DEPARTMENT OF ECOLOGY
State of Washington

Northwest Regional Office Addendum to Quality Assurance Project Plan A2

Nonpoint Pollution Investigations in Western Washington

South Skagit Bay Water Quality Assessment

December 2021
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This Quality Assurance Project Plan Addendum is on the Department of Ecology's website at https://fortress.wa.gov/ecy/publications/SummaryPages/2110066.html This is an addition to an original Quality Assurance Project Plan (QAPP). It is not a correction (errata) to the original plan.

This QAPP addendum was approved to begin work in July 2021. It was final in December 2021. Finalized and approved for publication in December 2021.

Data for this project will be available on Ecology's Environmental Information Management (EIM) website at EIM Database. Search Study ID SSB_WQ.

Original Quality Assurance Project Plan:

Ultican, S., J. Riedmayer, and M. Gleason. 2021. Quality Assurance Project Plan: Nonpoint Pollution Investigations in Western Washington. Publication 21-10-027. Washington State Department of Ecology, Olympia.
https://fortress.wa.gov/ecy/publications/SummaryPages/2110027.html.

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Nonpoint Pollution Investigations in Western Washington

South Skagit Bay Water Quality Assessment

By: Heather Khan and Scott Bohling

December 2021

Approved by:

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EAP: Environmental Assessment Program

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Background

Introduction and Problem Statement

In 2017, Washington State Department of Health (DOH) recorded high bacteria levels at a few marine stations in the South Skagit Bay area. High bacteria levels in a northern portion of Skagit Bay and in Port Susan to the south of the bay prompted DOH to close shellfish beds in those areas. DOH classified shellfish beds within South Skagit Bay itself as "threatened." The goal of this monitoring effort is to prevent shellfish bed closures by guiding efforts to find and fix pollution sources.

Through an earlier Memorandum of Understanding, Ecology was assigned as the lead agency for investigative studies. From 2018 to early 2020, Ecology conducted its watershed study beginning in Big Ditch/Maddox Slough drainage. COVID-19 restrictions significantly reduced this work in 2020. Beginning in 2021, Ecology will expand the South Skagit Bay bacteria assessment into the Old Stillaguamish drainage while keeping a few key sampling locations in the Big Ditch/Maddox Slough drainage.

Study area and Surroundings

Skagit Bay is located in the northern Puget Sound, surrounded by Fidalgo Island to the north, the Skagit and Stillaguamish deltas to the east, Camano Island to the south, Whidbey Island to the west. As part of our South Skagit Bay Watershed Assessment Plan, we are focusing on four drainage areas within the Skagit Bay watershed including the Skagit delta, Big Ditch/Maddox Slough, Fisher/Carpenter Creeks and Old Stillaguamish Channel (Figure 1).

As noted above, we are reducing our focus in the Big Ditch/Maddox Slough drainage and expanding our focus to include the Old Stillaguamish Channel drainage area. The Old Stillaguamish Channel empties into South Skagit Bay via West Pass. West Pass receives streamflow from the Stillaguamish River via the Old Stillaguamish Channel. Roughly 10% of the Stillaguamish River flows to the Old Stillaguamish Channel. The remaining 90% flows through Hatt Slough to Port Susan. Further downstream on the Old Stillaguamish Channel, there is further branching where 20% of the Old Stillaguamish Channel flows through West Pass to Skagit Bay and the remaining 80% flows through South Pass to Port Susan (Pelletier and Sullivan, 2006; Kardouni, 2012).

Land uses and significant features of the Big Ditch/Maddox and Old Stillaguamish drainage areas are discussed below.

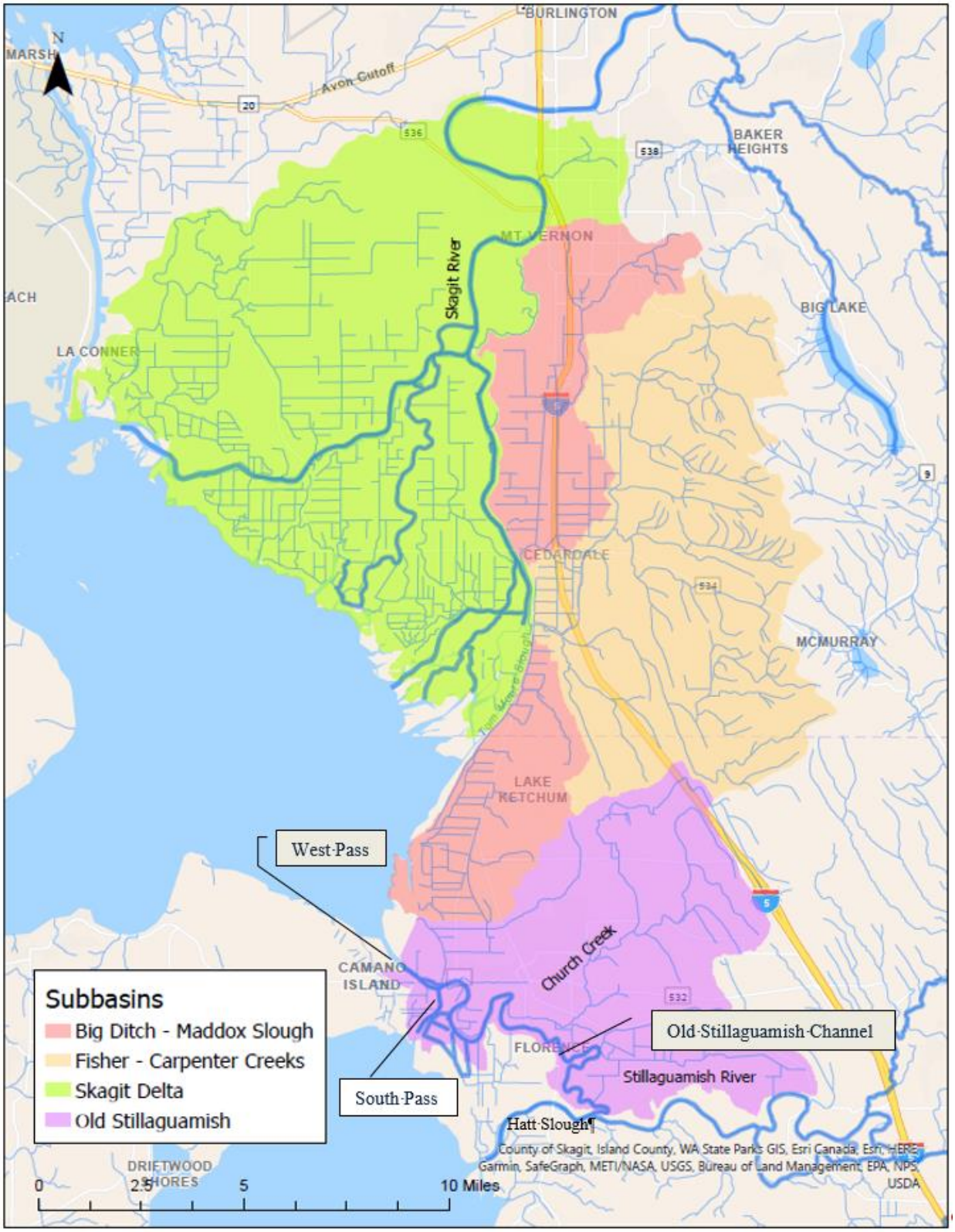

Figure 1. South Skagit Bay Map

Big Ditch/Maddox Slough

Big Ditch receives partial flow from the south fork of the Skagit River through a tide gate operated by Washington State Department of Fish and Wildlife near Conway. High tides raise Skagit River water levels, which flow into Big Ditch through this gate (Kardouni 2012). Most of the land use within this drainage area is agricultural or developed (Table 1).

Table 1. Percent cover of various land uses and land covers in Big Ditch/Maddox Slough drainage area. Data from Cropland Data Layer.

Land Use/Land Cover	Percent of drainage
Row crop agriculture	34.0%
Developed	27.4%
Pasture/grass/hay	15.8%
Forests	13.8%
Wetlands	7.2%
Shrubs/barren	1.8%

Old Stillaguamish

The Old Stillaguamish Channel drainage area is made up of smaller drainages including Douglas Slough, Irvine Slough, Church Creek, and Miller Creek (Figure 2). Douglas Slough receives water from upland sources that flow through nearby agricultural fields to the outlet. Irvine Slough, located partly within Stillaguamish Flood Control District and City of Stanwood, discharges through a pump station into Old Stillaguamish Channel. Church Creek is one of the major tributaries to the Old Stillaguamish Channel. Freedom Creek is a tributary to Church Creek. Land use/land cover is divided relatively evenly among agriculture, developed land, and forest (Table 2).

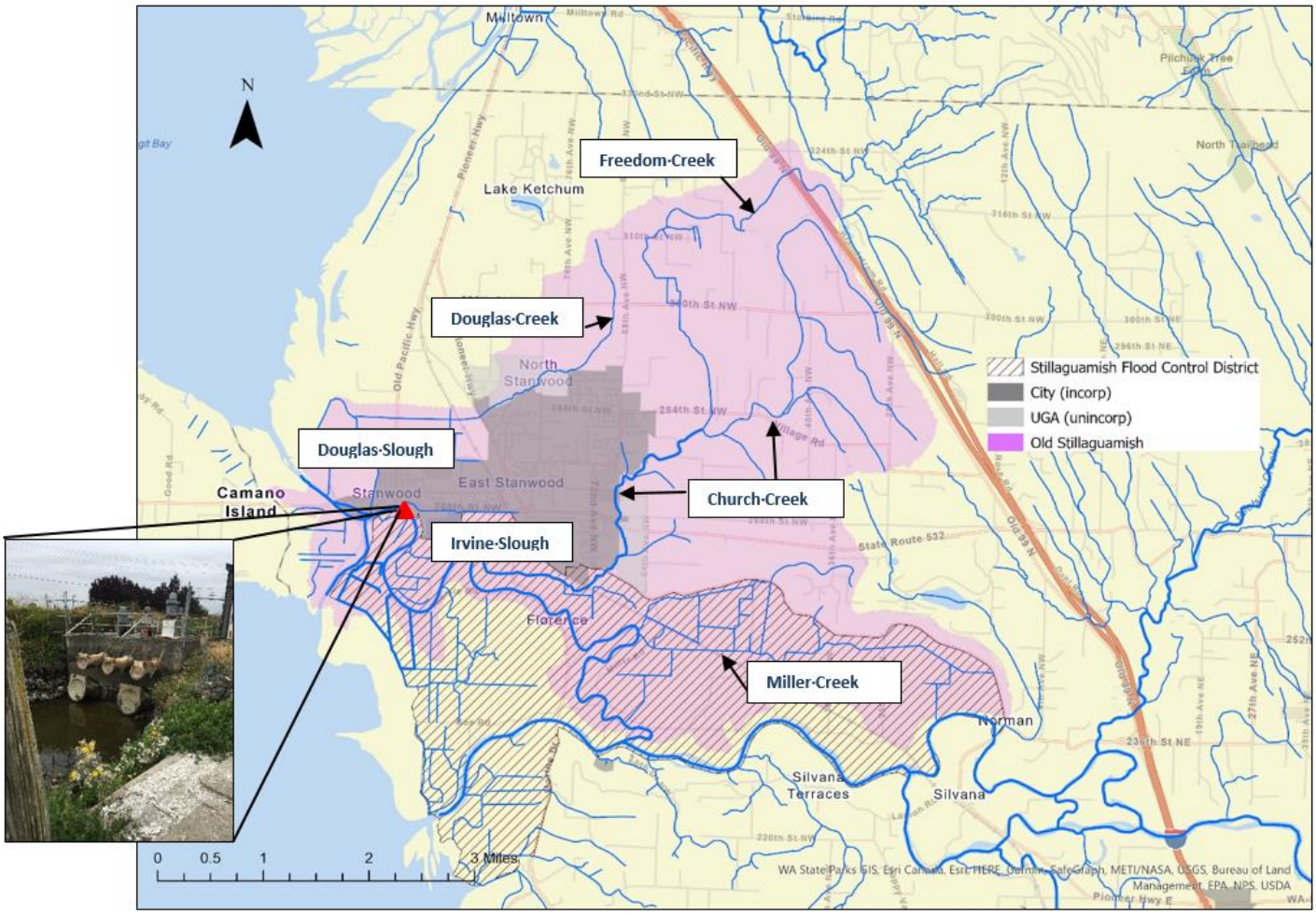

Figure 2. Old Stillaguamish Drainage Area. Red triangle denotes location of pump station on Irvine Slough pictured here.

Table 2. Percent cover of various land uses and land covers in Old Stillaguamish drainage area. Data from United States Department of Agriculture National Agricultural Statistics Service Cropland Data Layer.

Land Use/Land Cover	Percent of drainage
Pasture/grass/hay	24.6%
Forest	24.1%
Developed	20.8%
Row crop agriculture	17.3%
Wetlands	8.1%
Shrubs/barren	5.0%

Summary of Previous studies and existing data

In 2017, Washington State Department of Health (DOH) recorded high bacteria levels at a few marine stations in the South Skagit Bay area. Elevated bacteria levels have closed shellfish beds to the north and south of Skagit Bay. Shellfish beds within South Skagit Bay itself were classified as "threatened" by DOH on the 2020 Threatened Shellfish Growing Areas.[1] Based on the Skagit Bay South Annual Shellfish Growing Area Review by DOH (Chernoff, 2020), Marine Stations 185 and 192 are categorized as "threatened" status while four other marine stations (180, 184, 186 and 179) are categorized as "concerned" status (Figure 3).

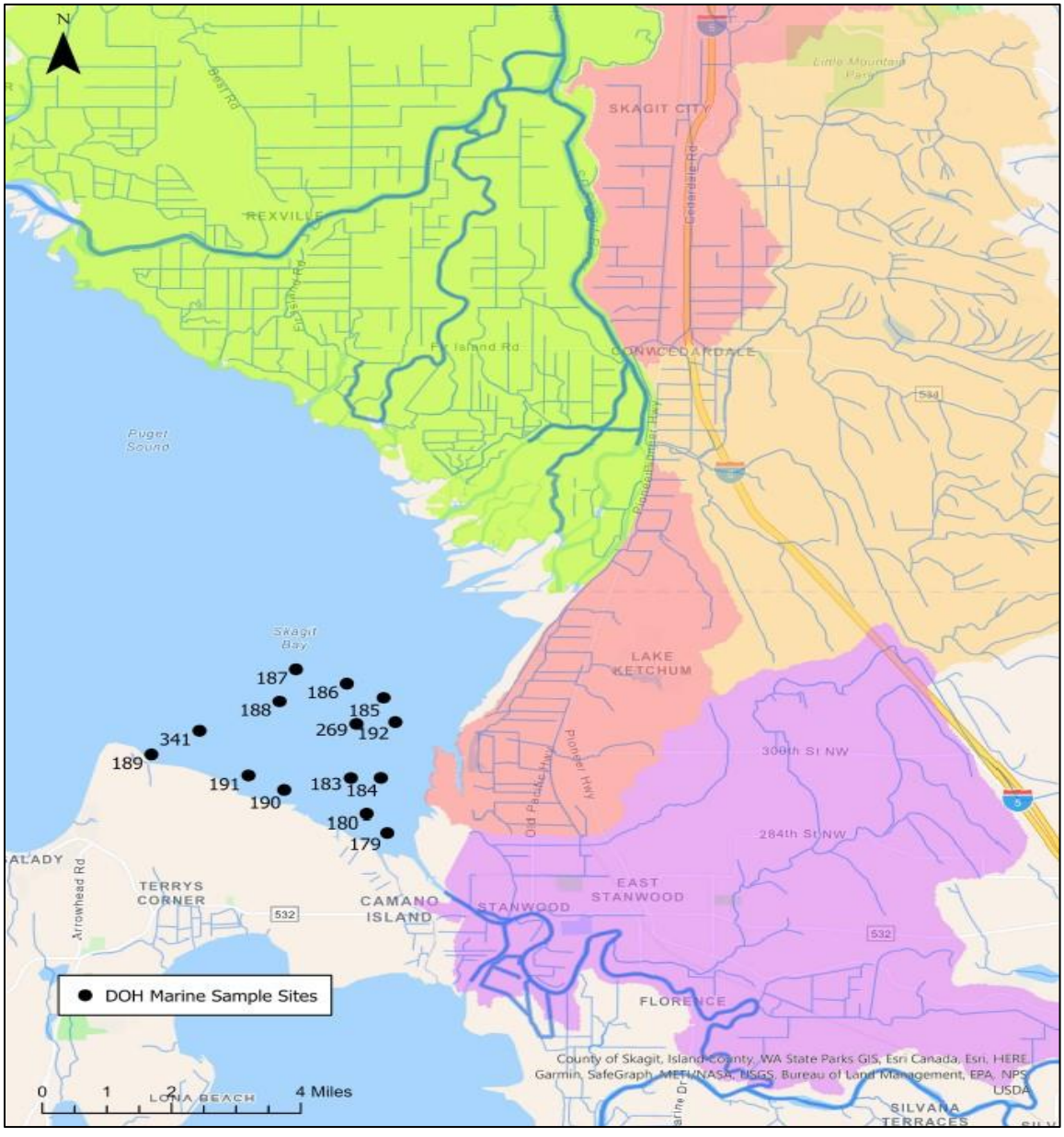

Figure 3. Washington State Department of Health marine water sampling sites.

[1] https://www.doh.wa.gov/Portals/1/Documents/4400/threatareas.pdf

A Memorandum of Understanding names Ecology as the lead agency for investigative studies. From 2018 to early 2020, Ecology investigated the Big Ditch and Maddox Slough drainage. COVID-19 restrictions significantly reduced this work in 2020. Beginning in 2021, Ecology will expand the South Skagit Bay assessment into the Old Stillaguamish drainage while maintaining a few key sampling locations in the Big Ditch/Maddox Slough drainage. Table 1 shows the Category 303 (d) listings from the draft 2018 water quality assessment. New listings marked with an asterisk, could be subject to change, pending a public comment period and EPA approval during late 2021.

Table 3. Category 5 303(d) Listings: WRIA 3 is shown in white and WRIA 5 is shown in blue (Big Ditch/Maddox Slough and Old Stillaguamish drainage areas respectively). *Draft 2018 listings may be subject to change.

Stream	Parameter	Listing ID#
Big Ditch/Maddox	Bacteria	74170*
Unnamed Slough	Bacteria	88302*
Unnamed Creek	Bacteria	88951*
Unnamed Creek	Bacteria	88484*
Douglas Slough	Bacteria	88181*
Douglas Slough	Bacteria	74175 *

Table 4. Category 4A Listings: WRIA 3 is shown in white and WRIA 5 is shown in blue (Big Ditch/Maddox Slough and Old Stillaguamish drainage areas respectively).

Stream	Parameter	Listing ID#
Carpenter Creek	Bacteria	7136
Skagit S.F.	Bacteria	9770
Big Ditch/Maddox	Bacteria	45650
Hill Ditch	Bacteria	45651
Fisher Creek	Bacteria	45700
Church Creek	Bacteria	7202
Church Creek	Bacteria	7204
Church Creek	Bacteria	7205
Old Stilly Channel	Bacteria	7213
Stillaguamish River	Bacteria	8217
Old Stilly/West Pass	Bacteria	8230
Miller Creek	Bacteria	9784
Irvine Slough	Bacteria	43042
Old Stilly Channel	Bacteria	43045

Previous water quality studies, and their recommendations, include:

1) 2012 Water Quality Monitoring Report: Irvine Slough at Stanwood (SCSWM, 2014)

    - Water Quality standards were not met in Irvine Slough – further investigation to isolate sources of bacterial pollution including sewer infiltration/flows.
    - Source ID should focus on warm-blooded animal inputs throughout Irvine Slough. "Additional monitoring for E. coli and fecal coliform at upstream sites could help isolate potential sources."
    - Continuous temperature monitoring during critical period of June 15-September 15. This was recommended for the City of Stanwood.

2) Skagit Bay Fecal Coliform (FC) Bacteria Loading Assessment (Kardouni, 2012)
    - Unnamed Slough at Old Pacific Hwy may have FC pollution sources that contribute significantly during times of little to no precipitation. Stormwater runoff is not the primary source of high FC concentrations.
    - Overall, precipitation events likely increased FC loading.
    - When pumps were discharging, loading occurred.
    - Conduct follow-up monitoring on Unnamed Slough off of Thomle Road (investigatory site, located south of Old Stilly Channel that had FC level of 2,700 cfu/mL).

3) Douglas Creek and Vicinity Basin Characterization Report (SCSWM, 2015) – While not a water quality study, this report describes Unnamed Slough (located north of Douglas Slough), Douglas Creek, and Irvine Slough drainages. This is also a source of information for local citizen input.

    The lower portions of Douglas Creek and Unnamed Slough were identified as complex systems with multiple outfalls and drainage directions depending on tidal elevations. It was also noted that there is a general lack of drainage inventory – large network of culverts and ditch connections at unknown elevations. There is tidal and river influence at system outfalls.

Partners that are sampling in the area include:

A. Stillaguamish Tribe of Indians is monitoring at a couple sites along Church Creek:

    - Church Creek at Jenson/56th Ave W
    - Church Creek at Marine Drive

    Stillaguamish Tribe of Indians is also collecting storm-event samples on Douglas Creek at Pioneer Highway and at Pacific Hwy.

B. Snohomish County is monitoring Douglas Creek at Pioneer Highway monthly.
C. Skagit County is monitoring at the Milltown Road location monthly.

D. WA State Department of Agriculture (WSDA) is monitoring within Miller Creek and surrounding areas in the lower Old Stillaguamish drainage (south of SR 532) due to the presence of dairies in the area. WSDA staff regularly input their data to the fecal coliform map.[2]

The Stillaguamish Pollution and Identification Correction Program (currently in Phase 3) meets regularly to share and discuss updates on monitoring and potential source identification cases among the local partners.

Parameters of interest and potential sources

Ecology will be looking for water pollution (bacteria) that affects streams and ditches in Old Stillaguamish and Big Ditch/Maddox Slough drainage areas. Specifically, field staff will look for:

- Signs of failing septic systems
- Practices that cause manure, sediment, or other pollutants to wash into surface waters.
- Livestock operations that pose an elevated risk as identified in Ecology's Clean Water and Livestock Operations: Assessing Risks to Water Quality.[3]
- Other sources of bacteria pollution that may enter surface waters (e.g. point-sources, industrial activities, congregated wildlife, etc.)

When a Ecology identifies a problem on a property, they will connect the property owner to the appropriate partner agency. Partner agencies include local conservation districts, local health departments, and WSDA. These agencies provide financial and technical assistance to property owners to help them solve the problem.

Tasks Required

Objective 1: Measure bacteria levels in streams and ditches within the Old Stillaguamish drainage.

Task 1.1: Collect monthly grab samples using the bottle dip method at selected sampling locations.

Task 1.2: For hot spot locations, evaluate potential source identification locations and collect grab samples using the bottle dip method.

Task 1.3: Evaluate the weather forecast and check Northwest River Forecast Center[4] for predicted rainfall totals and river elevation rise. Collect grab samples using the bottle dip method at selected sampling locations during 17 storm events.

Objective 2: Continue to measure bacteria levels in six select streams and ditches within the Big Ditch/Maddox Slough to keep an eye on hot spot areas.

[2] https://arcg.is/1famvy
[3] https://apps.ecology.wa.gov/publications/SummaryPages/1510020.html
[4] https://www.nwrfc.noaa.gov/rfc/

Task 2.1: Collect monthly grab samples using the bottle dip method at designated sampling locations. Identify source identification locations and collect samples as needed.

Task 2.2: Evaluate weather forecast and check Northwest River Forecast Center[5] for predicted rainfall totals and river elevation rise. Collect grab samples using bottle dip method at selected sampling locations during 17 targeted storm events.

Key Individuals and their responsibilities

Table 1. Organization of project staff and responsibilities.

Staff	Title	Responsibilities
Scott Bohling Watershed Unit Water Quality Program Phone: 425-229-5512	Water Clean-up Lead (WRIA 3)	Co-writes the QAPP. Oversees field sampling and transportation of samples to the laboratory. Conducts QA review of data, analyzes and interprets data, and enters data into EIM. Co-writes the draft report and final report.
Heather Khan Watershed Unit Water Quality Program Phone: 425-213-9832	Water Clean-up Lead (WRIA 5)	Co-writes the QAPP. Oversees field sampling and transportation of samples to the laboratory. Conducts QA review of data, analyzes and interprets data, and enters data into EIM. Co-writes the draft report and final report.
Michelle Quast Watershed Unit Water Quality Program Phone: 425-200-8252	Water Quality Specialist (WRIA 3)	Helps collect samples and records field information. Conducts windshield surveys to help identify sources and potential investigative sampling sites.
Marty Jacobson Watershed Unit Water Quality Program Phone: 425-301-7062	Water Quality Specialist (WRIA 5)	Helps collect samples and records field information. Conducts windshield surveys to help identify sources and potential investigative sampling sites.
Lea Shields (BFO) Water Quality Program Phone: 360-480-9237	Water Quality Specialist	Helps collect samples and records field information. Conducts windshield surveys to help identify sources and potential investigative sampling sites.
Ralph Svrjcek (NWRO) Watershed Unit Water Quality Program Phone: 206-594-0164	Unit Supervisor	Provides internal review of the QAPP, approves the budget, and approves the final QAPP.
Rachel McCrea Water Quality Program (NWRO) Phone: 206-594-0146	Water Quality Section Manager	Reviews the project scope and budget, tracks progress, reviews the draft QAPP, and approves the final QAPP.

[5] https://www.nwrfc.noaa.gov/rfc/

Staff	Title	Responsibilities
Alan Rue Manchester Environmental Laboratory Phone: 360-871-8801	Manchester Lab Director	Reviews and approves the final QAPP.
Arati Kaza Phone: 360-407-6964	Ecology Quality Assurance Officer	Reviews and approves the draft QAPP and the final QAPP.

Proposed Project Schedule

Ecology proposes to sample for at least one year starting in summer 2021. Ecology wants to continue sampling in South Skagit Bay (especially in Old Stillaguamish drainage) into 2023; however, this depends on future funding. Ecology team members will adjust the laboratory reports for submittal to EIM. The EIM coordinator has traditionally completed the final upload of sampling results to EIM.

Budget

Ambient and storm event samples will likely be sent to Ecology (ECY) Manchester Laboratory. The team selected ECY Manchester Laboratory in order to use in-house services for bacteria sampling and for the opportunity to potentially add microbial source tracking (MST) work at no extra cost. The Environmental Protection Agency (EPA) does MST analysis at the EPA Manchester Laboratory, where they currently test water samples for the presence or absence of human, dog, cow and ruminant markers. The team plans to submit a proposal for approval by EPA's Water Division. If the team's MST proposal is chosen, a separate QAPP will be drafted for this work. The budget in Table 5 includes both ambient and storm event sampling costs from ECY Manchester Laboratory. Samples will be analyzed for both fecal coliform and E.coli using membrane filtration method.

Ecology also included a budget for Edge Analytical, a fully accredited, private laboratory. Ecology has sent past storm event samples to Edge Analytical due to its close proximity to sample locations and greater flexibility to receive samples. If MST work is not added to this project, Ecology might use this laboratory for future samples. The budget in Table 6 includes the ambient sampling costs from ECY Manchester Laboratory and the storm event sampling costs from Edge Analytical Laboratory. Samples will be analyzed for both fecal coliform and E.coli using the membrane filtration method.

Table 5. Annual Project sampling budget using only ECY Manchester Laboratory.

Ecoli+Fecal Coliform (membrane filtration)	Number of Samples	Cost/Sample	Lab Cost
Ambient Screening Samples	156	$42	$6,552
Ambient Source ID Samples	60	$42	$2,520
Duplicates	24	$42	$1,008

Replicates	12	N/A	N/A
Ambient Subtotal	**252**	**N/A**	**$10,080**
Storm Event Screening Samples	153	$42	$6,426
Storm Source ID Samples	51	$42	$2,142
Duplicates	17	$42	$714
Replicates	17	N/A	N/A
Storm Event Subtotal	**238**	**N/A**	**$9,282**
		Screening Subtotal	$12,978
		Source ID Subtotal	$4,662
		Duplicate Subtotal	$1,722
		Grand Total Lab Cost	**$19,362**

Table 6. Annual Project sampling budget using both ECY Manchester and Edge Analytical Laboratories.

Ecoli+Fecal Coliform (membrane filtration)	Number of Samples	Cost/Sample	Lab Cost
Ambient Screening Samples	156	$42	$6,552
Ambient Source ID Samples	60	$42	$2,520
Duplicates	24	$42	$1,008
Replicates	12	N/A	N/A
Ambient Subtotal	**252**	N/A	**$10,080**
Storm Event Screening Samples	153	$39	$5,967
Storm Source ID Samples	51	$39	$1,989
Duplicates	17	$39	$663
Replicates	17	N/A	N/A
Storm Event Subtotal	**238**	**N/A**	**$8,619**
		Screening Subtotal	$12,519
		Source ID Subtotal	$4,509
		Duplicate Subtotal	$1,671
		Grand Total Lab Cost	**$18,699**

Sampling locations and frequency

Ecology team members will follow the standard operating procedure outlined in "Standard Operating Procedure EAP030, Version 2.1: Collection of Fecal Coliform Bacteria Samples in Surface Water."[6] Ambient samples will be collected monthly at the sites listed in Table 7 and Figure 4. Storm event sampling will occur as described in the "Tasks required" section.Storm

[6] https://apps.ecology.wa.gov/publications/documents/1803239.pdf

event sample frequency will vary depending on the wet season versus dry season. The team predicted 17 storm events per year based on the following assumptions:

- Wet season (October – February): Two storm events X five months = 10 storm events
- Dry season (March – September): One storm event X seven months = 7 storm events

The goal is to compare bacteria levels with and without storm events at a maximum of nine sampling locations. Higher bacteria levels are expected during storm events, which may help guide source identification efforts. The team may choose to change storm event locations depending on the results of bacteria samples collected during the ambient sampling runs.

If an ambient sampling site does not work out for any reason, the team may choose to sample an alternate location. Alternate sampling locations for the Old Stillaguamish drainage are listed in Table 8 and Figure 5. Any alternate sampling site located upstream from a short-term ambient site might be used for source identification work.

Table 7. Latitude and longitude of planned short-term ambient sample sites. Storm event sample locations may be subject to change depending on bacteria sampling results. (Datum: HARN 1983).

	Site/EIM Site ID	Description	Latitude	Longitude	Storm Event Site?
1	SSB.DC.01	Douglas Creek at Old Pacific Hwy	48.25226	-122.37087	Yes
2	SSB.Fre.01	Freedom Creek at 284th St NW	48.25408	-122.30634	Yes
3	SSB.Chu.01	Church Creek at 284 St NW/Village Rd	48.25394	-122.29842	TBD
4	SSB.Chu.02	Church Creek at Church Creek Park	48.24237	-122.32584	Yes
5	SSB.Irv.02	Irvine Slough at Marine Drive	48.23949	-122.34756	TBD
6	SSB.Irv.01	Irvine Slough/Old Stilly at 98th	48.23958	-122.36749	Yes
7	SSB.WP.01	West Pass at SR 532	48.24055	-122.38369	TBD
8	SSB.Sno.02	Big Ditch Trail	48.276581	-122.378162	Yes
9	SSB.Sno.02M	Marine side of tide gate	48.2766	-122.3781	Yes
10	SSB.Sno.04	County Line Road near 7300	48.2975836	-122.3321217	Yes
11	SSB.Ska. 07ref	Fisher Creek Reference Site	48.31919	-122.32971	TBD
12	SSB.Ska.10	Cedardale Rd, mid way	48.349762	-122.33526	Yes
13	SSB.Ska.16	Eleanor Ln, Mt Vernon	48.388097	-122.333044	Yes

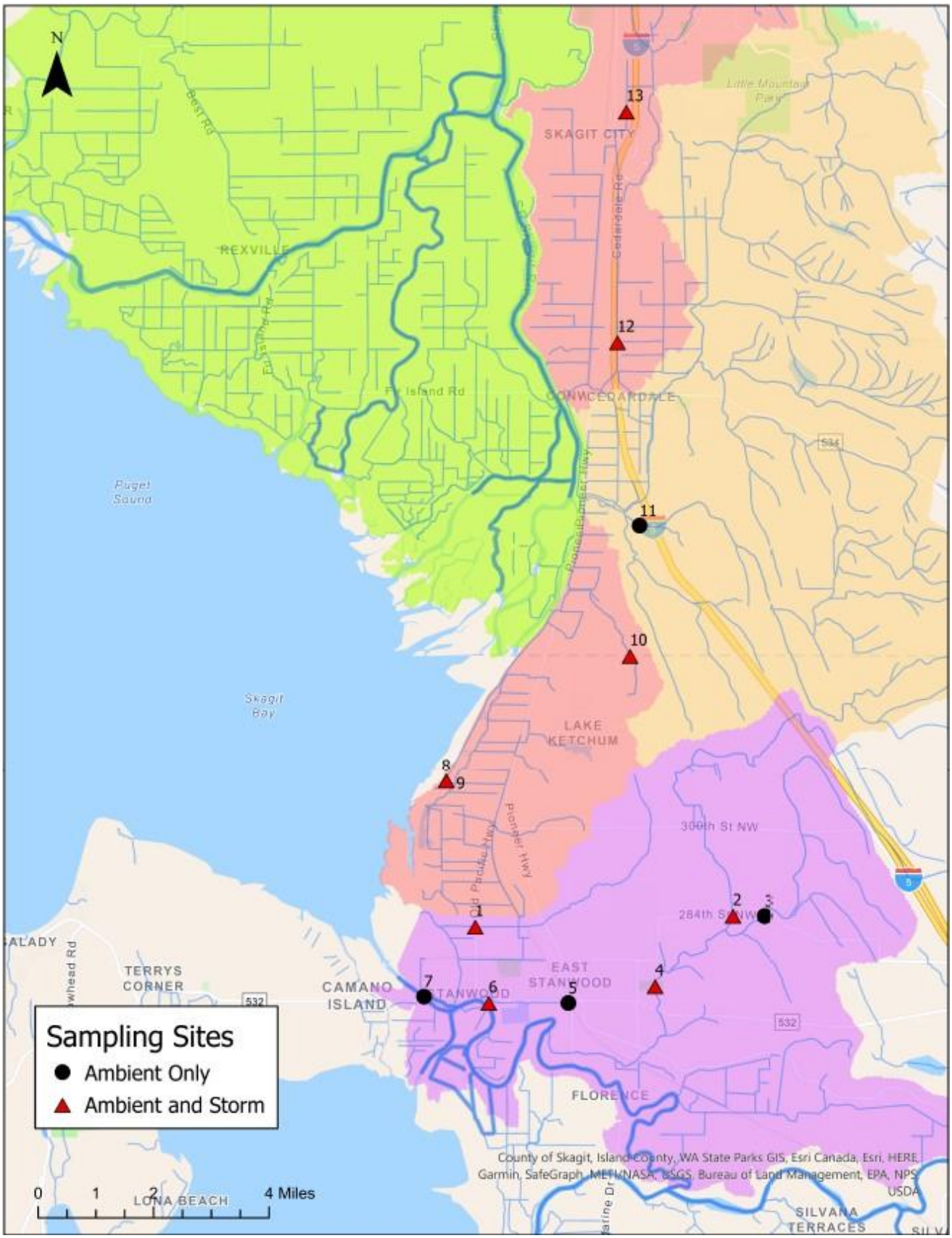

Figure 4. Locations of ambient and storm event sample sites

Table 8: Alternate sampling locations in Old Stillaguamish drainage.

	Description	Latitude	Longitude	Notes
1	Unnamed waterway at SR 532	48.241	-122.3754	Park in nearby parking lot; sample from south side (preferred)
2	Heritage Park (276th Street NW)	48.2468	-122.3627	Small ditch system
3	Freedom at 300th Street NW	48.2687	-122.3135	Busy road
4	Freedom Creek at Old 99 N	48.28696	-122.29233	Use care when accessing site
5	Church at 300th Street NW	48.2681	-122.2894	Busy road – potential source ID area
6	Confluence of West Pass/South Pass at Eide Rd	48.2371	-122.3774	Access from Eide Road; 7 min. walk on gravel levee to confluence

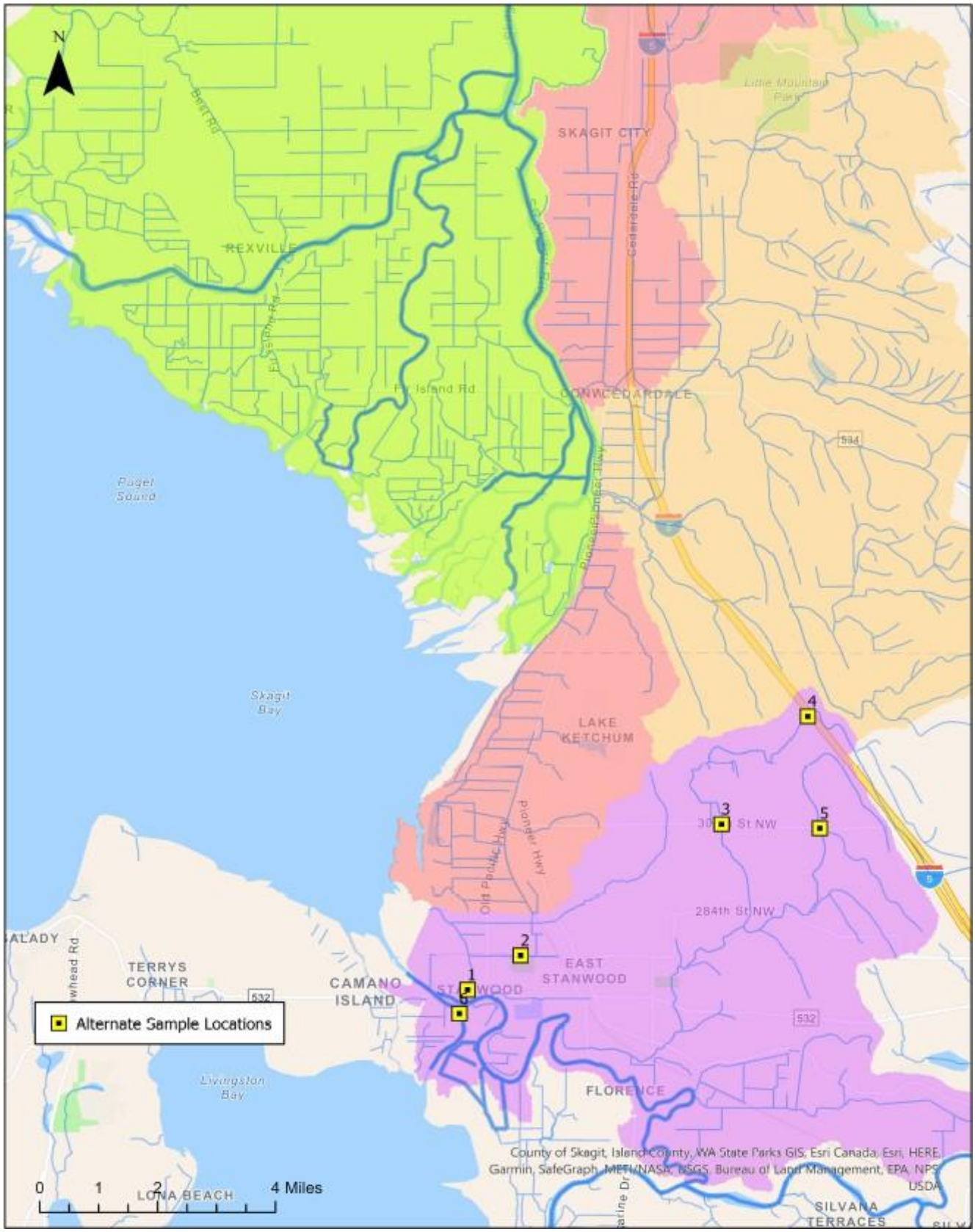

Figure 5. Alternate Sampling Locations in Old Stillaguamish drainage.

Field parameters and laboratory analytes to be measured

From Table 7 of the Quality Assurance Project Plan: Nonpoint Investigations in Western Washington.

Parameter	Matrix	Recommended Quantity	Container	Holding Time	Preservative
E. coli	Water	250 mL, 500 for QC	250 mL glass/polypropylene autoclaved bottle[5]	24 hours	Fill the bottle to the shoulder; Cool to ≤10°C
Fecal Coliform	Water	250 mL, 500 for QC	250 mL glass/polypropylene autoclaved bottle[5]	24 hours	Fill the bottle to the shoulder; Cool to ≤10°C

Invasive species

Invasive species evaluation and applicable procedures, depending on the watershed

New Zealand mudsnails (*Potamopyrgus antipodarum*) are an aquatic invasive species currently found in King County, Snohomish County, and an instance in Indian Slough (west of Burlington) in Skagit County. These mudsnails are considered an economic and environmental threat to Washington State. They are very small, measuring less than 1/8 inch and can be easily spread through hitchhiking on waders or other aquatic equipment.

To prevent the spread of New Zealand mudsnails, staff will use a sampling pole or other equipment as specified in the Western WA Nonpoint QAPP to minimize sediment disturbance while taking samples. Sampling will be done in an upstream to downstream sequence where necessary according to "Standard Operating Procedure EAP070, Version 2.2: Minimize the Spread of Invasive Species."[7] When traveling between drainage basins, appropriate agency decontamination steps will be used on equipment and protective gear as needed.

EIM data

Upload procedures, including project EIM Study ID when applicable.

All ambient and storm event data collected for this project will be uploaded to EIM. For ambient samples (including ambient source identification samples), the team plans to use SSB_WQ as the EIM Study ID. For storm event sampling results (including storm event source identification samples), the team plans to use SSB_WQ_SID as the EIM Study. If a sample is taken during high tide, affected samples (i.e. such as those at or near outlets) will be marked as "brackish" in EIM with a comment noting the sample was taken during high tide conditions. Instructions are available on the South Skagit Bay SharePoint site on editing ECY Manchester Laboratory reports, so they will be accepted by EIM. Similar instructions are also available for any samples that may go through Edge Analytical.

[7] https://apps.ecology.wa.gov/publications/documents/1803201.pdf

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