Good	Normal	**NA**
Color 1-3	Any unnatural color	4	1	25	Watch	2	NA
Odor 1-3	Any odor	4	0	0	Good	0	**NA**
Visual 1-3	Any unnatural phenom	4	0	0	Good	0	**NA**
Overall Health Rating: Watch							

*(Herrera Environmental Consultants & Aspect Consulting 2020)

**modified stormwater threshold, see Methods

The next outfall monitored, moving south, was F14-1005 which seldom flows. Due to the low number of samples, one *E. coli* exceeding the stormwater threshold resulted in an overall water quality health rating of Watch. The outfall was visited 45 times and only had enough flow to sample 13 times.

Anacortes Site Summary - Outfall F14-1006 (48.47500,-122.58880)



Water Quality Health Rating Key		
Exceedance Frequency	Parameter	Observation
≤ 10%	Good	Good
10% < x < 30%	Watch	Watch
≥ 30 %	Threat	Threat

Trend Key			
Improving	Worsening	Inconsistent	Stable
↑	↓	↑↓	↔

Stormwater threshold exceedances, extremum, health ratings, and water quality trends for select parameters at Outfall F14-1006.

Summary 2021-2025							
Parameter	Outfall Thresholds*	Sample #	Exceedances		Health Rating	Extremum	Trend
			#	%			
Water Temp °C	> Air +3**	27	4	15	Watch	12.5	↑
DO mg/l	<6	26	0	0	Good	6.18	↔
pH	<5 or >9	27	0	0	Good	5.2-7.8	↔
SPC uS/cm	>500	27	0	0	Good	474.5	↔
Turbidity ntu	>50	29	0	0	Good	20	↔
E. coli cfu/100ml	>320	14	1	7	Good	466	↔
Observation							
Flow	> Expected	7	0	0	Good	Lower	NA
Color 1-3	Any unnatural color	12	0	0	Good	0	↔
Odor 1-3	Any odor	12	1	8	Good	1	↔
Visual 1-3	Any unnatural phenom	12	1	8	Good	2	↔
Overall Health Rating: Watch							

*(Herrera Environmental Consultants & Aspect Consulting 2020)

**modified stormwater threshold, see Methods

Outfall F14-1006, the southern most outfall sampled in the F14 basin, had an overall health rating of Watch due to high water temperatures.

Anacortes Site Summary - Outfall F15-1002 (48.472780,-122.58770)



Water Quality Health Rating Key		
Exceedance Frequency	Parameter	Observation
≤ 10%	Good	Good
10% < x < 30%	Watch	Watch
≥ 30 %	Threat	Threat

Trend Key			
Improving	Worsening	Inconsistent	Stable
↑	↓	↑↓	↔

Stormwater threshold exceedances, extremum, health ratings, and water quality trends for select parameters at Outfall F15-1002.

Summary 2021-2025							
Parameter	Outfall Thresholds*	Sample #	Exceedances		Health Rating	Extremum	Trend
			#	%			
Water Temp °C	> Air +3**	21	4	19	Watch	13.2	↑
DO mg/l	<6	20	0	0	Good	6.26	↔
pH	<5 or >9	21	0	0	Good	6.46-8.01	↔
SPC uS/cm	>500	21	0	0	Good	266.3	↔
Turbidity ntu	>50	21	0	0	Good	23.7	↔
E. coli cfu/100ml	>320	10	2	20	Watch	1,232	NA
Observation							
Flow	> Expected	2	0	0	Good	Normal	NA
Color 1-3	Any unnatural color	8	1	13	Watch	1	NA
Odor 1-3	Any odor	8	0	0	Good	0	NA
Visual 1-3	Any unnatural phenom	8	0	0	Good	0	NA
Overall Health Rating: Watch							

*(Herrera Environmental Consultants & Aspect Consulting 2020)

**modified stormwater threshold, see Methods

Outfall F15-1002 is one of nine outfalls draining ~859 acres including parts of Fidalgo Bay Road, Highway 20, forestlands and a few homes to the east. The flow rate at this outfall is highly variable and dependent on rainfall. It was visited 20 times during the study period and 12 times the outfall was dry including a day when the reported 24hr rainfall was 1.8". Two high *E. coli* samples (2024), four high temperatures (2021/22) and a report of cloudiness (2024) resulted in

an overall health rating of Watch. The one sample collected in 2025, had an *E. coli* level of 33 cfu/100ml.

Anacortes Site Summary - Outfall F15-1006 (48.46740,-122.58590)



Water Quality Health Rating Key		
Exceedance Frequency	Parameter	Observation
≤ 10%	Good	Good
10% < x < 30%	Watch	Watch
≥ 30 %	Threat	Threat

Trend Key			
Improving	Worsening	Inconsistent	Stable
↑	↓	↑↓	↔

Stormwater threshold exceedances, extremum, health ratings, and water quality trends for select parameters at Outfall F15-1006.

Summary 2021-2024							
Parameter	Outfall Thresholds*	Sample #	Exceedances		Health Rating	Extremum	Trend
			#	%			
Water Temp °C	> Air +3**	15	0	0	Good	15.6	NA
DO mg/l	<6	14	0	0	Good	8.36	NA
pH	<5 or >9	13	0	0	Good	5.8-7.32	NA
SPC uS/cm	>500	13	2	15	Watch	2,565	NA
Turbidity ntu	>50	15	0	0	Good	23.6	NA
E. coli cfu/100ml	>320	4	1	25	Watch	2,065	NA
Observation							
Flow	> Expected	NA	NA	NA	NA	NA	NA
Color 1-3	Any unnatural color	15	4	27	Watch	3	NA
Odor 1-3	Any odor	15	0	0	Good	0	NA
Visual 1-3	Any unnatural phenom	15	1	7	Good	3	NA
Overall Health Rating: Watch							

*(Herrera Environmental Consultants & Aspect Consulting 2020)

**modified stormwater threshold, see Methods

Outfall F15-1006 receives stormwater runoff from Highway 20 and Fidalgo Bay Road and discharges into South Fidalgo Bay. The overall health rating for this outfall was Watch based on *E. coli*, conductivity and observations of black/brown color. A rust color has also been reported but may be due to the outfall pipe which is rusted through. The high conductivity levels are unusual for an outfall such as F15-1006 which has no saltwater intrusion.

The Good health rating for visual observations is misleading. In 2021/22 when a concerted effort was made to sample during or immediately after rain events, Outfall F15-1006 and several other nearby outfalls that receive Highway 20 runoff, were observed to have deposits of black goo covering the salt marsh below the outfalls. Subsequent visits then found the black deposits were gone, presumably washed away by tidal action. These observations warrant further investigation because stormwater associated with roadway runoff can contain compounds of concern associated with tire wear.

More recent sampling efforts in 2023/4 did not observe the extreme conditions of black stormwater and black deposits on the salt mash. However, this is more likely due to the lack of sampling during major rain events and not because these conditions are no longer occurring.

Anacortes Site Summary - Outfall F15-1007 (48.46670,-122.58590)



Water Quality Health Rating Key		
Exceedance Frequency	Parameter	Observation
≤ 10%	Good	Good
10% < x < 30%	Watch	Watch
≥ 30 %	Threat	Threat

Trend Key			
Improving	Worsening	Inconsistent	Stable
↑	↓	↑↓	↔

Stormwater threshold exceedances, extremum, health ratings, and water quality trends for select parameters at Outfall F15-1007.

Summary 2021-2022							
Parameter	Outfall Thresholds*	Sample #	Exceedances		Health Rating	Extremum	Trend
			#	%			
Water Temp °C	> Air +3**	13	1	7	Good	15.9	NA
DO mg/l	<6	13	0	0	Good	9.03	NA
pH	<5 or >9	13	0	0	Good	6.22-7.39	NA
SPC uS/cm	>500	13	2	15	Watch	4,097	NA
Turbidity ntu	>50	13	2	15	Watch	123	NA
E. coli cfu/100ml	>320	NA	NA	NA	NA	NA	NA
Observation							
Flow	> Expected	NA	NA	NA	NA	NA	NA
Color 1-3	Any unnatural color	13	6	46	Threat	NA	NA
Odor 1-3	Any odor	13	0	0	Good	NA	NA
Visual 1-3	Any unnatural phenom	13	6	46	Threat	NA	NA
Overall Health Rating: Threat***							

*(Herrera Environmental Consultants & Aspect Consulting 2020)

**modified stormwater threshold, see Methods

***the overall health rating was based on observations

Outfall F15-1007 receives stormwater runoff from Highway 20 and Fidalgo Bay Road and discharges into South Fidalgo Bay. A combination of numerous observations of black colored stormwater and black goo deposited in the saltmarsh downstream, along with occasional high turbidity and high conductivity resulted in an overall health rating of Threat. This is one of a handful of sites in this report where the overall health rating is based on observations. These

observations warrant further investigation because stormwater associated with roadway runoff can contain compounds of concern associated with tire wear. The observations were made in 2021/22 when sampling efforts focussed on rain events. The outfall was visited 22 times in 2023-2025 and found to have no flow. These visits included times when the prior 24hr rainfall had been up to 1.14”. This suggests that the flow at Outfall F15-1007 is flashy - occurring during, or for only a short time after, a significant rain event.

Anacortes Site Summary - Outfall F15-1008 (48.46630,-122.58570)



Water Quality Health Rating Key		
Exceedance Frequency	Parameter	Observation
≤ 10%	Good	Good
10% < x < 30%	Watch	Watch
≥ 30 %	Threat	Threat

Trend Key			
Improving	Worsening	Inconsistent	Stable
↑	↓	↑↓	↔

Stormwater threshold exceedances, extremum, health ratings, and water quality trends for select parameters at Outfall F15-1008.

Summary 2024-2025							
Parameter	Outfall Thresholds*	Sample #	Exceedances		Health Rating	Extremum	Trend
			#	%			
Water Temp °C	> Air +3**	13	1	8	Good	19.9	NA
DO mg/l	<6	13	2	15	Watch	5.6	NA
pH	<5 or >9	13	0	0	Good	6.79-7.68	NA
SPC uS/cm	>500	13	13	100	Tidal	45,783	NA
Turbidity ntu	>50	12	0	0	Good	11	NA
E. coli cfu/100ml	>320	14	3	21	Watch	2815	NA
Observation							
Flow	> Expected	9	0	0	Good	Normal	NA
Color 1-3	Any unnatural color	13	2	15	Watch	1	NA
Odor 1-3	Any odor	13	0	0	Good	1	NA
Visual 1-3	Any unnatural phenom	12	1	8	Good	1	NA
Overall Health Rating: Watch							

*(Herrera Environmental Consultants & Aspect Consulting 2020)

**modified stormwater threshold, see Methods

Outfall F15-1008 is located in the south end of the F15 basin and drains the area between Highway 20 and South Fidalgo Bay Road that includes a wetland. Data collection began in 2024. Based on two years of data, Outfall F15-1008 had an overall health rating of Watch due to high *E. coli* and low dissolved oxygen in 2024. Reports of yellow or brown colors are likely due to

wetland contributions to the stormwater which can turn amber in color from decaying vegetation.

When notified in 2024 of the high *E. coli* levels, the Anacortes Stormwater Manager shared that this outfall is a pipe that connects the wetlands to the west with Fidalgo Bay. The wetland has both Aqua Creek and Howard Creek draining to it, as well as receiving stormwater from a combination of County and City land. Wildlife in the wetland is a possible source of the bacteria. She suggested there might be other monitoring locations upstream of the wetland that would better reflect stormwater quality.

We have continued to monitor this outfall, finding much lower levels of *E. coli* in 2025 - five samples ranging from 0 to 67 cfu/100ml. The D.O. was also higher in these samples - 6.94 to 10.53 mg/l.

Anacortes Site Summary - Outfall SR20-05 (48.46588,-122.58543)



Water Quality Health Rating Key		
Exceedance Frequency	Parameter	Observation
≤ 10%	Good	Good
10% < x < 30%	Watch	Watch
≥ 30 %	Threat	Threat

Trend Key			
Improving	Worsening	Inconsistent	Stable
↑	↓	↑↓	↔

Stormwater threshold exceedances, extremum, health ratings, and water quality trends for select parameters at Outfall SR20-05.

Summary 2021-2022							
Parameter	Outfall Thresholds*	Sample #	Exceedances		Health Rating	Extremum	Trend
			#	%			
Water Temp °C	> Air +3**	9	3	33	Threat	16.5	NA
DO mg/l	<6	9	0	0	Good	8.72	NA
pH	<5 or >9	9	0	0	Good	6.32-7.11	NA
SPC uS/cm	>500	9	1	11	Watch	5,141	NA
Turbidity ntu	>50	9	1	11	Watch	134	NA
E. coli cfu/100ml	>320	NA	NA	NA	NA	NA	NA
Observation							
Flow	> Expected	NA	NA	NA	NA	NA	NA
Color 1-3	Any unnatural color	11	8	73	Threat	3	NA
Odor 1-3	Any odor	11	0	0	Good	0	NA
Visual 1-3	Any unnatural phenom	11	5	45	Threat	3	NA
Overall Health Rating: Threat***							

*(Herrera Environmental Consultants & Aspect Consulting 2020)

**modified stormwater threshold, see Methods

***the overall health rating was based, in part, on observations

Outfall SR20-05 receives stormwater runoff from Highway 20, discharges into South Fidalgo Bay, and is likely a Washington Department of Transportation outfall. Based on two years of data, 2021-22, it had an overall health rating of Threat due to dark black or light grey color and black goo deposited on the salt marsh below. The stormwater temperature was above the threshold in 33% of the samples. Bubbles or foam were present occasionally. One sample had high turbidity and conductivity. These water quality problems were similar to those found in other

nearby outfalls receiving Highway 20 runoff. Monitoring was discontinued due to the difficulty of maintaining a volunteer team that was available on short notice to sample during major rain events.

Anacortes Site Summary - Outfall SR20-01 (48.46579,-122.58550)



Water Quality Health Rating Key		
Exceedance Frequency	Parameter	Observation
≤ 10%	Good	Good
10% < x < 30%	Watch	Watch
≥ 30 %	Threat	Threat

Trend Key			
Improving	Worsening	Inconsistent	Stable
↑	↓	↑↓	↔

Stormwater threshold exceedances, extremum, health ratings, and water quality trends for select parameters at Outfall SR20-01.

Summary 2021-2022							
Parameter	Outfall Thresholds*	Sample #	Exceedances		Health Rating	Extremum	Trend
			#	%			
Water Temp °C	> Air +3**	9	3	33	Threat	16.4	NA
DO mg/l	<6	9	0	0	Good	9.02	NA
pH	<5 or >9	9	0	0	Good	6.44-7.01	NA
SPC uS/cm	>500	9	0	0	Good	82	NA
Turbidity ntu	>50	9	1	11	Watch	70	NA
E. coli cfu/100ml	>320	NA	NA	NA	NA	NA	NA
Observation							
Flow	> Expected	NA	NA	NA	NA	NA	NA
Color 1-3	Any unnatural color	11	7	63.64	Threat	3	NA
Odor 1-3	Any odor	11	0	0.00	Good	0	NA
Visual 1-3	Any unnatural phenom	11	7	63.64	Threat	3	NA
Overall Health Rating: Threat***							

*(Herrera Environmental Consultants & Aspect Consulting 2020)

**modified stormwater threshold, see Methods

***the overall health rating was based, in part, on observations

Outfall SR20-01 receives stormwater runoff from Highway 20, discharges into South Fidalgo Bay, and is likely a Washington Department of Transportation outfall. Based on two years of data, 2021-22, Outfall SR20-01 had an overall health rating of Threat due to elevated temperature, frequent observations of dark black to light grey color, and black goo deposited on the salt marsh below, along with occasional high turbidity. These water quality problems were similar to those found in other nearby outfalls receiving Highway 20 runoff and warrant further

investigation because stormwater associated with roadway runoff can contain compounds of concern associated with tire wear. Monitoring was discontinued due to the difficulty of maintaining a volunteer team that was available on short notice to sample during major rain events.

Anacortes Site Summary - Outfall F15-1009 (48.46570,-122.58540)



Water Quality Health Rating Key		
Exceedance Frequency	Parameter	Observation
≤ 10%	Good	Good
10% < x < 30%	Watch	Watch
≥ 30 %	Threat	Threat

Trend Key			
Improving	Worsening	Inconsistent	Stable
↑	↓	↑↓	↔

Stormwater threshold exceedances, extremum, health ratings, and water quality trends for select parameters at Outfall F15-1009.

Summary 2021-2025							
Parameter	Outfall Thresholds*	Sample #	Exceedances		Health Rating	Extremum	Trend
			#	%			
Water Temp °C	> Air +3**	11	1	9	Good	20.7	NA
DO mg/l	<6	11	6	55	Threat	3.9	NA
pH	<5 or >9	11	0	0	Good	6.94-8.55	NA
SPC uS/cm	>500	11	10	91	Tidal	46,467	NA
Turbidity ntu	>50	10	0	0	Good	11.25	NA
E. coli cfu/100ml	>320	10	0	0	Good	67	NA
Observation							
Flow	> Expected	9	0	0	Good	Normal	NA
Color 1-3	Any unnatural color	11	2	18	Watch	1	NA
Odor 1-3	Any odor	11	0	0	Good	0	NA
Visual 1-3	Any unnatural phenom	11	1	9	Good	1	NA
Overall Health Rating: Threat							

*(Herrera Environmental Consultants & Aspect Consulting 2020)

**modified stormwater threshold, see Methods

Outfall F15-1009 drains the area between Highway 20 and South Fidalgo Bay Road that includes a wetland. Based on two years of data, 2024/25, Outfall F15-1009 has an overall health rating of Threat due to low dissolved oxygen. This is one of the few stormwater outfalls that we monitor which consistently has poor water quality due to low dissolved oxygen. Reports of yellow or

straw colors are likely due to wetland contributions to the stormwater which can be amber in color due to decaying vegetation.

Anacortes Site Summary - Outfall F15-1010 (48.46520,-122.58480)



Water Quality Health Rating Key		
Exceedance Frequency	Parameter	Observation
≤ 10%	Good	Good
10% < x < 30%	Watch	Watch
≥ 30 %	Threat	Threat

Trend Key			
Improving	Worsening	Inconsistent	Stable
↑	↓	↑↓	↔

Stormwater threshold exceedances, extremum, health ratings, and water quality trends for select parameters at Outfall F15-1010.

Summary 2021-2022							
Parameter	Outfall Thresholds*	Sample #	Exceedances		Health Rating	Extremum	Trend
			#	%			
Water Temp °C	> Air +3**	13	2	15	Watch	16.2	NA
DO mg/l	<6	13	0	0	Good	8.77	NA
pH	<5 or >9	13	0	0	Good	5.71-7.55	NA
SPC uS/cm	>500	13	2	15	Watch	4,951	NA
Turbidity ntu	>50	13	2	15	Watch	109	NA
E. coli cfu/100ml	>320	NA	NA	NA	NA	NA	NA
Observation							
Flow	> Expected	NA	NA	NA	NA	NA	NA
Color 1-3	Any unnatural color	13	7	54	Threat	3	NA
Odor 1-3	Any odor	13	0	0	Good	0	NA
Visual 1-3	Any unnatural phenom	13	0	0	Good	0	NA
Overall Health Rating: Threat							

*(Herrera Environmental Consultants & Aspect Consulting 2020)

**modified stormwater threshold, see Methods

***overall health rating was based on observations

Outfall F15-1010 receives stormwater runoff from US Highway 20, discharges into South Fidalgo Bay, and is likely a Washington Department of Transportation outfall. Based on two years of data, 2021-22, Outfall F15-1010 had an overall health rating of Threat due to black to light grey color and occasional high turbidity and conductivity. This is one of a few sites in this report where the overall health rating was based on observations. These water quality problems were similar to those found in other nearby outfalls receiving Highway 20 runoff and warrant further

investigation because stormwater associated with roadway runoff can contain compounds of concern associated with tire wear. Monitoring was discontinued due to the difficulty of sampling during major rain events which required volunteer teams to be available on short notice.

Anacortes Site Summary - Outfall SR20-02 (48.46470,-122.58397)



Water Quality Health Rating Key		
Exceedance Frequency	Parameter	Observation
≤ 10%	Good	Good
10% < x < 30%	Watch	Watch
≥ 30 %	Threat	Threat

Trend Key			
Improving	Worsening	Inconsistent	Stable
↑	↓	↑↓	↔

Stormwater threshold exceedances, extremum, health ratings, and water quality trends for select parameters at Outfall SR20-02.

Summary 2021-2022							
Parameter	Outfall Thresholds*	Sample #	Exceedances		Health Rating	Extremum	Trend
			#	%			
Water Temp °C	> Air +3**	12	2	16	Watch	16.4	NA
DO mg/l	<6	12	0	0	Good	8.82	NA
pH	<5 or >9	12	0	0	Good	5.74-7.71	NA
SPC uS/cm	>500	12	1	8	Good	5,119	NA
Turbidity ntu	>50	12	1	8	Good	126	NA
E. coli cfu/100ml	>320	NA	NA	NA	NA	NA	NA
Observation							
Flow	> Expected	NA	NA	NA	NA	NA	NA
Color 1-3	Any unnatural color	12	10	83	Threat	3	NA
Odor 1-3	Any odor	12	0	0	Good	0	NA
Visual 1-3	Any unnatural phenom	12	1	8	Good	3	NA
Overall Health Rating: Threat							

*(Herrera Environmental Consultants & Aspect Consulting 2020)

**modified stormwater threshold, see Methods

***overall health rating was based, in part, on observations

Outfall SR20-02 receives stormwater runoff from Highway 20, discharges into South Fidalgo Bay, and is likely a Washington Department of Transportation outfall. Based on two years of data, 2021-22, Outfall SR20-02 had an overall health rating of Threat due to observations of dark black to light grey color, froth/bubbles, occasional high turbidity and conductivity. This is one of a few sites where the overall health rating is based on observational parameters. These water quality problems were similar to those found in other nearby outfalls receiving Highway 20

runoff and warrant further investigation because stormwater associated with roadway runoff can contain compounds of concern associated with tire wear. Monitoring was discontinued due to the logistical difficulty of sampling during major rain events.

Anacortes - Southeast Fidalgo Bay, Padilla Bay and Similk Bay Outfalls

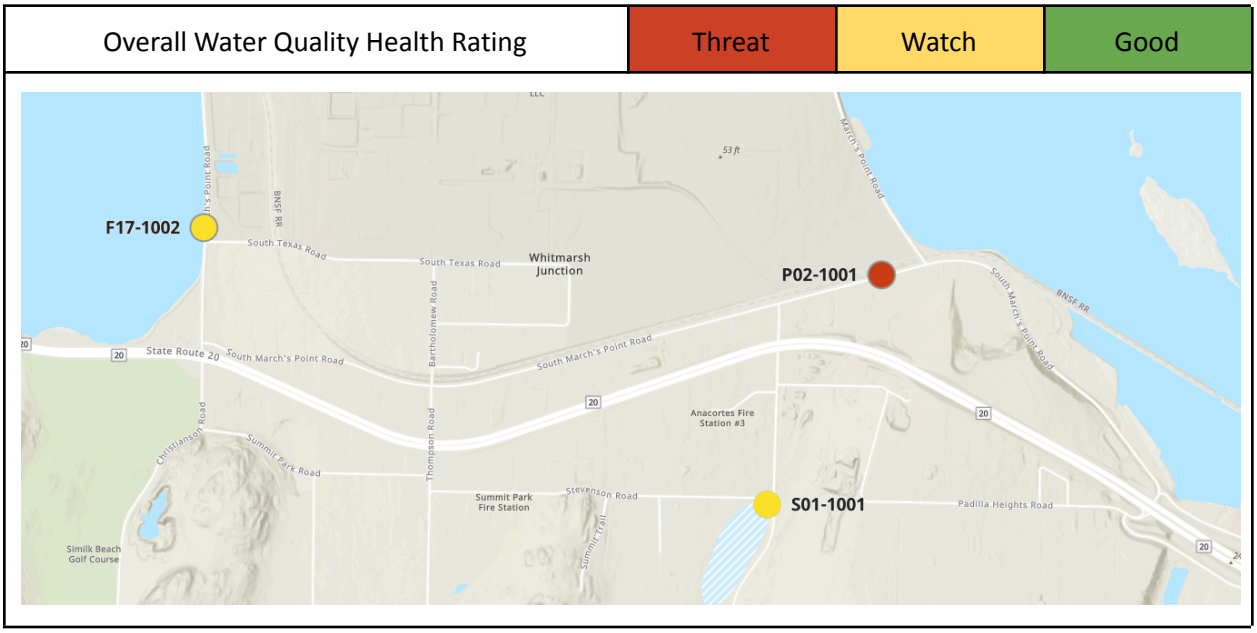


Figure 11. Anacortes, Southeast Fidalgo Bay, Padilla Bay and Similk Bay - Salish Sea Stormwater Monitoring Program sites with overall water quality health ratings.

Anacortes Site Summary - Outfall F17-1002 (48.46690,-122.57089)





Heath Rating Key		
Exceedance Frequency	Parameter	Observation
≤ 10%	Good	Good
10% < x < 30%	Watch	Watch
≥ 30 %	Threat	Threat

Trend Key			
Improving	Worsening	Inconsistent	Stable
↑	↓	↑↓	↔

Stormwater threshold exceedances, extremum, health ratings, and water quality trends for select parameters at Outfall F17-1002.

Summary 2021-2025							
Parameter	Outfall Thresholds*	Sample #	Exceedances		Health Rating	Extremum	Trend
			#	%			
Water Temp °C	> Air +3**	54	14	26	Watch	20.8	↑↓
DO mg/l	<6	53	0	0	Good	8.37	↔
pH	<5 or >9	54	3	6	Good	5.33-9.31	↑↓
SPC uS/cm	>500	54	1	2	Good	700	↔
Turbidity ntu	>50	51	7	14	Watch	141	↑↓
E. coli cfu/100ml	>320	17	3	18	Watch	566	↔
Observation							
Flow	> Expected	8	1	13	Watch	Higher	NA
Color 1-3	Any unnatural color	11	9	82	Threat	2	NA
Odor 1-3	Any odor	12	0	0	Good	0	NA
Visual 1-3	Any unnatural phenom	12	3	25	Watch	2	NA
Overall Health Rating: Watch							

*(Herrera Environmental Consultants & Aspect Consulting 2020)

**modified stormwater threshold, see Methods

Outfall F17-1002 is one of two outfalls sampled that are located on March Point. The drainage area consists of industrial oil refinery property. Stormwater travels down a roadside ditch adjacent to South Fidalgo Bay Road before entering a catch basin and discharging to Fidalgo Bay. While the outfall is in the city limits of Anacortes outfall, it drains almost entirely *county* land. The stormwater is either sampled as it enters the catch basin or after it passes under the road and discharges from a culvert. Depending on tide levels, the outfall can be submerged.

The overall health rating of Watch is based on a wide range of water quality problems including unusually high flows, high water temperatures, high turbidity, elevated *E. coli* levels, and numerous observations of brown/muddy/grey color, foam, bubbles and oil sheens. This is not surprising given the industrial nature of the drainage area. The observed conditions indicate that this drainage area may benefit from additional source control, flow control, or treatment best management practices, subject to evaluation of ownership and responsible jurisdiction.

Anacortes Site Summary - Outfall P02-1001 (48.46530, -122.53890)



Water Quality Health Rating Key		
Exceedance Frequency	Parameter	Observation
≤ 10%	Good	Good
10% < x < 30%	Watch	Watch
≥ 30 %	Threat	Threat

Trend Key			
Improving	Worsening	Inconsistent	Stable
↑	↓	↑↓	↔

Stormwater threshold exceedances, extremum, health ratings, and water quality trends for select parameters at Outfall P02-1001.

Summary 2021-2025							
Parameter	Outfall Thresholds*	Sample #	Exceedances		Health Rating	Extremum	Trend
			#	%			
Water Temp °C	> Air +3**	38	1	3	Good	18	↔
DO mg/l	<6	38	4	11	Watch	3.12	↑↓
pH	<5 or >9	38	0	0	Good	6.16-7.37	↔
SPC uS/cm	>500	38	23	61	Threat	2,567	↔
Turbidity ntu	>50	37	0	0	Good	30.4	↔
E. coli cfu/100ml	>320	15	2	13	Watch	4,928	NA
Observation							
Flow	> Expected	6	1	17	Watch	Higher	NA
Color 1-3	Any unnatural color	10	6	60	Threat	2	NA
Odor 1-3	Any odor	10	2	20	Watch	2	NA
Visual 1-3	Any unnatural phenom	10	2	20	Watch	1	NA
Overall Health Rating: Threat							

*(Herrera Environmental Consultants & Aspect Consulting 2020)

**modified stormwater threshold, see Methods

Outfall P02-1001 has a drainage area of 24 acres along South March Point Road, all of which is business and light industrial. The overall health rating for Outfall P02-1001 was Threat based on high conductivity and the presence of yellow color, metallic odor and surface oil sheen. There was also an extremely low dissolved oxygen recorded, 3.15 mg/l (June 2025), and two instances of *E. coli* exceedances, also in 2025.

The likely source of the conductivity, observed color and the surface oil sheen was the presence of a seasonal dense iron bacteria growth in an upstream ditch that has been present since monitoring began in 2021. The history of the stormwater quality at this outfall is complex and has involved two separate clean-up actions that have addressed many issues, yet the iron bacterial growth remains.

Early survey work in 2021/22 at Outfall P02-1001 resulted in the filing of an ERTS report to Ecology citing the presence of foul fuel odors, surface oil sheens and the presence of orange iron bacteria slime growths in the ditch just upstream of the outfall. As a result of the ERTS, Ecology inspected an adjacent oil recycling collection facility. Venoil was ordered to correct several problems which may have resulted in oil contaminated stormwater entering the ditch along their property that flows to outfall P02-1001. Since the remedial work was completed by Venoil, the strong fuel odors have not been present but the stormwater discharging from P02-1001 still reflects the presence of the dense iron bacteria growth in the upstream ditch.

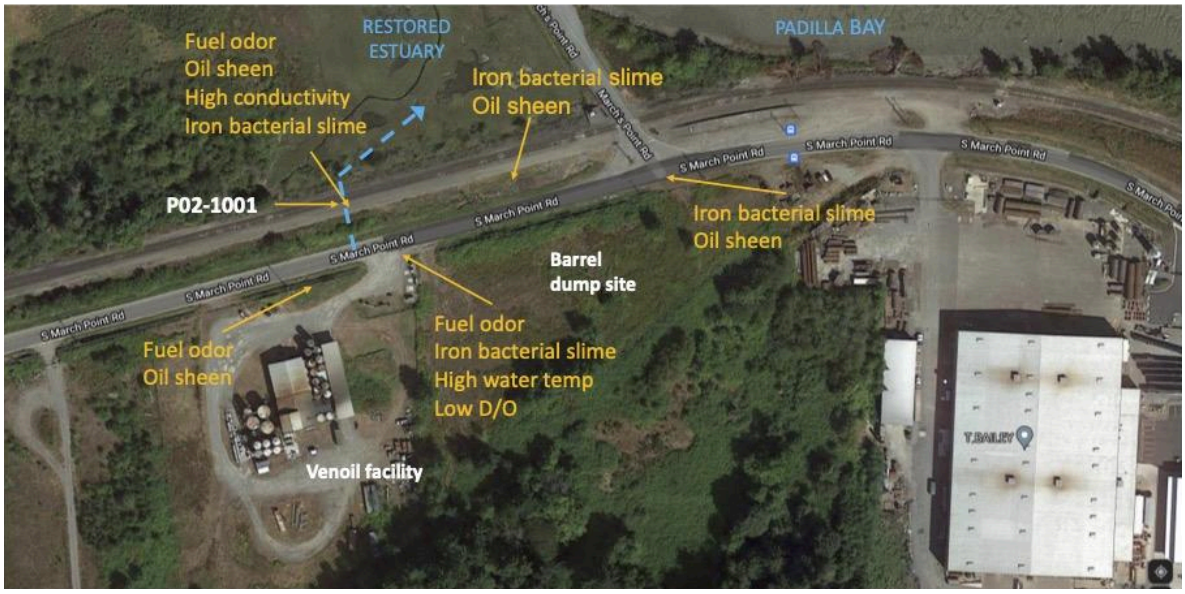


Figure 12. Select stormwater threshold exceedances in the vicinity of Anacortes stormwater Outfall P02-1001 from 2022-2025.

Further investigation by volunteers found that the iron bacteria growth was isolated to an area east of Venoil. The iron bacteria was only found in the ditch adjacent to a small undeveloped property. Obscured by blackberry brambles from the road, the property was found to contain 15 five gallon-size buckets and one 55 gallon drum containing unknown oil/petroleum products. All

of the containers were worn, broken or leaking. This discovery resulted in a second ERTS report to Ecology. As a result, the property owner was notified and the buckets and drum were removed.

What still remains is the dense growth of orange iron bacteria slime in the ditch. A quarterly photo monitoring project was initiated in February 2025. The bulk of the bacterial growth is isolated to the short ditch alongside the undeveloped property (Figure 13). However, the presence of orange deposits just below Outfall P02-1001 and in the wetland it feeds show it is not restricted to the ditch.



Figure 13. Dense iron bacteria slime growths in roadside ditch upstream of Anacortes Outfall P02-1001 on February 14, 2025.

The presence of the iron bacteria itself is not a problem. Rather the concern is what is feeding the continued growth of iron bacteria. One possible source is groundwater carrying iron from a naturally occurring iron deposit. The recent and longer term history of the land use in this area suggest it would be worth investigating other potential sources including the possibility of contaminated soils from the dumped containers, impacts from current and historical metals fabrication activities in the area and the presence of a storage lot for old metal parts and equipment located across HWY 20 that may drain to the area.

Anacortes Site Summary - Outfall S01-1001 (48.45810, -122.54430)



Water Quality Health Rating Key		
Exceedance Frequency	Parameter	Observation
≤ 10%	Good	Good
10% < x < 30%	Watch	Watch
≥ 30 %	Threat	Threat

Trend Key			
Improving	Worsening	Inconsistent	Stable
↑	↓	↑↓	↔

Stormwater threshold exceedances, extremum, health ratings, and water quality trends for select parameters at Outfall S01-1001.

Summary 2021-2025							
Parameter	Outfall Thresholds*	Sample #	Exceedances		Health Rating	Extremum	Trend
			#	%			
Water Temp °C	> Air +3**	53	4	8	Good	17.3	↔
DO mg/l	<6	53	1	2	Good	5.07	↔
pH	<5 or >9	53	0	0	Good	5.6-7.97	↔
SPC uS/cm	>500	53	4	8	Good	44,214	↑↓
Turbidity ntu	>50	52	1	2	Good	103	↔
E. coli cfu/100ml	>320	27	5	19	Watch	3,263	↓
Observation							
Flow	> Expected	15	3	20	Watch	Higher	NA
Color 1-3	Any unnatural color	18	5	28	Watch	2	NA
Odor 1-3	Any odor	17	1	6	Good	1	NA
Visual 1-3	Any unnatural phenom	17	4	24	Watch	1	NA
Overall Health Rating: Watch							

*(Herrera Environmental Consultants & Aspect Consulting 2020)

**modified stormwater threshold, see Methods

Outfall S01-1001 drains ~60 acres including country residential, light industrial, farmland and forest between Highway 20 and Stevenson Road. It discharges to an estuary at Reservation Road. The overall health rating was Watch due to *E. coli* levels with a high of 3,263 cfu/100ml. Observations have included green or yellow color, cloudy, soapy, bubbles, and foam. The City has received complaints regarding inhabited residential vehicles in the vicinity, including

concerns regarding potential wastewater disposal practices. The City is coordinating follow-up with the Skagit County Health Department.

Oak Harbor

Oak Harbor was added in 2023 as the third city in the Stormwater Monitoring Program. Located centrally on Whidbey Island, the six outfalls monitored all discharge to a bay named after the City - Oak Harbor Bay (Figure 14). The shoreline in this area is a diverse array of natural marshland, private homes/condos, a heavily used city park beach and a marina. Outfall FID2971 rated an overall water quality health rating of Threat with the other five rated as Watch.

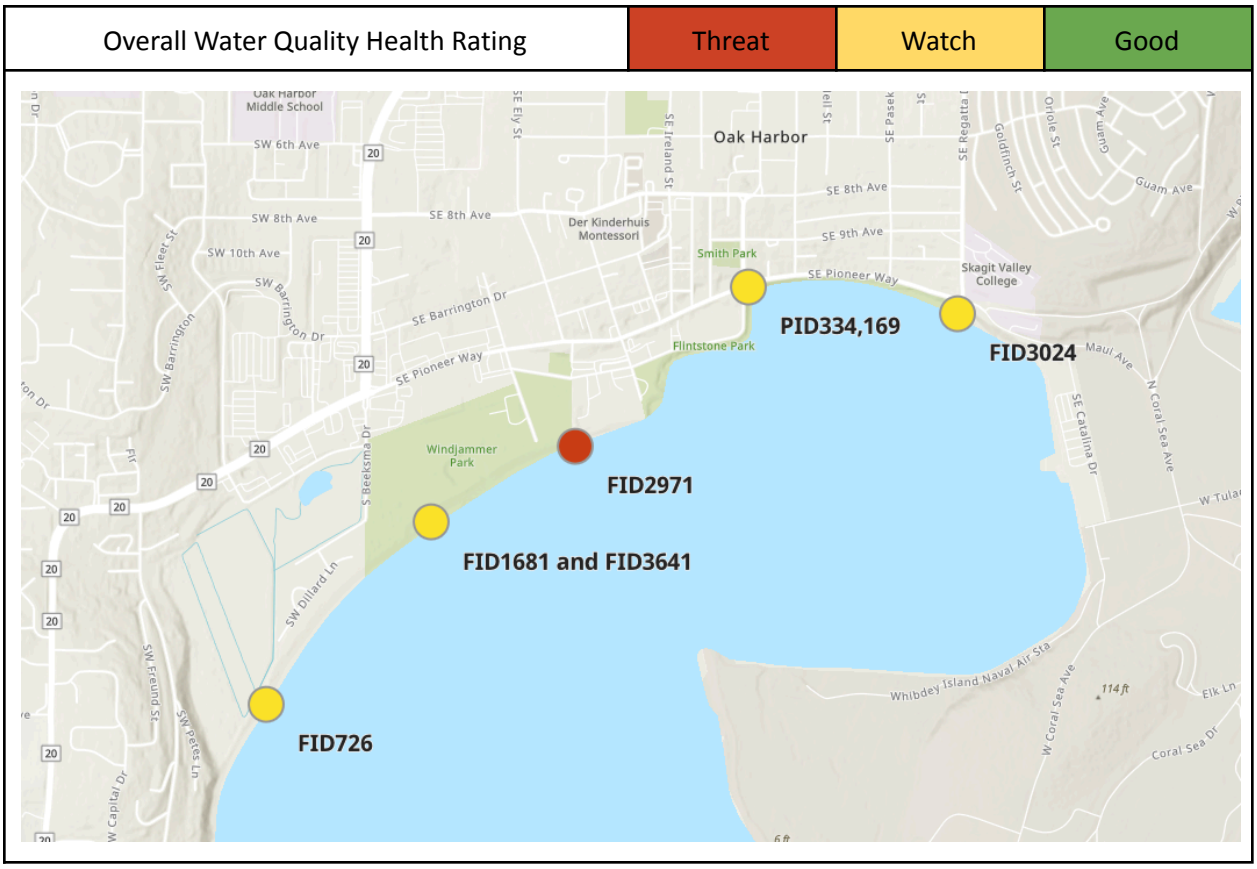


Figure 14. Oak Harbor - Salish Sea Stormwater Monitoring Program sites with overall water quality health ratings.

The primary concern for all the outfalls was elevated *E. coli* levels (Table 7). Outfalls FID726, FID3641, and FID1681 receive input from wetlands in their drainage basins, possible natural sources of bacteria from wildlife. The City plans to conduct eDNA analysis to identify if the bacteria is coming from human or animal sources and will sample two of the outfalls in the near future, FID726 (Freund Marsh) and one other, to be determined. Data published by Ecology's Beach Environmental Assessment, Communication & Health (BEACH) program was consistent with our findings. While the Oak Harbor beach remains open, "A permanent swimming advisory

is posted at this beach because of consistent moderately high bacteria levels" (Washington State Department of Ecology, n.d.).

Additional parameters of concern were low pH at Outfall FID726 and low dissolved oxygen at Outfall FID2971. Temperature exceeded the threshold in >10% of the samples for all the outfalls.

A detailed data summary for each outfall monitored follows.

Oak Harbor Site Summary - Outfall FID726 (48.27930, -122.66153)



Water Quality Health Rating Key		
Exceedance Frequency	Parameter	Observation
≤ 10%	Good	Good
10% < x < 30%	Watch	Watch
≥ 30 %	Threat	Threat

Trend Key			
Improving	Worsening	Inconsistent	Stable
↑	↓	↑↓	↔

Stormwater threshold exceedances, extremum, health ratings, and water quality trends for select parameters at Outfall FID726.

Summary 2022-2025							
Parameter	Outfall Thresholds*	Sample #	Exceedances		Health Rating	Extremum	Trend
			#	%			
Water Temp °C	> Air +3**	37	8	22	Watch	20.9	↑↓
DO mg/l	<6	38	5	13	Watch	3.71	↑↓
pH	<5 or >9	38	0	0	Good	6.93-7.76	↔
SPC uS/cm	>500	37	33	89	Tidal	14,802	NA
Turbidity ntu	>50	34	1	3	Good	506	↔
E. coli cfu/100ml	>320	32	8	25	Watch	15,184	↑↓
Observation							
Flow	> Expected	28	2	7	Good	Higher	↔
Color 1-3	Any unnatural color	38	34	89***	Watch	3	↔
Odor 1-3	Any odor	30	3	10	Good	3	↑↓
Visual 1-3	Any unnatural phenom	33	15	45***	Watch	2	↑↓
Overall Health Rating: Watch							

*(Herrera Environmental Consultants & Aspect Consulting 2020)

**modified stormwater threshold, see Methods

***health rating upgraded to Watch due to presence of natural source - wetland

Outfall FID726, commonly referred to as Freund Marsh, is located along Oak Harbor's southwestern shoreline, near Windjammer Park and has been monitored since 2022. It drains a large area of dense business development, including some of Highway 20. All of the stormwater that discharges from FID726 is filtered through Freund Marsh or runs down a drainage ditch on the eastern edge of the marsh.

This outfall had an overall health rating of Watch based on high *E. coli* and low dissolved oxygen. The *E. coli* samples exceeded the stormwater threshold in 25% of samples, with a maximum of 15,184 cfu/100ml in July 2024. The drainage area includes a popular dog walking area, which along with the wetland, may be a contributor to the elevated bacteria levels. The City is planning to conduct eDNA analysis on the stormwater from this outfall to identify if it originates from human or animal sources.

Color anomalies of yellow, amber or brown were recorded in 89% of observations and visual anomalies of foam/bubbles in 45%. However, they have been given Watch health ratings since the natural marsh could be the source of these observations.

Oak Harbor Site Summary - Outfall FID3641 (48.28380, -122.65546)



Water Quality Health Rating Key		
Exceedance Frequency	Parameter	Observation
≤ 10%	Good	Good
10% < x < 30%	Watch	Watch
≥ 30 %	Threat	Threat

Trend Key			
Improving	Worsening	Inconsistent	Stable
↑	↓	↑↓	↔

Stormwater threshold exceedances, extremum, health ratings, and water quality trends for select parameters at Outfall FID3641.

Summary 2022-2025							
Parameter	Outfall Thresholds*	Sample #	Exceedances		Health Rating	Extremum	Trend
			#	%			
Water Temp °C	> Air +3**	36	8	22	Watch	18.8	↑↓
DO mg/l	<6	36	0	0	Good	6.94	↔
pH	<5 or >9	36	0	0	Good	6.82-7.93	↔
SPC uS/cm	>500	35	30	86	Tidal	24,396	NA
Turbidity ntu	>50	31	1	3	Good	53	↔
E. coli cfu/100ml	>320	29	8	28	Watch	3,696	↓
Observation							
Flow	> Expected	15	1	7	Good	Higher	↔
Color 1-3	Any unnatural color	36	25	69***	Watch	3	↓
Odor 1-3	Any odor	37	14	38***	Watch	3	↑↓
Visual 1-3	Any unnatural phenom	31	7	23	Watch	3	↑↓
Overall Health Rating: Watch							

*(Herrera Environmental Consultants & Aspect Consulting, 2020)
**modified stormwater threshold, see Methods
***health rating upgraded to Watch due to presence of natural source - wetland

Outfall FID3641, one of the “twin pipes”, lies on Oak Harbor's western shoreline, between Outfall FID726 to the south and the downtown core to the northeast. It has also been monitored since 2022 and had an overall health rating of Watch based on bacteria. *E. coli* exceeded the threshold in 28% of samples with a maximum of 3,696 cfu/100ml in December 2025. The number of times that *E. coli* levels exceeded the stormwater threshold has increased over the period of study. In 2023 the exceedance rate was 0%, in 2024 it was 27% and in 2025 it

was 45%, indicating a trend of worsening water quality. No known sources of the bacteria levels have been identified yet. The City is considering this site for eDNA analysis to identify if the source is human or animal.

Colors were recorded for 69% of samples (yellow, amber, tea, brown and red brown) and odors were flagged in 38% of samples (rotten, sulfur, industrial, and decomposition). Occasional observations of foam and murky/cloudy samples were recorded. While the percentage of exceedances for color and odors falls into the Threat health rank, some observations can be attributed to the presence of natural wetlands in the drainage basin. For this reason, the overall health rating was upgraded to Watch for these two categories.

Oak Harbor Site Summary - Outfall FID1681 (48.28380, -122.65546)



Water Quality Health Rating Key		
Exceedance Frequency	Parameter	Observation
≤ 10%	Good	Good
10% < x < 30%	Watch	Watch
≥ 30 %	Threat	Threat

Trend Key			
Improving	Worsening	Inconsistent	Stable
↑	↓	↑↓	↔

Stormwater threshold exceedances, extremum, health ratings, and water quality trends for select parameters at Outfall FID1681.

Summary 2022-2025							
Parameter	Outfall Thresholds*	Sample #	Exceedances		Health Rating	Extremum	Trend
			#	%			
Water Temp °C	> Air +3**	36	10	28	Watch	21.6	↑↓
DO mg/l	<6	37	2	5	Good	4.2	↔
pH	<5 or >9	37	0	0	Good	6.7-7.8	↔
SPC uS/cm	>500	36	33	92	Tidal	29,762	NA
Turbidity ntu	>50	31	0	0	Good	43.8	↔
E. coli cfu/100ml	>320	30	6	20	Watch	2,231	↓
Observation							
Flow	> Expected	14	0	0	Good	Normal	NA
Color 1-3	Any unnatural color	37	28	76***	Watch	3	↔
Odor 1-3	Any odor	35	9	26	Watch	3	↑↓
Visual 1-3	Any unnatural phenom	32	8	25	Watch	3	↑↓
Overall Health Rating: Watch							

*(Herrera Environmental Consultants & Aspect Consulting, 2020)

**modified stormwater threshold, see Methods

***health rating upgraded to Watch due to presence of natural source - wetland

Outfall FID1681, the other twin pipe, is located adjacent to Outfall FID3641. This outfall had an overall health rating of Watch due to *E. coli* exceedances in 20% of samples with a maximum of 2,231 cfu/100ml in October 2025. In 2023 there were no exceedances (seven samples) and a maximum of 140 cfu/100ml. Having exceedances in both 2024 and 2025 suggest a recurring source and possibly declining water quality. So far, no known sources have been identified by the City. The City is considering this site for eDNA analysis to identify if the source is human or animal.

Unusual color was reported in 76% of samples including yellow, tea, dark brown, and amber which would place it in the Threat category. However, due to the presence of natural wetlands in the drainage basin, this was upgraded to Watch. Field notes describe the discharge as exhibiting frequent sulfur odor; occasional oil sheen, foam/bubbles, or murkiness. On a visit in June 2023, the stormwater had an "industrial, almost poopy smell." While some of the odors and observations are likely due to the influence of wetlands, others suggest a different pollution source may be present.

Oak Harbor Site Summary - Outfall FID2971 (48.28566, -122.65013)



Water Quality Health Rating Key		
Exceedance Frequency	Parameter	Observation
≤ 10%	Good	Good
10% < x < 30%	Watch	Watch
≥ 30 %	Threat	Threat

Trend Key			
Improving	Worsening	Inconsistent	Stable
↑	↓	↑↓	↔

Stormwater threshold exceedances, extremum, health ratings, and water quality trends for select parameters at Outfall FID2971.

Summary 2022-2025							
Parameter	Outfall Thresholds*	Sample #	Exceedances		Health Rating	Extremum	Trend
			#	%			
Water Temp °C	> Air +3**	31	5	16	Watch	19.1	↑
DO mg/l	<6	32	9	28	Watch	2.96	↑
pH	<5 or >9	32	0	0	Good	6.54-7.88	↔
SPC uS/cm	>500	32	29	91	Tidal	33,290	NA
Turbidity ntu	>50	26	0	0	Good	40.3	↔
E. coli cfu/100ml	>320	23	9	39	Threat	47,319	↓
Observation							
Flow	> Expected	18	0	0	Good	Normal	↔
Color 1-3	Any unnatural color	26	10	38	Threat	2	↑↓
Odor 1-3	Any odor	24	7	29	Watch	2	↔
Visual 1-3	Any unnatural phenom	23	1	4	Good	1	↔
Overall Health Rating: Threat							

*(Herrera Environmental Consultants & Aspect Consulting, 2020)

**modified stormwater threshold, see Methods

Outfall FID2971 is located along Oak Harbor's west/central shoreline between outfall FID3641 and the downtown core and is commonly referred to as the Ball Fields. *E. coli* concentrations along with dissolved oxygen levels, and color and odor observations, resulted in an overall health rating of Threat for this outfall. The stormwater threshold of 320 cfu/100ml was exceeded in 39% of samples with an extreme of 47,319 cfu/100ml in August 2025, the highest of the Oak Harbor outfalls sampled. The combination of chronic and sometimes extreme *E. coli* concentrations, and the worsening trend make this a high priority outfall for follow-up source

investigation. So far, no known sources have been identified by the City. The City is considering this site for eDNA analysis to identify if the source is human or animal.

Overall, dissolved oxygen was below the stormwater threshold in 28% of the samples, with a minimum of 2.96 mg/l in July 2023. However, the rate of exceedances has decreased over time from 50% in 2022 to 9% in 2025 indicating an improvement in water quality.

Unusual color was observed in 38% of samples. Field notes record sulfur odors on multiple occasions and a slight yellow color.

Oak Harbor Site Summary - Outfall PID334,169 (48.28957, -122.64372)



Water Quality Health Rating Key		
Exceedance Frequency	Parameter	Observation
≤ 10%	Good	Good
10% < x < 30%	Watch	Watch
≥ 30 %	Threat	Threat

Trend Key			
Improving	Worsening	Inconsistent	Stable
↑	↓	↑↓	↔

Stormwater threshold exceedances, extremum, health ratings, and water quality trends for select parameters at Outfall PID334,169.

Summary 2022-2025							
Parameter	Outfall Thresholds*	Sample #	Exceedances		Health Rating	Extremum	Trend
			#	%			
Water Temp °C	> Air +3**	13	3	23	Watch	19	↑↓
DO mg/l	<6	13	0	0	Good	8.99	↔
pH	<5 or >9	13	0	0	Good	6.54-7.85	↔
SPC uS/cm	>500	12	0	0	Good	342.8	↔
Turbidity ntu	>50	10	0	0	Good	42	↔
E. coli cfu/100ml	>320	17	5	29	Watch	21,678	↓
Observation							
Flow	> Expected	7	0	0	Good	NA	NA
Color 1-3	Any unnatural color	14	1	7	Good	1	NA
Odor 1-3	Any odor	13	0	0	Good	0	NA
Visual 1-3	Any unnatural phenom	14	3	21	Watch	1	NA
Overall Health Rating: Watch							

*(Herrera Environmental Consultants & Aspect Consulting, 2020)

**modified stormwater threshold, see Methods

Outfall PID334,169 has been monitored since 2022. Known as the Midway/Pioneer outfall, it drains what is essentially the heart of Oak Harbor's urban commercial core. The contributing area along Pioneer Way and Highway 20 falls within what the City designates as its High Intensity Commercial zone.

The overall health rating for PID334,169 was Watch with *E. coli* the primary concern. Of 17 samples collected, five exceeded the stormwater threshold, representing a 29% exceedance

rate which almost put it into the Threat category. The maximum recorded was 21,678 cfu/100ml in February 2025. It should be noted that the flow when this sample was collected was very low, falling into the trickle category (fills a 16 oz. cup in two minutes). Alone, the results from a trickle sampled may not be reflective of general stormwater quality, but combined with the other regularly recorded *E. coli* exceedances, it does suggest the need for investigations into source identification. So far, no known sources have been identified by the City. The City is considering this site for eDNA analysis to identify if the source is human or animal.

Oak Harbor Site Summary - Outfall FID3024 (48.28891, -122.63602)



Water Quality Health Rating Key		
Exceedance Frequency	Parameter	Observation
≤ 10%	Good	Good
10% < x < 30%	Watch	Watch
≥ 30 %	Threat	Threat

Trend Key			
Improving	Worsening	Inconsistent	Stable
↑	↓	↑↓	↔

Stormwater threshold exceedances, extremum, health ratings, and water quality trends for select parameters at Outfall FID3024.

Summary 2022-2025							
Parameter	Outfall Thresholds*	Sample #	Exceedances		Health Rating	Extremum	Trend
			#	%			
Water Temp °C	> Air +3**	23	3	13	Watch	16	↑↓
DO mg/l	<6	23	0	0	Good	8.54	↔
pH	<5 or >9	24	0	0	Good	6.29-8.15	↔
SPC uS/cm	>500	23	0	0	Good	244.5	↔
Turbidity ntu	>50	19	0	0	Good	47.4	↔
E. coli cfu/100ml	>320	21	4	19	Watch	3,863	↑↓
Observation							
Flow	> Expected	6	0	0	Good	Normal	NA
Color 1-3	Any unnatural color	19	3	16	Watch	1	↔
Odor 1-3	Any odor	17	0	0	Good	0	↔
Visual 1-3	Any unnatural phenom	16	0	0	Good	0	↔
Overall Health Rating: Watch							

*(Herrera Environmental Consultants & Aspect Consulting, 2020)

**modified stormwater threshold, see Methods

Outfall FID3024 sits along Oak Harbor's eastern shoreline near the marina. This outfall, monitored since 2022, had an overall health rating of Watch. *E. coli* is the primary concern, exceeding the stormwater threshold in 19% of samples, with a maximum of 3,863 cfu/100ml in June 2025. Exceedances were distributed across 2023, 2024, and 2025, suggesting a recurring source. The other parameters and the observations indicate that the stormwater quality was good except for the periodic elevated bacteria.

Everett

Everett, the largest city in the Salish Sea Stormwater Monitoring Program, has a population of ~113,000. Located between Port Gardner Bay and the Snohomish River delta, it has extensive freshwater and saltwater shoreline. The City's ~48 square miles are divided into 23 drainage basins across three watersheds. Runoff from homes, roads, and parking lots makes its way to Lake Washington, the Snohomish River, and Port Gardner Bay. The waterfront is heavily industrial, home to Naval Station Everett, the Boeing factory, and the Port of Everett. Portions of older Everett neighborhoods are served by combined sewers that carry both wastewater and stormwater in the same pipes and are permitted to discharge untreated overflow during rain events to prevent sewage from backing up into homes and businesses.

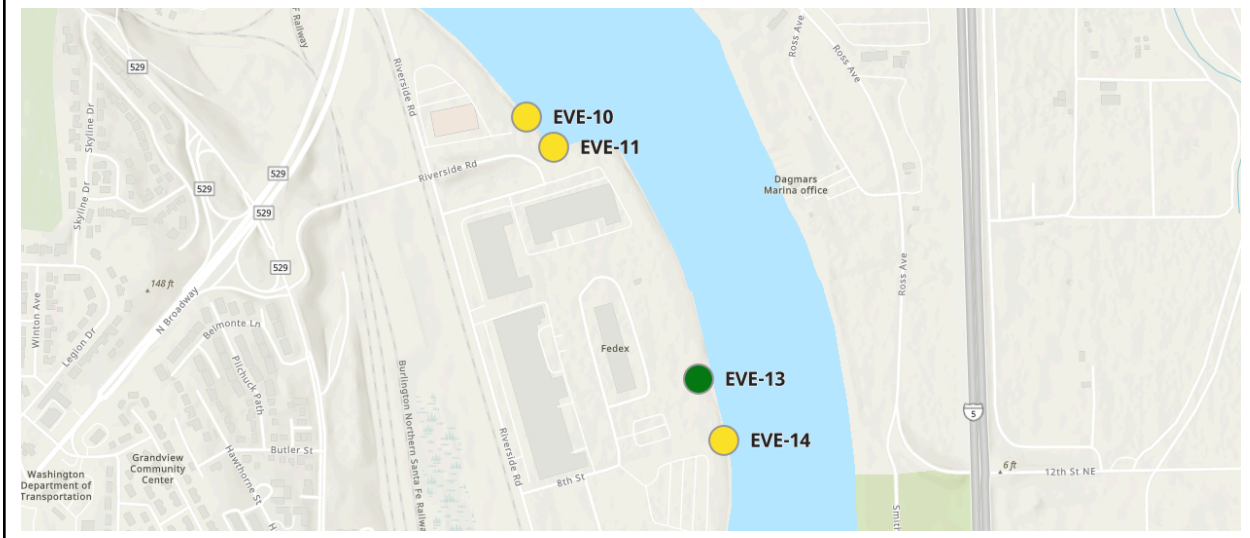
Added to the program in 2023, Everett monitoring sites include four stormwater outfalls discharging to the Snohomish River and four freshwater creeks that flow into Possession Sound (Figure 15). All of the creeks have been designated as salmonid rearing, spawning and migrating habitat. Due to low water quality, the Snohomish River, its tributaries and estuary have been listed in the State's 303(d) list of polluted waters (Listing ID 61019; Washington State Department of Ecology, n.d.) and Ecology has applied a special regulatory tool, a total maximum daily load (TMDL) to address the multiple sources of the low dissolved oxygen and elevated bacteria levels (Butkus et al., 1999).

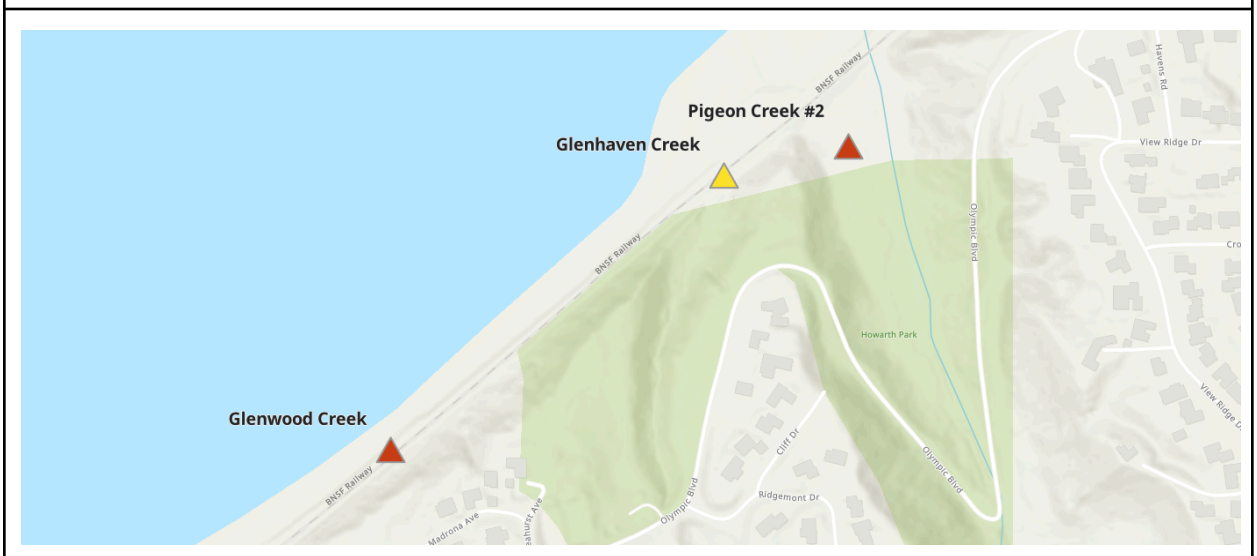
Outfall EVE-13 had an overall water quality health rating of Good. The remaining three stormwater outfalls monitored received overall water quality health ratings of Watch. The parameters of concern varied among the outfalls and included *E. coli* (EVE-10, EVE-14), dissolved oxygen (EVE-10, EVE-11), and pH (EVE-11, EVE-14). Everett outfalls stand out as having a parameter (pH) other than *E. coli* as the most frequent pollutant of concern. Everett also stands out as having no outfalls rated in the Threat category. Three of the four stormwater outfalls monitored were rated as Watch for parameters (bacteria and dissolved oxygen) identified in the 303(d) polluted waters listing for the Snohomish River.

Based on the data for the freshwater creeks, two were given overall water quality health ratings of Threat, Glenwood and Pigeon #2. Low dissolved oxygen levels were a primary concern at both creeks along with high turbidity in Glenwood Creek. The other two creeks, Glenhaven and Edgewater, were rated as Watch due to *E. coli* (Glenhaven), dissolved oxygen (both creeks), and turbidity (Edgewater).

Detailed site summaries for each of the eight monitoring locations follows.

Map key:	Outfall ◯	Creek △	Overall Water Quality Healthy Rating		
			Threat	Watch	Good





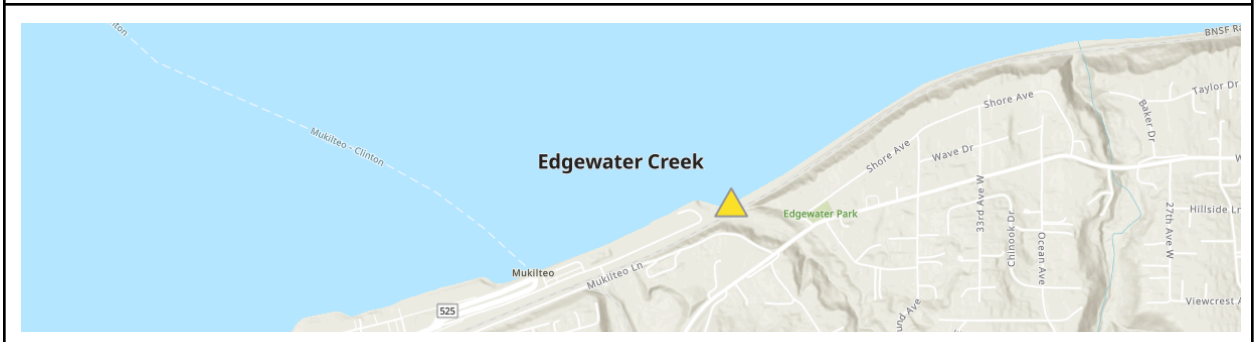


Figure 15. Everett - Salish Sea Stormwater Monitoring Program sites with overall water quality health ratings. Note: the scale for the three maps are not the same.

Everett Site Summary - Outfall EVE-10 (48.01275, -122.18437)



Water Quality Health Rating Key		
Exceedance Frequency	Parameter	Observation
≤ 10%	Good	Good
10% < x < 30%	Watch	Watch
≥ 30 %	Threat	Threat

Trend Key			
Improving	Worsening	Inconsistent	Stable
↑	↓	↑↓	↔

Stormwater threshold exceedances, extremum, health ratings, and water quality trends for select parameters at Outfall EVE-10.

Summary 2023-2025							
Parameter	Outfall Thresholds*	Sample #	Exceedances		Health Rating	Extremum	Trend
			#	%			
Water Temp °C	> Air +3**	14	1	7	Good	17.3	↔
DO mg/l	<6	14	3	21	Watch	3.8	↔
pH	<5 or >9	14	0	0	Good	6.53-7.87	↔
SPC uS/cm	>500	14	13	93	Tidal	6,344	NA
Turbidity ntu	>50	14	0	0	Good	32	↔
E. coli cfu/100ml	>320	12	2	17	Watch	799	↑↓
Observation							
Flow	> Expected	7	2	29	Watch	Higher	NA
Color 1-3	Any unnatural color	11	5	45***	Watch	1	NA
Odor 1-3	Any odor	10	2	20	Watch	1	NA
Visual 1-3	Any unnatural phenom	10	0	0	Good	0	NA
Overall Health Rating: Watch							

*(Herrera Environmental Consultants & Aspect Consulting 2020)

**modified stormwater threshold, see Methods

***health rating upgraded to Watch due to presence of stormwater retention ponds

Outfall EVE-10 drains a portion of the Riverside Business Park and discharges to a tidal-influenced receiving water, the Snohomish River. Sampling spanned 2023–2025 with 10–14 samples depending on the parameter. The overall water quality health rating was Watch due to elevated *E. coli* and dissolved oxygen reaching as low as 3.8 mg/l. Frequent observations of pale yellow color placed color in the Threat health rating category. However, this outfall is connected to two stormwater ponds that can naturally exhibit strong coloration from decaying vegetation so the health rating for color was upgraded to Watch.

Everett Site Summary - Outfall EVE-11 (48.01230, -122.18377)



Water Quality Health Rating Key		
Exceedance Frequency	Parameter	Observation
≤ 10%	Good	Good
10% < x < 30%	Watch	Watch
≥ 30 %	Threat	Threat

Trend Key			
Improving	Worsening	Inconsistent	Stable
↑	↓	↑↓	↔

Stormwater exceedance frequency, extremum, health ratings, and water quality trends for select parameters at Outfall EVE-11.

Summary 2023-2025							
Parameter	Outfall Thresholds*	Sample #	Exceedances		Health Rating	Extremum	Trend
			#	%			
Water Temp °C	> Air +3**	14	0	0	Good	18.2	↔
DO mg/l	<6	14	2	14	Watch	5.16	↔
pH	<5 or >9	14	0	0	Good	5.81-7.41	↔
SPC uS/cm	>500	14	12	86	Tidal	39,508	NA
Turbidity ntu	>50	15	0	0	Good	3.66	↔
E. coli cfu/100ml	>320	13	0	0	Good	167	↔
Observation							
Flow	> Expected	6	0	0	Good	Normal	NA
Color 1-3	Any unnatural color	10	1	10	Good	1	NA
Odor 1-3	Any odor	10	4	40***	Watch	3	NA
Visual 1-3	Any unnatural phenom	10	0	0	Good	0	NA
Overall Health Rating: Watch							

*(Herrera Environmental Consultants & Aspect Consulting 2020)

**modified stormwater threshold, see Methods

***health rating upgraded to due to presence of natural source - tide lands

Outfall EVE-11 drains a portion of the Riverside Business Park and discharges to a tidal-influenced receiving water, the Snohomish River. According to the City, this is a private outfall. Sampling was conducted from 2023–2025 with six to 14 samples depending on the parameter. The primary concern is periodic low dissolved oxygen levels contributing to an overall water quality health rating of Watch. Although odor was flagged in four out of 10

samples, field notes describe a muddy smell with no further detail. Given the tidal and wetland-adjacent setting the health rating for odor was upgraded to Watch.

Everett Site Summary - Outfall EVE-13 (48.00889, -122.18056)



Water Quality Health Rating Key		
Exceedance Frequency	Parameter	Observation
≤ 10%	Good	Good
10% < x < 30%	Watch	Watch
≥ 30 %	Threat	Threat

Trend Key			
Improving	Worsening	Inconsistent	Stable
↑	↓	↑↓	↔

Stormwater threshold exceedances, extremum, health ratings, and water quality trends for select parameters at Outfall EVE-13.

Summary 2024-2025							
Parameter	Outfall Thresholds*	Sample #	Exceedances		Health Rating	Extremum	Trend
			#	%			
Water Temp °C	> Air +3**	4	0	0	Good	13.8	NA
DO mg/l	<6	3	0	0	Good	0	NA
pH	<5 or >9	4	0	0	Good	5.81-7.25	NA
SPC uS/cm	>500	4	2	50	Tidal	5,634	NA
Turbidity ntu	>50	5	0	0	Good	10.71	NA
E. coli cfu/100ml	>320	5	0	0	Good	33	NA
Observation							
Flow	> Expected	6	1	17	Watch	Higher	NA
Color 1-3	Any unnatural color	5	0	0	Good	0	NA
Odor 1-3	Any odor	5	0	0	Good	0	NA
Visual 1-3	Any unnatural phenom	5	0	0	Good	0	NA
Overall Health Rating: Good							

*(Herrera Environmental Consultants & Aspect Consulting 2020)

**modified stormwater threshold, see Methods

Outfall EVE-13, located adjacent to EVE-11, is also, according to the City, a private outfall that drains the Riverside Business Park. Notably, no flow was encountered in 2023, so the dataset is limited to 2024-2025, resulting in smaller sample sizes (3-6 samples per parameter). The overall water quality health rating based on this very limited dataset was Good.

Everett Site Summary - Outfall EVE-14 (48.00798,-122.18000)



Water Quality Health Rating Key		
Exceedance Frequency	Parameter	Observation
≤ 10%	Good	Good
10% < x < 30%	Watch	Watch
≥ 30 %	Threat	Threat

Trend Key			
Improving	Worsening	Inconsistent	Stable
↑	↓	↑↓	↔

Stormwater exceedance frequency, extremum, health ratings, and water quality trends for select parameters at Outfall EVE-14.

Summary 2023-2025							
Parameter	Outfall Thresholds*	Sample #	Exceedances		Health Rating	Extremum	Trend
			#	%			
Water Temp °C	> Air +3**	9	1	11	Watch	22.4	NA
DO mg/l	<6	9	0	0	Good	7.54	NA
pH	<5 or >9	9	0	0	Good	5.86-7.37	NA
SPC uS/cm	>500	9	4	44	Tidal	2,021	NA
Turbidity ntu	>50	10	0	0	Good	14.14	NA
E. coli cfu/100ml	>320	10	1	10	Good	400	NA
Observation							
Flow	> Expected	7	5	71	Threat	Higher	NA
Color 1-3	Any unnatural color	9	2	22	Watch	1	NA
Odor 1-3	Any odor	9	1	11	Watch	1	NA
Visual 1-3	Any unnatural phenom	9	1	11	Watch	1	NA
Overall Health Rating: Watch							

*(Herrera Environmental Consultants & Aspect Consulting 2020)

**modified stormwater threshold, see Methods

Stormwater Outfall EVE-14 drains a portion of the Riverside Business Park and has been sampled since 2023. However, dry conditions have been frequently encountered resulting in very small sample sizes across all parameters. The limited data resulted in an overall water quality health rating of Watch based on a single temperature exceedance. Higher than expected flows recorded for 71% of the samples make flow rate worthy of special attention during future site visits. There have been some reports of the presence of color, odor or visuals at the pipe, the only note was that foam was encountered once.

Everett Site Summary - Pigeon Creek #2 (47.96377, -122.23967)



Water Quality Health Rating Key		
Exceedance Frequency	Parameter	Observation
≤ 10%	Good	Good
10% < x < 30%	Watch	Watch
≥ 30 %	Threat	Threat

Trend Key			
Improving	Worsening	Inconsistent	Stable
↑	↓	↑↓	↔

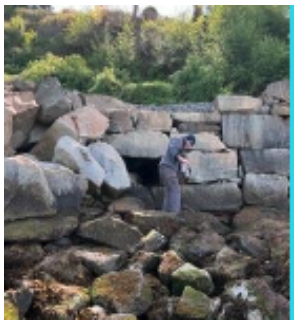
Water quality standard exceedances, extremum, health ratings, and water quality trends for select parameters at Pigeon Creek #2.

Summary 2023-2025							
Parameter	Water Quality Standard Spawn/Rear/Migrate*	Sample #	Exceedances		Health Rating	Extremum	Trend
			#	%			
Water Temp °C	>17.5	20	0	0	Good	14.9	↔
DO mg/l	<10	20	9	45	Threat	7.2	↔
pH	<6.5 or >8.5	20	0	0	Good	6.68-8.24	↔
SPC uS/cm	>500**	20	0	0	Good	459	↔
Turbidity ntu	>13.8***	20	7	35	Threat	51.8	↔
E. coli cfu/100ml	>320	20	3	15	Watch	1,166	↑↓
Observation							
Color 1-3	Any unnatural color	19	2	11	Watch	1	↔
Odor 1-3	Any odor	19	0	0	Good	0	↔
Visual 1-3	Any unnatural phenom	19	0	0	Good	0	↔
Overall Health Rating: Threat							

*(Washington Department of Ecology, 2024)
**(City of Bellingham, 2015)
***(City of Everett, 2022)

Pigeon Creek #2 has been sampled since 2022 and drains an approximate 1.29 square mile basin in southwest Everett. The upper watershed is heavily urbanized, with a mix of residential, commercial and industrial zoning. It had an overall water quality health rating of Threat. Low dissolved oxygen and high turbidity were recorded in nearly half of all samples. High, although less frequent, *E. coli* water quality standard exceedances, are also a concern particularly given the Creek's designation as salmon spawning, rearing and migration habitat.

Everett Site Summary - Glenwood Creek (47.96139, -122.24527)



Water Quality Health Rating Key		
Exceedance Frequency	Parameter	Observation
≤ 10%	Good	Good
10% < x < 30%	Watch	Watch
≥ 30 %	Threat	Threat

Trend Key			
Improving	Worsening	Inconsistent	Stable
↑	↓	↑↓	↔

Water quality standard exceedances, extremum, health ratings, and water quality trends for select parameters at Glenwood Creek.

Summary 2024-2025							
Parameter	Water Quality Standard Spawn/Rear/Migrate*	Sample #	Exceedances		Health Rating	Extremum	Trend
			#	%			
Water Temp °C	>17.5	16	3	19	Watch	25.2	NA
DO mg/l	<10	16	8	50	Threat	7.2	NA
pH	<6.5 or >8.5	16	1	6	Good	5.83-8.3	NA
SPC uS/cm	>500**	16	0	0	Good	191.8	NA
Turbidity ntu	>14.5***	16	4	25	Watch	32.8	NA
E. coli cfu/100ml	>320	16	0	0	Good	200	NA
Observation							
Color 1-3	Any unnatural color	15	1	7	Good	1	NA
Odor 1-3	Any odor	15	1	7	Good	1	NA
Visual 1-3	Any unnatural phenom	15	0	0	Good	0	NA
Overall Health Rating: Threat							

*(Washington Department of Ecology, 2024)
**(City of Bellingham, 2015)
***(City of Everett, 2022)

Glenwood Creek drains 0.59 square miles in southwest Everett, running roughly south to north and discharging into Port Gardner Bay through Harborview Park under the BNSF railway. Sampling began here in 2024. Glenwood Creek has an upper drainage area of mixed residential, office, and industrial/warehouse spaces, with a less developed natural ravine in the lower basin. Glenwood Creek has been designated to support salmon spawning, rearing and migration.

This creek was rated Threat for overall water quality health due to the dissolved oxygen exceedance rate of 50%. Turbidity was also a concern with an exceedance rate of 25%. As a

designated salmon stream, the routine low dissolved oxygen and temperature extreme of 25.2°C in Glenwood Creek is a concern.

Everett Site Summary - Glenhaven Creek (47.96361, -122.24138)



Water Quality Health Rating Key		
Exceedance Frequency	Parameter	Observation
≤ 10%	Good	Good
10% < x < 30%	Watch	Watch
≥ 30 %	Threat	Threat

Trend Key			
Improving	Worsening	Inconsistent	Stable
↑	↓	↑↓	↔

Water quality standard exceedances, extremum, health ratings, and water quality trends for select parameters at Glenhaven Creek.

Summary 2024-2025							
Parameter	Water Quality Standard Spawn/Rear/Migrate*	Sample #	Exceedances		Health Rating	Extremum	Trend
			#	%			
Water Temp °C	>17.5	12	0	0	Good	16.9	NA
DO mg/l	<10	12	2	17	Watch	9.4	NA
pH	<6.5 or >8.5	12	1	8	Good	6.4-7.59	NA
SPC uS/cm	>500**	12	0	0	Good	171	NA
Turbidity ntu	>12.0***	12	1	8	Good	50.1	NA
E. coli cfu/100ml	>320	12	3	25	Watch	6,660	NA
Observation							
Color 1-3	Any unnatural color	12	2	17	Watch	1	NA
Odor 1-3	Any odor	12	0	0	Good	0	NA
Visual 1-3	Any unnatural phenom	12	0	0	Good	0	NA
Overall Health Rating: Watch							

*(Washington Department of Ecology, 2024)
**(City of Bellingham, 2015)
***(City of Everett, 2022)

Glenhaven Creek is the smallest of the Everett creeks sampled, draining just 0.18 square miles. The basin consists almost entirely of single-family residential homes. Sampling began in 2024 giving a total of twelve samples. Glenhaven Creek has been designated to support salmon spawning, rearing and migration.

E. coli was the most significant concern with 25% of samples exceeding the water quality standard with a maximum of 6,660 cfu/100mL. Dissolved oxygen levels were low in 17% of the samples. The color has been observed to be light yellow. Based on the first year of data, the overall water quality health rating was Watch. The color has been observed to be light yellow.

Everett Site Summary - Edgewater Creek (47.95238, -122.28841)



Water Quality Health Rating Key		
Exceedance Frequency	Parameter	Observation
≤ 10%	Good	Good
10% < x < 30%	Watch	Watch
≥ 30 %	Threat	Threat

Trend Key			
Improving	Worsening	Inconsistent	Stable
↑	↓	↑↓	↔

Water quality standard exceedances, extremum, health ratings, and water quality trends for select parameters at Edgewater Creek.

Summary 2021-2025							
Parameter	Water Quality Standard Spawn/Rear/Migrate*	Sample #	Exceedances		Health Rating	Extremum	Trend
			#	%			
Water Temp °C	>17.5	7	0	0	Good	13.7	NA
DO mg/l	<10	7	1	14	Watch	9.75	NA
pH	<6.5 or >8.5	7	0	0	Good	7.84-8.3	NA
SPC uS/cm	>500**	7	0	0	Good	262.4	NA
Turbidity ntu	>11.2	7	4	57****	Watch	98.6	NA
E. coli cfu/100ml	>320	7	1	14	Watch	1,499	NA
Observation							
Color 1-3	Any unnatural color	7	1	14	Watch	3	NA
Odor 1-3	Any odor	7	0	0	Good	0	NA
Visual 1-3	Any unnatural phenom	7	1	14	Watch	1	NA
Overall Health Rating: Watch							

*(Washington Department of Ecology, 2024)
**(City of Bellingham, 2015)
***(City of Everett, 2022)
****health rating upgraded to Watch based on source identification and control

Edgewater Creek, sampled since 2025, drains just 0.35 square miles in southwest Everett. The basin is predominantly forested and lawns with an impervious area of only 20%. In the upper basin, Boeing and other office & industrial facilities are present. Edgewater Creek has been designated to support salmon spawning, rearing and migration.

Edgewater Creek was designated Watch for an overall water quality health rating. With only seven samples, the most significant water quality standard exceedances were turbidity with a high of 98.6 ntu, and an *E. coli* maximum of 1,499 cfu/100ml. Both of these were found to be due to a single identified source - a property owner draining a retention pond without proper

erosion protection in place. When the City stormwater manager was notified of these results they contacted the property owner to educate them on proper procedures for future pond drainage events. Since the source has been controlled, the health rating for turbidity, which would have been Threat based on the percent exceedances, was upgraded to Watch.

This is the kind of success story the Salish Sea Stormwater Monitoring Program was designed to achieve - a pollution event was detected, a source was identified, and corrective action was taken to prevent the problem from recurring.

Mukilteo

Mukilteo is on the Salish Sea coast between Edmonds and Everett occupying about 6.25 square miles, with a 2024 population of ~21,300. The City's geography is defined by a series of deep ravines and gulches that funnel stormwater to the Salish Sea. Four stormwater outfalls and four creeks are monitored (Figure 16).

Map key:	Outfall ◯	Creek △	Overall Water Quality Healthy Rating		
			Threat	Watch	Good

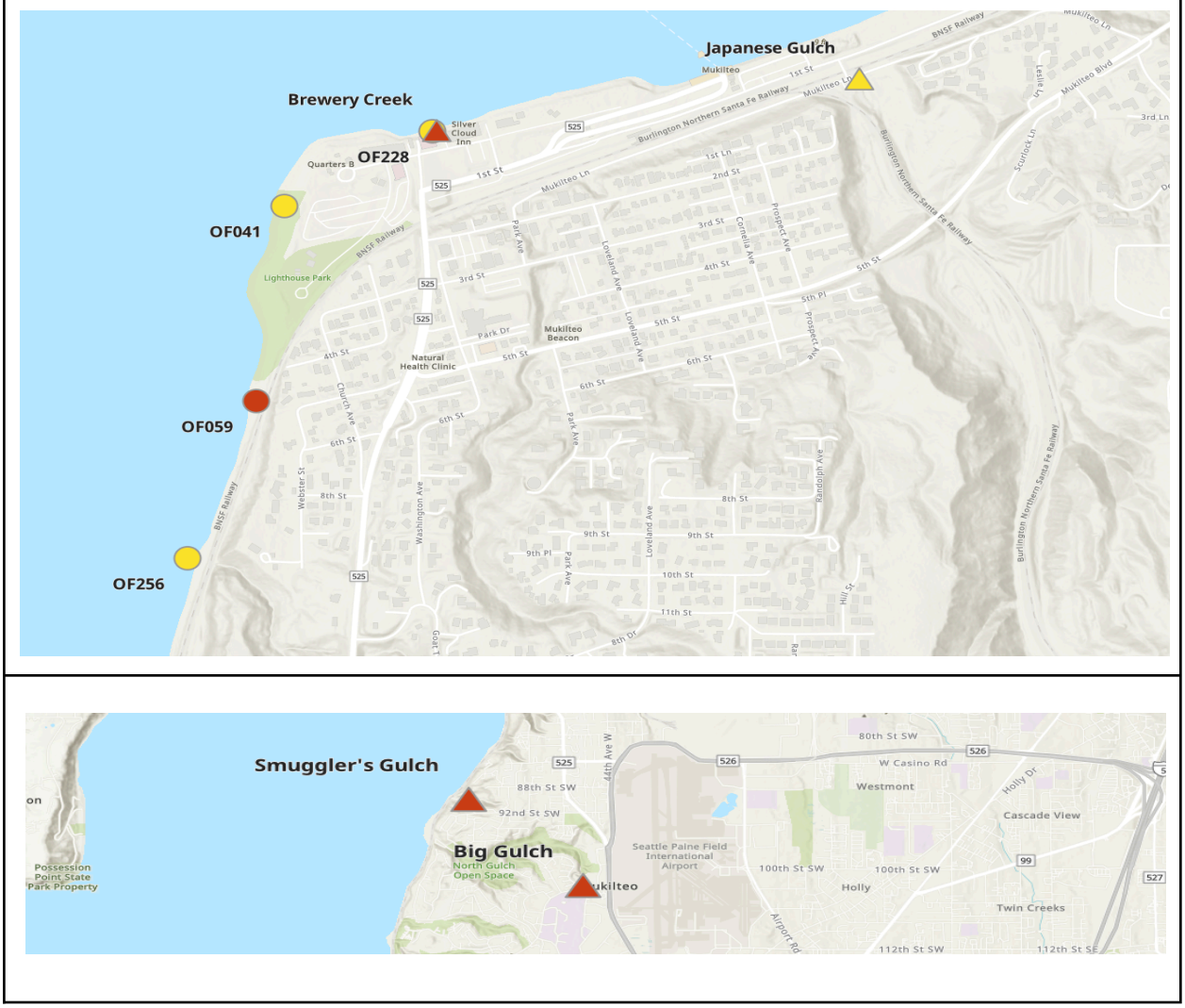


Figure 16. Mukilteo - Salish Sea Stormwater Monitoring Program sites with overall water quality health ratings.

Big Gulch and Brewery Creeks are protected as salmonid core summer habitat, while Smuggler's and Japanese Gulches are protected as salmonid spawning, rearing and migrating habitats. Possession Sound was listed in the State's polluted waters 303(d) list due to *Enterococcus sp.* (Listing ID 61019; Washington State Department of Ecology, n.d.).

Of the four stormwater outfalls monitored, one had an overall water quality health rating of Threat (OF059) while the remaining three were rated Watch. In all cases, the primary parameter of concern was elevated *E. coli* levels. For Outfall OF059, source investigation work by the City identified a contributing source (dense bird roosting on a garage roof) that was remediated (roof washed). Levels dropped afterwards, however, *E. coli* concentrations still exceeded the stormwater threshold on a regular basis. To our knowledge, no specific bacteria sources have been identified for the other outfalls. Additional parameters of concern, with Watch health ratings, included dissolved oxygen at Outfall OF041 and temperature at Outfalls OF041 and OF228.

Overall water quality health ratings of Threat were given to three of the four streams monitored based on high *E. coli levels* (Big Gulch and Brewery Creek) and high turbidity (Brewery Creek and Smuggler's Gulch). In the case of Brewery Creek, which had a maximum *E. coli* concentration of over 14,000 cfu/100ml, extensive source investigations conducted cooperatively between the volunteer monitoring team and City stormwater staff discovered two sources which were successfully controlled resulting in a significant drop in bacteria levels. Based on health ratings of Watch, other parameters of concern included high turbidity and low dissolved oxygen for all the outfalls and pH for Japanese and Big Gulches.

Detailed site summaries for each of the eight Mukilteo monitoring sites follow.

Mukilteo Site Summary - Outfall OF041 (47.94782, -122.30748)



Water Quality Health Rating Key		
Exceedance Frequency	Parameter	Observation
≤ 10%	Good	Good
10% < x < 30%	Watch	Watch
≥ 30 %	Threat	Threat

Trend Key			
Improving	Worsening	Inconsistent	Stable
↑	↓	↑↓	↔

Stormwater exceedance frequency, extremum, health ratings, and water quality trends for select parameters at Outfall OF041.

Summary 2022-2025							
Parameter	Outfall Thresholds*	Sample #	Exceedances		Health Rating	Extremum	Trend
			#	%			
Water Temp °C	> Air +3**	36	5	14	Watch	18.2	↑↓
DO mg/l	<6	31	5	16	Watch	5.04	↑↓
pH	<5 or >9	36	0	0	Good	6.5-7.7	↔
SPC uS/cm	>500	36	31	86	Tidal	54,685	NA
Turbidity ntu	>50	34	0	0	Good	23.8	↔
E. coli cfu/100ml	>320	36	7	19	Watch	7,525	↑↓
Observation							
Flow	> Expected	18	0	0	Good	Normal	↔
Color 1-3	Any unnatural color	22	2	9	Good	1	NA
Odor 1-3	Any odor	22	1	0	Good	1	NA
Visual 1-3	Any unnatural phenom	22	0	0	Good	0	NA
Overall Health Rating: Watch							

*(Herrera Environmental Consultants & Aspect Consulting 2020)

**modified stormwater threshold, see Methods

Outfall OF041 is subject to regular tidal influence. This outfall mainly drains the parking lot for Lighthouse Park, and a portion of the Mukilteo Old Town residential area east of the BNSF Railroad tracks and west of the Speedway. The overall water quality health rating for this outfall was Watch due to high *E. coli*, low dissolved oxygen and elevated temperatures. *E. coli* exceeded the threshold in 19% of the samples with a maximum of 7,525 cfu/100ml. Observations of color and odor have been infrequent and minor.

Mukilteo Site Summary - Outfall OF059 (47.94417, -122.30817)



Water Quality Health Rating Key		
Exceedance Frequency	Parameter	Observation
≤ 10%	Good	Good
10% < x < 30%	Watch	Watch
≥ 30 %	Threat	Threat

Trend Key			
Improving	Worsening	Inconsistent	Stable
↑	↓	↑↓	↔

Stormwater threshold exceedances, extremum, health ratings, and water quality trends for select parameters at Outfall OF059.

Summary 2022-2025							
Parameter	Outfall Thresholds*	Sample #	Exceedances		Health Rating	Extremum	Trend
			#	%			
Water Temp °C	> Air +3**	28	2	7	Good	17.9	↑↓
DO mg/l	<6	26	0	0	Good	7.8	↔
pH	<5 or >9	28	0	0	Good	6.47-8.75	↔
SPC uS/cm	>500	28	4	14	Tidal	900	NA
Turbidity ntu	>50	28	1	4	Good	100.7	↔
E. coli cfu/100ml	>320	28	9	32	Threat	3,663	↑↓
Observation							
Flow	> Expected	15	6	40	Threat	Higher	↔
Color 1-3	Any unnatural color	21	8	38	Threat	3	↔
Odor 1-3	Any odor	19	1	5	Good	1	↔
Visual 1-3	Any unnatural phenom	19	3	16	Watch	2	↔
Overall Health Rating: Threat							

*(Herrera Environmental Consultants & Aspect Consulting 2020)

**modified stormwater threshold, see Methods

Outfall OF059 drains the southern portion of the Mukilteo Old Town residential area east of the BNSF tracks and west of the Speedway. The outfall had an overall water quality rating of Threat based on *E. coli* levels with 32% of samples exceeding the 320 cfu/100ml stormwater threshold and a maximum of 3,663 cfu/100ml in February 2024. After being notified of the February results, City staff conducted follow-up sampling confirming the high *E. coli* levels. The City's upstream source investigations found a stormwater pipe entering the system coming from a

single residence. The home owner shared that a lot of birds roost on his roof. After flushing the roof with a hose, a grab sample of the stormwater from that pipe was negative for bacteria.

Since these actions, the *E. coli* levels have been lower but have still exceeded the stormwater threshold on a regular basis. The trend is inconsistent, suggesting episodic rather than continuous inputs. Field notes described a light-yellow or light brown color, and cloudy water. These observations, combined with the higher than expected flows and bacteria counts, suggest the outfall may still be receiving inputs that deserve closer attention.

Mukilteo Site Summary - Outfall OF256 (47.94125, -122.30984)



Water Quality Health Rating Key		
Exceedance Frequency	Parameter	Observation
≤ 10%	Good	Good
10% < x < 30%	Watch	Watch
≥ 30 %	Threat	Threat

Trend Key			
Improving	Worsening	Inconsistent	Stable
↑	↓	↑↓	↔

Stormwater Threshold Exceedances, Extremum, Health Ratings, and Water Quality Trends for Select Parameters at Outfall OF256.

Summary 2022-2025							
Parameter	Outfall Thresholds*	Sample #	Exceedances		Health Rating	Extremum	Trend
			#	%			
Water Temp °C	> Air +3**	32	1	3	Good	17.1	↔
DO mg/l	<6	30	0	0	Good	8.75	↔
pH	<5 or >9	32	0	0	Good	5.7-8.65	↔
SPC uS/cm	>500	32	2	6	Good	2,700	↔
Turbidity ntu	>50	31	2	6	Good	91	↔
E. coli cfu/100ml	>320	31	3	10	Watch	1,832	↑↓
Observation							
Flow	> Expected	16	3	19	Watch	Higher	NA
Color 1-3	Any unnatural color	20	3	15	Watch	2	↔
Odor 1-3	Any odor	20	0	0	Good	0	↔
Visual 1-3	Any unnatural phenom	20	1	5	Good	1	↔
Overall Health Rating: Watch							

*(Herrera Environmental Consultants & Aspect Consulting 2020)

**modified stormwater threshold, see Methods

Outfall OF256 had a higher quality of stormwater than most outfalls that were monitored. The percent exceedance rates did still warrant an overall water quality rating of Watch for *E. coli* and for higher than expected flow rates. *E. coli* exceeded the stormwater threshold in 10% of the samples with a maximum of 1,832 cfu/100ml. Field notes described yellow color and cloudiness on a few occasions. There are multiple detention ponds upstream of this location that may be the source of the color observations.

Mukilteo Site Summary - Outfall OF228 (47.94921, -122.30388)



Water Quality Health Rating Key		
Exceedance Frequency	Parameter	Observation
≤ 10%	Good	Good
10% < x < 30%	Watch	Watch
≥ 30 %	Threat	Threat

Trend Key			
Improving	Worsening	Inconsistent	Stable
↑	↓	↑↓	↔

Stormwater threshold exceedances, extremum, health ratings, and water quality trends for select parameters at Outfall OF228.

Summary 2022-2025							
Parameter	Outfall Thresholds*	Sample #	Exceedances		Health Rating	Extremum	Trend
			#	%			
Water Temp °C	> Air +3**	17	3	18	Watch	16.8	↑↓
DO mg/l	<6	14	0	0	Good	6.03	↔
pH	<5 or >9	16	0	0	Good	6.6-7.6	↔
SPC uS/cm	>500	16	15	94	Tidal	53,900	NA
Turbidity ntu	>50	17	1	6	Good	51.6	↔
E. coli cfu/100ml	>320	18	3	17	Watch	3,529	↑↓
Observation							
Flow	> Expected	7	5	72	Threat	Higher	↔
Color 1-3	Any unnatural color	9	2	22	Watch	2	NA
Odor 1-3	Any odor	10	2	20	Watch	2	NA
Visual 1-3	Any unnatural phenom	8	0	0	Good	0	NA
Overall Health Rating: Watch							

*(Herrera Environmental Consultants & Aspect Consulting 2020)

**modified stormwater threshold, see Methods

Outfall OF228 receives stormwater runoff from impervious parking lots adjacent to Ivars and the Silver Cloud Motel. Overall, this site had a water quality health rating of Watch due to *E. coli* exceedances. *E. coli* concentrations exceeded the stormwater threshold at a rate of 17%, showed no consistent trend, and had a maximum of 3,529 cfu/100ml. Other parameters of concern include elevated temperature, flow rates higher than expected, and observations. The discharge location near a popular dive spot and the public exposure that presents makes the high *E. coli* a particular concern warranting source investigations.

Mukilteo Site Summary - Big Gulch (47.91014, -122.31796)



Water Quality Health Rating Key		
Exceedance Frequency	Parameter	Observation
≤ 10%	Good	Good
10% < x < 30%	Watch	Watch
≥ 30 %	Threat	Threat

Trend Key			
Improving	Worsening	Inconsistent	Stable
↑	↓	↑↓	↔

Water Quality Standard Exceedances, Extremum, Health Ratings, and Water Quality Trends for Select Parameters at Big Gulch.

Summary 2023-2025							
Parameter	Water Quality Standard Core Summer Habitat*	Sample #	Exceedances		Health Rating	Extremum	Trend
			#	%			
Water Temp °C	>16	17	0	0	Good	17.2	↔
DO mg/l	<10	17	4	24	Watch	9.05	↑↓
pH	<6.5 or >8.5	17	4	24	Watch	5.5-8.05	↑↓
SPC uS/cm	>500**	17	0	0	Good	385.6	↔
Turbidity ntu	>10.19	16	2	13	Watch	15.8	↔
E. coli cfu/100ml	>320	16	5	31	Threat	2,797	↑↓
Observation							
Color 1-3	Any unnatural color	16	4	25	Watch	1	↑↓
Odor 1-3	Any odor	16	0	0	Good	0	↔
Visual 1-3	Any unnatural phenom	16	1	6	Good	2	↔
Overall Health Rating: Threat							

*(Washington Department of Ecology, 2024)
**(City of Bellingham, 2015)

Sampling at Big Gulch began in 2023. This creek drains the south end of Paine Field and much of the northern part of the commercial district of Mukilteo along the Speedway, as well as southern & central residential neighborhoods. It is a major stormwater discharge pathway. This creek had an overall water quality health rating of Threat driven by exceedances for *E. coli*, dissolved oxygen, and pH and to a lesser extent, turbidity. In 2024 the exceedance rate for *E. coli* was 80% with a maximum of 2,797 cfu/100mL. However this dropped to only 10% with a maximum of 334 cfu/100ml in 2025.

Mukilteo Site Summary - Brewery Creek (47.94922, -122.30377)



Water Quality Health Rating Key		
Exceedance Frequency	Parameter	Observation
≤ 10%	Good	Good
10% < x < 30%	Watch	Watch
≥ 30 %	Threat	Threat

Trend Key			
Improving	Worsening	Inconsistent	Stable
↑	↓	↑↓	↔

Water Quality Standard Exceedances, Extremum, Health Ratings, and Water Quality Trends for Select Parameters at Brewery Creek.

Summary 2022-2025							
Parameter	Water Quality Standard Core Summer Habitat*	Sample #	Exceedances		Health Rating	Extremum	Trend
			#	%			
Water Temp °C	>16	36	0	0	Good	16.7	↔
DO mg/l	<10	33	7	21	Watch	8.1	↑↓
pH	<6.5 or >8.5	36	1	3	Good	6.5-8.41	↔
SPC uS/cm	>500**	36	1	3	Good	550	↔
Turbidity ntu	>10.19	35	15	43	Threat	79	↑↓
E. coli cfu/100ml	>320	43	22	51***	Watch	14,319	↔
Observation							
Color 1-3	Any unnatural color	24	4	17	Watch	2	↑
Odor 1-3	Any odor	24	0	0	Good	0	↔
Visual 1-3	Any unnatural phenom	24	1	8	Good	1	↔
Overall Health Rating: Threat							

*(Washington Department of Ecology, 2024)
**(City of Bellingham, 2015)
***health rating upgraded to Watch due to source identification and control

Brewery Creek drains into Puget Sound through Outfall OF227 and has been monitored since 2022. The primary concerns at Brewery Creek were turbidity, dissolved oxygen and *E. coli* giving the site an overall health rating of Threat. Turbidity exceeded the water quality standard in 43% of the samples with a maximum of 79 ntu. Dissolved oxygen had a Watch rating for water quality health with 21% of samples falling below the 10 mg/l threshold. The creek on occasion was observed to be murky and yellowish.

*E. co*li, with 51% of samples exceeding the water quality standard and a maximum of 14,319 cfu/100ml, had a health rating of Threat. The presence of elevated *E. coli* levels is of particular concern at this location because it discharges to a popular scuba diving site which is under study by the City of Mukilteo for designation as a diving reserve. Monitoring revealed two distinct periods of elevated *E. coli*, each found to come from a different source. In both cases, identifying the cause required sustained investigation at multiple upstream monitoring sites that was carried out by volunteers in close partnership with the City and was successful in identifying multiple sources.

In one case, eDNA testing confirmed that elevated bacteria levels were coming from a human source. Investigations revealed the presence of a leaking sewer line that ran over the top of the creek. The line was from a commercial property that was found to have an oil trap that had not been properly maintained.

In another incident, eDNA testing performed by the City found the bacteria to not be from a human source. Source investigations found the cause to be pet waste on a creek side property that the owner was neglecting to clean up. The City talked to the dog owner and increased their general education and outreach on the importance of picking up pet waste. So far in 2026, *E. coli* levels have dropped back well below the threshold suggesting that source remediations were successful.

Mukilteo Site Summary - Smuggler's Gulch (47.91693, -122.31511)



Water Quality Health Rating Key		
Exceedance Frequency	Parameter	Observation
≤ 10%	Good	Good
10% < x < 30%	Watch	Watch
≥ 30 %	Threat	Threat

Trend Key			
Improving	Worsening	Inconsistent	Stable
↑	↓	↑↓	↔

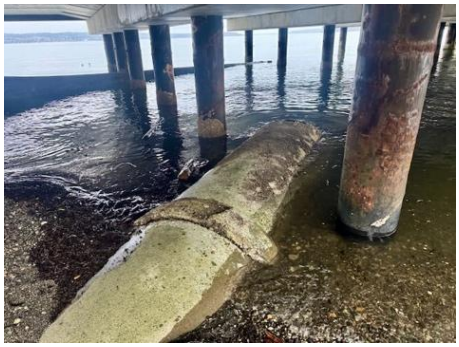
Water Quality Standard Exceedances, Extremum, Health Ratings, and Water Quality Trends for Select Parameters at Smuggler's Gulch.

Summary 2024-2025							
Parameter	Water Quality Standard Spawn/Rear/Migrate*	Sample #	Exceedances		Health Rating	Extremum	Trend
			#	%			
Water Temp °C	>17.5	12	0	0	Good	15.6	NA
DO mg/l	<10	12	2	17	Watch	8.83	NA
pH	<6.5 or >8.5	12	1	8	Good	6.42-8.45	NA
SPC uS/cm	>500**	12	0	0	Good	441.5	NA
Turbidity ntu	>10.19	12	5	42	Threat	64.9	NA
E. coli cfu/100ml	>320	13	1	8	Good	733	NA
Observation							
Color 1-3	Any unnatural color	12	7	58	Threat	12	NA
Odor 1-3	Any odor	12	0	0	Good	0	NA
Visual 1-3	Any unnatural phenom	12	1	8	Good	2	NA
Overall Health Rating: Threat							

*(Washington Department of Ecology, 2024)
**(City of Bellingham, 2015)

Smuggler's Gulch drains the south end of Paine Field as well as southern and central residential neighborhoods of Mukilteo along the Speedway. The creek is sampled just downstream of a box culvert under a stream crossing at 91st Pl SW. Monitoring began in 2024, giving this site a two-year dataset of 12-13 samples, depending on the parameter, enough to begin characterizing the water quality though insufficient for identifying trends. The overall water quality health rating was Threat due to a turbidity exceedance rate of 42%, with an extremum of 64.9 ntu. Dissolved oxygen had two exceedances out of 12 samples (17%), with a low of 8.83 mg/l. Unusual color was frequently reported as light or faint yellow.

Mukilteo Site Summary - Japanese Gulch (47.95019, -122.29347)



Water Quality Health Rating Key		
Exceedance Frequency	Parameter	Observation
≤ 10%	Good	Good
10% < x < 30%	Watch	Watch
≥ 30 %	Threat	Threat

Trend Key			
Improving	Worsening	Inconsistent	Stable
↑	↓	↑↓	↔

Water Quality Standard Exceedances, Extremum, Health Ratings, and Water Quality Trends for Select Parameters at Japanese Gulch.

Summary 2022-2025							
Parameter	Water Quality Standard Spawn/Rear/Migrate*	Sample #	Exceedances		Health Rating	Extremum	Trend
			#	%			
Water Temp °C	>17.5	28	0	0	Good	14.5	↔
DO mg/l	<10	26	7	27	Watch	8.63	↑↓
pH	<6.5 or >8.5	28	3	11	Watch	6-7.96	↑↓
SPC uS/cm	>500**	27	23	85	Tidal	4,804	NA
Turbidity ntu	>10.19	27	5	19	Watch	36.9	↔
E. coli cfu/100ml	>320	27	2	7	Good	2,631	↓
Observation							
Color 1-3	Any unnatural color	16	3	19	Watch	1	↔
Odor 1-3	Any odor	17	2	12	Watch	1	↑↓
Visual 1-3	Any unnatural phenom	16	1	6	Good	2	↑↓
Overall Health Rating: Watch							

*(Washington Department of Ecology, 2024)
**(City of Bellingham, 2015)

Japanese Gulch has been monitored since 2022. It is a small urban stream draining the northern portion of Paine Field and its surrounding commercial and light-industrial areas, as well as residential neighborhoods in north Mukilteo. It flows through a jointly owned city park and private railroad land. The Gulch is protected for salmonid spawning, rearing and migrating and some effort has been made to enhance salmon habitat within the gulch. Near its lower reach, the creek enters a pipe beneath the BNSF Railroad tracks and travels several hundred yards east to Outfall OF186. The site is currently under study for daylighting (excavating and rerouting) and

potential estuary restoration. Salinity at the outfall can be elevated due to saltwater intrusion during high tide events, which is reflected in the conductivity data.

The overall water quality health rating for Japanese Gulch was Threat based primarily on low dissolved oxygen and to a lesser extent, high turbidity and low pH. Of 26 samples, seven exceeded the <10 mg/l water quality standard for DO, a 27% exceedance rate. Five of 27 samples (19%) exceeded the turbidity water quality standard of 10.19 ntu with a maximum of 36.9 ntu. Color, odor, and visual observations were all rated Watch or Good water quality. One notable observation was a sulfur smell recorded on a single occasion. Overall, Japanese Gulch has reasonably good water quality for an urban stream. But low dissolved oxygen and occasional turbidity exceedances are a concern.

Edmonds

With a population of approximately 42,800 as of mid-2024, the City of Edmonds covers about 8.9 square miles of land, making it considerably more densely populated and developed than many of its neighbors. The City is bisected by the Burlington northern rail line that separates the upland urban core from the waterfront. Four beaches, all designated as beach sanctuaries draw heavy summertime use and give the community a strong connection to the Salish Sea. North of the Edmonds-Kingston Ferry terminal is the Edmonds Underwater Park, a marine preserve and sanctuary covering more than 27 acres that draws ~ 25,000 scuba divers each year. Waters off multiple Edmonds beaches are on the state's polluted waters 303(d) list due to fecal coliform (Listing ID 42487 and 42488) and *Enterococcus* bacteria (Listing ID 84183; Washington State Department of Ecology, n.d.).

Edmonds joined the Salish Sea Stormwater Monitoring Program in 2022 with monitoring at four stormwater outfalls and in 2024 sites on four creeks were added (Figure 17). One of the stormwater outfalls, CV664, had an overall water quality rating of Threat due to *E. coli* concentrations. The remaining three outfalls had water quality health ratings of Watch due to *E. coli* levels (CV663 and CV665) or elevated turbidity (CV2309).

Outfall CV664 is located at a popular beach, Brackett's Landing, with a high risk of public exposure. Children have been seen playing in the outfall discharge waters. Overall, 38% of samples from this outfall have exceeded the stormwater threshold with a maximum of 4325 cfu/100ml. In 2025, 67% of the samples exceeded the standard. Dramatic changes in the flow rate during a survey alerted volunteers to a potential source, a nearby bathroom and shower building. City source investigations by stormwater and health department staff are in progress. Given the three years of data showing periodic exceedances and public exposure, the lack of progress regarding finding a source are concerning.

The two years of data for Edmonds creeks has identified bacteria as the primary concern at Shellabarger and Shell Creeks and low dissolved oxygen at Hindley Creek. All three creeks have overall water quality health ratings of Threat. The original upstream site on Perrinville Creek, CV399, had a high percentage of samples with dissolved oxygen just below the water quality standard of 10 mg/l and is rated a Threat. The current downstream monitoring site, near Talbot Road, had an overall water quality health rating of Watch based on *E. coli*, dissolved oxygen and turbidity.

Detailed data summaries for each of the sites monitored follow.



Figure 17. Edmonds - Salish Sea Stormwater Monitoring Program sites with overall water quality health ratings.

Edmonds Site Summary - Outfall CV665 (47.81295, -122.38334)



Water Quality Health Rating Key		
Exceedance Frequency	Parameter	Observation
≤ 10%	Good	Good
10% < x < 30%	Watch	Watch
≥ 30 %	Threat	Threat

Trend Key			
Improving	Worsening	Inconsistent	Stable
↑	↓	↑↓	↔

Stormwater threshold exceedances, extremum, health ratings, and water quality trends for select parameters at Outfall CV665.

Summary 2023-2025							
Parameter	Outfall Thresholds*	Sample #	Exceedances		Health Rating	Extremum	Trend
			#	%			
Water Temp °C	> Air +3**	35	3	9	Good	18.2	↔
DO mg/l	<6	35	1	3	Good	5.7	↔
pH	<5 or >9	35	0	0	Good	6.2-7.7	↔
SPC uS/cm	>500	35	35	100	Tidal	48,137	NA
Turbidity ntu	>50	34	2	6	Good	64.3	↔
E. coli cfu/100ml	>320	35	4	11	Watch	3,950	↑↓
Observation							
Flow	> Expected	16	7	44	Threat	Higher	NA
Color 1-3	Any unnatural color	26	4	15	Watch	2	↔
Odor 1-3	Any odor	26	1	4	Good	1	↔
Visual 1-3	Any unnatural phenom	26	2	8	Good	2	↔
Overall Health Rating: Watch							

*(Herrera Environmental Consultants & Aspect Consulting 2020)

**modified stormwater threshold, see Methods

Monitoring at Outfall CV665 spans three years beginning in 2023. This outfall is located just north of the Edmonds ferry terminal and is tidally influenced. It drains a small portion of downtown Edmonds and the ferry holding lanes. The overall health rating was Watch based on E. *coli* exceedances which occurred in all three monitored years with a maximum of 3,950 cfu/100ml. In addition, observations of flow rates higher than expected based on prior 24hr rainfall, were reported for 44% of the samples.

Edmonds Site Summary - Outfall CV664 (47.81370, -122.38220)



Water Quality Health Rating Key		
Exceedance Frequency	Parameter	Observation
≤ 10%	Good	Good
10% < x < 30%	Watch	Watch
≥ 30 %	Threat	Threat

Trend Key			
Improving	Worsening	Inconsistent	Stable
↑	↓	↑↓	↔

Stormwater threshold exceedances, extremum, health ratings, and water quality trends for select parameters at Outfall CV664.

Summary 2022-2025							
Parameter	Outfall Thresholds*	Sample #	Exceedances		Health Rating	Extremum	Trend
			#	%			
Water Temp °C	> Air +3**	41	7	17	Watch	18.3	↑↓
DO mg/l	<6	40	0	0	Good	6.9	↔
pH	<5 or >9	41	0	0	Good	6-8.3	↔
SPC uS/cm	>500	41	40	97	Tidal	42,670	NA
Turbidity ntu	>50	40	1	3	Good	53.9	↔
E. coli cfu/100ml	>320	42	15	36	Threat	4,325	↓
Observation							
Flow	> Expected	16	3	19	Watch	Higher	NA
Color 1-3	Any unnatural color	27	7	26	Watch	2	↔
Odor 1-3	Any odor	27	0	0	Good	0	↔
Visual 1-3	Any unnatural phenom	26	2	8	Watch	1	↔
Overall Health Rating: Threat							

*(Herrera Environmental Consultants & Aspect Consulting 2020)

**modified stormwater threshold, see Methods

Outfall CV664 has been monitored since 2022. Located at Brackett's Landing, at a popular beach access site, it drains a small portion of downtown Edmonds and an older residential area. With an overall water quality health rating of Threat based on high *E. coli* levels, Outfall CV664 is a serious concern due to the high probability of public exposure. During monitoring visits, volunteers have encountered toddlers playing in the outfall stormwater that, in 2025, exceeded the *E. coli* stormwater threshold in two out of every three samples. Additional field observations suggest a likely identifiable point source**.** During a routine monitoring visit, volunteers observed

a discernible change in flow at the outfall. In addition, the water temperature tends to be colder than at other outfalls. The suspected source is a nearby bathroom and shower building.
The City of Edmonds is aware of the situation and are investigating the source. The City has escalated the results to both the Parks and Sewer Departments. The City's investigation plan has two parallel tracks. First, during the next stretch of consistent dry weather, crews will conduct closed-circuit camera inspection of the restroom drain lines to identify any compromised pipes or cross-connections with the sewer system. Second, water quality samples will be collected from upstream structures to help isolate the source. If upstream structures return clean results, the restroom plumbing and its associated sewer lateral become the primary suspect.

Edmonds Site Summary - Outfall CV663 (47.81570, -122.37930)



Water Quality Health Rating Key		
Exceedance Frequency	Parameter	Observation
≤ 10%	Good	Good
10% < x < 30%	Watch	Watch
≥ 30 %	Threat	Threat

Trend Key			
Improving	Worsening	Inconsistent	Stable
↑	↓	↑↓	↔

Stormwater threshold exceedances, extremum, health ratings, and water quality trends for select parameters at Outfall CV663.

Summary 2022-2024							
Parameter	Outfall Thresholds*	Sample #	Exceedances		Health Rating	Extremum	Trend
			#	%			
Water Temp °C	> Air +3**	11	0	0	Good	13.8	↔
DO mg/l	<6	11	0	0	Good	9.24	↔
pH	<5 or >9	11	0	0	Good	5.8-7.97	↔
SPC uS/cm	>500	11	0	0	Good	112.4	↔
Turbidity ntu	>50	10	0	0	Good	32.3	↔
E. coli cfu/100ml	>320	10	2	20	Watch	6,375	↑↓
Observation							
Flow	> Expected	NA	NA	NA	NA	NA	NA
Color 1-3	Any unnatural color	7	3	43	NA	1	NA
Odor 1-3	Any odor	7	1	14	NA	2	NA
Visual 1-3	Any unnatural phenom	7	0	0	NA	0	NA
Overall Health Rating: Watch							

*(Herrera Environmental Consultants & Aspect Consulting 2020)

**modified stormwater threshold, see Methods

Outfall CV663 drains a small section of north Edmonds that is primarily single family residential. This outfall has generally favorable water quality across most parameters and an overall health rating of Watch based on *E. coli* levels in two samples collected in 2024. Out of 39 site visits conducted over the three year monitoring period, volunteers were able to collect samples on ten occasions, meaning the outfall was dry roughly 75% of the time.

Edmonds Site Summary - Outfall CV2309 (47.81430, -122.38070)



Water Quality Health Rating Key		
Exceedance Frequency	Parameter	Observation
≤ 10%	Good	Good
10% < x < 30%	Watch	Watch
≥ 30 %	Threat	Threat

Trend Key			
Improving	Worsening	Inconsistent	Stable
↑	↓	↑↓	↔

Stormwater threshold exceedances, extremum, health ratings, and water quality trends for select parameters at Outfall CV2309.

Summary 2022-2024							
Parameter	Outfall Thresholds*	Sample #	Exceedances		Health Rating	Extremum	Trend
			#	%			
Water Temp °C	> Air +3**	15	2	13	Watch	16.8	NA
DO mg/l	<6	11	0	0	Good	0	NA
pH	<5 or >9	14	0	0	Good	7-8	NA
SPC uS/cm	>500	14	0	0	Good	400.3	NA
Turbidity ntu	>50	13	2	15	Watch	97.5	NA
E. coli cfu/100ml	>320	12	0	0	Good	140	NA
Observation							
Flow	> Expected	NA	NA	NA	NA	NA	NA
Color 1-3	Any unnatural color	NA	NA	NA	NA	NA	NA
Odor 1-3	Any odor	NA	NA	NA	NA	NA	NA
Visual 1-3	Any unnatural phenom	NA	NA	NA	NA	NA	NA
Overall Health Rating: Watch							

*(Herrera Environmental Consultants & Aspect Consulting 2020)

**modified stormwater threshold, see Methods

Outfall CV2309 drains an area of Edmonds that is composed almost entirely of well-established, low-density single-family neighborhoods with large lots and mature tree canopies. Sampling was conducted through 2024, after which time the Outfall CV2309 became inaccessible due to tidal changes that blocked the outfall opening. The results identified few concerns with overall good water quality. The exceedances of water temperature and turbidity stormwater thresholds, that gave this outfall an overall water quality rating of Watch, could have been influenced by chronic clogging issues.

Edmonds Site Summary - Hindley Creek-CV761 (47.81938, -122.36747)



Water Quality Health Rating Key		
Exceedance Frequency	Parameter	Observation
≤ 10%	Good	Good
10% < x < 30%	Watch	Watch
≥ 30 %	Threat	Threat

Trend Key			
Improving	Worsening	Inconsistent	Stable
↑	↓	↑↓	↔

Water Quality Standard exceedances, extremum, health ratings, and water quality trends for select parameters at Hindley Creek.

Summary 2024-2025							
Parameter	Water Quality Standard Core Summer Habitat*	Sample #	Exceedances		Health Rating	Extremum	Trend
			#	%			
Water Temp °C	>16	6	0	0	Good	16.7	NA
DO mg/l	<10	6	5	83	Threat	8.3	NA
pH	<6.5 or >8.5	6	0	0	Good	7.6-8.39	NA
SPC uS/cm	>500**	6	0	0	Good	283.2	NA
Turbidity ntu	>10.19	6	0	0	Good	8.09	NA
E. coli cfu/100ml	>320	6	2	33	Watch	400	NA
Observation							
Color 1-3	Any unnatural color	6	0	0	Good	0	NA
Odor 1-3	Any odor	6	0	0	Good	0	NA
Visual 1-3	Any unnatural phenom	6	0	0	Good	0	NA
Overall Health Rating: Threat							

*(Washington Department of Ecology, 2024)

**(City of Bellingham, 2015)

The City of Edmonds describes Hindley Creek as draining about 178 acres, predominantly urban/residential, and joining Shell Creek about 1,100 feet upstream of Shell Creek's mouth. Monitoring began in 2024, the small dataset showed a chronic low dissolved oxygen problem at Hindley Creek with an overall water quality health rating of Threat. Five of six samples (83%) fell below the 10 mg/l water quality standard for salmonid core summer habitat, with a minimum of 8.3 mg/l. One sample in 2024 and one in 2025 exceeded the water quality standard for *E. coli,* which due to the small sample size, rated a water quality health rating of Watch.

Edmonds Site Summary - Hindley & Shell Creeks (47.81852, -122.37224)



Water Quality Health Rating Key		
Exceedance Frequency	Parameter	Observation
≤ 10%	Good	Good
10% < x < 30%	Watch	Watch
≥ 30 %	Threat	Threat

Trend Key			
Improving	Worsening	Inconsistent	Stable
↑	↓	↑↓	↔

Water Quality Standard exceedances, extremum, health ratings, and water quality trends for select parameters at the Hindley & Shell Creeks convergence.

Summary 2024-2025							
Parameter	Water Quality Standard Core Summer Habitat*	Sample #	Exceedances		Health Rating	Extremum	Trend
			#	%			
Water Temp °C	>16	5	0	0	Good	15	NA
DO mg/l	<10	5	1	20	Watch	8.5	NA
pH	<6.5 or >8.5	5	0	0	Good	7.9-8.27	NA
SPC uS/cm	>500**	5	0	0	Good	283.4	NA
Turbidity ntu	>10.19	5	0	0	Good	0	NA
E. coli cfu/100ml	>320	5	1	20	Watch	1,398	NA
Observation							
Color 1-3	Any unnatural color	5	0	0	Good	0	NA
Odor 1-3	Any odor	5	0	0	Good	0	NA
Visual 1-3	Any unnatural phenom	5	0	0	Good	0	NA
Overall Health Rating: Watch							

*(Washington Department of Ecology, 2024)

**(City of Bellingham, 2015)

This location is no longer actively sampled. Monitoring was separated to locations on each creek to provide a more targeted look at Hindley Creek and Shell Creek individually. With an overall water quality health rating of Watch, most parameters indicated good water quality. The dissolved oxygen and *E. coli* exceedances occurred in 2025 and separating the monitoring locations should help determine which waterway is the primary contributor to these results going forward.

Edmonds Site Summary - Shellabarger Creek (47.80610, -122.37310)



Water Quality Health Rating Key		
Exceedance Frequency	Parameter	Observation
≤ 10%	Good	Good
10% < x < 30%	Watch	Watch
≥ 30 %	Threat	Threat

Trend Key			
Improving	Worsening	Inconsistent	Stable
↑	↓	↑↓	↔

Water Quality Standard exceedances, extremum, health ratings, and water quality trends for select parameters at Shellabarger Creek.

Summary 2024-2025							
Parameter	Water Quality Standard Core Summer Habitat*	Sample #	Exceedances		Health Rating	Extremum	Trend
			#	%			
Water Temp °C	>16	7	0	0	Good	17.7	NA
DO mg/l	<10	7	5	71	Threat	8.8	NA
pH	<6.5 or >8.5	7	0	0	Good	7.45-8.05	NA
SPC uS/cm	>500**	7	0	0	Good	292.9	NA
Turbidity ntu	>10.19	6	0	0	Good	7.95	NA
E. coli cfu/100ml	>320	7	4	57	Threat	4,295	NA
Observation							
Color 1-3	Any unnatural color	7	1	14	Watch	1	NA
Odor 1-3	Any odor	7	0	0	Good	0	NA
Visual 1-3	Any unnatural phenom	7	1	14	Watch	1	NA
Overall Health Rating: Threat							

*(Washington Department of Ecology, 2024)

**(City of Bellingham, 2015)

Shellabarger Creek drains approximately 378 acres of predominantly residential and commercial development before flowing into the Edmonds Marsh, which ultimately drains to Puget Sound. While the dataset for this creek was limited, two parameters have significantly and consistently exceeded water quality standards giving the creek an overall health rating of Threat. Low dissolved oxygen exceedances increased from 50% in 2024 to 80% in 2025, showing a possible downward trend in water quality. High *E. coli* levels were also a concern with four of seven samples exceeding the water quality standard with a maximum of 4,295 cfu/100ml.

Edmonds Site Summary - Shell Creek (47.81200, -122.36750)



Water Quality Health Rating Key		
Exceedance Frequency	Parameter	Observation
≤ 10%	Good	Good
10% < x < 30%	Watch	Watch
≥ 30 %	Threat	Threat

Trend Key			
Improving	Worsening	Inconsistent	Stable
↑	↓	↑↓	↔

Water Quality Standard exceedances, extremum, health ratings, and water quality trends for select parameters at Shell Creek.

Summary 2024-2025							
Parameter	Water Quality Standard Core Summer Habitat*	Sample #	Exceedances		Health Rating	Extremum	Trend
			#	%			
Water Temp °C	>16	8	0	0	Good	14.5	NA
DO mg/l	<10	8	1	13	Watch	0	NA
pH	<6.5 or >8.5	8	1	13	Watch	7.7-8.75	NA
SPC uS/cm	>500**	8	0	0	Good	328	NA
Turbidity ntu	>10.19	8	1	13	Watch	16.6	NA
E. coli cfu/100ml	>320	8	3	38	Threat	765	NA
Observation							
Color 1-3	Any unnatural color	8	3	38***	Watch	2	NA
Odor 1-3	Any odor	8	0	0	Good	0	NA
Visual 1-3	Any unnatural phenom	8	1	13	Watch	1	NA
Overall Health Rating: Threat							

*(Washington Department of Ecology, 2024)

**(City of Bellingham, 2015)

***health rating upgraded to Watch due to presence of natural source

Shell Creek is the second of two sites established when monitoring was separated from the former Hindley & Shell Creek convergence, allowing for more targeted assessment of each waterway. The creek flows through predominantly suburban neighborhoods, commercial zones and Yost Park, receiving stormwater runoff along the way. With an overall water quality health rating of Threat, Shell Creek had high *E. coli* levels and low pH. The descriptions of a light tea color were likely due to naturally decaying plant material and therefore, the health rating for color was upgraded to Watch. As with Hindley Creek, there is not yet enough data to establish

trends, and continued monitoring will be essential to understanding conditions in this watershed.

Edmonds Site Summary - Perrinville Creek-CV399 (47.83270, -122.33790)



Water Quality Health Rating Key		
Exceedance Frequency	Parameter	Observation
≤ 10%	Good	Good
10% < x < 30%	Watch	Watch
≥ 30 %	Threat	Threat

Trend Key			
Improving	Worsening	Inconsistent	Stable
↑	↓	↑↓	↔

Water Quality Standard exceedances, extremum, health ratings, and water quality trends for select parameters at Perrinville Creek-CV399.

Summary 2024-2025							
Parameter	Water Quality Standard Core Summer Habitat*	Sample #	Exceedances		Health Rating	Extremum	Trend
			#	%			
Water Temp °C	>16	5	0	0	Good	13.5	NA
DO mg/l	<10	5	4	80	Threat	9.46	NA
pH	<6.5 or >8.5	5	0	0	Good	7.2-7.6	NA
SPC uS/cm	>500**	5	0	0	Good	270	NA
Turbidity ntu	>10.19	5	0	0	Good	4.6	NA
E. coli cfu/100ml	>320	5	0	0	Good	100	NA
Observation							
Color 1-3	Any unnatural color	5	0	0	Good	0	NA
Odor 1-3	Any odor	5	0	0	Good	0	NA
Visual 1-3	Any unnatural phenom	5	0	0	Good	0	NA
Overall Health Rating: Threat							

*(Washington Department of Ecology, 2024)

**(City of Bellingham, 2015)

This is the original monitoring location on Perrinville Creek near the Perrinville Post Office. Sampling has since been relocated to a site further downstream which better captures the creek's overall condition and watershed influences. The sole parameter of concern was dissolved oxygen, which earned a Threat water quality health rating with four of five samples falling below the water quality standard. It is worth noting that the lowest dissolved oxygen recorded, 9.46 mg/l, was only marginally below the standard.

Edmonds Site Summary - Perrinville Creek-Talbott Road (47.84197, -122.34540)



Water Quality Health Rating Key		
Exceedance Frequency	Parameter	Observation
≤ 10%	Good	Good
10% < x < 30%	Watch	Watch
≥ 30 %	Threat	Threat

Trend Key			
Improving	Worsening	Inconsistent	Stable
↑	↓	↑↓	↔

Water quality standard exceedances, extremum, health ratings, and water quality trends for select parameters at Perrinville Creek near Talbott Road.

Summary 2024-2025							
Parameter	Water Quality Standard Core Summer Habitat*	Sample #	Exceedances		Health Rating	Extremum	Trend
			#	%			
Water Temp °C	>16	8	0	0	Good	14.6	NA
DO mg/l	<10	8	1	13	Watch	8.67	NA
pH	<6.5 or >8.5	8	0	0	Good	7.18-8.3	NA
SPC uS/cm	>500**	8	0	0	Good	256	NA
Turbidity ntu	>10.19	8	1	17	Watch	25.8	NA
E. coli cfu/100ml	>320	8	2	25	Watch	1,332	NA
Observation							
Color 1-3	Any unnatural color	8	1	13	Watch	2	NA
Odor 1-3	Any odor	8	0	0	Good	0	NA
Visual 1-3	Any unnatural phenom	8	2	25	Watch	1	NA
Overall Health Rating: Watch							

*(Washington Department of Ecology, 2024)
**(City of Bellingham, 2015)

This downstream location on Perrinville Creek is the current monitoring site. This creek has been a subject of public and media attention in recent years, with ongoing controversy surrounding the management of extreme flow events due to a combination of urban development and natural geography. The upper reaches of the drainage basin sit on a broad plateau before dropping 260 feet in elevation over the course of just about one mile. The creek drains approximately 541 acres within the city boundary, with its headwaters originating in Lynnwood. The overall water quality health rating of Watch is based on high *E. coli,* low

dissolved oxygen and elevated turbidity. Obvious bank erosion has been observed during sampling.

Shoreline

With approximately 61,400 residents across 11.7 square miles of land, Shoreline is a primarily residential community in King County that incorporated as a city in 1995. Six drainage basins lie within Shoreline's city limits, Middle Puget Sound and Boeing Creek basins flowing west to the Salish Sea, while several other creeks flow east to Lake Washington. Starting in 2023, two stormwater outfalls and two of the creeks flowing into the Salish Sea were monitored (Figure 18). One of the creeks, Storm Creek, was placed on the state's polluted waters 303(d) list due to fecal coliform bacteria based on 2016 data (Listing ID 89212), while the receiving waters around Richmond Beach's Saltwater Park have been listed due to *Enterococcus* bacteria based on 2021 data (Listing ID 61016; Washington State Department of Ecology, n.d.).

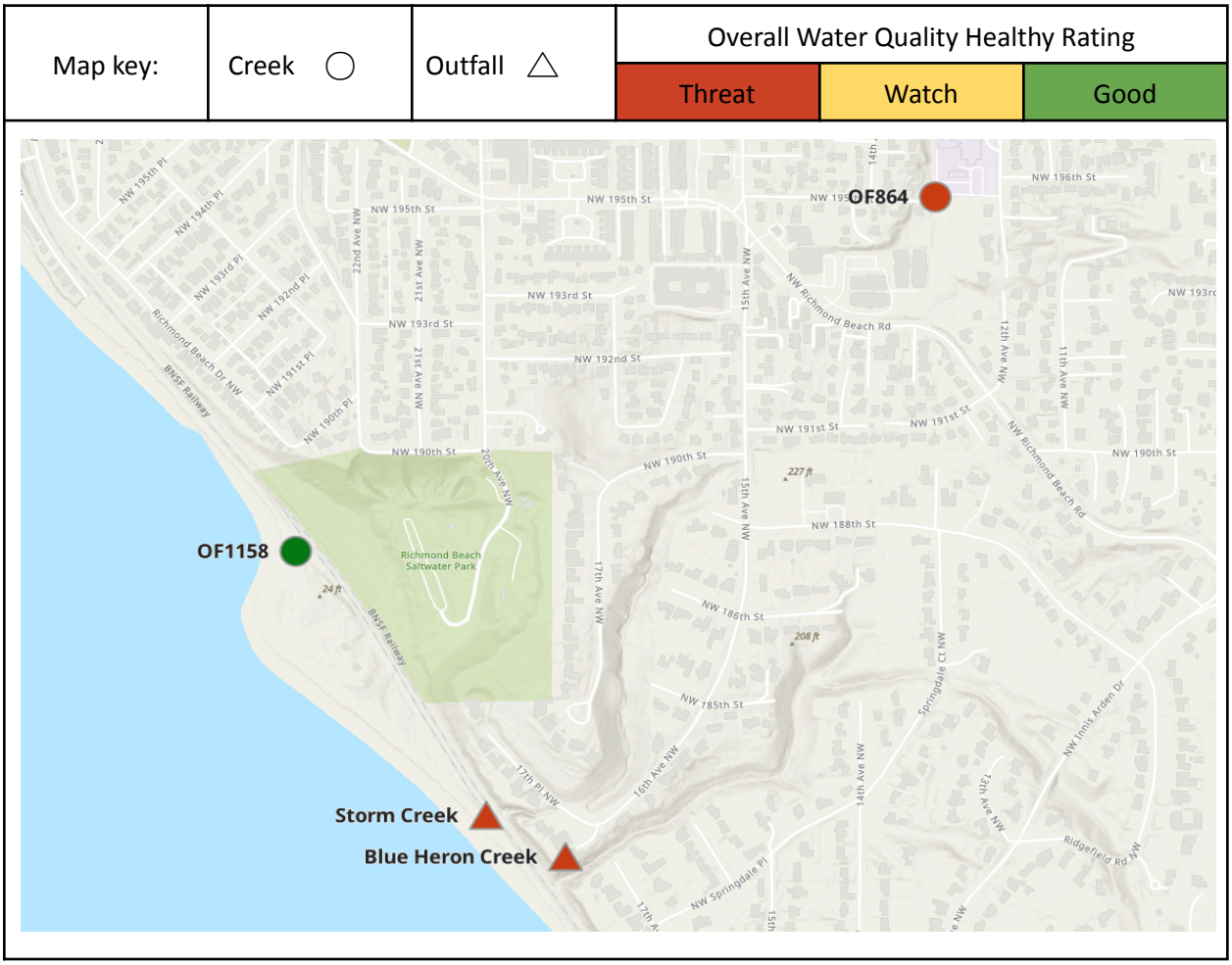


Figure 18: Shoreline - Salish Sea Stormwater Monitoring Program sites with overall water quality health ratings.

The monitoring results showed a mix of water quality for the Shoreline stormwater outfalls. One of the outfalls, Outfall OF864, had an overall health rating of Threat due to high *E. coli* levels and to a lesser extent low dissolved oxygen. In contrast, Outfall OF1158 had an overall water quality health rating of Good, one of only six stormwater outfalls monitored program-wide to do so. Both of the creeks, Blue Heron and Storm Creek had overall water quality ratings of Threat due to low dissolved oxygen, and to a lesser extent, low pH (Blue Heron), *E.coli* (Storm), and turbidity (Storm).

Detailed summaries of the data for each site monitored follow.

Shoreline Site Summary - Outfall OF864 (47.77067, -122.37329)



Water Quality Health Rating Key		
Exceedance Frequency	Parameter	Observation
≤ 10%	Good	Good
10% < x < 30%	Watch	Watch
≥ 30 %	Threat	Threat

Trend Key			
Improving	Worsening	Inconsistent	Stable
↑	↓	↑↓	↔

Stormwater threshold exceedances, extremum, health ratings, and water quality trends for select parameters at Outfall OF864.

Summary 2023-2025							
Parameter	Outfall Thresholds*	Sample #	Exceedances		Health Rating	Extremum	Trend
			#	%			
Water Temp °C	> Air +3**	9	0	0	Good	15.6	NA
DO mg/l	<6	9	0	0	Good	9.01	NA
pH	<5 or >9	9	0	0	Good	5-7.35	NA
SPC uS/cm	>500	9	0	0	Good	259	NA
Turbidity ntu	>50	9	0	0	Good	18.2	NA
E. coli cfu/100ml	>320	8	3	38	Threat	6,150	NA
Observation							
Flow	> Expected	8	4	13	Watch	Higher	NA
Color 1-3	Any unnatural color	9	6	67	Threat	2	NA
Odor 1-3	Any odor	9	0	0	Good	0	NA
Visual 1-3	Any unnatural phenom	9	3	33	Threat	1	NA
Overall Health Rating: Threat							

*(Herrera Environmental Consultants & Aspect Consulting 2020)

**modified stormwater threshold, see Methods

Outfall OF864 has been sampled since 2023, with eight to nine samples across most parameters. It discharges into Storm Creek, which ultimately discharges into the Salish Sea. The drainage area is predominantly single-family residential with minimal commercial use. The outfall does not flow frequently - high rainfall is needed to activate it. *E. coli* exceeded the stormwater threshold in three of eight samples (38%), with a maximum of 6,150 cfu/100ml recorded in 2024 giving the site an overall water quality health rating of Threat. The orange and brown tints to the water and observations of orange slime suggest an iron source. Nearby

Boeing Creek is iron-rich suggesting that natural sources of iron may be the cause of the stormwater observations.

Shoreline Site Summary - Outfall OF1158 (47.76547, -122.38661)



Water Quality Health Rating Key		
Exceedance Frequency	Parameter	Observation
≤ 10%	Good	Good
10% < x < 30%	Watch	Watch
≥ 30 %	Threat	Threat

Trend Key			
Improving	Worsening	Inconsistent	Stable
↑	↓	↑↓	↔

Stormwater threshold exceedances, extremum, health ratings, and water quality trends for select parameters at Outfall OF1158.

Summary 2021-2025							
Parameter	Outfall Thresholds*	Sample #	Exceedances		Health Rating	Extremum	Trend
			#	%			
Water Temp °C	> Air +3**	30	0	0	Good	17.5	
DO mg/l	<6	30	0	0	Good	8.29	
pH	<5 or >9	30	0	0	Good	6.1-7.8	
SPC uS/cm	>500	30	1	3	Good	952.4	
Turbidity ntu	>50	29	0	0	Good	20.6	
E. coli cfu/100ml	>320	29	0	0	Good	233	
Observation							
Flow	> Expected	14	0	0	Good	Normal	
Color 1-3	Any unnatural color	24	5	21	Watch	2	
Odor 1-3	Any odor	23	0	0	Good	0	
Visual 1-3	Any unnatural phenom	23	2	9	Good	1	
Overall Health Rating: Good							

*(Herrera Environmental Consultants & Aspect Consulting 2020)

**modified stormwater threshold, see Methods

Outfall OF1158 is located on the north end of Richmond Beach. The City of Shoreline has it labeled as an outfall owned by the BNSF Railroad. It has been sampled since 2023, with a dataset of 29-30 samples depending on the parameter and 14 samples for flow. This outfall runs constantly and at high volume year-round, independent of rainfall. The drainage area is a bit of a mystery because of its constant flow. We suspect it is ground water coming from the hill above the beach. Outfall OF1158 is one of just six stormwater outfalls monitored program-wide that had an overall water quality health rating of Good. The one conductivity exceedance of 952.4

uS/cm in 2024, was notable compared to the readings of 235-240 µS/cm measured in the other 29 samples. Observed colors included light brown, tea-colored, dark tea, and milky across multiple years.

Shoreline Site Summary - Blue Heron Creek (47.76100, -122.38100)



Water Quality Health Rating Key		
Exceedance Frequency	Parameter	Observation
≤ 10%	Good	Good
10% < x < 30%	Watch	Watch
≥ 30 %	Threat	Threat

Trend Key			
Improving	Worsening	Inconsistent	Stable
↑	↓	↑↓	↔

Water quality standard exceedances, extremum, health ratings, and water quality trends for select parameters at Blue Heron Creek.

Summary 2025							
Parameter	Water Quality Standard Core Summer Habitat*	Sample #	Exceedances		Health Rating	Extremum	Trend
			#	%			
Water Temp °C	>16	4	0	0	Good	15	NA
DO mg/l	<10	3	3	100	Threat	9.17	NA
pH	<6.5 or >8.5	4	1	25	Watch	5.93-7.7	NA
SPC uS/cm	>500**	4	0	0	Good	189	NA
Turbidity ntu	>10.19	4	0	0	Good	0	NA
E. coli cfu/100ml	>320	4	0	0	Good	133	NA
Observation							
Color 1-3	Any unnatural color	4	3	75***	Watch	1	NA
Odor 1-3	Any odor	4	0	0	Good	0	NA
Visual 1-3	Any unnatural phenom	4	0	0	Good	0	NA
Overall Health Rating: Threat							

*(Washington Department of Ecology, 2024)

**(City of Bellingham, 2015)

***health rating upgraded to Watch due to presence of natural source - wetland

Blue Heron Creek drains a residential neighborhood and portions of Richmond Beach Road before discharging into the Salish Sea. Multiple wetlands exist upstream. Sampling began in 2025, and with only four samples this is the smallest dataset for Shoreline. Dissolved oxygen was below the water quality standard in all three samples with a minimum of 9.17 mg/l. Based on this data Blue Heron Creek had an overall water quality health rating of Threat. Tea-like colors reported for three out of four samples could be attributed to wetlands located upstream.

Shoreline Site Summary - Storm Creek (47.77100, -122.37330)



Water Quality Health Rating Key		
Exceedance Frequency	Parameter	Observation
≤ 10%	Good	Good
10% < x < 30%	Watch	Watch
≥ 30 %	Threat	Threat

Trend Key			
Improving	Worsening	Inconsistent	Stable
↑	↓	↑↓	↔

Water Quality Standard Exceedances, Extremum, Health Ratings, and Water Quality Trends for Select Parameters at Storm Creek.

Summary 2023-2025							
Parameter	Water Quality Standard Core Summer Habitat*	Sample #	Exceedances		Health Rating	Extremum	Trend
			#	%			
Water Temp °C	>16	30	0	0	Good	18.2	↔
DO mg/l	<10	30	11	37	Threat	8.7	↑↓
pH	<6.5 or >8.5	30	1	3	Good	6.5-7.8	↔
SPC uS/cm	>500**	30	0	0	Good	262	↔
Turbidity ntu	>10.19	29	4	14	Watch	84.9	↔
E. coli cfu/100ml	>320	29	3	10	Watch	566	↔
Observation							
Color 1-3	Any unnatural color	23	4	17	Watch	1	↑↓
Odor 1-3	Any odor	22	2	9	Good	1	↑↓
Visual 1-3	Any unnatural phenom	22	7	32	Watch	3	↑↓
Overall Health Rating: Threat							

*(Washington Department of Ecology, 2024)
**(City of Bellingham, 2015)

The Storm Creek drainage basin is predominantly single family residential with minimal commercial use. The three-year dataset identified low dissolved oxygen, high turbidity and elevated bacteria as problems giving the creek an overall water quality health rating of Threat. A creosote log found in the creek in April 2024, that washed away six months later during a high tide, was the source of a tar smell and oil flecks observed during that period.

Poulsbo

Poulsbo is the most recent addition to the Salish Sea Stormwater Monitoring Program and the only city on the western shore of the Salish Sea to be included. Tucked into the head of Liberty Bay on the Kitsap Peninsula it is the smallest city in the monitoring program with a population of approximately 12,000 and an area of about 4.7 square miles. Liberty Bay is a relatively enclosed arm of Hood Canal which makes it especially sensitive to bacterial accumulation and shellfish impacts due to low flush rates. Liberty Bay is on the State's polluted waters 303(d) list due to low dissolved oxygen and high water temperature (Listing IDs 10268 and 10269; Washington State Department of Ecology, n.d.). The Liberty Bay Watershed Fecal Coliform TMDL, finalized in 2013, identified South Fork Dogfish, Big Scandia, Little Scandia, Bjorgen, and Lemolo Creeks as priority streams for clean-up, and requires a reduction of bacteria in stormwater discharges (Lawrence and Swanson, 2013). Stormwater pollution has resulted in periodic closures of shellfish beds in the bay. Some improvement has been documented since the TMDL was established, but ongoing stormwater pollution remains a challenge.

Beginning in 2025, three stormwater outfalls have been monitored in Poulsbo (Figure 19).

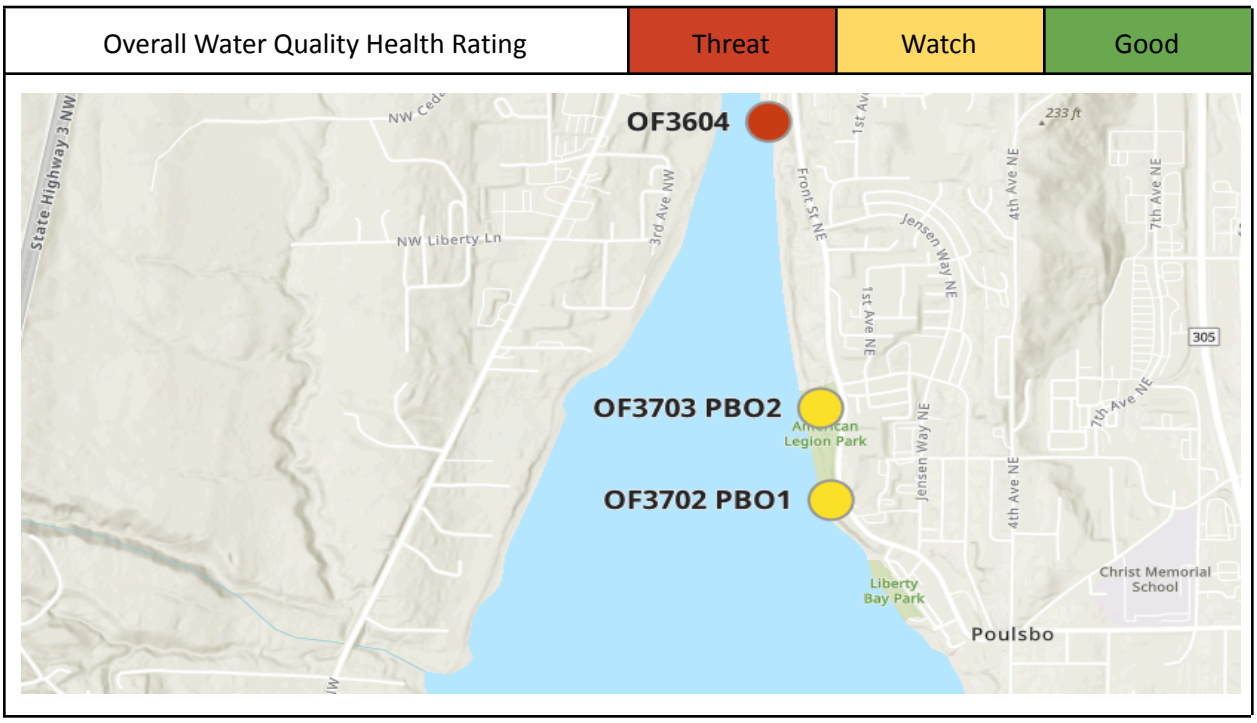


Figure 19. Poulsbo - Salish Sea Stormwater Monitoring Program sites with overall water quality health ratings.

Two of the outfalls had overall water quality health ratings of Watch, OF3703 and OF3702, and OF3604 had a rating of Threat. For each of these sites, due to the small sample size, the health rating was based on a single exceedance. Turbidity measured 202 ntu at Outfall OF3604 on June 20th and *E. coli* levels were 6,893 cfu/100ml at Outfall OF3703 on December 10th. Both of these single exceedances were significantly over the stormwater thresholds. In the case of the high *E. coli* levels, City staff performed an upstream survey to visually identify a source but were unsuccessful. For Outfall OF3702, the stormwater temperature exceeded the air temperature by 3.6 °C. Given this was a relatively cold day (7°C), the stormwater may not have had time to equilibrate.

Detailed data summaries for each of the stormwater outfalls monitored follow.

Poulsbo Site Summary - Outfall OF3703 PB02 (47.73830, -122.64970)



Water Quality Health Rating Key		
Exceedance Frequency	Parameter	Observation
≤ 10%	Good	Good
10% < x < 30%	Watch	Watch
≥ 30 %	Threat	Threat

Trend Key			
Improving	Worsening	Inconsistent	Stable
↑	↓	↑↓	↔

Stormwater threshold exceedances, extremum, health ratings, and water quality trends for select parameters at Outfall OF3703 PB02.

Summary 2025							
Parameter	Outfall Thresholds*	Sample #	Exceedances		Health Rating	Extremum	Trend
			#	%			
Water Temp °C	> Air +3**	6	0	0	Good	16.5	NA
DO mg/l	<6	5	0	0	Good	9.65	NA
pH	<5 or >9	5	0	0	Good	7.8-8.41	NA
SPC uS/cm	>500	5	2	40	Tidal	624.7	NA
Turbidity ntu	>50	5	0	0	Good	7.88	NA
E. coli cfu/100ml	>320	8	1	13	Watch	6,893	NA
Observation							
Flow	> Expected	8	0	0	Good	Normal	NA
Color 1-3	Any unnatural color	8	1	13	Watch	1	NA
Odor 1-3	Any odor	8	0	0	Good	0	NA
Visual 1-3	Any unnatural phenom	8	0	0	Good	0	NA
Overall Health Rating: Watch							

*(Herrera Environmental Consultants & Aspect Consulting 2020)

**modified stormwater threshold, see Methods

Outfall OF3703 has been monitored since 2025. It is a marine outfall, discharging into Liberty Bay on the western side of the City near the downtown waterfront area. The surrounding land-use consists of commercial zones with older residential development. *E. coli* was the primary concern with one exceedance, 6,893 cfu/100ml on October 10th, giving Outfall OF3703 an overall health rating of Watch. This is a single sample but the level is concerning given the outfall discharges into Liberty Bay, a sensitive shellfish resource. In October 2025, the City's

Public Works department performed an upstream survey to try and visually source trace the *E.coli* exceedance but were unable to find anything.

Poulsbo Site Summary - Outfall OF3702 PB01 (47.73630, -122.64940)



Water Quality Health Rating Key		
Exceedance Frequency	Parameter	Observation
≤ 10%	Good	Good
10% < x < 30%	Watch	Watch
≥ 30 %	Threat	Threat

Trend Key			
Improving	Worsening	Inconsistent	Stable
↑	↓	↑↓	↔

Stormwater threshold exceedances, extremum, health ratings, and water quality trends for select parameters at Outfall OF 3702 PB01.

Summary 2025							
Parameter	Outfall Thresholds*	Sample #	Exceedances		Health Rating	Extremum	Trend
			#	%			
Water Temp °C	> Air +3**	7	1	14	Watch	18.6	NA
DO mg/l	<6	5	0	0	Good	9.63	NA
pH	<5 or >9	5	0	0	Good	7.8-8.17	NA
SPC uS/cm	>500	5	1	20	Tidal	771	NA
Turbidity ntu	>50	5	0	0	Good	11.14	NA
E. coli cfu/100ml	>320	9	0	0	Good	200	NA
Observation							
Flow	> Expected	9	1	11	Watch	Higher	NA
Color 1-3	Any unnatural color	9	0	0	Good	0	NA
Odor 1-3	Any odor	9	0	0	Good	0	NA
Visual 1-3	Any unnatural phenom	9	0	0	Good	0	NA
Overall Health Rating: Watch							

*(Herrera Environmental Consultants & Aspect Consulting 2020)

**modified stormwater threshold, see Methods

Outfall OF3702 is a marine outfall discharging into Liberty Bay on the western side of the City near the downtown/waterfront area. The surrounding land use in that vicinity is the Viking Avenue commercial zone, along with older residential development. Monitoring began in 2025. Based on the first year of data, OF3702 had an overall water quality health rating of Watch driven by two parameters - flow rate and water temperature - each had a single exceedance.

Poulsbo Site Summary - Outfall OF3604 (47.74460, -122.65120)



Water Quality Health Rating Key		
Exceedance Frequency	Parameter	Observation
≤ 10%	Good	Good
10% < x < 30%	Watch	Watch
≥ 30 %	Threat	Threat

Trend Key			
Improving	Worsening	Inconsistent	Stable
↑	↓	↑↓	↔

Stormwater threshold exceedances, extremum, health ratings, and water quality trends for select parameters at Outfall OF3604.

Summary 2025							
Parameter	Outfall Thresholds*	Sample #	Exceedances		Health Rating	Extremum	Trend
			#	%			
Water Temp °C	> Air +3**	4	0	0	Good	19	NA
DO mg/l	<6	3	0	0	Good	7.43	NA
pH	<5 or >9	3	0	0	Good	7.21-7.42	NA
SPC uS/cm	>500	3	3	100	Tidal	17,384	NA
Turbidity ntu	>50	3	1	33	Threat	202.1	NA
E. coli cfu/100ml	>320	5	0	0	Good	200	NA
Observation							
Flow	> Expected	5	0	0	Good	Normal	NA
Color 1-3	Any unnatural color	5	2	40	Threat	1	NA
Odor 1-3	Any odor	5	0	0	Good	0	NA
Visual 1-3	Any unnatural phenom	5	2	40	Good	0	NA
Overall Health Rating: Threat							

*(Herrera Environmental Consultants & Aspect Consulting 2020)

**modified stormwater threshold, see Methods

Outfall OF3604 is a marine-influenced outfall in the central/mid-city area near the South Fork Dogfish Creek basin. This basin has been identified in the Poulsbo Stormwater Functional Plan as the highest-priority basin for water quality improvement. The surrounding area is a mix of single family residential and some commercial land use along the SR-305 corridor. Sampling began in 2025. The primary concern was a single turbidity sample of 202.1 ntu that, because of the small sample size, gave the outfall an overall water quality health rating of Threat. Observations included yellow or gray-yellow color, foam, and surface sheen.

Conclusions

The Salish Sea Stormwater Monitoring Program (SSSMP) was developed to measure the quality of stormwater entering the Salish Sea, specifically from Phase II municipalities. Phase II stormwater permits are presumptive in nature, meaning that if all of the criteria of the permit are met then it is presumed that the stormwater discharge is meeting water quality criteria set by Ecology. Phase II cities have two choices to meet monitoring requirements. A Phase II city could choose to monitor their stormwater but the protocols developed by Ecology to monitor are prohibitively expensive. Instead, most cities choose the alternative which is to pay into a regional fund for stormwater monitoring called the Stormwater Action Monitoring (SAM) collective. While the projects and programs developed out of this collective provide meaningful data to help minimize and mitigate stormwater pollution, they do not provide widespread local data on stormwater discharges.

This monitoring program was developed to fill that knowledge gap and has shown that even when municipalities are meeting and even exceeding the requirements of their permit, pollution is entering the Salish Sea via stormwater. In addition, this program has provided a viable model for stormwater monitoring that provides meaningful data at a reasonable cost while also engaging and educating the community. Education and outreach are requirements of the Phase II stormwater permits.

This project was conceived and developed with the help of city stormwater managers and Ecology staff and the program has succeeded in deepening the relationships between community members, the non-profit organizations running the Salish Sea Stormwater Monitoring Program, and regulatory agencies. Each city's municipal stormwater staff has a unique relationship with the Salish Sea Stormwater Monitoring Program. Most city stormwater managers embrace this monitoring program, recognizing the benefit of getting valuable data on a monthly basis and work collaboratively with the program to find and fix pollution sources.

Program Successes and Challenges

The program has been successful in elevating general awareness of stormwater pollution in NW Washington. It has also provided the public with tangible ways to reduce their contribution to stormwater pollution and information to help keep them safe when recreating in water. Members have given community and school presentations, tabled at community events, demonstrated stormwater runoff with a watershed model, and created printed and digital stormwater education materials. Most notably, RE Sources published a How to Spot and Report

Pollution manual (RE Sources 2026) which helps people identify pollution on the landscape and in the water and who to contact.

In coordination with city stormwater teams, this program has successfully detected and eliminated sources of pollution on numerous occasions. A partial list of examples is provided below.

- Extremely high levels of *E. coli* bacteria were measured at Olive Street Outfall on multiple occasions in 2024 and 2025 by volunteers and in follow-up sampling by the City of Bellingham. With the help of eDNA (environmental DNA) analysis, the City was able to determine that the bacteria was human in origin. Upon investigation, City crews found a basin with stagnant, warm water, which is an ideal environment for bacteria to grow. City stormwater maintenance staff thoroughly cleaned the structure, and after this cleanup the bacteria levels at this site had gone down to more typical levels. While this cleanup was effective in the short term, unfortunately, recent samples in 2026 have shown spikes of *E. coli* once again. Based on the information provided by the City, it is not clear if the root cause of the high bacteria counts had actually been found and fixed, especially since the eDNA analysis pointed to a human origin, likely sewage.
- Stormwater sampling in Anacortes discovered an illegal sanitary hook up from a house that was discharging sewage into the storm system. The problem was fixed and the pollution stopped.
- Due to their experience with the program and awareness of stormwater issues, volunteers knew to call, the Anacortes pollution hotline to report orange paint that was seen flowing directly into a storm drain (Figure 20). City employees arrived within minutes, blocked the flow, ran a street sweeper, and checked stormwater vaults downstream from the spill.



Figure 20. Paint spill flowing into a storm drain that was reported by program volunteers and promptly cleaned up by the City of Anacortes stormwater staff.

- In Everett, volunteers measured high turbidity in Edgewater Creek and the City was able to track the source to property owners doing maintenance work on their private retention pond. Inspectors met with the owners to rectify the situation.
- In Mukilteo, Brewery Creek has had two periods with high bacteria counts. The first instance was similar to Bellingham's Olive Street Outfall. The City of Mukilteo ordered an eDNA test that determined the *E. coli* was human in origin. The City then traced the bacteria source to a side sewer coming from a nearby building that was leaking due to an oil trap that had not been properly maintained and cleaned out. The second instance of high bacteria counts was determined to not be human in nature but rather from pet waste that was not being cleaned up on a creekside property. In both cases, the City worked with the responsible parties to correct the situation and the bacteria levels declined.
- In Shoreline, a volunteer on their morning walk noticed a long ribbon of oil in the road that measured the length of four to five houses. The volunteer called the City of Shoreline stormwater hotline and within 20 minutes a crew was on site laying down absorbent materials to clean up the spill.
- In Poulsbo, an initial sample of a stormwater outfall tested high for *E. coli* bacteria. In communications with the stormwater manager, it was found that this site was in the process of being remediated in part to correct the bacteria problem. The remedial work was just completed and volunteers hope to find lower levels of bacteria when sampling resumes in the next few months.
- Olympia, just added to the monitoring program in mid-August of 2026, was found to have an outfall with high *E. coli* levels in the first monthly sampling event. The data provided to the stormwater manager will hopefully help the City identify the source.

There are many other examples of how this stormwater monitoring program, through education, outreach, and monitoring, has led to source tracing, pollution identification, and clean-up actions. While a lot of progress has been made in these eight cities, there are still unresolved pollution issues.

Bellingham and Edmonds both have outfalls that have chronically high bacteria counts and also coincidentally discharge onto popular beaches which makes them a public health concern. For both of these sites, the bacteria counts do not follow a typical stormwater pattern, meaning the bacterial levels do not coincide with increasing amounts of rainfall. This suggests that the bacteria is not coming from the landscape such as from pet waste or wildlife but likely from the internal pipe system - either an illicit sewage connection or dysfunctional stormwater pipes.

Bennett Street Outfall, in Bellingham, has an *E. coli* exceedance rate of 59% over the last five years with an extremum of 20,480 cfu/100 ml — 64 times the threshold value. Some of the highest recorded *E. coli* values were recorded during summer, low flows. It discharges near

Taylor Dock which is a very popular place to jump from and swim. The City of Bellingham has taken a couple of follow-up samples but have not employed eDNA analysis yet. In spring 2026, the City stated that they were planning to create a plan to address this chronic bacteria problem and hopefully there will be resolution soon.

The Edmonds Outfall CV664 discharges very close to a popular underwater scuba park. Its *E. coli* exceedance rate is 36% with an extremum of 4,325 cfu/100 ml. It has a unique pattern - high bacteria counts through the spring, summer, and fall and then lower or zero in the winter. This pattern correlates to when the public restroom and outdoor shower are open - they shut down during the winter. So far, the City has not been able to trace the source of bacteria pollution.

Program Wide Bacteria Problem

As previously stated, bacteria is by far the most common problem identified based on exceedance rates. The stormwater threshold value of 320 cfu/100 ml for *E. coli* was determined by Ecology, with guidance from the EPA, as the upper most amount of bacteria that can be in the water to prevent people from getting sick (Washington State Department of Ecology, 2024) This includes people who are fully submerged in the water including eyes, ears, nose, and throat and if they were to ingest some water. There is a causal relationship between the dose of bacteria, such as *E. coli*, in recreational water and gastrointestinal (GI) symptoms. This means that the more bacteria there are, the more GI symptoms occur in people. Water with only a few colonies to about 30 cfu/100 ml has been shown to cause illness (Prüss, 1998). These values are low compared with the water quality standards and thresholds that are currently used for assessing safety.

Fecal coliform bacteria, like *E. coli,* originate from human and other warm-blooded animals and if detected means the water has been contaminated by fecal matter and may contain pathogens that could lead to serious intestinal illness such as other bacteria, protozoans, or viruses. In reality, measuring fecal viruses may be a more reliable way to assess the safety of water than fecal coliform bacteria, but this methodology is not yet readily available or affordable (Liang et al., 2015 and Toribio-Avedillo et al., 2021). Also, the presence of fecal bacteria, if coming from sewage, means that there can be other pollutants including detergents, pharmaceuticals, and anything else people may put down a drain.

The SSSWP typically takes only one bacteria sample every month from each monitoring site to locate bacterial problem spots, whereas, the standard protocol for assessing Washington State Water Quality Standard (WQS) for primary contact recreation in freshwater (WAC 173-201A) is

to take at least three samples from each site. Then a geometric mean is calculated from at least 10 samples, ideally for each different season. Because our protocol differs from what is written in the WQS, our data is intended to alert stormwater managers and the community about bacteria hot spots but can't be used to determine whether an area is technically safe or unsafe for recreation. We report our findings with the hope that it will lead to further studies to find and fix the bacteria source and give the public an idea of where bacteria may be in the water.

The principal manual that guides stormwater managers on how to identify and find stormwater pollution provides another set of guidelines for *E. coli* bacteria. The ICID manual recommends that follow-up investigations should occur when bacteria is found to be between 300 and 1,000 cfu/100ml (Herrera Environmental Consultants & Aspect Consulting, 2020).

Additionally, data taken from the National Stormwater Quality Database (Maestre & Pitt, 2005) and graphed by Kardouni (2023) demonstrates that bacteria levels are typically much higher than water quality thresholds and what would be recommended for follow-up sampling (Figure 21).

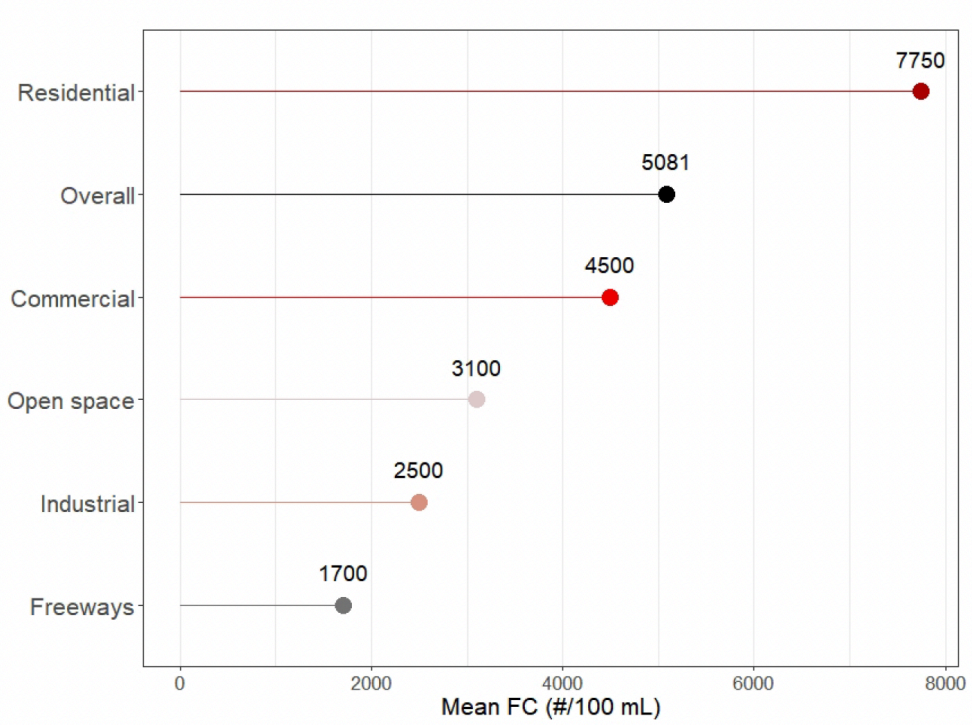


Figure 21. Mean fecal coliform (FC) concentrations in stormwater by land use — data source: Maestre & Pitt, 2005, graph source: Kardouni 2023. Note: in the Whatcom Creek watershed, the ratio of fecal coliform to E. coli is 1 fecal coliform to 0.9 E. coli.

For example, this data set shows that it is typical for stormwater originating from residential areas to have a mean of 7750 fecal coliform cfu/100ml; magnitudes higher than what is currently deemed safe.

Because many of the monitored outfalls discharge into the Salish Sea near or at places where people recreate, using the WQS of 320 cfu/100 ml is the most protective. Therefore, when counts are higher than 320 cfu it is important to track that site to see if the high count was an anomaly or a pattern and to potentially make a plan to investigate further.

One of the tricky parts of tracking bacteria pollution is that the counts are often flashy — they will be high for a few days and then drop off. Many of the follow-up samples that have been performed by the City's stormwater teams don't capture the high counts because their follow-up sampling doesn't occur until days or weeks later.

One of the goals for this program is to do more follow-up sampling so that patterns can be determined for bacteria counts. For example, if a high count is observed, a volunteer crew will take a sample the next day to see how the count is trending - up, down, or the same. Other goals for this program include expanding to additional Phase II cities and areas where shellfish harvesting occurs. Bacteria can contaminate shellfish making it unsafe to consume.

Costs and Funding

The ultimate goal of this program is to keep it funded and running in perpetuity. The data from this project provides very local data on the quality of stormwater that is being discharged to the Salish Sea every single day. The current permitting structure does not require Phase II cities to monitor their outfalls so this critical data is currently not being collected by municipalities or any other agency. Phase II permits give permittees the option of paying into a fund for regional studies or conducting their own local outfall monitoring. All of the nine cities we currently monitor opt to pay into the regional study fund at an annual cost of $4470 to $41,921 depending on the population of the city and the category of studies they chose to fund. This program shows that high quality data can be taken by community volunteers which not only makes it economical but also engages the public in environmental stewardship.

Designed to provide local water quality data at a relatively low cost, each city participating in the SSSMP requires approximately $6000 in the first year and an estimated $3000 for each subsequent year. This covers monitoring and laboratory equipment and consumable supplies. An additional cost equivalent to 1 FTE (full time equivalent) paid staff is required to provide

volunteer training and support, data management, quality assurance reviews, data reporting and program coordination.

The program's low cost is made possible by its community science model. Our trained volunteers conduct monthly field monitoring, collect samples, perform simple laboratory analyses, enter data and document observations. Since the start of the monitoring program in October of 2020 thru December of 2025 volunteers have contributed over 5,300 hours. Their contributions substantially reduce the cost of providing this level of consistent, site-specific monitoring while also building community knowledge and stewardship.

Funding for the program has come from a combination of grants, nonprofit resources, and support from community members. With the program expanding from two cities to eight, maintaining reliable funding has become increasingly important. The five-year results demonstrate that this small investment can lead to tangible outcomes, including identification and remediation of pollution sources.

Acknowledgements

Thank you to the 90 plus volunteers who conduct the monthly stormwater sampling and provide the life blood of the SSSMP. The program's success rests in their dedication to go out rain or shine. Some of whom have been volunteering since 2020 when we started surveying possible sites. Others started just a few months ago in our newest city. While you may not be listed as authors - this is your report.

Thank you Tim Gohrke and Wayne Huseby for supporting the Salish Sea Stormwater Monitoring Project (SSSMP), from creating and shepherding the expanded program we have today including and for finding the grant funding to keep the program going.

Thank you to Dianne Hennbert, former City of Anacortes Stormwater Manger, Mac Kaufman, retired Department of Ecology Municipal Stormwater General Permit Planner, and Kirsten McDade, RE Sources North Sound Waterkeeper, whose guidance in developing the scope and methods of the SSSMP contributed greatly to the programs success.

Thank you to all of the SSSMP City's Stormwater Managers for their work in preventing stormwater pollution and for providing feedback on the five year report.

Thank you to local agencies like County Health Departments and Conservation Districts, and state agencies like the Department of Ecology for assisting with technical aspects of this work.

Thank you to the organizations who have generously funded the SSSMP (*major donors):

*National Fish and Wildlife Foundation**
*The Rose Foundation**
*Satterberg Foundation**
Darby Foundation
Horizons Foundation
Lummi Indian Business Council
Marathon Anacortes Refinery
Northwest Fund for the Environment
Sinclair Anacortes Refinery
Soroptimist International of Anacortes
Swinomish Indian Tribal Community
The Burning Foundation
The Dudley Foundation
The Harder Foundation
The Hugh and Jane Ferguson Foundation
Tulalip Tribes Charitable Contributions Fund
Washington Sea Grant
Washington State Dept of Ecology

References

2016 Salish Sea toxics monitoring review: A selection of research | Encyclopedia of Puget Sound. (2017, April 24). https://www.eopugetsound.org/articles/2016-salish-sea-toxics-monitoring-review-selection-research

2022 Salish Sea toxics monitoring synthesis: A selection of research | Encyclopedia of Puget Sound. (2023, September 1). https://www.eopugetsound.org/articles/2022-salish-sea-toxics-monitoring-synthesis-selection-research

Butkus, S. R., Cusimano, R. F., & Wright, D. E. (1999). Snohomish River estuary total maximum daily load: Submittal report (Publication No. 99-57-WQ). Washington State Department of Ecology.

City of Bellingham. (2015). 2015 urban stream monitoring program report. https://cob.org/wp-content/uploads/2015-urban-stream-monitoring-program-report.pdf

City of Everett. (2022). Surface water comprehensive plan volume III: Port Gardner Bay watershed plan. https://www.everettwa.gov/876/Surface-Water-Comprehensive-Plan-SWCP

Hahn, J. L., Van Alstyne, K. L., Gaydos, J. K., Wallis, L. K., West, J. E., Hollenhorst, S. J., Ylitalo, G. M., Poppenga, R. H., Bolton, J. L., McBride, D. E., & Sofield, R. M. (2022). Chemical contaminant levels in edible seaweeds of the Salish Sea and implications for their

consumption. *PLoS ONE*, *17*(9), e0269269. https://doi.org/10.1371/journal.pone.0269269

Hardy, J., McBride, D., Niewolny, L. A., Lanksbury, J. A., & West, J. E. (2017). Human health evaluation of contaminants in Puget Sound Dungeness crab (Metacarcinus magister) and spot prawn (Pandalus platyceros). In C. A. James, J. Lanksbury, D. Lester, S. O'Neill, T. Roberts, C. Sullivan, & J. West (Eds.), 2016 Salish Sea toxics monitoring review: A selection of research (pp. 13–14). Puget Sound Ecosystem Monitoring Program. https://wdfw.wa.gov/sites/default/files/publications/02230/wdfw02230.pdf

Herrera Environmental Consultants, Inc., & Aspect Consulting, LLC. (2020). Illicit connection and illicit discharge field screening and source tracing guidance manual (May 2020 Revision). Prepared for King County Department of Natural Resources, Stormwater Services Section, and Washington State Department of Ecology, Stormwater Action Monitoring Program.

James, C. A., Lanksbury, J., Khangaonkar, T., & West, J. (2020). Evaluating exposures of bay mussels (*Mytilus trossulus*) to contaminants of emerging concern through environmental sampling and hydrodynamic modeling. *Science of The Total Environment*, *709*, 136098. https://doi.org/10.1016/j.scitotenv.2019.136098

Joy, J. (2002). Upper Yakima River basin suspended sediment and organochlorine pesticide total maximum daily load evaluation (Publication No. 02-03-012). Washington State Department of Ecology. https://apps.ecology.wa.gov/publications/documents/0203012.pdf

Kaksonen, A. H., Wylie, J., Morgan, M. J., Walsh, T., Tjandraatmadja, G., Barry, K., Gonzalez, D., Goodman, N., Vanderzalm, J., Dillon, P., Sidhu, J., & Puzon, G. J. (2025). Impact of stormwater on biofilm density and microbial community composition in water distribution networks. Water Research, 272, 122989. https://doi.org/10.1016/j.watres.2024.122989

Kardouni, J. (2023, July). Whatcom Creek bacteria total maximum daily load study: Water quality improvement report and implementation plan (Publication No. 23-10-013). Washington State Department of Ecology. https://apps.ecology.wa.gov/publications/documents/2310013.pdf

King County Stormwater Services. (2023). IC/IDDE SOP: R-CARD® ECC (Appendix C-8–C-14). King County.

Lawrence, S., & Swanson, T. (2013). Liberty Bay watershed fecal coliform bacteria total maximum daily load: TMDL and water quality implementation plan (Publication No. 13-10-014). Washington State Department of Ecology. https://apps.ecology.wa.gov/publications/documents/1310014.pdf

Liang, L., Goh, S. G., Vergara, G. G., Fang, H. M., Rezaeinejad, S., Chang, S. Y., Bayen, S., Lee, W. A., Sobsey, M. D., Rose, J. B., & Gin, K. Y. (2015). Alternative fecal indicators and their empirical relationships with enteric viruses, Salmonella enterica, and Pseudomonas aeruginosa in surface waters of a tropical urban catchment. Applied and Environmental Microbiology, 81(3), 850–860. https://doi.org/10.1128/AEM.02670-14

LoGiudici, J., & May, C. (2024). R-Card standard operating procedure. Washington State Department of Agriculture, Dairy Nutrient Management Program; Whatcom Conservation District.

Maestre, A., & Pitt, R. (2005). The national stormwater quality database, version 1.1: A compilation and analysis of NPDES stormwater monitoring information. Center for Watershed Protection; U.S. EPA Office of Water. https://www.waterboards.ca.gov/rwqcb9/water_issues/programs/stormwater/docs/wqip/2013-0001/J_References/J099.pdf

Prüss, A. (1998). Review of epidemiological studies on health effects from exposure to recreational water. International Journal of Epidemiology, 27(1), 1–9. https://doi.org/10.1093/ije/27.1.1

RE Sources. (2026). How to spot and report pollution. https://www.re-sources.org/wp-content/uploads/2026/04/2026_HowToSpotPollution_RE_Sources_web.pdf

Shook, J. (ECY). (2024). WESTERN WASHINGTON PHASE II MUNICIPAL STORMWATER PERMIT.

Toribio-Avedillo, D., Blanch, A. R., Muniesa, M., & Rodríguez-Rubio, L. (2021). Bacteriophages as fecal pollution indicators. Viruses, 13(6), 1089. https://doi.org/10.3390/v13061089

Toxic substances, Wash. Admin. Code § 173-201A-240 (2024). https://app.leg.wa.gov/WAC/default.aspx?cite=173-201A-240

U.S. Environmental Protection Agency. (2012). Average shallow groundwater temperatures. https://www3.epa.gov/ceampubl/learn2model/part-two/onsite/ex/jne_henrys_map.html

U.S. Environmental Protection Agency. (2024, April). PFAS national primary drinking water regulation: FAQs for drinking water primacy agencies. https://www.epa.gov/system/files/documents/2024-04/pfas_npwdr_faqsstates_4.8.24.pdf

U.S. Environmental Protection Agency. (2025, October 2). Copper biotic ligand model. https://www.epa.gov/wqs-tech/copper-biotic-ligand-model

Washington State Department of Ecology. (n.d.). [Check the status of your beach]. https://gis.ecology.wa.gov/portal/apps/webappviewer/index.html?id=e32edf4767184fd88e4ce2aa367ffd5c

Washington State Department of Ecology. (n.d.). I & J Waterway. Cleanup and Tank Search. Retrieved August 27, 2026, from https://apps.ecology.wa.gov/cleanupsearch/site/2012

Washington State Department of Ecology. (n.d.). Water Quality Assessment 303(d)/305(b) List. https://apps.ecology.wa.gov/ApprovedWQA/ApprovedPages/ViewApprovedListing.aspx?

Washington State Department of Ecology. (2024). Water quality standards for surface waters of the state of Washington (WAC 173-201A). Washington State Legislature. https://app.leg.wa.gov/wac/default.aspx?cite=173-201A&full=true

Washington State Department of Ecology, & King County Department of Natural Resources. (2011). Control of toxic chemicals in Puget Sound: Assessment of selected toxic chemicals in the Puget Sound basin, 2007–2011 (Publication No. 11-03-055). Washington State Department of Ecology. https://apps.ecology.wa.gov/publications/documents/1103055.pdf

Wisconsin Department of Natural Resources. (n.d.). PFAS and foam on waterways. Retrieved June 4, 2026, from https://dnr.wisconsin.gov/topic/PFAS/Foam

Appendices

Appendix A: Salish Sea Stormwater Monitoring Program Monitoring Locations

Monitoring sites are ordered alphabetically first by city and then by site ID. Highlighted monitoring sites have a site summary in the Results & Discussion section. Other sites listed have some data but not enough to warrant a summary. The raw data available for any site is available upon request.

Key to threshold codes: O - outfall; T - experiences seawater inundation; S - freshwater stream; RM - protected for salmonid spawning, rearing, and migration; and H - protected for core summer salmonid habitat.

City	Outfall or Stream	Threshold Code	Site Category	Latitude	Longitude
Anacortes	B03-1001	OT	Yes	48.49470	-122.68370
Anacortes	B04-1001	OT	Yes	48.49310	-122.68370
Anacortes	B04-1002	OT	Yes	48.49200	-122.68689
Anacortes	B04-1003	OT	Yes	48.49060	-122.68110
Anacortes	B11-1001	OT	Yes	48.49070	-122.67600
Anacortes	F01-1001	OT	Yes	48.51100	-122.60970
Anacortes	F02-1002	OT	Yes	48.50880	-122.60660
Anacortes	F03-1001	O	No	48.50440	-122.60599
Anacortes	F04-1001	O	Yes	48.50080	-122.60490
Anacortes	F05-1001	OT	Yes	48.49740	-122.60129
Anacortes	F06-1001	OT	Yes	48.49550	-122.60100
Anacortes	F08-1001	OT	Yes	48.49174	-122.59993
Anacortes	F08-Culvert	O		48.49278	-122.60063
Anacortes	F09-1001	OT	Yes	48.49030	-122.59916
Anacortes	F09-1001-US	O	No	48.49030	-122.59924
Anacortes	F09-1002	OT	Yes	48.48954	-122.59884
Anacortes	F09-1003	OT	No	48.48850	-122.59800
Anacortes	F09-1004	OT	Yes	48.48570	-122.59620
Anacortes	F14-1001	O	No	48.48070	-122.59280
Anacortes	F14-1002	OT	Yes	48.47870	-122.59210
Anacortes	F14-1003	O	No	48.47830	-122.59180
Anacortes	F14-1004	O	No	48.47790	-122.59170
Anacortes	F14-1005	O	No	48.47640	-122.58980
Anacortes	F14-1006	O	No	48.47500	-122.58880
Anacortes	F15-1001	OT	Yes	48.47300	-122.58790
Anacortes	F15-1002	O	No	48.47280	-122.58770
Anacortes	F15-1003	O	No	48.47200	-122.58750
Anacortes	F15-1004	O	No	48.47020	-122.58620
Anacortes	F15-1005	O	No	48.46830	-122.58629

City	Outfall or Stream	Threshold Code	Site Category	Latitude	Longitude
Anacortes	F15-1006	O	No	48.46740	-122.58590
Anacortes	F15-1007	O	No	48.46670	-122.58590
Anacortes	F15-1008	OT	Yes	48.46630	-122.58570
Anacortes	F15-1008-CLVRT0337	O	No	48.46616	-122.58694
Anacortes	F15-1009	O	No	48.46570	-122.58540
Anacortes	F15-1009-CLVRT0040	O	No	48.46506	-122.58597
Anacortes	F15-1009-CLVRT0042	O	No	48.46570	-122.58668
Anacortes	F15-1010	O	No	48.46520	-122.58480
Anacortes	F17-1002	O	No	48.46690	-122.57089
Anacortes	F17-1002-US	O	No	48.46677	-122.57092
Anacortes	F18-1001	OT	Yes	48.51410	-122.60910
Anacortes	F20-1001	OT	Yes	48.49991	-122.60210
Anacortes	G02-1001	O	No	48.50370	-122.69029
Anacortes	G05-1001	OT	Yes	48.50583	-122.66482
Anacortes	G05-1002	OT	Yes	48.50450	-122.66870
Anacortes	G05-1003	OT	Yes	48.50390	-122.67059
Anacortes	G06-1001	OT	Yes	48.50809	-122.65811
Anacortes	G07-1001	OT	Yes	48.50900	-122.65460
Anacortes	G07-1002	OT	Yes	48.50845	-122.65696
Anacortes	G07-1003	O	No	48.50948	-122.65203
Anacortes	G07-1003 pipe to the east of	OT	Yes	48.50963	-122.65145
Anacortes	G11-1001	OT	Yes	48.51430	-122.63440
Anacortes	G12-1001	O	No	48.51460	-122.63290
Anacortes	G12-1001-US	O	No	48.51433	-122.63271
Anacortes	G15-1001	OT	Yes	48.51860	-122.62330
Anacortes	G16-1001	O	No	48.51910	-122.62020
Anacortes	G17-1001	OT	Yes	48.52010	-122.61700
Anacortes	G18-1001	OT	Yes	48.52050	-122.61550
Anacortes	G19-1001	OT	Yes	48.52140	-122.61400
Anacortes	G20-1039-MH		No	48.51952	-122.61086
Anacortes	G21-1001	OT	Yes	48.52100	-122.60650
Anacortes	G21-1003	O	No	48.51810	-122.59930
Anacortes	G21-1005	OT	Yes	48.51560	-122.60830
Anacortes	G21-1006	O	No	48.52100	-122.60469
Anacortes	P02-1001	O	No	48.46530	-122.53890
Anacortes	P02-1001-US A-east ditch	O		48.46520	-122.53860
Anacortes	P02-1001-US B-west ditch	O		48.46530	-122.53800
Anacortes	P02-1001-US C-north marsh			48.46550	-122.53770

City	Outfall or Stream	Threshold Code	Site Category	Latitude	Longitude
Anacortes	S01-1001	O	No	48.45810	-122.54430
Anacortes	SR20-01	O	No	48.46579	-122.58550
Anacortes	SR20-02	O	No	48.46470	-122.58397
Anacortes	SR20-05	OT	Yes	48.46588	-122.58543
Bellingham	Bennett Ave	OT	Yes	48.72640	-122.50620
Bellingham	Broadway St	OT	Yes	48.75570	-122.49230
Bellingham	C St	OT	Yes	48.75040	-122.48990
Bellingham	CBC Dock	OT	No	48.72188	-122.50896
Bellingham	CBC Midpoint	OT	No	48.72434	-122.50797
Bellingham	Cedar St	OT	Yes	48.74160	-122.49160
Bellingham	Cornwall Ave	OT	Yes	48.74300	-122.49079
Bellingham	Little Squalicum Creek	SRM	No	48.76470	-122.51730
Bellingham	Olive St	OT	Yes	48.73360	-122.49950
Bellingham	Padden Creek	SH	No	48.72010	-122.50720
Bellingham	Squalicum Creek	SRM	No	48.76110	-122.50850
Bellingham	Taylor Dock	OT	No	48.72541	-122.50724
Bellingham	Whatcom Creek	SH	No	48.75460	-122.48330
Bellingham	Willow St	OT	Yes	48.70840	-122.51550
Edmonds	CV1053 - Marsh		No	47.80620	-122.39120
Edmonds	CV12			47.8561	-122.3344
Edmonds	CV17		No	47.85239	-122.33552
Edmonds	CV18		No	47.85239	-122.33552
Edmonds	CV2309	OT	No	47.81430	-122.38070
Edmonds	CV333		No	47.82946	-122.36319
Edmonds	CV34			47.8438	-122.3368
Edmonds	CV59N			47.84885	-122.33801
Edmonds	CV59S			47.84885	-122.33801
Edmonds	CV662	OT	Yes	47.81692	-122.37815
Edmonds	CV663	OT	No	47.81570	-122.37930
Edmonds	CV664	OT	Yes	47.81370	-122.38220
Edmonds	CV665	OT	Yes	47.81295	-122.38334
Edmonds	CV670	OT	No	47.81190	-122.38500
Edmonds	CV676	OT	Yes	47.81698	-122.37807
Edmonds	Hindley & Shell Creeks	SH	No	47.81852	-122.37224
Edmonds	Hindley Creek near CV701	SH	No	47.82031	-122.36654
Edmonds	Hindley Creek-CV761	SH		47.81938	-122.36747
Edmonds	Perrinville Creek-Talbott Rd	SH	No	47.84197	-122.34540
Edmonds	Perrinville Creek-CV399	SH	No	47.83270	-122.33790
Edmonds	Shell Creek	SH	No	47.81200	-122.36750

City	Outfall or Stream	Threshold Code	Site Category	Latitude	Longitude
Edmonds	Shellabarger Creek	SH	No	47.80160	-122.37310
Edmonds	Shellabarger Ck near CV2234	SH	No	47.80615	-122.37727
Edmonds	Upper Stilthouse Ck N Fork			47.847995	-122.336525
Edmonds	Upper Stilthouse Ck S Fork			47.84667	-122.336366
Edmonds	Willow Ck near CV1202	SH	No	47.79837	-122.37491
Everett	Edgewater Creek	SRM		47.95238	-122.28841
Everett	EVE-03		Yes	47.99640	-122.21456
Everett	EVE-04		Yes	48.00167	-122.21829
Everett	EVE-05		Yes	48.00316	-122.21813
Everett	EVE-10	O	Yes	48.01275	-122.18437
Everett	EVE-11	OT	Yes	48.01230	-122.18377
Everett	EVE-13	O	No	48.00889	-122.18056
Everett	EVE-14	O	No	48.00798	-122.18000
Everett	Forgotten Creek	SRM	No	47.97635	-122.21982
Everett	Glenhaven Creek	SRM	No	47.96354	-122.24119
Everett	Glenwood Creek	SRM	No	47.96131	-122.24527
Everett	Pigeon Creek 1	ST	Yes	47.97052	-122.23074
Everett	Pigeon Creek #2	SRM	No	47.96377	-122.23967
Mukilteo	OF041	OT	Yes	47.94782	-122.30748
Mukilteo	OF041-US Lighthouse Pk MH1		No	47.94777	-122.30526
Mukilteo	OF041-US Lighthouse Pk MH2		No	47.74711	-122.30803
Mukilteo	OF059	O	No	47.94417	-122.30817
Mukilteo	OF186	O	Yes	47.95241	-122.28856
Mukilteo	Japanese Gulch (OF186-US Japanese Gulch)	SRM	No	47.95019	-122.29347
Mukilteo	Brewery Creek (OF227-Brewery Ck)	SHT	Yes	47.94922	-122.30377
Mukilteo	OF227-US Brewery Ck 810 Washington	SH		47.94213	-122.30380
Mukilteo	OF227-US Brewery Ck between 2nd & 3rd	SH	No	47.94707	-122.30137
Mukilteo	OF227-US Brewery Ck Culvert @ 8th	SH		47.93988	-122.29880
Mukilteo	OF227-US Brewery Ck Culvert above 5th	SH		47.94500	-22.30164
Mukilteo	OF228	OT	Yes	47.94921	-122.30388
Mukilteo	OF256	O	No	47.94125	-122.30984
Mukilteo	OF259		No	47.94465	-122.30804
Mukilteo	Smuggler's Gulch (OF360-US Smuggler's Gulch DS of 61st Pl W)	SRM	No	47.91693	-122.31511

City	Outfall or Stream	Threshold Code	Site Category	Latitude	Longitude
Mukilteo	OF360-US Smuggler's Gulch US of 61st Pl W		No	47.91724	-122.31507
Mukilteo	OF361-US Big Gulch Library	SRM	No	47.90522	-122.29714
Mukilteo	OF361-US Big Gulch US of PN12909	SRM	No	47.91155	-122.32093
Mukilteo	Big Gulch Creek (OF361-US Big Gulch US of WWTP)	SRM	No	47.91014	-122.31796
Oak Harbor	FID1681	OT	Yes	48.28380	-122.65546
Oak Harbor	FID2971	OT	Yes	48.28566	-122.65013
Oak Harbor	FID3024	O	No	48.28891	-122.63602
Oak Harbor	FID3641	OT	Yes	48.28380	-122.65546
Oak Harbor	FID726	OT	Yes	48.27930	-122.66153
Oak Harbor	PID334,169	O	No	48.28957	-122.64372
Poulsbo	OF3502	O		47.746083	-122.6529
Poulsbo	OF3604	OT	Yes	47.74460	-122.65120
Poulsbo	OF3702 PBO1	O	No	47.73630	-122.64940
Poulsbo	OF3703 PBO2	O	No	47.73830	-122.64970
Shoreline	Blue Heron Creek	SH		47.76100	-122.38100
Shoreline	NC275-Creosote Log	SHT	Yes	47.76162	-122.38266
Shoreline	Storm Creek	SHT	Yes	47.76162	-122.38266
Shoreline	OF1158	OT	Yes	47.76547	-122.38661
Shoreline	OF864	O	No	47.77067	-122.37329
Shoreline	Storm Creek	SH	No	47.77100	-122.37330
Olympia	OF22771	SH		47.047252	-122.894747
Olympia	OF130	O		47.047905	-122.895345
Olympia	OF16347	O		47.051099	-122.904942
Olympia	OF589	O		47.045522	-122.904619

Appendix B: Salish Sea StormwaterMonitoring Program Methods

This page left intentionally blank.

Appendix B.1: Site and Safety Survey Worksheet

Outfall Site & Safety Survey Worksheet

City			
Date mm-dd-yy		Start time	
Volunteer Names		End time	

STORMWATER MONITORING PROJECT

Outfall ID#	GPS - Latitude	GPS - Longitude	Elevation - Meters

Pictures Taken?	Yes or No	File Name(s):	

Accessibility Assessment Part I - Check all that apply					
Pathway to Outfall		**Difficulty of Access**		**Access Affected by Tide?**	
Steep	☐	Easy	☐	No	☐
RipRap	☐	Mocerate	☐	Yes	☐
Loose Soil/Rock	☐	Difficult	☐	If yes, Tide Height Required for Access	Less than ____ feet
Brush	☐	Unsafe/Not Recommended	☐		
Wet	☐				

Accessibility Assessment Part II - Check all that apply			
Access Ownership		**Access Restrictions**	
Public	☐	Key	☐
Private	☐	Gate	☐
Unknown	☐	Other	☐
Owner (if known)		Contact for Access (if known)	

Parking Information - Check which applies								
Room for:	1 car	☐	2 cars	☐	2+ cars	☐	**Distance to Outfall (paces)**	

Describe any landmarks helpful for locating outfall:

Other pertinent recommendations/comments:

2023-06-05rev

FRIENDS of the Salish Sea

Field Procedures

STORMWATER MONITORING PROJECT

Before You Head Out

1. Print out Stormwater Monitoring Worksheets from https://friendsofsalishsea.org/
2. Fill out top section of the Field & Lab Datasheets
3. Assemble Equipment:
   - Map of sites
   - Clipboard
   - Datasheets - field & lab
   - Field notebook - reference docs
   - Pen/pencil/sharpie
   - Hand sanitizer
   - Plastic gloves (if using)
   - YSI -**Turn on before packing**
   - Distilled water (if using)
   - Thermometer
   - Sampling buckets
   - Collecting pole with bucket
   - Phone/camera
   - Bottles for bacteria (1 for each outfall + 1 for duplicate)
   - Cooler & ice/icepack
4. Determine the tide height at start of sampling: www.tidesandcurrents.noaa.gov
5. Record the rainfall for the 24 hours just preceding the start of sampling. For best source of rainfall data for your city visit www.friendsofsalishsea.org

In the Field

IMPORTANT: At any time, if you see a significant source of pollution (ex: large oil sheen, rushing water when it hasn't rained, very strong color or odor) immediately call one of the contact numbers listed below in the section "Reporting Pollution".

1. **As you are leaving to sample, turn on the YSI meter** by pressing and holding the ON/OFF button. At the first monitoring location, (turn meter on if you forgot) remove the gray vinyl sleeve and place meter in the shade while you get set up. You can leave the instrument powered on in between sites.
2. **Arrival Time:** Record the time when you reach the site, even if dry or stagnant.
3. **Flow**:
   a. Record water flow in the creek or coming out of the pipe and record as N, T, M or H.

b. Indicate if flow is greater or less than expected given the last 24 hours of rain.

Flow Rate	Stormwater Outfall	Creek
N = none	no flow/stagnant pooled water	creek bed is dry
T = trickle	fills 16 oz. cup in 2 minutes	lots of exposed rocks/sediment
M = moderate	between trickle and high	between trickle and high
H = high	fills 16 oz. cup in 1 second	flow close to high water mark

4. **Air Temp**: Record air temperature using field thermometer placed in the shade, at shoulder height. Depending upon the type of thermometer used, it may take up to 3-4 minutes for it to stabilize.

5. **Bacteria/Turbidity Sample**:

   a. Collect the water sample from flowing water (preferred method) using a sterile bottle, rinse the bottle and cap 3 times with sample water before collecting the sample. If the flow is too low or only reachable using the bucket on the pole, rinse the sampling bucket 3 times and then collect the sample from the bucket.

   b. Do not touch or contaminate the inside of the bottle or cap. Fill to the shoulder of the bottle in order to leave enough room to allow mixing of the sample back at the lab. Tightly screw lid back on the sample bottle.

   c. Keep the samples at 4°C (40°F) by placing them in an ice-filled cooler. Within 6 hours of sampling either begin culture procedures or place in a refrigerator.

   d. **Note:** Do not place YSI meter into sample bucket prior to collecting bacteria sample.

   e. Record the bottle letter on the Field Datasheet.

6. **Water sample for YSI measurements**: Collect water sample from the outfall or creek by rinsing the plastic bucket 3 times with the water to be sampled and then collecting a 4th sample to measure. Avoid collecting sediment with the water sample, avoid touching the water or inside of the bucket.

7. **Water Temperature** (T) C°**, Dissolved Oxygen** (DO) mg/L**, Specific Conductivity** (SPC) µS/cm**, Salinity** (ppt)**,** and **pH:**

   a. Measure using the YSI Meter. Rinse the meter to remove any remaining droplets from prior outfall. This can be done with the water from your 3x rinsing of the sample container or directly in the outflow.

b. Dip the probe in the water sample and stir gently for 15 seconds. Parameters should be measured as soon as possible after the sample has stabilized as conditions in the bucket will change quickly.

c. DO will take the longest to stabilize. Swirl the probe quickly, but slow enough to not spill the sample. If you are swirling too fast, DO will keep increasing. If you are swirling too slow, DO will keep decreasing. When DO is both increasing and decreasing slightly with a random pattern, it is time to take the reading.

d. Record the values shown on the meter on the worksheet.

e. Replace the gray vinyl sleeve.

Troubleshooting DO
If the DO probe provides unusual measurements like: ● abnormally high values greater than 20 mg/l, ● negative numbers, ● never stabilizes, ● or values swing up and down no matter if you stir or not, then the membrane in the yellow cap may be perforated or split. Disregard the DO values for the rest of the survey. The yellow cap requires replacement. Back at the lab, email the person who calibrates the instrument and report that the DO cap membrane is possibly perforated or split.

8. **Observations of the outfall or creek, the sample and immediate downstream area**: Record both a number representing severity of the condition observed and write out a short description in the space provided. Use the Notes section if additional space is needed.

    a. **Color**: Assess color qualitatively using visual observations of how severely a sample is discolored. Observations included brown, reddish brown, light green etc… Record the color seen followed by a 1 to 3 scale. Ex: Brown, 3. See below.

    b. **Odor**: Assess odor by describing the intensity or severity of the odor. Observations may include sulfur, fossil fuel, sewer, perfume etc. Record 0 or the odor/smell followed by a 1 to 3 scale. Ex: Rotten eggs 2. See below.

    c. **Visual Indicators**: Document the visual observations by describing objects that are on the surface of the water. Observations include sheen, floaters, foam etc... Record 0 or the visual followed by a 1 to 3 scale. Ex: Sheen 1. See below.

    d. Take a photo to document any unusual observations.

e. **NOTE**: If the situation is complex with multiple odors, color and other visuals, fill out a detailed Color, Odor & Visual Indicators Worksheet for the outfall.

Color Severity Scale		Odor Severity Scale		Visual Indicators Scale	
0	None	**0**	None	**0**	None
2	Color clearly visible in sample	**2**	Odor easily detected	**2**	Moderate
3	Color clearly visible in outfall flow or creek	**3**	Odor noticeable from a distance	**3**	Excessive/severe
1	Faint color in sample	**1**	Faint odor	**1**	Few/slight

9. Pack up equipment and clipboard and proceed to the next site, repeat steps 1-8.

10. Turn off the YSI meter after the last sampling site.

Back at the Lab

1. Process bacteria samples and measured turbidity - See Lab Methods.
2. If you are not doing bacteria samples then:
    a. **Photograph datasheets**: Create a digital copy of your worksheets using your smartphone, or any other method, to generate a clear, readable pdf (preferred), jpg, or HEIC file.
    b. **Share datasheets:** Email to surveydatasheets@googlegroups.com as soon after incubation as possible. This helps us get the news to the cities quickly.
    c. **Enter data**: Go to https://friendsofsalishsea.org/volunteer-resources/ to access the VI Data Entry Form.
    d. **Datasheets**: Place original datasheets in a designated place or take home and keep until you are notified a clear readable version was received.
3. **Clean & Store Equipment**:
    a. Wipe YSI meter down with Clorox sanitizing wipes.
    b. Wipe YSI cable down with Clorox wipes.
    c. Remove gray vinyl probe cover and set it in white tub in an upside-down position.
    d. Knock out yellow sponge and leave in the tub, also.

e. Place YSI probe into 1qt storage container with pink pH 4 solution, in the tub.

Reporting Pollution

OIL SPILLS
Call Immediately!

WA Emergency Management Division (800) OILS-911 or (800) 645-7911
National Spills Response (800) 424-8802

OTHER POLLUTION
Including sick salmon

Ecology NW Regional Office (Island, King, Kitsap, San Juan, Skagit, Snohomish and Whatcom) (206) 594-0000 or nwroerts@ecy.wa.gov

LOCAL STORMWATER HOTLINES

Anacortes (360) 293-1921
Bellingham (360) 778-7979
Edmonds (425) 771-0235
Everett (425) 257-8821
Mukilteo (425) 263-8088
Oak Harbor (360) 279-4764
Shoreline (206) 801-2700
Poulsbo (360) 779-4078

If it is after business hours and no one answers, call 911 to make your report. Some cities, maybe all, are set up for the dispatchers to notify the WWTP staff who are on duty 24 hrs/day.

OTHER HOTLINES

Derelict Boats (Dept of Natural Resources) (360) 902-2628
Derelict Fishing Gear (Dept of Fish & Wildlife) (855) 542-3935
Large marine debris, creosote debris, abandoned boats: https://mycoast.org/wa
Navigation Hazards (US Coast Guard Puget Sound (206) 217-6200
West Coast Marine Mammal Stranding Network (888) 767-6114

Parameters - What they Indicate

Flow: Flow in an outfall during dry weather is an indicator that a water source other than stormwater is flowing through the storm drainage system. It could be natural groundwater flow but could also be sanitary sewer cross-connection, potable water (swimming pool, hydrant flushing), or illegal dumping.

Color: The color of water is influenced by the presence or absence of substances such as metallic salts, organic matter, dissolved or suspended materials. Color can indicate when stormwater has been contaminated by an illicit discharge or illicit connection, but not all illicit discharges will have a color.

Odor: Odor should be assessed qualitatively in the field using your nose to determine if a water sample has a distinct smell. Odor observations are subjective and may include descriptions such as a petroleum, sewage, or chemical odor.

Visual Indicators: Visual indicators other than color, odor, and flow can often indicate when stormwater has been contaminated by an illicit discharge or illicit connection; however, not all illicit discharges will have visual indicators. Visual indicators are assessed qualitatively by field staff using simple visual observations. Ex: abnormal vegetation, algae/bacteria/fungus, deposits/staining, fish kills, floatable, surface film/sum/sheen, or trash/debris.

Water Temperature (T) °C: Temperature extremes can threaten the health and survival of fish and other aquatic species in many life stages including embryonic development, juvenile growth, and adult migration. Water temperature can be useful in identifying contamination by sanitary wastewater or industrial cooling water. Household and commercial sewage produces heat due to microbial activity during anaerobic decomposition, while industrial cooling water is heated as it is circulated through heat exchangers. Water temperature measurements are typically the most useful for IDDE when indicator sampling is being conducted during cold weather and temperature differences can be significant.

Dissolved Oxygen (DO) mg/L*:* DO is an important parameter for salmonids and other aquatic organisms. Low dissolved oxygen levels can be harmful to larval life stages and respiration of juveniles and adults. DO depends on local hydraulic conditions affecting the oxygenation of the discharge. For this reason, DO is not a widely useful indicator for illicit discharges.

Specific Conductivity (SPC) µS/cm*:* Specific conductivity, also referred to as specific conductance, is a measure of how well water can conduct an electrical current based on ionic activity and content. Specific conductivity is an indicator of dissolved solids from potential pollutant sources such as sewage and wash water, and can help distinguish groundwater from illicit discharges and identify commercial/ industrial liquid waste if used in combination with another parameter such as Hardness, Turbidity, or Detergents/Surfactants. Specific conductivity can also be used in combination with caffeine or pharmaceuticals (see Other Indicators) to indicate sanitary wastewater.

Salinity (ppt)*:* This is the saltiness or dissolved inorganic salt content of water. The Pacific Ocean has an average salinity of 34 parts per thousand (ppt) compared to 29 ppt in Puget Sound. Measuring salinity will indicate if there is saltwater intrusion in the outfall or creek which will affect conductivity (make it higher).

pH*:* pH measures the hydrogen ion activity on a scale from 1 to 14. Water with a pH below 7.0 is acidic and water with a pH above 7.0 is alkaline or basic. pH values that are lower than 6.5 or higher than 8.5 may be harmful to fish and other aquatic organisms. A low pH can cause heavy metals to leach out of stream sediments, resulting in an increase in dissolved metals concentrations. A high pH can produce a toxic environment, in which ammonia becomes more poisonous to aquatic organisms.

Turbidity (ntu): Turbidity is a measure of how transparent or clear water is based on the amount of sediment or suspended particulates. Large amounts of suspended material can affect fish growth and survival by impairing their vision, gill function, and affecting egg and larval development. Higher turbidity can also increase temperature and thereby decrease dissolved oxygen concentrations in water bodies, affecting the growth of both aquatic animals and plants. High turbidity in water can be attributed to many different sources including soil erosion, construction activities, sanitary wastewater, excessive algal growth, or industrial processes.

***E. coli and Enterococci* Bacteria (cfu/100 ml)**: These bacteria indicate the presence of fecal contamination by warm-blooded animals. *E. coli is* typically used as an indication of fecal contamination of stormwater and fresh water systems while *Entero* is used as an indication of fecal contamination in marine waters. A relatively elevated test result for fecal coliform bacteria may indicate an illicit discharge or illicit connection associated with sewage or a failing septic system. However, it may also indicate waste related to large domestic animals (such as cows, llamas, etc.), pets, or wild animals.

References

- WA Stormwater Center: https://www.wastormwatercenter.org/
- Stormwater Action Monitoring (SAM) Program
- IC-ID Field Screening and Source Tracing Manual May 2020
- City of Bellingham Surface and Stormwater Comprehensive Plan 2020

Appendix B.3: Field Datasheet

Field Datasheet

City				Date			STORMWATER MONITORING PROJECT		
Investigators			Start Time		End Time				
Tide Height +/- ft.			Tide Time				Past 24hr Rainfall		
Weather (circle)	Sun/Clear Part Cloud Overcast Rain-Light, Mod, Heavy Snow						DRY OUTFALLS		
SIte ID									
Arrival Time									
Flow: T, M or H							Thresholds		
							Outfall	Creek	
Flow compared to expected based on rainfall (circle one)	Higher	Higher	Higher	Higher	Higher	Higher	unexpected high or low flow		
	Normal	Normal	Normal	Normal	Normal	Normal			
	Lower	Lower	Lower	Lower	Lower	Lower			
Air Temp °C									
Water Temp °C							> air T	**> 16 C habitat > 17.5 C spawn, rear, migrate**	
DO mg/l							< 6 mg/l	< 10.0 mg/l	
SPC µS/cm							> 500 µS/cm		
Salinity ppt									
pH							< 5 or > 9	< 6.5 or > 8.5	
Color	Rank 0-3						any non natural phenomena		
	Describe								
Odor	Rank 0-3								
	Describe								
Visual	Rank 0-3								
	Describe								
Bacteria Bottle #									
Notes									

2025-01-29 ver 4.4

Protocol Reminders

- YSI meter – turn on before you leave to sample and leave on between sites.
- Flow - do not monitor/sample stagnant/pooled water. There must be an observable flow.
- Rinse all containers 3x each with outfall/creek water and keep 4th fill to sample/monitor.
- Collect samples directly from outfall or creek for bacteria when possible.
- DO - swirl YSI probe quickly, but slow enough not to spill sample. When DO value increases or decreases slightly with a random pattern record the value.

Guide to Filling Out Worksheet

- **Investigators:** list all who are present. This is how we track volunteer hours for grants.
- **Tide**: record tide at start of sampling, example - 0.25' @ 13:14
- **Past 24hr Rainfall:** from the start of sampling; use recommended website/app for your city.
- **Air Temp:** read field thermometer while shaded from the sun; give it 3-4 minutes to stabilize.
- **Flow:** record appropriate letter and circle if greater or less than expected based on rainfall.

Flow Rate	Stormwater Outfall	Creek
N = none	no flow/stagnant pooled water	creek bed is dry
T = trickle	fills 16 oz. cup in 2 minutes	lots of exposed rocks/sediment
M = moderate	between trickle and high	between trickle and high
H = high	fills 16 oz. cup in 1 second	flow close to high water mark

- **Color:** Observations may include brown, reddish brown, light green etc**…** Record the color seen and a severity rating. Ex: Brown 3.
- **Odor**: Observations may include sulfur, fossil fuel, sewer, perfume... Record the odor smell and a severity rating. Ex: Rotten Eggs 2.
- **Visual**: Observations may include sheen, floaters, foam etc... Record the visual and a severity rating. Ex: Sheen 1.
- **Any condition rated >0**: photograph and describe in Notes.

Color Severity Scale		Odor Severity Scale		Visual Severity Scale	
0	None	0	None	0	None
1	Faint - faint color in sample	1	Faint - odor barely noticeable	1	Few/slight
2	Moderate - color clearly visible in sample	2	Moderate - odor easily detected	2	Moderate
3	Intense - color clearly visible in outfall flow or creek	3	Strong - noticeable several feet away	3	Excessive/severe

Back at the Lab

- Complete datasheet. Include completion time.
- Snap photo of worksheet with smartphone and send to **surveydatasheets@googlegroups.com**
- Rinse out sample cup and vial of any sediment or debris.
- Wipe down YSI instrument with Clorox wipes.
- Remove grey vinyl probe cover and place probe in pink storage solution**.**

For additional resources and instructional materials visit: www.friendsofsalishsea.org

Stormwater Monitoring Datasheet – Color, Odor & Visual Indicators

City	
Outfall	
Date	
Time	
Volunteers	

Photos Taken?	
YES	NO

Salish Sea STORMWATER MONITORING

Observations					
Color Severity Index	**#**	**Odor Severity Index**	**#**	**Visual Indicators Severity**	**#**
Faint color in sample	1	Faint odor	1	Few/slight	1
Color clearly visible in sample	2	Odor easily detected	2	Moderate	2
Color clearly visible in outfall flow	3	Odor noticeable from a distance	3	Excessive/severe	3
Brown to Reddish Brown		Musty		Excessive Vegetation	
Orange-Red		Rotten Eggs		Dead Vegetation	
Dark Red or Purple		Rotten/Spoiled		Fish Kills	
Blue Green to Brown Green		Sewage		Dried White Mat-like Residue	
Black		Soapy/Perfume		Algae Bloom	
Gray to Milky White		Kerosene or Gasoline		Bubbles or Suds with Rainbow Sheen	
Yellow to Bright Green		Yeasty		Petroleum Sheen	
Other - Explain		Beer, Alcohol		Fats, Grease, or Oils	
Orange-Red		Sharp, Acrid		Deposits, Staining	
Dark Red or Purple		Chlorine		Sewage Signs – Toilet Paper	
		Sweet, Musty		Other - Explain	
		Other - Explain			

Do Odor/Color/Other Visual Indicators suggest possible pollution?	**CIRCLE ONE**
Unlikely	**NO**
Potentially – presence of two or more indicators; suggest increased observation	**MAYBE**
Suspected – one or more indicators with a severity of 3; suggest further investigation	**YES**

Notes & Questions:

Photo Monitoring with Observations

City	
Date	
Time	
Volunteers	

Photo Monitoring Sites
-A
-B
-C

STORMWATER MONITORING PROJECT

Observations											
Color Severity	**Rank**			**Odor Severity**	**Rank**			**Visual Severity**	**Rank**		
Faint color in sample	1			Faint odor	1			Few/slight	1		
Color clearly visible in sample	2			Odor easily detected	2			Moderate	2		
Color clearly visible in outfall flow	3			Odor noticeable from a distance	3			Excessive/severe	3		
Photo Monitoring Site:	**A**	**B**	**C**	**Photo Monitoring Site:**	**A**	**B**	**C**	**Photo Monitoring Site:**	**A**	**B**	**C**
Brown to Reddish Brown				Musty				Excessive Vegetation			
Orange-Red				Rotten Eggs				Dead Vegetation			
Dark Red or Purple				Rotten/Spoiled				Fish Kills			
Blue Green to Brown Green				Sewage				Dried White Mat-like Residue			
Black				Soapy/Perfume				Algae Bloom			
Gray to Milky White				Kerosene or Gasoline				Bubbles or Suds with Rainbow Sheen			
Yellow to Bright Green				Yeasty				Petroleum Sheen			
Other - Explain				Beer, Alcohol				Fats, Grease, or Oils			
Orange-Red				Sharp, Acrid				Deposits, Staining			
Dark Red or Purple				Chlorine				Sewage Signs – Toilet Paper			
				Sweet, Musty				Other - Explain			
				Other - Explain							

Do Odor/Color/Other Visual Indicators suggest possible pollution?	**CIRCLE ONE**		
Photo Monitoring Site			
Unlikely	**NO**	**NO**	**NO**
Potentially – presence of two or more indicators; suggest increased observation	**MAYBE**	**MAYBE**	**MAYBE**
Suspected – one or more indicators with a severity of 3; suggest further investigation	**YES**	**YES**	**YES**

Notes & Questions:

Lab Procedures

STORMWATER MONITORING PROJECT

Collecting Samples

For each site:

1. Collect a water sample from flowing water (preferred method) using a sterile bottle, rinse the bottle and cap 3 times with sample water before collecting the sample. If the flow is too low or only reachable using the sampling bucket on the pole, rinse the sampling bucket 3 times and then collect the sample from the bucket. Do not touch or contaminate the inside of the bottle or cap. Fill to the shoulder of the bottle in order to leave enough room to allow mixing of the sample back at the lab. Tightly screw lid back on the sample bottle. Keep the samples at 4°C (40°F) by placing them in an ice-filled cooler. Within 6 hours of sampling either begin culture procedures or place in a refrigerator.
2. Record the bottle ID on the Lab Datasheet.

Processing Bacteria

For each water sample:

1. Turn on the incubator and set to 37°C (97°F).
2. Spray down the lab work surface with isopropyl alcohol.
3. Wash and/or sanitize hands. Put on gloves if desired.
4. Label R-CARDs (one per sample bottle, plus one negative control) with:
    a. Date
    b. Outfall/Field Site ID
    c. Sample Bottle Number
    d. For negative control, write 'NC'
    e. For duplicate, write 'dupe' after outfall ID
5. Use distilled water for negative control (NC). It is not necessary to sterilize the distilled water.
6. Collect needed materials: micropipette, sterile micropipette tips & forceps and sterilization materials if you choose to use them.

7. Sterilize the forceps - i**f you choose to use the forceps to lift the cover on the R-CARD, make sure to sterilize before each use.**
8. Make sure the micropipette is set to 3 ml (3000 µL). This will look like 3.00 on the micropipette.
9. Put a sterile tip on the micropipette.
10. Shake the sample bottle 30 times moving the bottle in an arc from about your ear to your waist.
11. After shaking, take the sample as quickly as possible. Press down on the top button until you hit the first stop. Submerge the micropipette tip in the sample and extract a 3 ml sample by releasing the top button while stirring and moving the micropipette up and down in the bottle.

Note: Release the top button slowly to prevent sucking up air bubbles in the tip. To find the first stop, press down on the top button gently until you feel a natural stopping point. You can push past this point if you exert more pressure but you should feel a defined stop.

IMPORTANT: Be careful not to lay the micropipette down flat or invert it as this will allow the sample in the tip to run back into the machinery of the micropipette.

12. Make sure the R-CARD is on a level surface and carefully lift the top layer of the R-CARD without touching the underside of the cover. Expel the sample water as droplets spreading it across the R-CARD, but avoiding the very edges, by slowly pushing down on the top button of the micropipette. Go past the first stop on the micropipette all the way to the final stop to expel the sample. Gently lower the top cover of the R-CARD. Do not press it down with your fingers.
13. Use the button on the back of the micropipette to remove the tip into a ‘non-sterile’ container.
14. Wait 60 seconds to allow the R-CARD coating to absorb the sample water. **Note**: You can also complete all of the samples first and then wait 60 seconds after the final sample before putting all of the samples in the incubator at the same time.
15. Place the R-CARD into the incubator and record the time on the Lab Datasheet.
16. Incubate for approximately 23 hours. It is better to be a bit shorter than to go over 23 hours.

Continued on next page

Measuring Turbidity

Step	Check for Accuracy	To Calibrate	To Use
1	QUICK Press the POWER/CAL button (upper center button)	When 'STBY' is on screen, press and hold down the POWER/CAL button for 3 seconds. This will take you into calibration. You should see 'Cal 1' in the lower left corner of the screen	RINSE the vial 3 times with sterile water from a lab squeeze bottle.
2	Take 100 ntu vial from calibration kit	Start with 0 ntu calibration vial and invert slowly 3 times	INVERT 250 ml sample bottle 3 times and fill vial with sample water.
3	Slowly INVERT 3 times - careful to not introduce bubbles	Insert 0 ntu vial into AMTAST meter matching black bump with gray triangle	WIPE down outside of vial to remove fingerprints & water droplets.
4	WIPE down outside of vial to remove fingerprints	Press READ button and wait until '20' appears on screen	Insert vial making sure to match up the small dot on lid with the arrow on meter.
5	Insert vial, making sure to match up black bump on lid with gray triangle	Replace 0 ntu with 20 ntu and press READ button; Cal symbol should blink Wait until '100' appears on screen	QUICK Press READ button. Value will appear in screen within 10-15 seconds
6	QUICK Press READ button	Replace 20 ntu vial with 100 ntu and press READ button. Wait until '800' appears on screen	Record number on datasheet, remove and empty the vial.
7	If reading is between 97-103, continue to Column 4: "To Use"	Replace 100 ntu vial with 800 ntu vial and press READ button. Wait until STBY appears.	Repeat steps for all sample bottles.
8	If reading is outside range, continue to Column 3: 'To Calibrate'	Remove 800 NTU vial. Screen should read 'STBY'. You are now ready to take a reading.	To turn off: QUICK Press POWER/CAL button.

Sterilization & Clean-up

1. Dispose of all extra sample water. Put a spritz of distilled water in each used sample bottle and place lids in a container together with a spritz of distilled water. Sterilize by microwaving for 60 seconds at 100% power. If the bottles have been properly sterilized, you should see steam rising from them when you pull them out of the microwave. You may need to microwave longer depending on the power of your microwave.
2. Sterilize all used micropipette tips by putting a spritz of distilled water in the non-sterile container containing the used tips. Microwave for 60 seconds at 100% power. You may need to microwave longer depending on the power of your microwave. Sanitize your hands and then return the sterile tips to the tip container.
3. Put away all equipment.
4. Spray down workspace with isopropyl alcohol.
5. Wash and sanitize hands.

Day 2: Counting, Recording & Clean-up

For each R-CARD:

1. Count the number of large, dark blue/green dots on the R-CARD. Ignore pinhole-sized or very faint dots. If there are a lot of dots, you can use the estimation method below.
2. Record the pertinent information on the Lab Datasheet.
3. Remember to also calculate the total number of cfu/100 ml.
4. Calculating for 3 ml samples: # of green dots on card X 33.3. Round to the nearest whole cfu.
5. Place R-CARDs in a plastic baggie, squirt about 1 ml of isopropyl alcohol into the bag and seal. Swirl the liquid around the baggie to ensure all the R-CARDs are covered and then dispose of the plastic baggie in the trash.

Estimation Method (developed by the Whatcom Conservation District)

1. Only use this method if there appears to be >60 colonies on the R-CARD.
2. Choose 5 squares randomly (these squares must be populated, no blank squares), and count them. Record the number of colonies for each square.

3. Take the average of the 5 squares and multiply by how many total squares are populated on the R-CARD.
4. While counting all the populated squares on the card, you can combine squares, if needed. (Ex. Combining 2 squares that are only half-populated = 1 square)

Submit & Enter Data

As soon as possible after incubation:

1. Create a digital copy of your worksheets and R-CARDs using your smartphone, or any other method, to generate a clear, readable pdf (preferred), jpg, or HEIC file.
2. Email to surveydatasheets@googlegroups.com and woodc@umich.edu as soon after incubation as possible. This helps us get the news to the cities as quickly as possible!
3. Open the data entry form at https://friendsofsahlissea.org/volunteer-resources/.
    a. Choose 'sign in as Guest' to open the form and complete the form with the data from your survey.
    b. **IMPORTANT: Check the 'complete' box in the upper left corner of the screen and log out when complete** or your data will not load into the database and will need to be re-entered.
4. Place original datasheets in a designated place or take home and keep until you have been notified that clear readable copies have been received.

Appendix B.7: Lab Datasheet

Lab Datasheet

STORMWATER MONITORING PROJECT

City								
Sample Collectors				Date	Start Time	End Time	Reminders	
							Rinse bottle 3 x, collect 4th Fill to round shoulder of bottle	
							Deliver to lab no more than 6 hrs from collecting	
Lab Processors							Process all bacteria samples before turbidity	
							Turbidity instructions on back of datasheet	
							Incubate RCARDs for 18-23 hours	
Colony Counter							E. coli Threshold > 320 cfu/100 ml	
							Incubator IN	Incubator OUT

Site ID	Bottle ID	Sample Vol. ml	*E.coli* Count	Multiply	*E.coli* cfu/ 100 ml	Turbidity ntu	Comments (Leak, etc)
-dup		3		33.3			
		3		33.3			
		3		33.3			
		3		33.3			
		3		33.3			
		3		33.3			
		3		33.3			
		3		33.3			
Distilled water		3		33.3			

Notes:

AMTAST Turbidity Meter Procedures

Step	Check for Accuracy:	To Calibrate:	To Use:
1	QUICK Press the POWER/CAL button (upper center button)	When 'STBY' is on screen, press and hold down the POWER/CAL button for 3 seconds. This will take you into calibration. You should see 'Cal 1' in the lower left corner of the screen	RINSE the vial 3 times with sterile water from a lab squeeze bottle.
2	Take 100 NTU vial from calibration kit	Start with 0 NTU calibration vial and invert slowly 3 times	INVERT 250 ml. lab-sample bottle 3 times and fill vial with sample water.
3	Slowly INVERT 3 times - careful to not introduce bubbles	Insert 0 NTU vial into AMTAST meter Match black bump with gray triangle	WIPE down outside of vial to remove fingerprints/water droplets.
4	WIPE down outside of vial to remove fingerprints	Press READ button and wait until '20' appears on screen	Insert vial making sure to match up the small dot on the lid with the arrow on meter.
5	Insert vial, making sure to match up black bump on lid with gray triangle	Replace 0 NTU with 20 NTU and press READ button; Cal symbol should blink Wait until '100' appears on screen	QUICK Press READ button. Value will appear in screen within 10-15 seconds
6	QUICK Press READ button	Replace 20 NTU vial with 100 NTU and press READ button Wait until '800' appears on screen	Record number on datasheet, remove and empty the vial.
7	If reading is between 97-103, continue to Column 4: 'To Use'	Replace 100 NTU vial with 800 NTU vial. Press READ button. Wait until STBY appears.	Repeat steps for all sample bottles.
8	If reading is outside range, continue to Column 3: 'To Calibrate'	Remove 800 NTU vial. Screen should read 'STBY', You are now ready to take a reading.	To turn off: QUICK Press POWER/CAL button.

Notes:

- Buttons are dual use related to length of press
- QUICK Press - Power On/OFF and READ
- LONG Press - Move into calibration mode
- Make sure to wipe vial in between each use, we want to keep moisture out of the machine.

Appendix C: Bellingham Stream Background Turbidity Calculations

The Washington Department of Ecology water quality standard for turbidity in freshwater streams is set at not to exceed 5 ntu over background when the background is 50 ntu or less or should not exceed a 10% increase in turbidity when the background is more than 50 ntu. Background turbidity levels would be represented by sampling upstream of known point sources such as active construction sites. RE Sources collects turbidity data at all Bellingham streams monthly, since late 2020. Originally, the turbidity tube method was used then in 2023 methods switched to an Amstat turbidity meter to provide more accurate data. Using this data, RE Sources staff calculated turbidity thresholds for each urban creek based on the procedure in the Urban Streams Monitoring Program Report (City of Bellingham, 2015).

To establish the background turbidity of each urban creek monitored, the average was calculated using the 2.5 yrs of turbidity data collected using the AMSTAT meter (Table C.1.). The average turbidity levels calculated compare favorably with previously reported background levels (Table C.2). With the background turbidity calculated, 5 ntu was added to establish site specific water quality standards.

Table C.1. Salish Sea Stormwater Monitoring turbidity values with no duplicates or turbidity tube data entries for the urban creeks in Bellingham and site specific Water quality Standards.

SSSWM Turbidity - No Duplicates or Turbidity Tube Data (ntu)			
Stream Name	2025 Avg	2.5 yr Avg	Site Specific WQS 2.5 yr Avg + 5 ntu
Little Squalicum Creek	1.15	2.25	**7.25**
Squalicum Creek	6.62	9.29	**14.29**
Whatcom Creek	2.06	2.35	**7.35**
Padden Creek	10.85	6.87	**11.87**

Table C.2. City of Bellingham (2015) urban stream monitoring data on turbidity for urban creeks.

Turbidity (ntu)			
Stream Name	2015 Avg	5 yr Avg	10 Yr Avg
Little Squalicum Creek	NA	NA	NA
Squalicum Creek (Mouth)	6.02	8.31	7.96
Whatcom Creek (Dupont)	2.42	3.14	3.23
Padden Creek (Mouth)	3.39	7.63	6.52

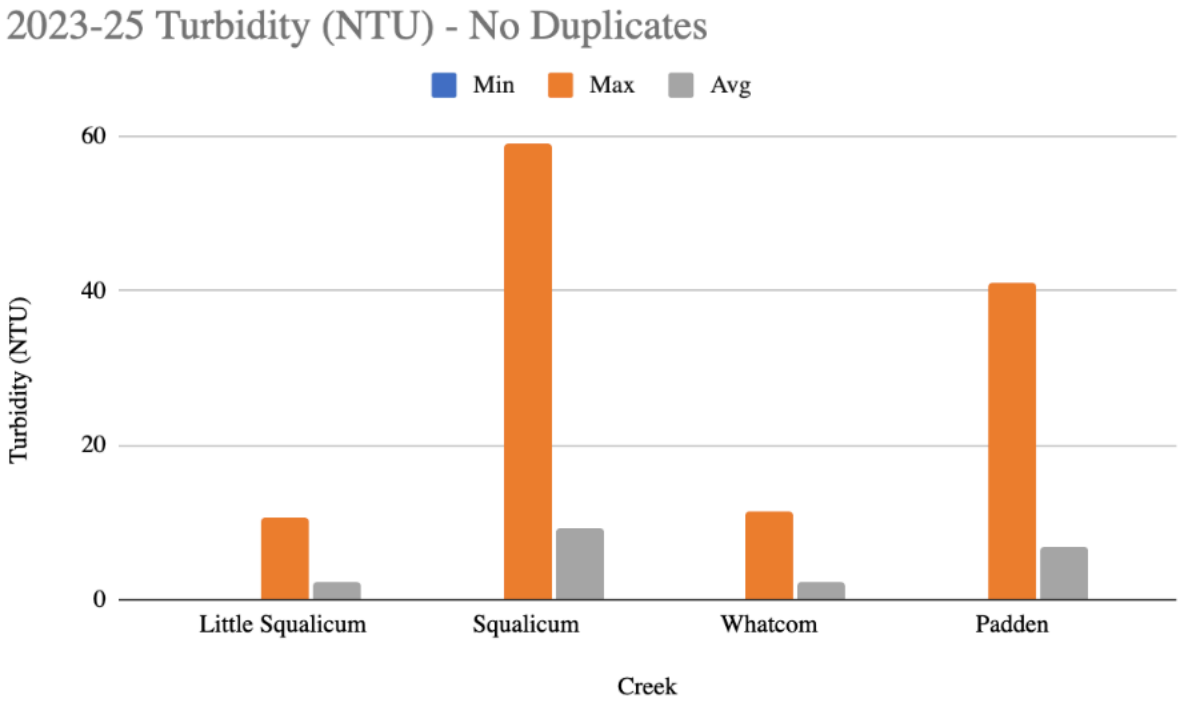


Fig. C.1. The four urban creeks monitored in Bellingham are shown on the x axis. Turbidity in ntu is shown on the y-axis. The minimum, maximum, and average values of turbidity calculated from data that was observed between 2023 and 2025 are shown per each creek. Squalicum creek had the highest level of turbidity observed at 59 ntu. Squalicum Creek also had the highest average turbidity at 9.288 ntu. All creeks had a shared minimum value of 0 ntu.