

Skagit Stream Team 2008/09 Water Quality Report:



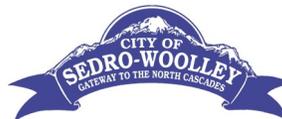
Citizen Monitoring Summary for the Samish Bay, Padilla Bay, Brickyard Creek, Gages Slough, Trumpeter Basin, Kulshan Creek, and Fisher Creek Watersheds.



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I. Introduction

Skagit Stream Team

This report summarizes the results of the 2008-2009 Skagit Stream Team Program, the eleventh consecutive year of data collection by volunteers. From October 2008 through August 2009, fifty-nine dedicated citizen volunteers monitored the water quality of freshwater streams that drain into Skagit County's Samish Bay, Padilla Bay, and the Skagit River. This past year, sampling was begun in 4 urban watersheds: Brickyard Creek in Sedro Woolley, Gages Slough in Burlington, Kulshan Creek and Trumpeter Basin in Mount Vernon. Sampling was discontinued in Joe Leary Slough and Nookachamps Creek. Some sites in the Samish River watershed were changed this year to align with efforts by Skagit County to address fecal coliform problems in this priority watershed.

This report is meant to provide valuable background WQ data collected at the highest possible level, but it is NOT intended to provide a legal documentation of water quality violations. All data and methods are available to the public.

Background

The Skagit Stream Team Program was established in 1998 to educate and involve local citizens in the protection and stewardship of local streams. It is sponsored by the Skagit Conservation District (SCD) in partnership with the Padilla Bay National Estuarine Research Reserve (PBNERR), City of Mount Vernon, City of Burlington, City of Sedro Woolley, and Skagit County. Funding was provided by the Washington State Conservation Commission, the Washington State Department of Ecology's Centennial Clean Water Fund Program, and partnering jurisdictions. Volunteers gave of their own time (unpaid) for the duration of the study.

Skagit Stream Team Objectives

- To inspire community stewardship of water resources by educating local citizens about land use and non-point sources of pollution and involving them in the process of water quality data gathering;
- To develop and implement a routine sampling program that can be used to assess water quality trends, characterize the existing water quality of priority freshwater drainages, and determine how water quality conditions compare to State Standards;
- To document improvements in water quality as a result of the implementation of Best Management Practices on farmlands and the repair and/or replacement of failing septic systems;
- To teach community volunteers the sampling and analytical techniques used by environmental professionals, how to manage the data collected and create a database, and the importance of establishing a long-term water quality monitoring program.

Volunteers measured fecal coliform (FC) bacteria, dissolved oxygen (DO), water temperature, turbidity, and total depth. Some of the questions the study hoped to address were:

- How do water quality conditions compare to State Standards in our 3 priority watersheds?
- Could water quality conditions support aquatic life such as salmon?

II. Methods

Efforts were made to insure high quality data from this volunteer-based study. Quality Assurance/Quality Control (QA/QC) plan and laboratory plan were submitted to and approved by the WA Department of Ecology. These plans have since been updated and revised. Volunteers were

given ten hours of training before sampling in the field, and were accompanied by a trainer for their first sampling. All analysis and collection methods are detailed in the QA/QC plan, and are available on request.

The Samish watershed was divided into two upper and two lower teams, and was coached by Jennifer Hinderman, SCD. The Padilla Bay watershed had two teams on No Name Slough, and two teams on Bay View coached by David Henry and Susan Wood, PBNERR. Fisher Creek, Kulshan Creek, and Trumpeter Basin each had two teams coached by Kristi Carpenter. Brickyard Creek and Gages Slough each had two teams coached by Cindy Pierce.

At each site, samples were usually taken twice monthly. Temperature, dissolved oxygen (DO), and salinity (when applicable) were measured on-site with an electronic YSI Data Probe. Field measurements and samples were taken just below the surface, in the deepest part of the stream that could be reached. Depth was measured on staff gages or with a weighted measuring tape. Samples were tested for Fecal coliform either at the Padilla Bay volunteer lab (Padilla, Samish, Fisher Creek samples), taken to Edge Analytical Laboratory (Gages Slough), taken to the Mount Vernon Wastewater Treatment Plant (Trumpeter Basin, Kulshan Creek) or the Sedro Woolley Waste Water Treatment Plant (Brickyard Creek) for analysis. Turbidity samples were either taken back to Padilla Bay's lab to be tested, or measured in the field. Volunteers also recorded water appearance/ color. Quality procedures are outlined in more detail in Appendix C.

Quality control checks by staff were conducted periodically in the lab and in the field to assure that volunteers were using proper and consistent protocols, and to emphasize the importance of quality control measures.

The data was recorded on field sheets (See Appendix D) and transferred to a Microsoft Excel spreadsheet by a volunteer. Padilla Bay staff then went back and verified all the original data with the computer entries, making edits as appropriate. Any anomalies were recorded in the metadata.

Final FC data compilation methods were based on consultation with the Washington State Department of Health's Food, Safety, and Shellfish division to accurately represent field conditions. In accordance with Chapter 173-201A -030 (2) WAC Water Quality Standards for Surface Waters of the State of Washington, the FC data will be considered using the geometric mean. "Too Numerous To Count" (TNTC) results are assigned a value of 9,999 FC/100 ml. (Estimates of high TNTC values recorded by volunteers ranged from 10,000 to 60,000 FC/100 ml.) For the sake of calculation, readings of zero FC were entered as 1 FC/100 ml. Volunteer FC lab tests documented both a high and low reading, from which geometric means were calculated. Averages were calculated for dissolved oxygen, temperature and turbidity levels.

III. Samish Storm Team

During the 2007-2008 sampling season, a Samish watershed team of volunteers happened to sample immediately following an unusually heavy rainfall. Their results showed extremely high fecal coliform counts, even though numbers had been very low several days earlier. This initiated interest in quantifying fecal coliform bacterial contamination entering the river and its tributaries during **rain events**. Large concentrations of fecal coliform during heavy rains could have an impact on public health and the commercial shellfish beds downstream.

A group of very dedicated volunteers, working with Skagit County and WA State Health Department staff, began a sampling program focused on measuring water quality throughout the watershed immediately following rain events. The goal was to identify stream reaches and tributaries with elevated fecal coliform levels and to support county and state efforts to insure safe harvesting of shellfish. After a pilot period testing different rainfall levels and sites, the volunteers settled on about 20 sites that were monitored after each rain event during the 2008-2009 sampling season. Volunteers measured only fecal coliform, following the procedures set for the Samish watershed Stream Team.

While storm event sampling is not the best method for determining overall health of a watershed or collecting baseline data, it has been very helpful in identifying sources of fecal coliform bacteria, informing local commercial shellfish growers, and supporting state and county health departments. Sampling locations are listed in section IV below. Results are discussed in section V. Complete data are found in Appendix B.

IV. Sampling Sites

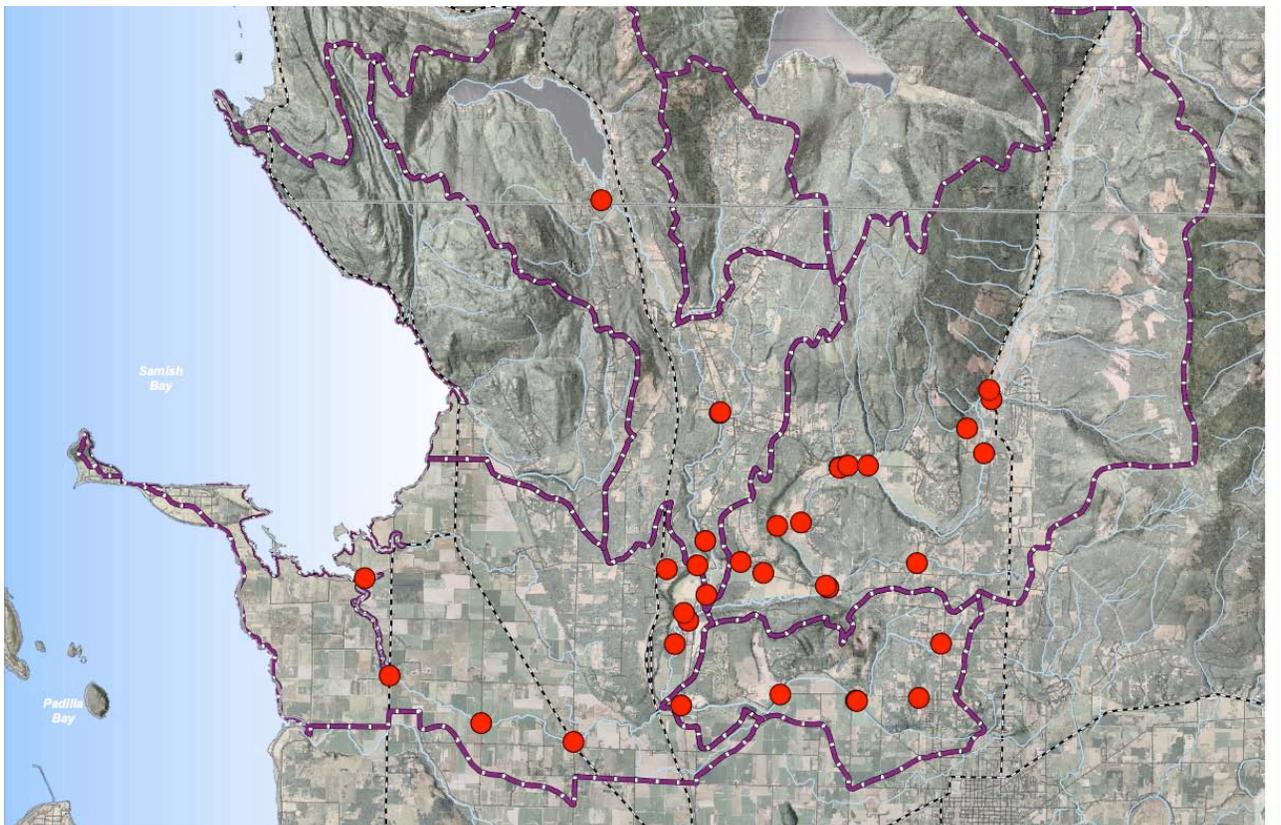


Figure 1. Map of All Samish Storm Team Sites.

Table 1. Samish Storm Team Sites – Sedro Woolley, WA

Site name	latitude	longitude	Water Type
Bayview-Edison Bridge (mouth)	48 33' 16N	122 27' 13W	Main stem Samish

Farm-to-Market Rd	48 31' 53N	122 26' 39W	Main stem Samish
Thomas Road	48 31' 14N	122 24' 40W	Main stem Samish
Chuckanut Drive	48 31' 0N	122 22' 42W	Main stem Samish
Thomas Creek - Hwy 99	48 31' 33N	122 20' 25W	Tributary
Thomas Creek - Kelleher Rd.	48 31' 44N	122 18' 18W	Tributary
Willard Creek. - F&S Grade Rd.	48 31' 40N	122 16' 41W	Tributary
Thomas Creek - F&S Grade Rd.	48 31' 40N	122 16' 40W	Tributary
Willard Cr. - upper station	48 31' 43N	122 15' 21W	Tributary
Site name	48 32' 30N	122 14' 54W	Water Type
Thomas Creek - upper station	48 33' 38N	122 15' 26W	Tributary
Swede Creek - Hoogdal Branch Rd.	48 33' 16N	122 17' 19W	Tributary
Swede Creek - Grip Rd.	48 33' 17N	122 17' 22W	Tributary
Grip Road	48 33' 27N	122 18' 43W	Main stem Samish
4/5 Ditch - Prairie	48 33' 36N	122 19' 12W	Tributary
Ware Creek - Prairie	48 32' 45N	122 20' 18W	Tributary
Hwy 99	48 32' 25N	122 20' 34W	Main stem Samish
Jolly Road	48 32' 52N	122 20' 24W	Main stem Samish
Bob Smith Creek - WDFW	48 33' 7N	122 19' 55W	Tributary
Friday Creek - KOA	48 33' 32N	122 20' 8W	Tributary
"Moody Ditch" - Bow Hill RD	48 33' 29N	122 20' 46W	Tributary
Bob Smith Creek - Dark lane	48 34' 11N	122 17' 56W	Tributary
Prairie Rd. - Double Creek LN	48 34' 7N	122 18' 26W	Main stem Samish
Skarrup Creek - Double Creek LN	48 34' 58N	122 17' 8W	Tributary
Parsons Creek - Prairie	48 34' 58N	122 17' 8W	Tributary
Samish at Parson's Creek	48 35' 0N	122 16' 57W	Main stem Samish
Unnamed Creek by Parsons	48 35' 0N	122 16' 31W	Tributary
Dry Creek - Prairie	48 35' 12N	122 14' 3W	Tributary
Prairie Road	48 35' 33N	122 14' 25W	Main stem Samish
Vernon Creek - Upper Samish Rd.	48 35' 58N	122 13' 55W	Tributary
Thunder Creek - Hwy 9	48 36' 6N	122 13' 58W	Tributary
Hwy 9	48 38' 42N	122 22' 20W	Main stem Samish
Friday Creek - Nulle Road	48 35' 43N	122 19' 43W	Tributary
Butler Creek - Fish Rd.	48 35' 43N	122 19' 42W	Tributary
	48 33' 53N	122 19' 58W	Tributary
	48 33' 16N	122 27' 13W	Tributary

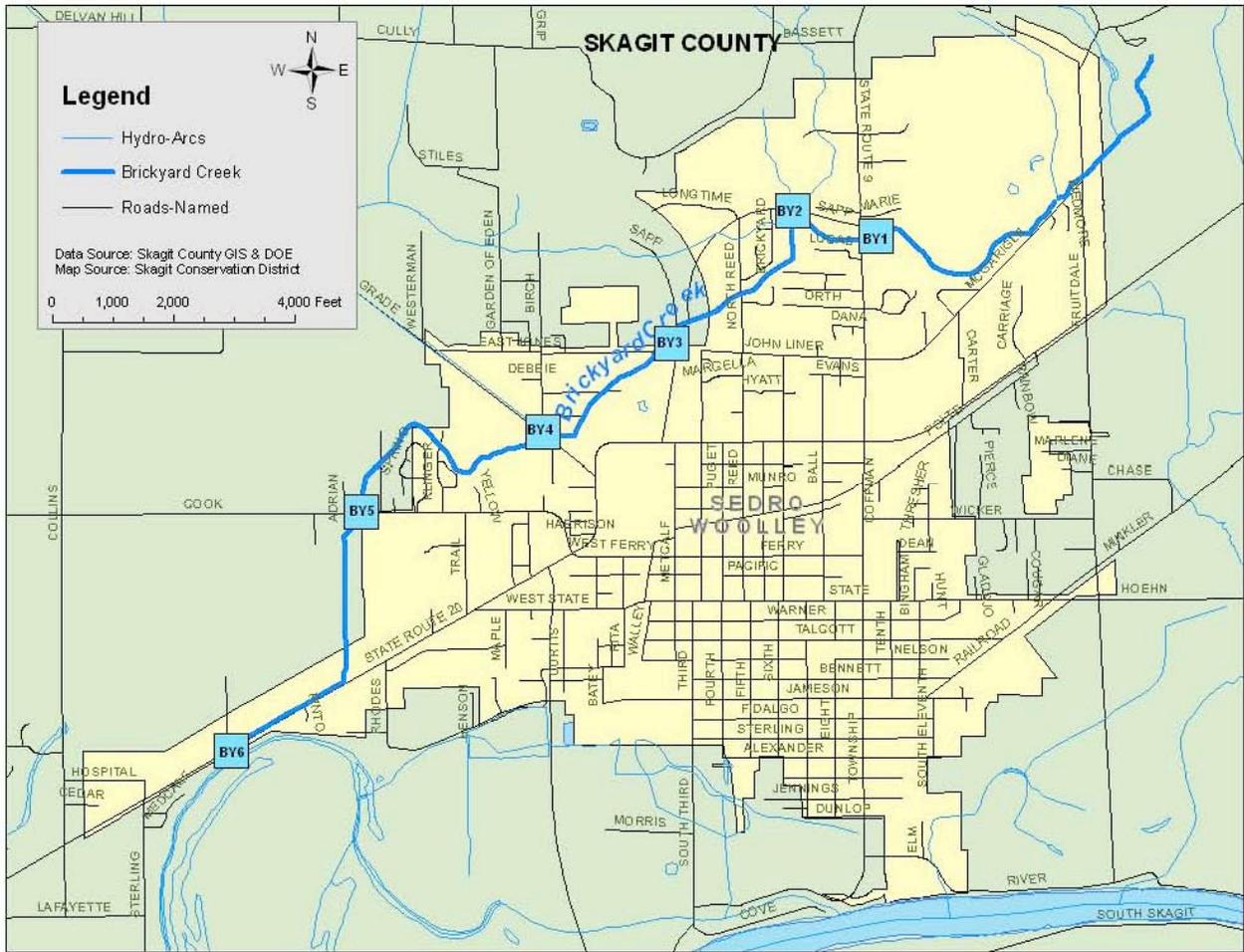


Figure 2. Map of Brickyard Creek Basin. Sites 1 – 6.

Table 2. Brickyard Creek Sites – Sedro Woolley, WA

BY #1	721 Township Street	N48°31'08 W122°13'32
BY #2	Logan Estates	N48°31'12 W122°13'49
BY #3	Sapp Road Trestle	N48°30'57 W122°14'73
BY #4	501 F & S Grade Road	N48°30'39 W122°14'52
BY #5	22431 Cook Road	N48°30'27 W122°15'35
BY #6	Holtcamp Road	N48°29'49 W122°16'08

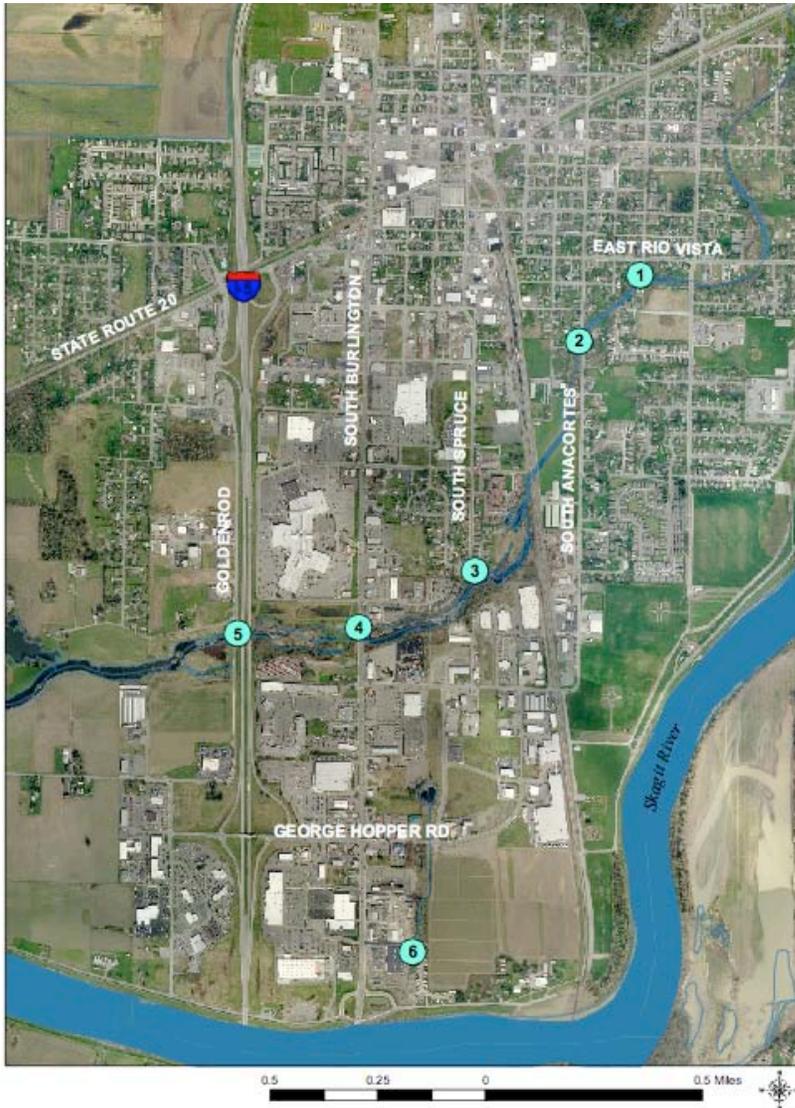


Figure 3. Map of Gages Slough Sampling Locations

Table 3. Gages Slough Sites – Burlington, WA

GS #1	Regent and East Rio Vista Streets	N48°28'16 W122°19'19
GS #2	South Anacortes Street	N48°28'08 W122°19'30
GS #3	South Spruce Street	N48°27'40 W122°19'48
GS #4	Burlington Boulevard	N48°27'33 W122°20'09
GS #5	Goldenrod Road	N48°27'32 W122°20'31
GS #6	Sportsman's Warehouse	N48°26'54 W122°19'58

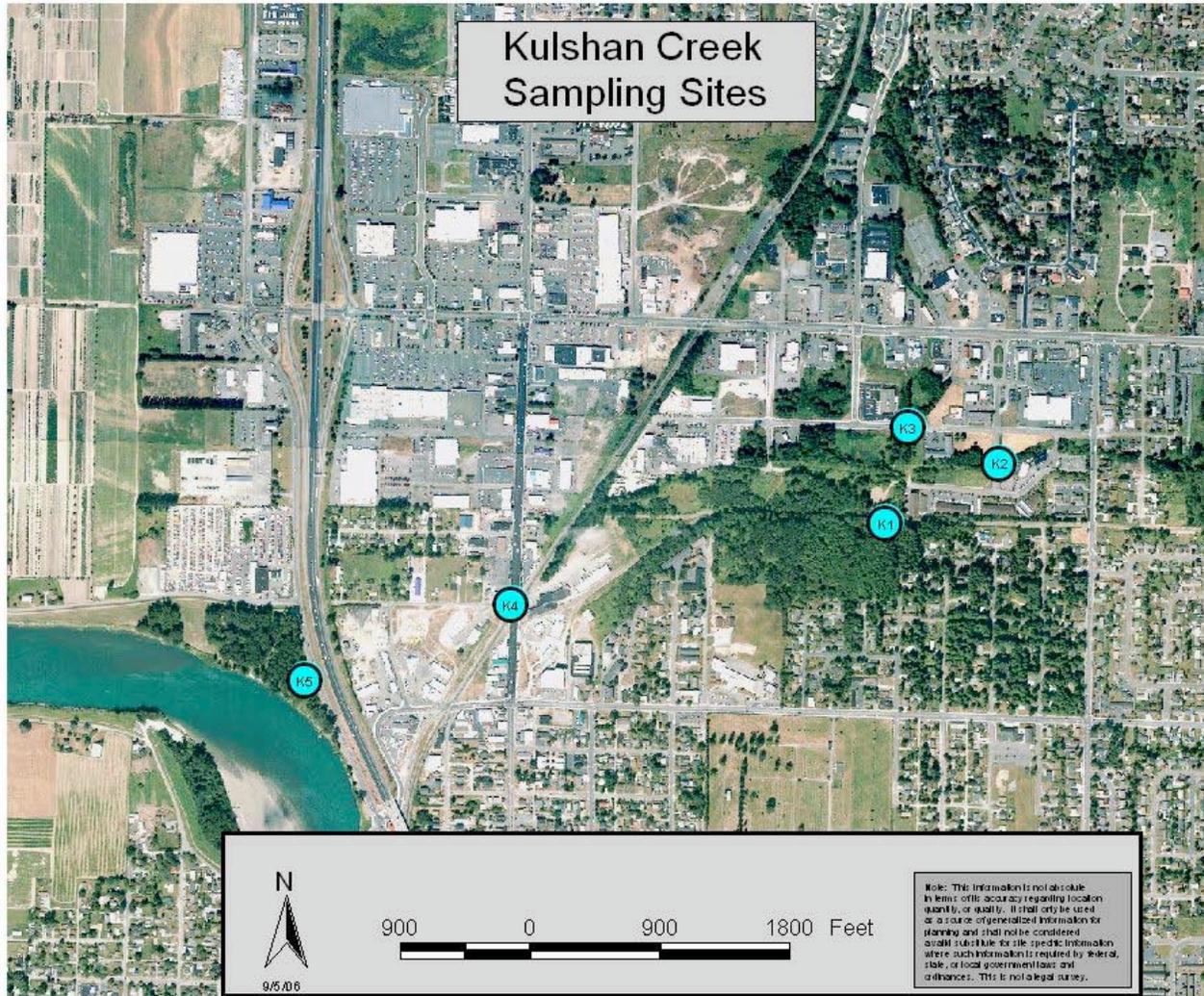


Figure 4. Map of Kulshan Creek Basin. Sites 1 – 5.

Table 4. Kulshan Creek Sampling Sites, Mount Vernon, WA

KC #1	North end of S 14 th /Kulshan Trail	N48°25'59 W122°19'27
KC #2	Parker Way	N48°25'59 W122°19'17
KC #3	S side Roosevelt/1 blk W of Paker Way	N48°26'11 W122°19'25
KC #4	E of Riverside - N of RR crossing	N48°25'54 W122°20'04
KC #5	Freeway Drive at Lions Park	N48°25'43 W122°20'28
KC #6	Lions Park/ discharge pipe from N	N48°25'43 W122°20'28

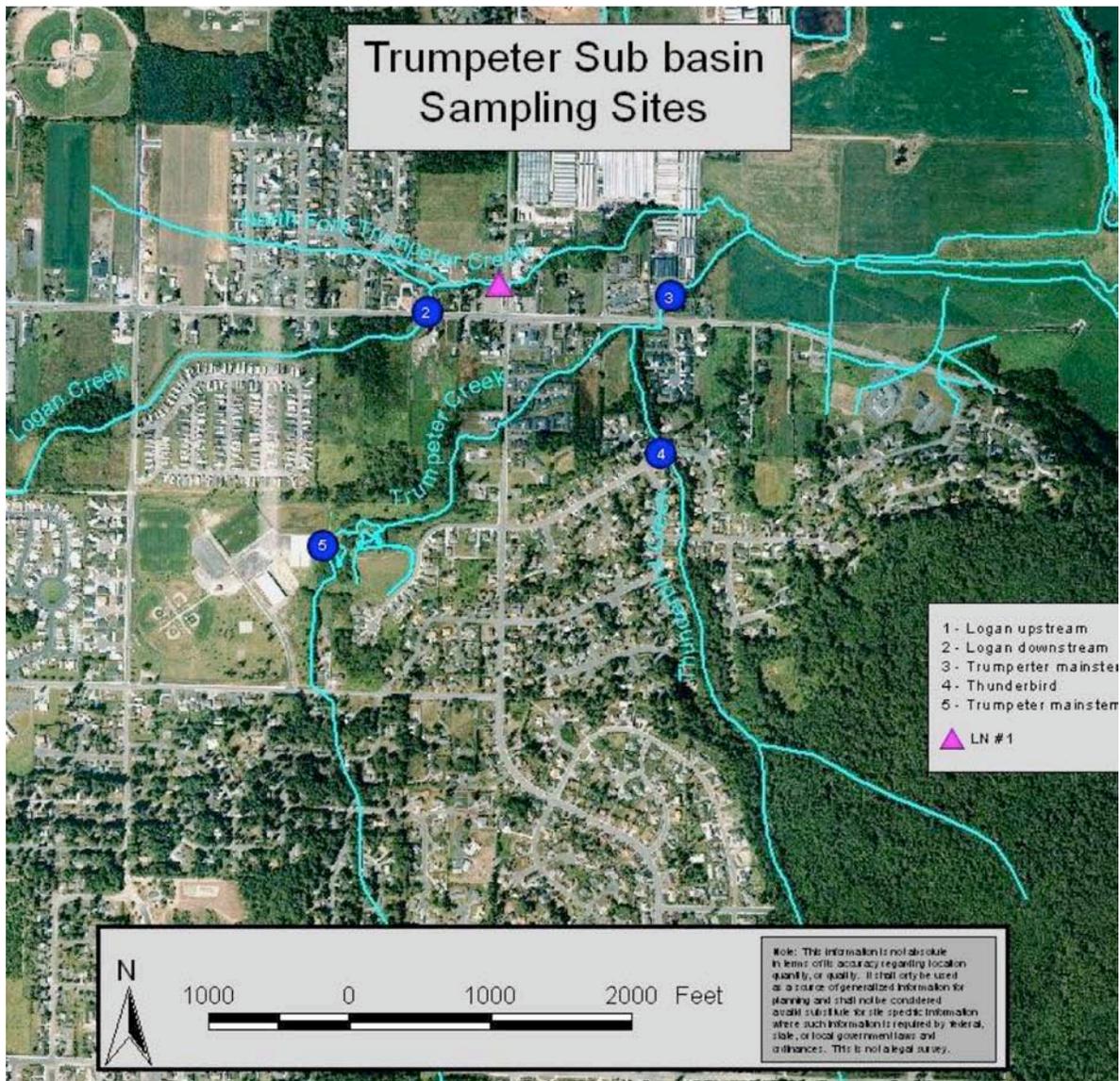


Figure 5. Map of Trumpeter Basin Sampling Sites

Table 5. Trumpeter Basin Sampling Sites, Mount Vernon, WA

TC #1	Stonebridge Adult Community, Logan Creek Bridge	N48°25'33 W122°18'32
TC #2	College Way west of Martin /Waugh Road, Logan Creek	N48°26'09 W122°17'12
TC #3	Summersun Nursery Footbridge, Trumpeter/Thunderbird	N48°26'07 W122°17'17
TC #4	Culvert on Kiowa, Thunderbird	48°25'53 W122°17'12
TC #5	Bakerview Park Footbridge, Trumpeter	N48°25'51 W122°17'48

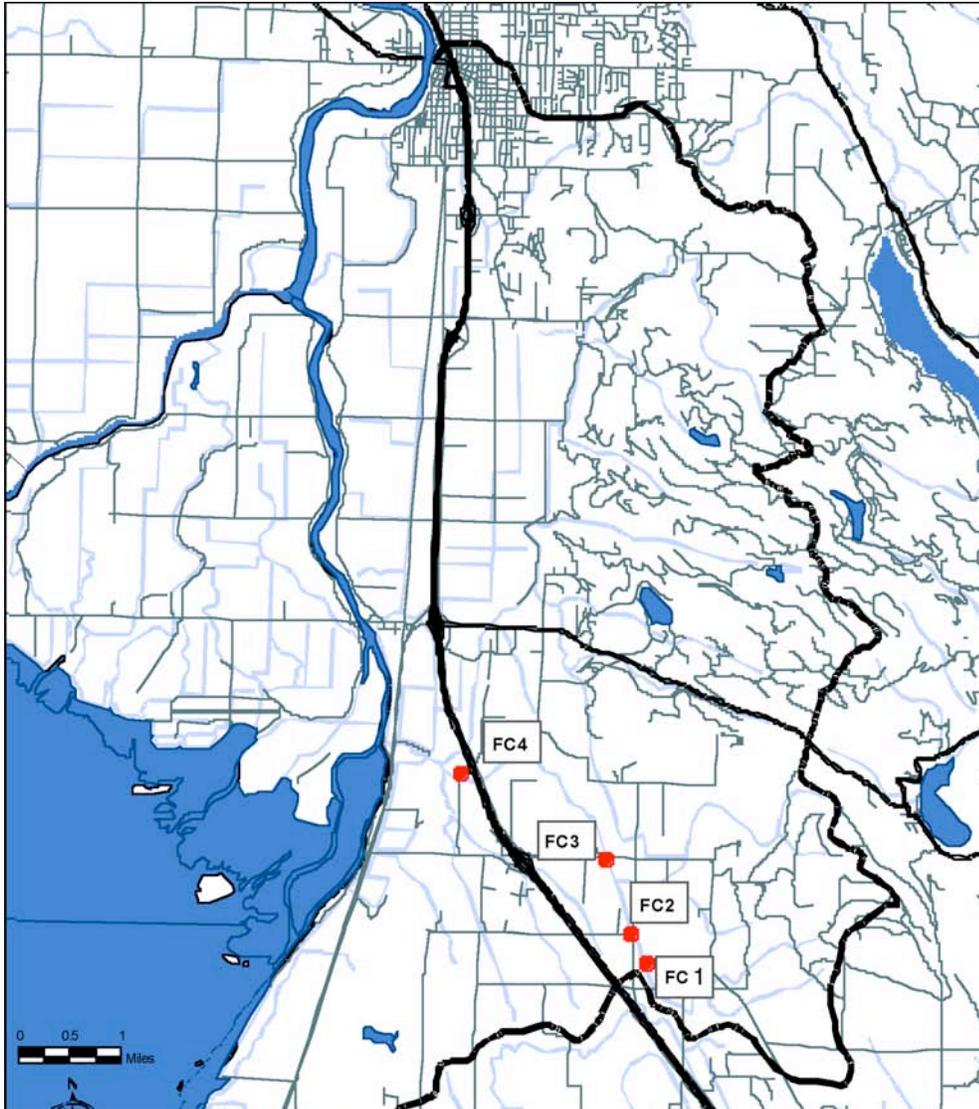


Figure 6. Map of Fisher Creek Sites

Table 6. Fisher Creek Sampling Locations

FC #1	Bulson Road at Skagit/Snohomish County Line	N48°17'53. W122°17'31
FC #2	Private Property Access at 23616 Bulson Road	N48°18'121 W122°17'41
FC #3	Fisher Creek Crossing at Starbird Hill Road	N48°18'30. W122°17'53
FC #4	Fisher Creek at Franklin Road Bridge	N48°19'11 W122°19'47

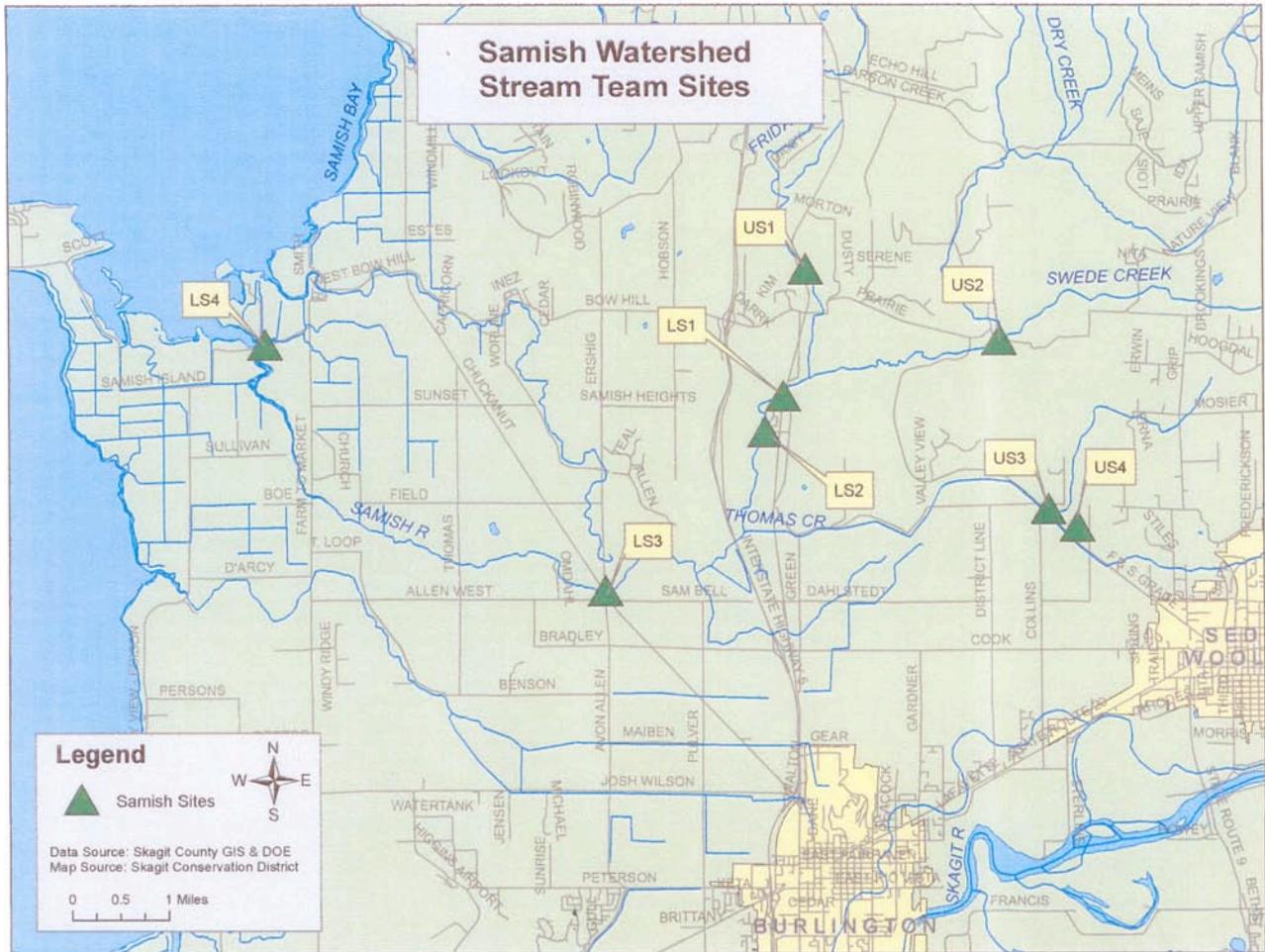


Figure 7. Map of Samish Sites

Table 7. Samish Sampling Locations

US #1	Friday Creek @ Pomona Grange Park	N48°17'53. W122°17'31
US #2	Swede Creek @ Grip Rd	N48°18'121 W122°17'41
US #3	Thomas Creek @ F&S Grade Rd	N48°18'30. W122°17'53
US #4	Willard Creek @ 8274 F & S Grade Rd	N48°19'11 W122°19'47
LS #1	Hwy 99 Bridge over Samish River	N48°17'53. W122°17'31
LS #2	Samish River @ Jolly Road	N48°18'121 W122°17'41
LS #3	Chuckanut Bridge over Samish River	N48°18'30. W122°17'53
LS #4	Mouth of the Samish River (boat dock)	N48°19'11 W122°19'47

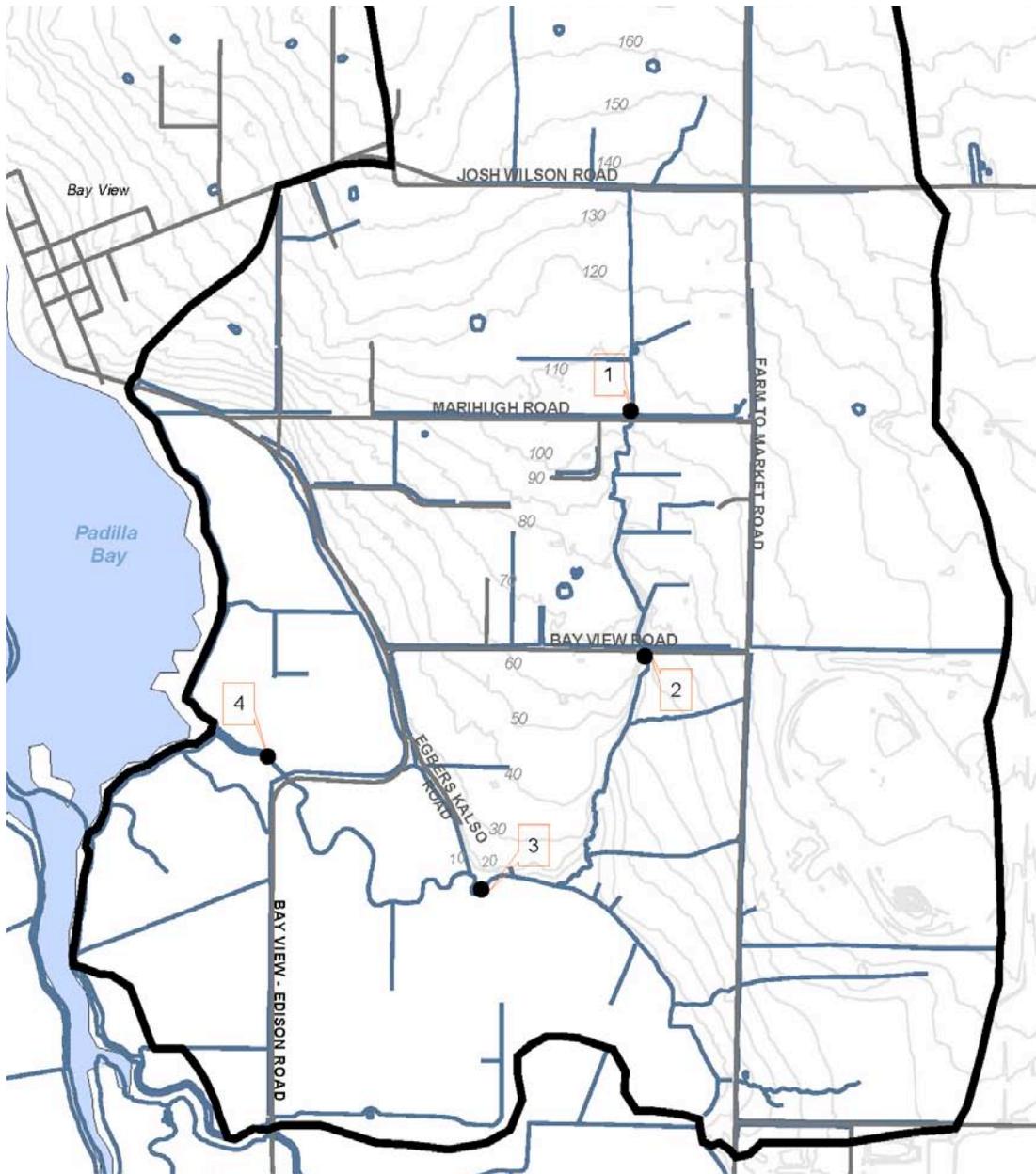


Figure 8. Map of No Name Slough Sites

Table 8. No Name Slough Sampling Locations

NN #1	Marihugh Road Culvert	N48°17'53. W122°17'31
NN #2	Bay View Road Ravine	N48°18'121 W122°17'41
NN #3	Egber's Field Bridge	N48°18'30. W122°17'53
NN #4	Field Culvert, Bay View-Edison Road	N48°19'11 W122°19'47



Figure 9. Map of Bay View Sites

Table 9. Bay View Sampling Locations

BV #1	Wilson Road and Walker Road	N48°29'199. W122°27'982
BV #2	Wilson Road and C Street	N48°29'105 W122°28'321
BV #3	Culvert at Boat Launch	N48°29'067. W122°28'720
BV #4	N Beach at Bay View State Park	N48°27'217 W122°28'884

V. Results

This section presents the data collected in this project and provides a preliminary overview and summary of the data, followed by details for each watershed. The complete data for all watersheds is provided in Appendix A.

1. Dissolved Oxygen

Washington State surface water quality standards are based in part on aquatic life habitat. For dissolved oxygen, the Class A Standard referenced in Figure 10 below refers to 9.5 mg/L necessary

for core summer salmonid habitat. Most of the sampling sites met standards. The exceptions were Site 4 on No Name Slough, Sites 1-5 on Gages Slough, and Sites 2-3 on Kulshan Creek. This annual average does not show incidences of low DO that could be harmful to aquatic life.

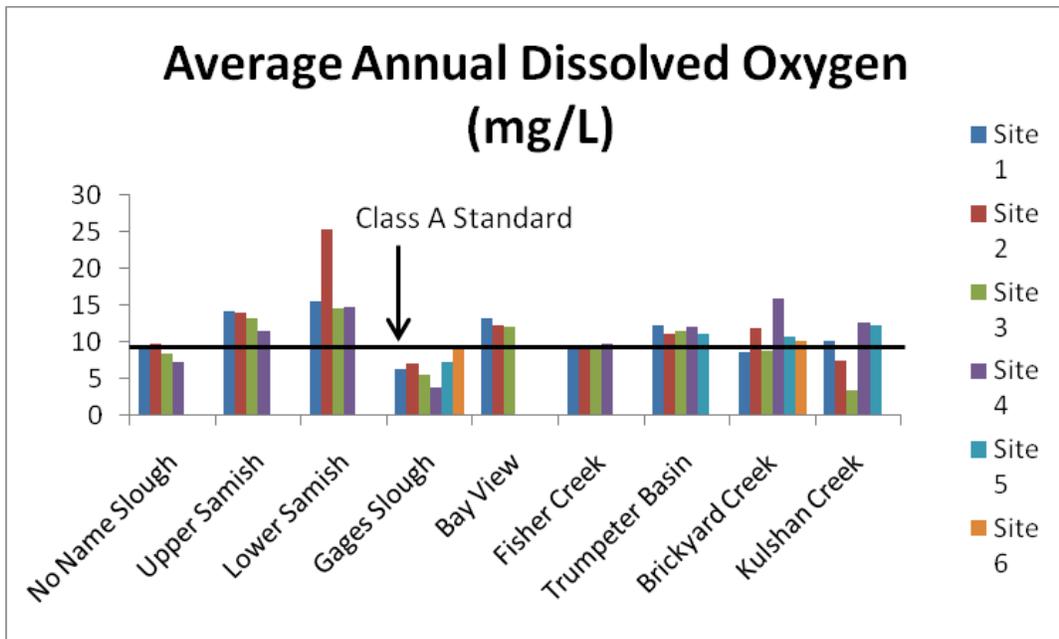


Figure 10. Average Annual Dissolved Oxygen

2. Temperature

Temperature standards referenced in Figure 11 below are 16°C based on salmon core summer salmonid habitat criteria. All sites averaged temperatures below the maximum state standard.

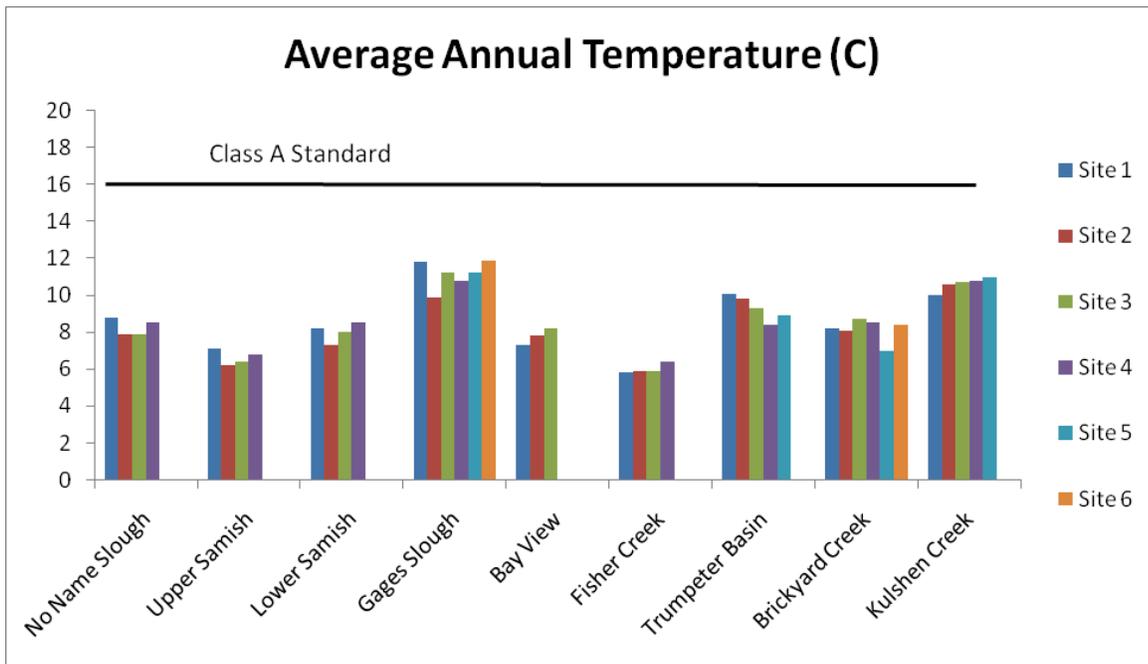


Figure 11. Average Annual Temperature

3. Turbidity

Turbidity averages are not referenced to a state standard because that standard is relative to naturally occurring background levels. For streams with background levels less than 50 NTU (all of the Stream Team sites), turbidity should not exceed 5 NTU above the background level. Figure 12 is useful for comparing turbidity between watersheds. Short-term occurrences of high turbidity are not as harmful to aquatic animals as extended periods of moderately elevated turbidity.

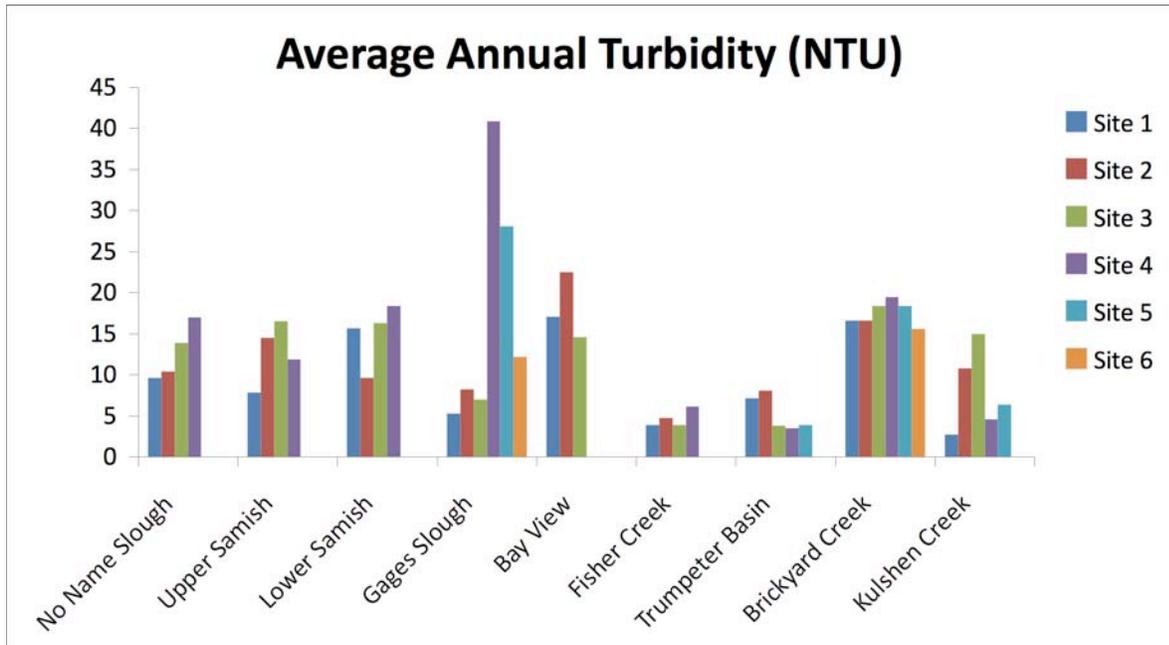


Figure 12. Average Annual Turbidity

4. Fecal Coliform

To meet state standards, streams must meet two criteria. 1. The annual geometric mean of fecal coliform bacteria levels cannot exceed 100 colonies/100 ml. 2. No more than 10% of the samples during a year can exceed 200 colonies /100 ml. The following sites met both these criteria: Upper Samish sites 1 and 4, all Lower Samish sites, Trumpeter Basin sites 3 and 4, and Fisher Creek site 4.

The following discussion considers only the geometric mean standard. State regulations are based on the geometric mean, an averaging technique that reduces the weight of occasional extreme results or results that don't fall within a reasonable range of the overall sample database. This is helpful when analyzing bacteria concentrations, because levels may vary anywhere from 10 to 10,000 fold over a given period. Figures 13 and 14 show the annual geometric mean for each stream team site. Most sites fell within state standards for this criterion. No name has consistently had the highest fecal coliform levels of any stream team site, and this year was no exception. Three of the four sites on No Name Slough exceeded standards for geometric mean. For other watersheds, every sub basin had at least one site that exceeded standards with the exception of Lower Samish, Fisher Creek, and Bay View Drainage. More detailed figures with seasonal variation are found within the discussions of individual sub-basins below.

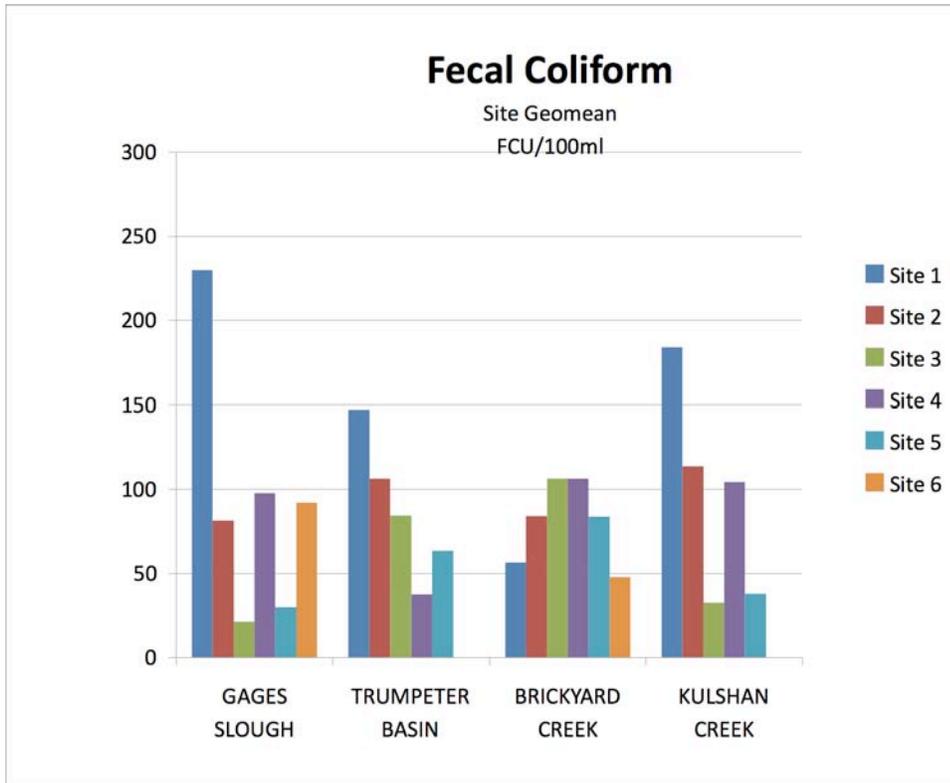


Figure 13. Geometric Mean Annual Fecal Coliform

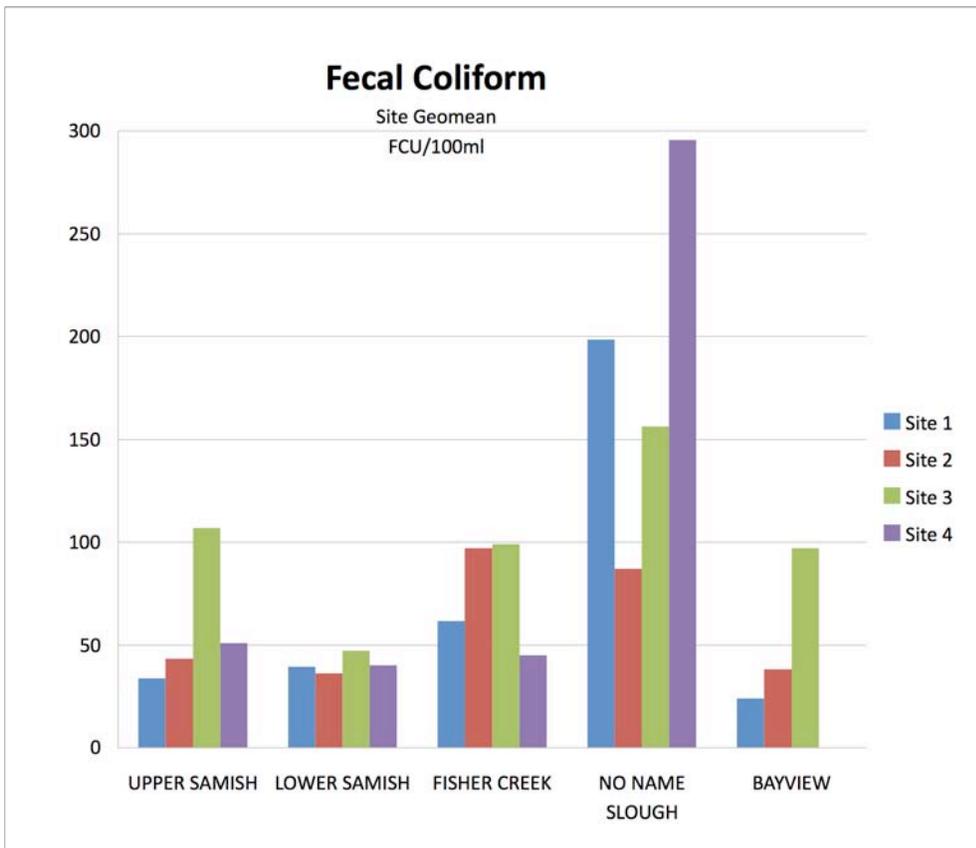


Figure 14. Geometric Mean Annual Fecal Coliform

1. Brickyard Creek

Brickyard Creek generally met the state standards for temperature at all six sampling sites during most of the year. Some sites dry up in the summer, and temperatures rise as water level and flow decrease. Site 2 exceeded the standard of 16°C in July and August. Sites 3, 4, and 5 exceeded the standard in June and July.

Dissolved oxygen is closely correlated with temperature, and levels generally dropped below state standards during late spring and summer months. Site 1 did not meet the standard of 9.5 mg/L from late April through July. Site 2 (Sapp Rd / Logan Estates) met the state standard throughout the year. Site 3 dropped below the standard from late May through early July. Site 4 met the standard with the exception of one sampling, June 10. Site 5 met the standard throughout the year. (It was dry during the warmest months.) Site 6 met standards with the exception of two June dates, before drying up for the summer.

Figure 15 summarizes fecal coliform results for all six Brickyard sampling sites throughout the year. The scale does not include the very high counts at site 4, F & S Grade Road, in June (3300 /100 ml), but allows better differentiation of sampling sites at the lower FC levels. All sampling sites exceeded the state standard of 100 FCU/100ml at some point during the year, with just over half of the total samples exceeding standards.

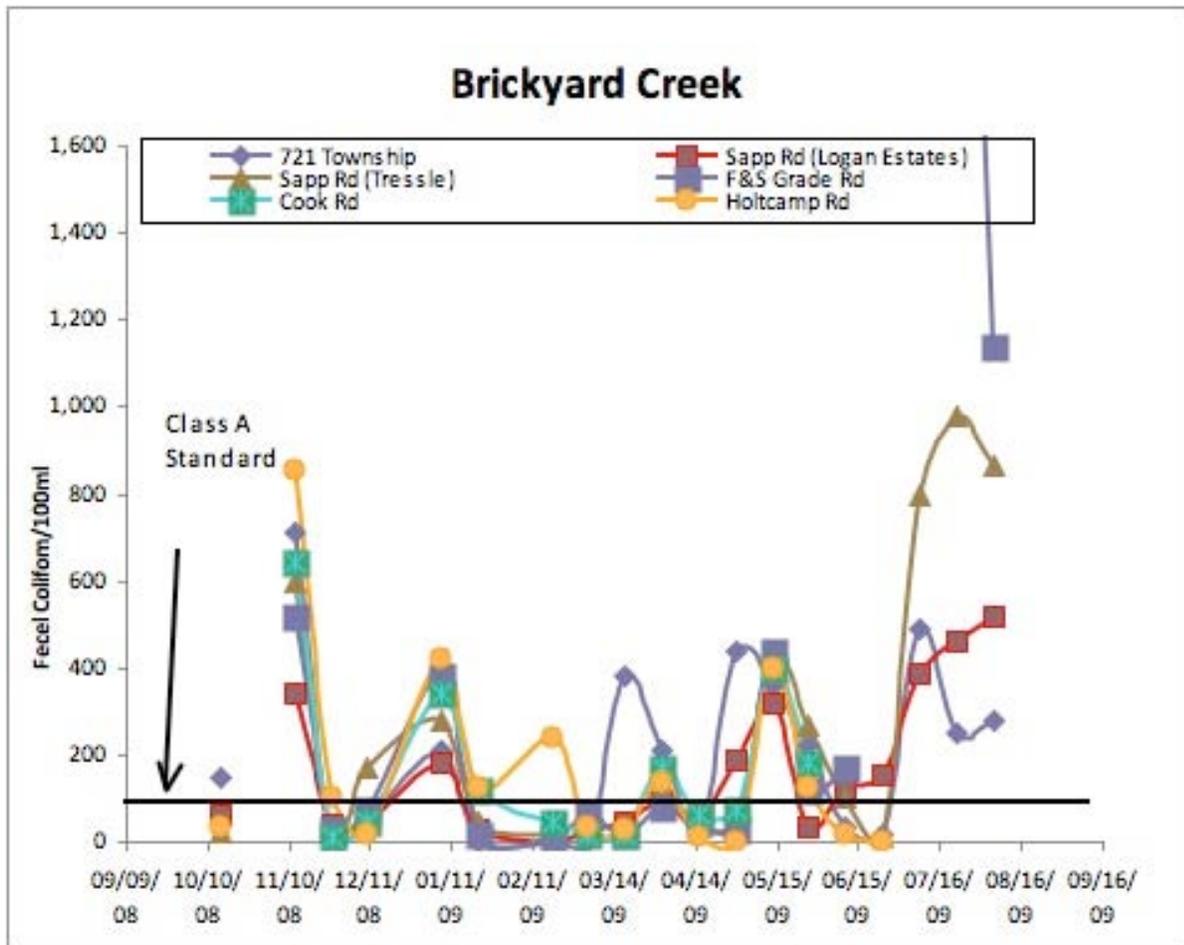


Figure 15. Brickyard Creek Fecal Coliform

2. Gages Slough

All sites exceeded state temperature standards in June and July. Site 1 exceeded temperature standards in November, December as well. Temperatures above 20°C (Sites 3 and 6) could be lethal to salmonids.

Average dissolved oxygen was below the state standard of 8.0 mg/L in all sites except Site 6. All sites experienced periods of very low oxygen levels in the summer months.

Of the six Gages Slough sampling sites, Site 3 had the lowest overall numbers of fecal coliform, and Site 1 had the highest numbers (over twice the next lowest site). All sites exceeded the state standards 30% or more of the time. Figure 16 shows the high variability of results, with numbers well over 1000.

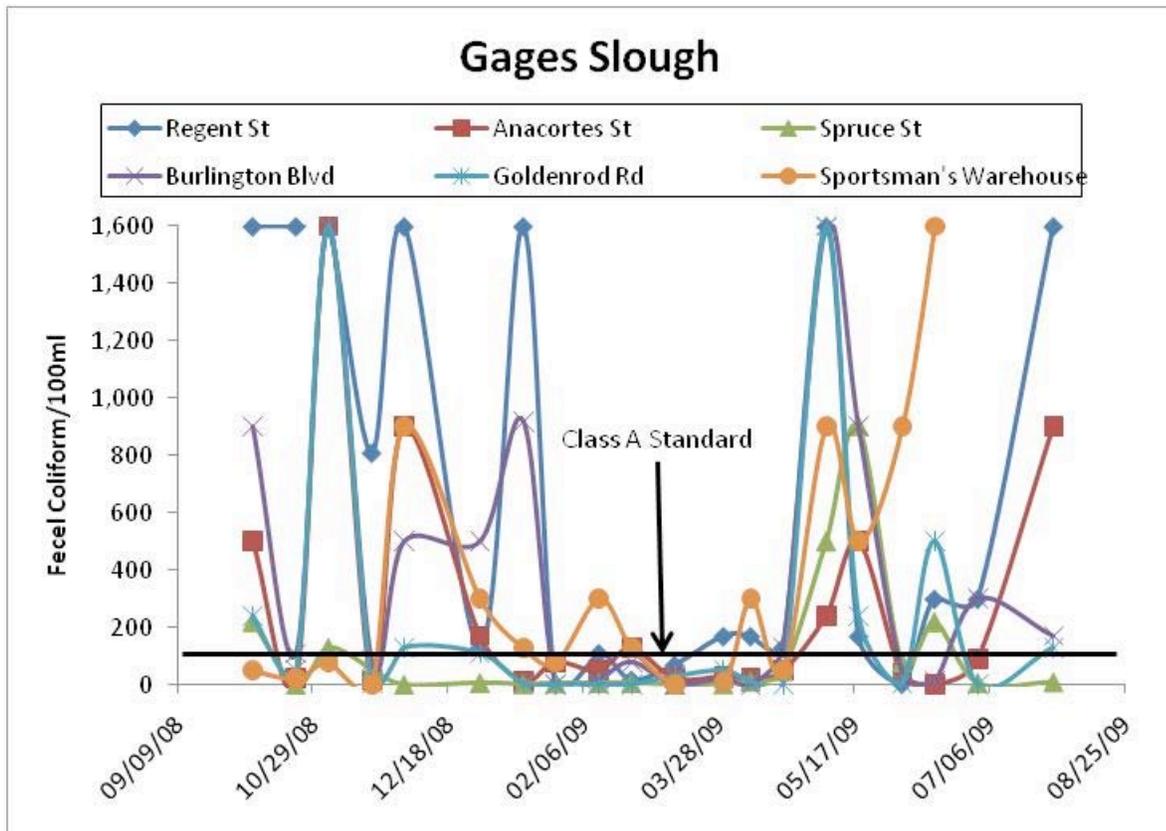


Figure 16. Gages Slough Fecal Coliform

3. Kulshan Creek

Temperatures in all sampling locations tended to follow the same pattern of low numbers within state standards during fall through spring, with temperatures exceeding the standard of 16°C between May and August. All five sites averaged below the standard, at around 10.5°C.

Dissolved oxygen was within acceptable levels throughout the year at Site 1. All other sites dipped below state standards at some point during the May-August period. Sites 3 and 4 also had low oxygen levels intermittently during the winter months.

Fecal coliform levels for all sites often exceeded state standards. Figure 17 shows frequent spikes in fecal coliform at all sites relative to lower background levels.

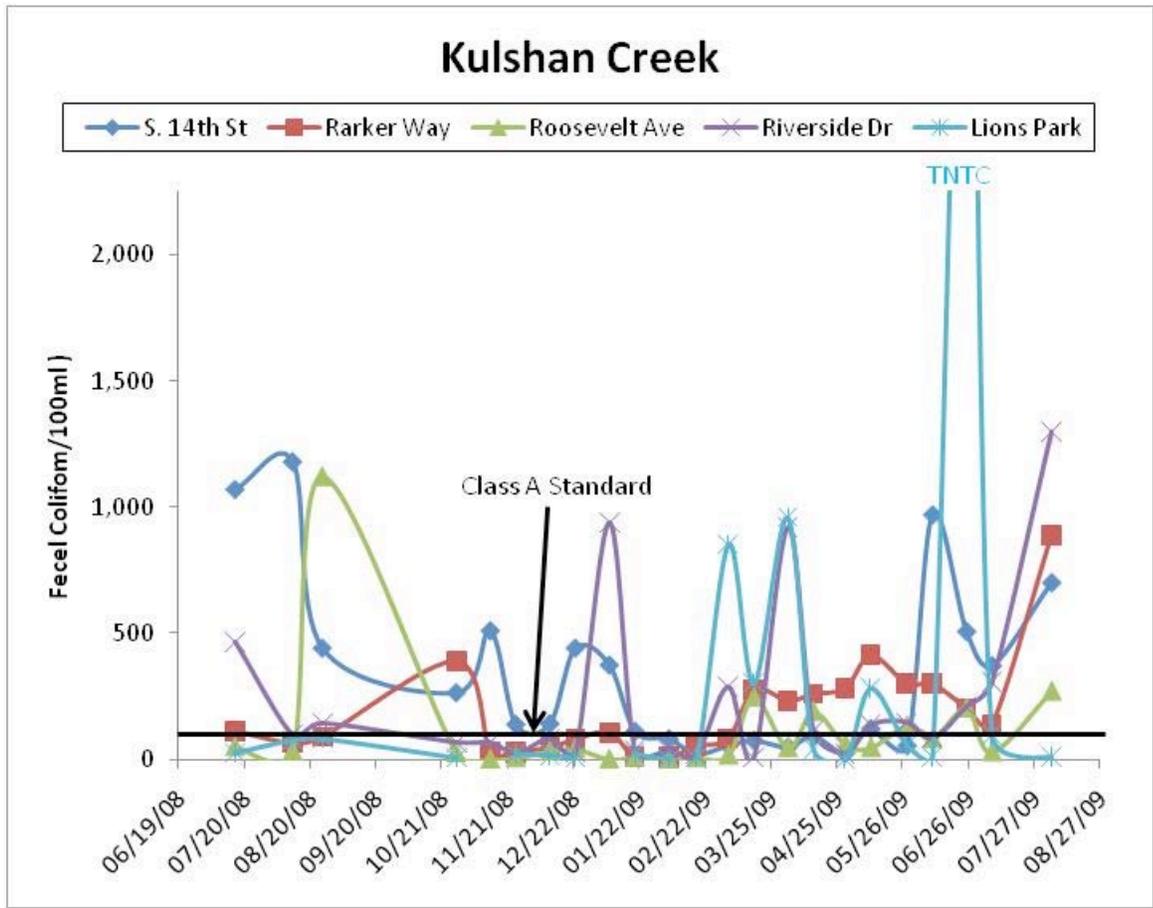


Figure 17. Kulshan Creek Fecal Coliform

4. Trumpeter Basin

Trumpeter Basin appears to have the best water quality among the urban Stream Team watersheds. As in the other urban watersheds, temperature exceeded state standards during July-August. Dissolved oxygen levels were within standards except for Sites 2 and 5 in July/August, when readings were just below standards.

Fecal Coliform levels were below or near the state standard of 100 colonies/100ml for much of the winter. Figure 18 shows spikes in October and March and high levels again during May-July.

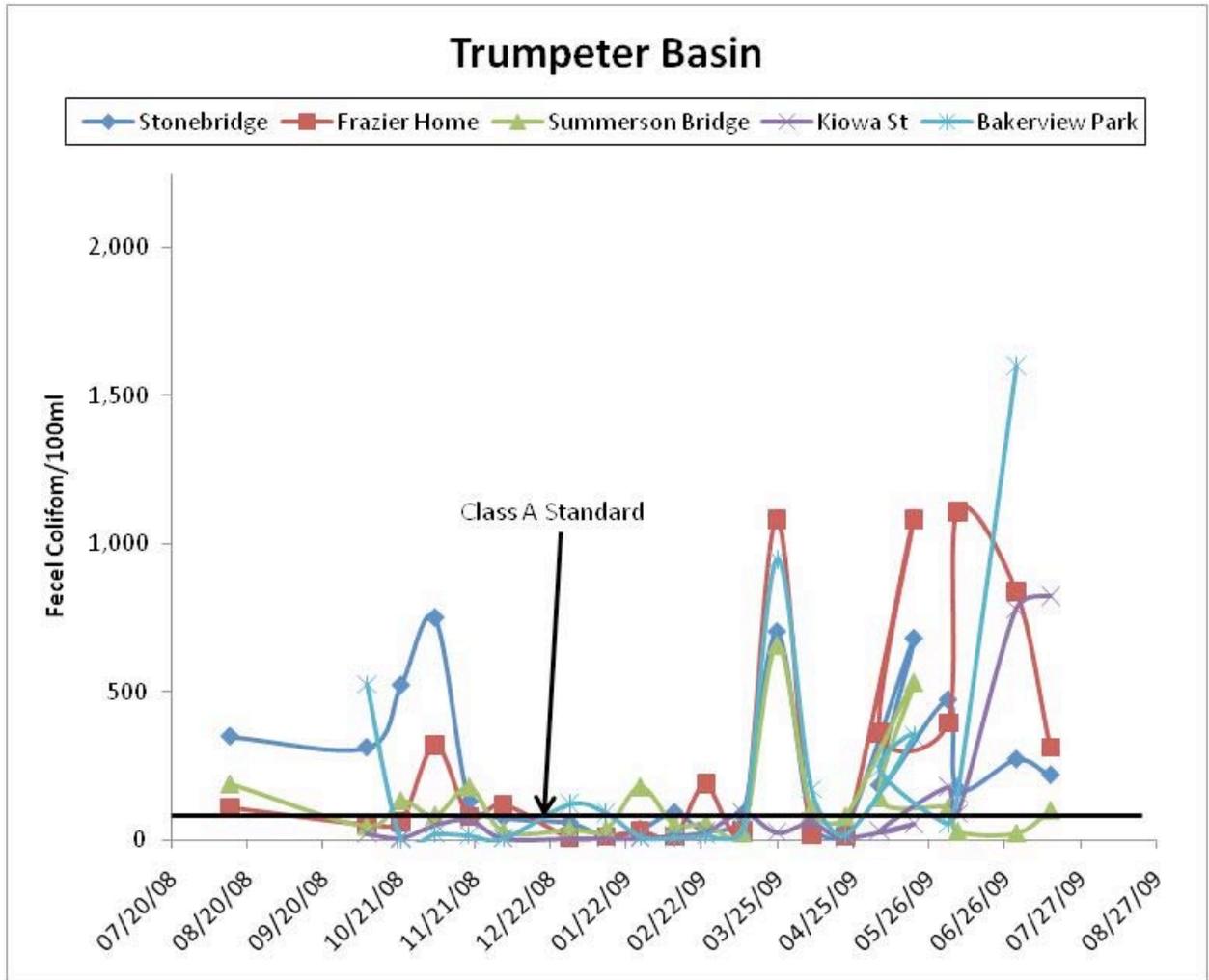


Figure 18. Trumpeter Basin Fecal Coliform

5. Fisher Creek

Average temperature, dissolved oxygen, and fecal coliform all met state surface water quality standards. Temperatures met standards for every site throughout the year. Dissolved oxygen levels were below the state standard of 9.5 °C at all sites during March through May.

Though geometric means for fecal coliform were within state standards, individual measurements show occasional high numbers. Site 2 had extremely high counts in October and November. Site 4 had the lowest numbers overall. All four sites had high levels in November and again in May.

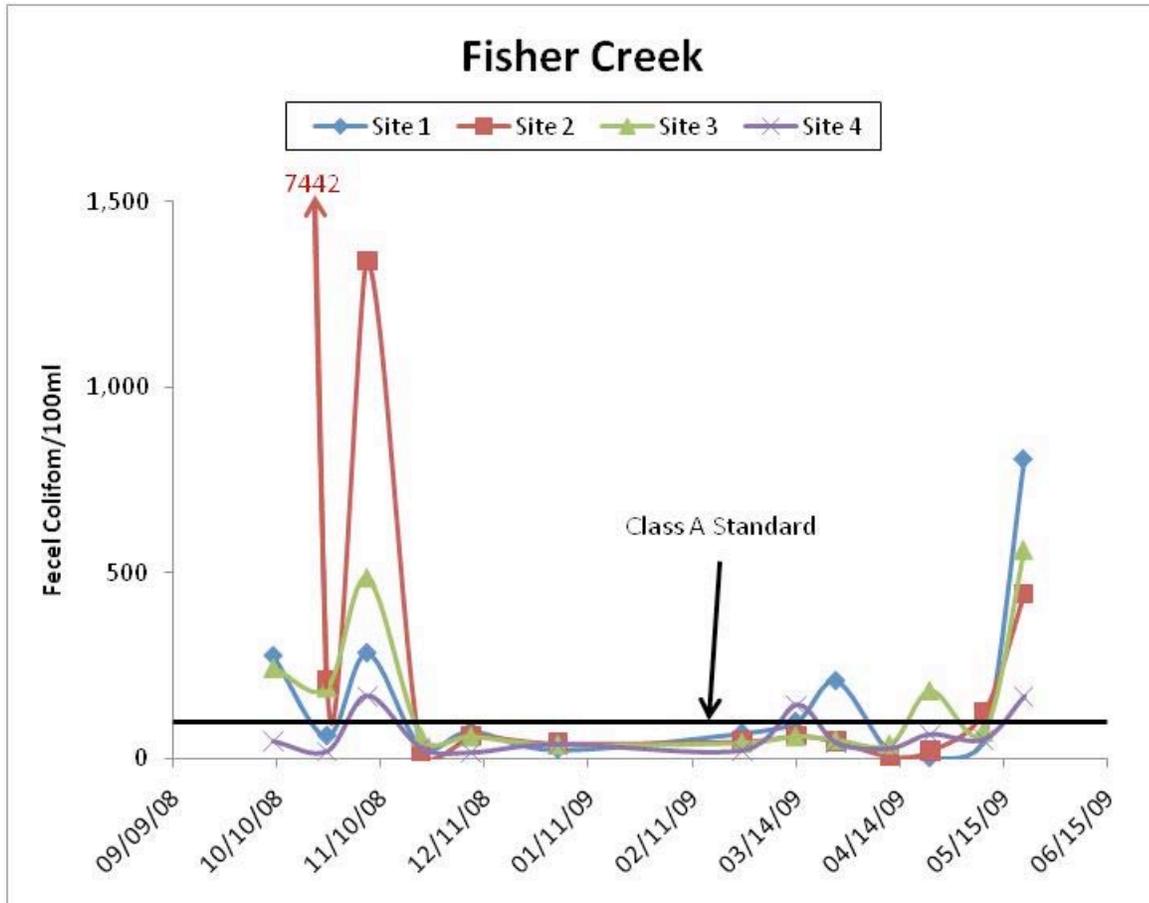


Figure 19. Fisher Creek Fecal Coliform

6. Samish Watershed

Temperature and dissolved oxygen were within state standards for all eight Samish sites throughout the sampling season with the exception of one day, October 4. Dissolved oxygen was below the standard of 9.5 mg/l on all four Lower Samish Sites that day.

The geometric mean for fecal coliform at Upper Samish Site 3 (Thomas Creek) was slightly above the state standard, but for all other sites the geomean was below 100 FCU/100 ml. Except for spikes in November and again in late February-early March, most individual counts were under 200 FCU/100 ml. One anomaly, May 16 at Jolly Road stands out. Figures 20 and 21 show fecal coliform levels in Upper and Lower Samish sites.

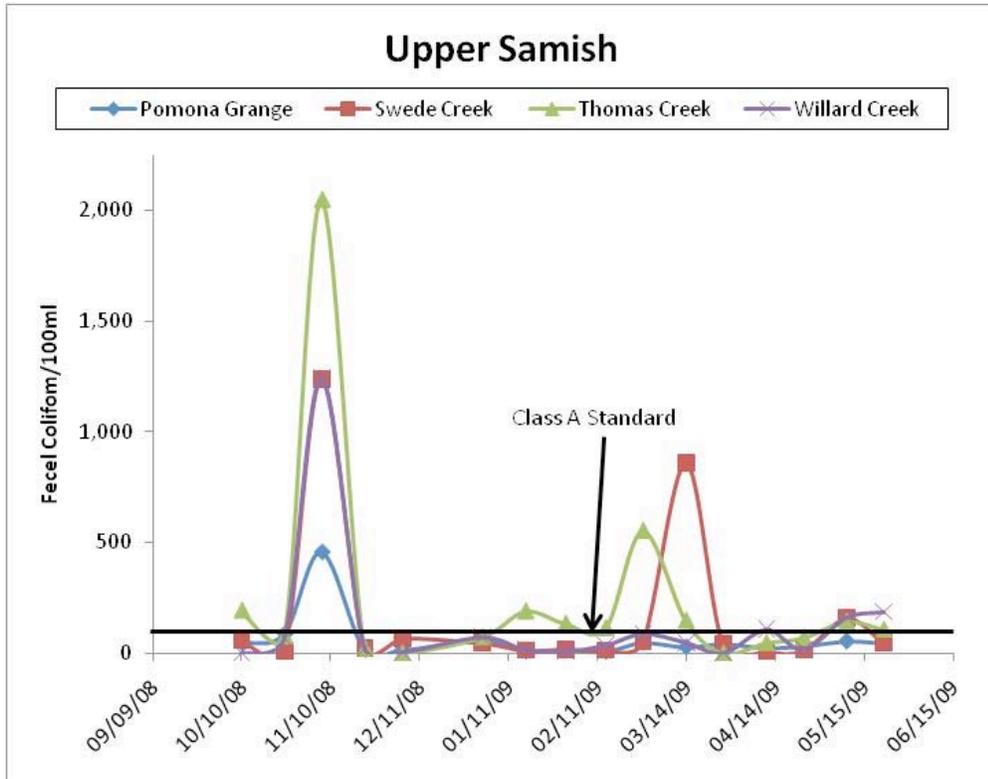


Figure 20. Upper Samish Fecal Coliform

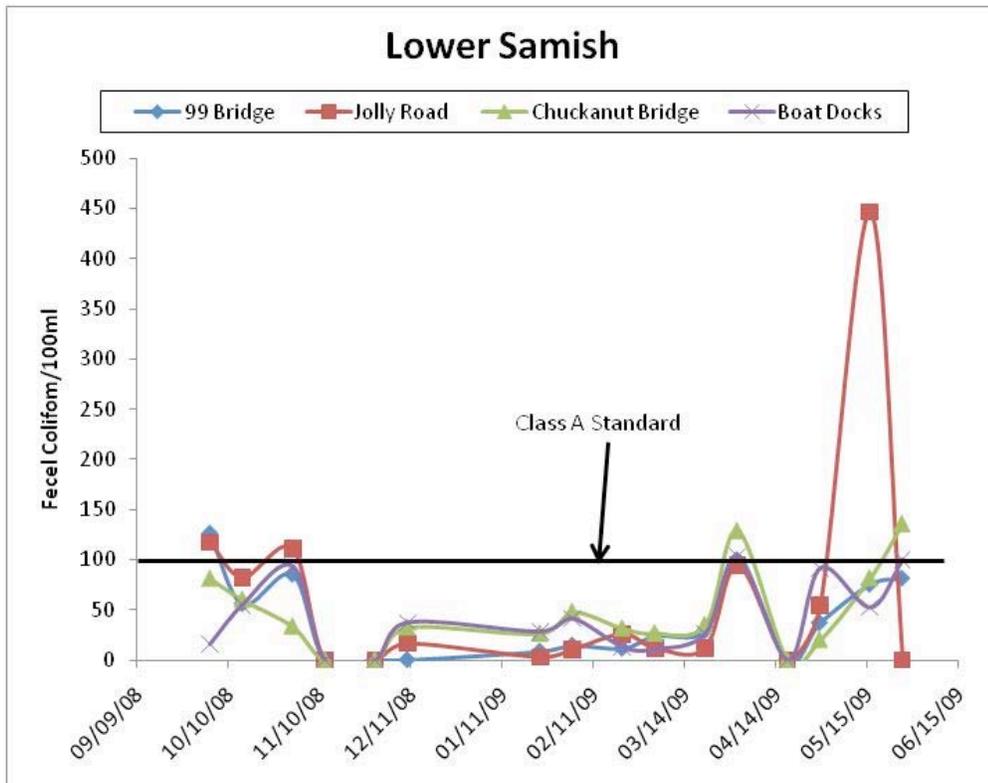


Figure 21. Lower Samish Fecal Coliform

7. No Name Slough (Padilla Bay)

Temperature in No Name Slough generally fell within state standards, with the exception of Site 1 in October and Site 4 in April. Dissolved oxygen levels were variable, starting the sampling season well below healthy levels in three of the four sites. Site 4 near the tide gates had the lowest levels of dissolved oxygen overall.

Consistent with results from past years, the highest average FC levels of all watersheds were recorded at No Name Slough. All sites exceeded state standards. Site 4 (Field Culvert) had the highest geometric mean for fecal coliform of any Stream Team Site.

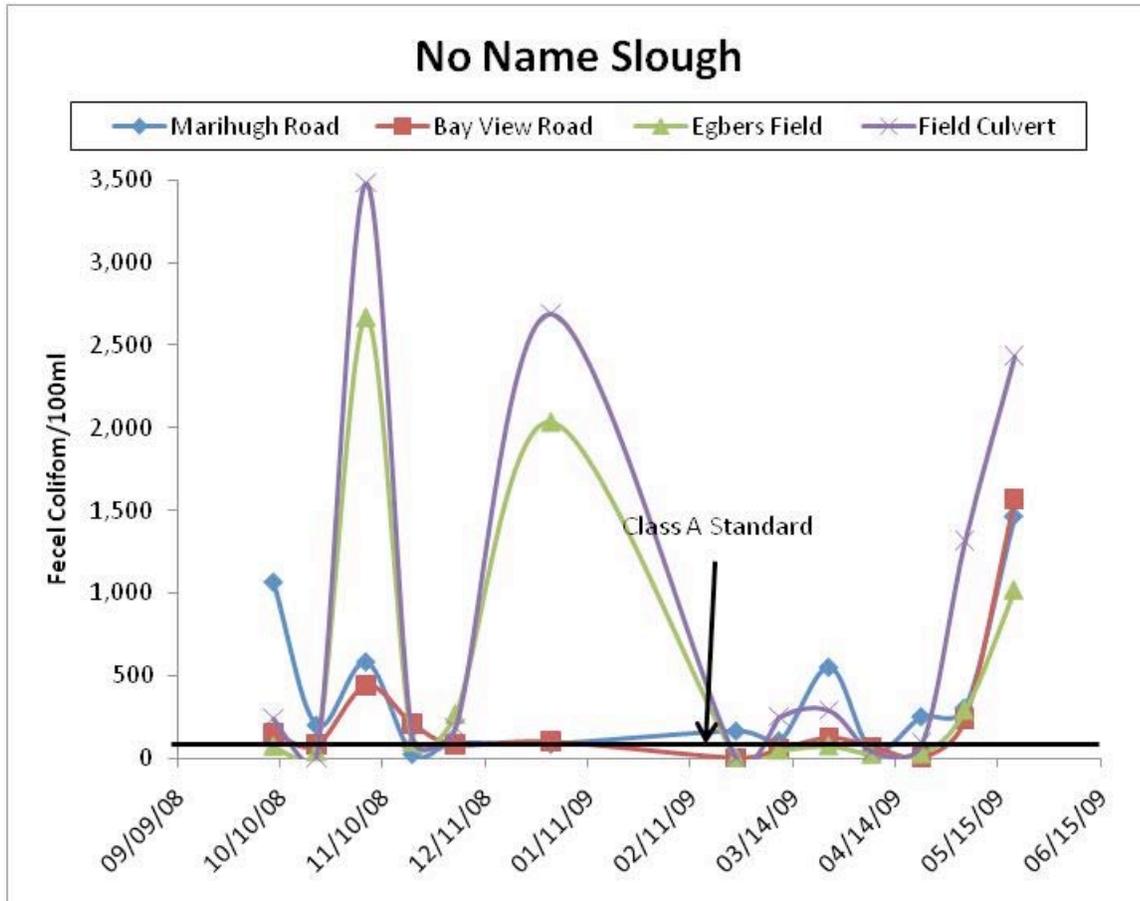


Figure 22. No Name Slough Fecal Coliform

8. Bay View Drainage

Volunteers assigned to the Bay View drainage had difficulties with scheduling. The data collected for this new watershed is not complete. Site 4, which is a salt water site at Bay View State Park, was difficult for the team to access, and low tides sometimes made sampling impossible. Sites 1 and 2 were sometimes dry. Looking at the data which was collected, temperature and dissolved oxygen fell well within state standards. Turbidity was very high on two occasions, March 12 and May 7. The May 7 high turbidity was accompanied by the highest fecal coliform counts.

Fecal coliform levels were often below the state standard, but, like other stream team watersheds, showed a flush of high bacteria levels during heavy rains in early May.

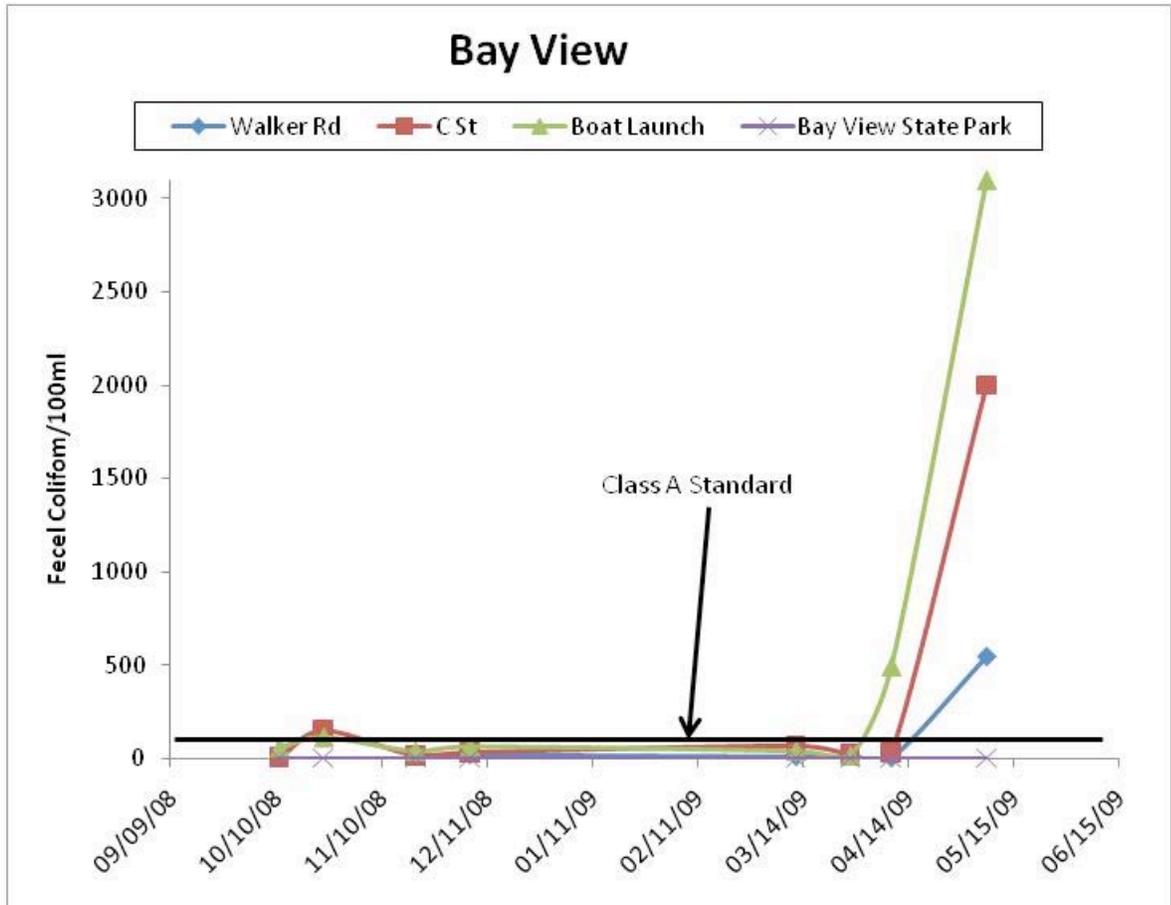


Figure 23. Bay View Drainage Fecal Coliform

9. Samish Storm Team

Storm team volunteers spent much of the 2008-2009 season scouting out the watershed. They tried different sampling locations, sampled multiple times during rainfall events to investigate the correlation between rainfall, river depth and fecal coliform levels, and tried to understand the contribution of various tributaries to the water quality in the Samish River. They were able to respond quickly to a weather event, and get results to various agencies and shellfish growers within 24 hours. Many of the trial sites were sampled only once or twice, while others were sampled throughout the season. Only the sites sampled three or more times are included in Figure 24 below.

Nearly all the sites exceeded the state standard of 100 fcu/ 100 ml. Those sites on the left of the chart (up to Hwy 9) are main stem Samish River sites. Those on the right are tributaries. Tributaries tend to have much higher levels of fecal coliform contamination than the main stem of the river. Because of the much greater volume of water in the Samish River, even relatively low fecal counts per 100 ml can represent high total numbers of bacteria that could potentially reach Samish Bay.

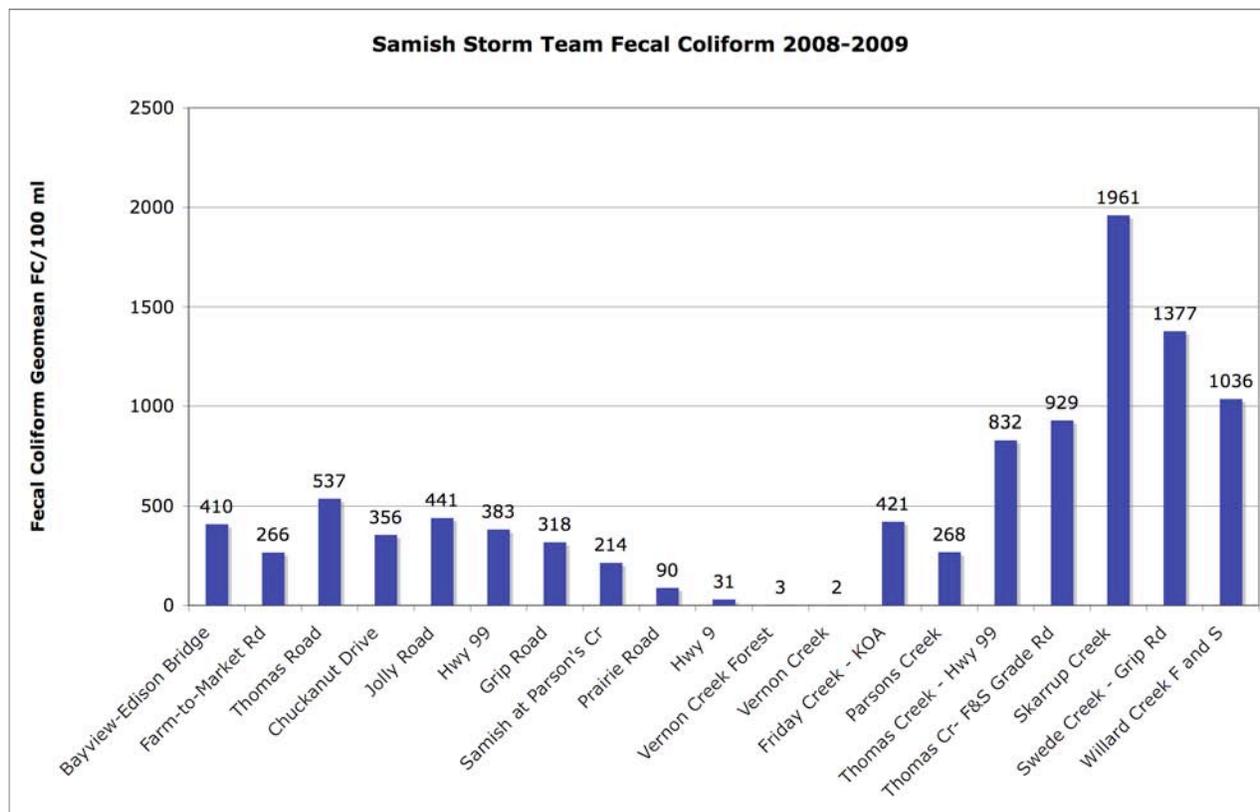


Figure 24. Samish Storm Team Fecal Coliform

VI. Summary

Table 10. Ranking of Sub-basins

Rank	F. Coliform Geomean FCU/100ml		Temp Ave °C		Dissolved Oxygen Ave mg/ L		Turbidity Ave NTU	
1	L Samish	40.6	Fisher Cr	6.0	L Samish	17.4	Fisher Cr	4.6
2	U Samish	51.2	U Samish	6.6	U Samish	13.25	Trumpeter	5.3
3	Bay View	54.5	Bay View	7.8	Bay View	12.49	Kulshan Cr	7.9
4	Gages Sl	68.4	L Samish	8.0	Trumpeter	11.6	U Samish	12.70
5	Fisher Cr	71.9	Brickyard Cr	8.2	Brickyard Cr	10.9	No Name Sl	13.03
6	Brickyard Cr	77.3	No Name Sl	8.3	Fisher Cr	9.2	L Samish	15.1
7	Kulshan Cr	77.9	Trumpeter	9.3	Kulshan Cr	9.13	Gages Sl	17.02
8	Trumpeter	80.3	Kulshan Cr	10.6	No Name Sl	8.91	Brickyard Cr	17.5
9	No Name Sl	166.5	Gages Sl	11.1	Gages Sl	6.46	Bay View	18.29

Table 10 above summarizes the averaged data for all sites in each sub-basin. Sub-basins have been ranked according to each parameter. It is difficult to make generalized conclusions, since different streams rank differently for each parameter. Four sub-basins rise to the top for most parameters:

Lower Samish, Fisher Creek, Upper Samish, and Bay View have the best overall water quality. Gages Slough, No Name Slough and Kulshan Creek have the poorest overall water quality, while Trumpeter Basin and Brickyard Creek tend to land towards the middle. All watersheds showed periods of good water quality and periods of poorer water quality. For example, heavy rains in November and again in early May correlate with spikes in fecal coliform levels in all the sub-basins.

The 2008-2009 Stream Team volunteers built upon the success of ten previous years, and provided an eleventh year of baseline WQ data for Skagit County's three priority watersheds. This year saw the addition of four new sub-basins, as well as the fearless Storm Team sampling throughout the Samish watershed during heavy rain events.

Over 60 adult volunteers were exposed to a firsthand view of the impact that non-point source pollution has on local water quality. Along the way they also experienced sampling and analytical techniques used by environmental professionals, learned the importance of establishing a long-term, routine sampling program, and enriched their own lives through volunteering.

Thanks to over 1000 volunteer hours, this program has provided valuable data to citizens and agencies, assessing current conditions so water quality improvements can be made, and documented in the future. This is key data for the long-term protection of our water resources. As citizens of this State and residents of these watersheds, we hope that our data is useful in identifying problem areas for the attention of the appropriate agencies.

APPENDIX A. 2008-2009 STREAM TEAM DATA

Site	Date	Water Temp (° C)	Turbidity (NTU)	D.O. (mg/l)	FC Low (/100ml)	FC High (/100ml)	FC AVERAGE (/100ml)	FC SITE GEOMEAN (/100ml)
NO NAME SLOUGH								
Marihugh Road								
	10-8-08	16.0	4.10	3.48	930	1,200	1,065	
	10-21-08	8.8	4.90	4.21	160	240	200	
	11-5-08	13.3	14.90	7.16	540	625	583	
	11-19-08	8.9	6.60	9.37	10	39	25	
	12-2-08	9.4	12.00	9.43	85	96	91	
	12-31-08	3.0	10.70	12.58	60	114	87	
	2-25-09	7.1	13.70	10.52	128	200	164	
	3-10-09	0.8	8.80	13.00	85	126	106	
	3-25-09	6.5	12.10	10.57	531	570	551	
	4-7-09	8.2	6.20	10.12	33	55	44	
	4-22-09	11.6	10.80	8.57	228	275	252	
	5-5-09	9.8	9.30	9.17	279	325	302	
	5-20-09	11.3	11.00	9.68	1,425	1,500	1,463	205
Bay View Road								
	10-8-08	9.4	5.20	8.43	140	160	150	
	10-21-08	7.2	4.50	7.57	40	120	80	
	11-5-08	7.3	14.70	10.59	340	540	440	
	11-19-08	8.6	9.20	9.80	200	220	210	
	12-2-08	9.3	12.80	9.98	80	90	85	
	12-31-08	2.7	14.40	13.10	80	120	100	
	2-25-09	6.3	9.40	10.27	0	4	2	
	3-10-09		10.30	6.54	50	60	55	
	3-25-09	5.8	13.10	10.58	100	150	125	
	4-7-09	7.8	8.70	9.80	60	80	70	
	4-22-09	9.8	10.10	9.15	0	10	5	
	5-5-09	9.6	10.10	9.73	170	300	235	
	5-20-09	11.0	12.70	10.41	1,380	1,760	1,570	87
Egbers Field								
	10-8-08	12.1	5.20	5.60	30	110	70	
	10-21-08	8.7	7.40	6.61	30	45	38	
	11-5-08	7.5	15.70	7.19	2,550	2,785	2,668	
	11-19-08	8.8	8.60	6.36	96		96	
	12-2-08	9.4	15.90	8.70	264		264	
	12-31-08	2.7	17.30	12.20	1,668	2,400	2,034	
	2-25-09	6.2	16.80	9.51				
	3-10-09	0.3		11.10	32	60	46	
	3-25-09	6.1	15.50	9.75	70	75	73	
	4-7-09	8.2	17.20	9.96	21	25	23	
	4-22-09	11.5	13.50	6.23	12	40	26	
	5-5-09	10.3	12.30	8.80	270	305	288	
	5-20-09	11.2	21.40	8.16	948	1,085	1,017	156

Site	Date	Water Temp (° C)	Turbidity (NTU)	D.O. (mg/l)	FC Low (/100ml)	FC High (/100ml)	FC AVERAGE (/100ml)	FC SITE GEOMEAN (/100ml)
Field Culvert								
	10-8-08	11.5	20.10	2.64	235	248	242	
	10-21-08	8.2	7.70	6.00	8	10	9	
	11-5-08	8.5	20.20	5.46	3,090	3,875	3,483	
	11-19-08	9.6	9.10	1.62	100	145	123	
	12-2-08	9.5	16.90	6.45	184		184	
	12-31-08	3.0	21.10	11.52	2,664	2,720	2,692	
	2-25-09	6.4	28.30	9.04				
	3-10-09	0.1	22.70	10.92	207	300	254	
	3-25-09	6.2	14.40	8.75	279	305	292	
	4-7-09	11.2	17.60	9.10	42	45	44	
	4-22-09	13.3	12.50	8.37	87	100	94	
	5-5-09	11.4	7.50	7.32	880	1,755	1,318	
	5-20-09	12.1	22.30	5.87	2,215	2,655	2,435	296

UPPER SAMISH

Pomona Grange								
	10-10-08	8.6	2.00	11.40	40	50	45	
	10-25-08	9.5	1.60	15.40	80	96	88	
	11-7-08	9.7	36.80	11.60	448	468	458	
	11-22-08	8.0	4.10	>20	15	16	16	
	12-5-08	6.9	4.40	12.80	6	22	14	
	1-2-09	3.3	8.30	13.65	46	66	56	
	1-17-09	4.1	10.80	>20	8	9	9	
	1-31-09	3.6	7.90	13.23	8.0	27	18	
	2-14-09	3.6	4.40	>	4	12	8	
	2-27-09	3.8	9.10	12.40	45	50	48	
	3-14-09	5.8	9.30	>	27	28	28	
	3-27-09	6.8	5.60	12.20	33	50	42	
	4-11-09	8.5	3.50	15.30	18	30	24	
	4-24-09	8.5	6.40	11.34	30	33	32	
	5-9-09	9.6	5.30	19.00	48	60	54	
	5-22-09	12.8	5.30	10.20	44	48	46	34

Swede Creek								
	10-10-08	6.3	6.30	11.08	58	60	59	
	10-25-08	8.2	4.70	13.70	0	18	9	
	11-7-08	9.8	73.80	11.11	1,222	1,254	1,238	
	11-22-08	6.7	11.60	18.70	18	24	21	
	12-5-08	5.4	11.20	12.40	54	81	68	
	1-2-09	2.3	17.50	13.68	42	50	46	
	1-17-09	3.2	9.10	>20	12	14	13	
	1-31-09	2.2	8.80	13.73	14	21	18	
	2-14-09	3.0	9.10	18.96	10.0	15	13	
	2-27-09	3.4	5.50	12.11	48	56	52	
	3-14-09	4.6	17.40	12.00	840	876	858	
	3-27-09	6.8	12.80	12.36	33	50	42	
	4-11-09	8.7	6.50	11.50	6	8	7	
	4-24-09	7.8	12.70	11.80	10	15	13	
	5-9-09	9.0	14.10	18.00	152	165	159	
	5-22-09	11.3	10.30	13.09	45	48	47	43

Site	Date	Water Temp (° C)	Turbidity (NTU)	D.O. (mg/l)	FC Low (/100ml)	FC High (/100ml)	FC AVERAGE (/100ml)	FC SITE GEOMEAN (/100ml)
Thomas Creek								
	10-10-08	6.8	3.90	10.89	180	204	192	
	10-25-08	8.6	3.70	12.60	50	100	75	
	11-7-08	9.6	69.80	11.22	2,050		2,050	
	11-22-08	6.7	11.60	18.70	18	24	21	
	12-5-08	5.9	13.20	11.83				
	1-2-09	2.8	10.10	11.45	66	78	72	
	1-17-09	3.8	12.80	16.40	180	198	189	
	1-31-09	2.7	15.80	12.79	117	150	134	
	2-14-09	3.7	11.50	15.70	100	126	113	
	2-27-09	3.8	21.70	11.66	385	720	553	
	3-14-09	4.8	19.90	12.25	129	165	147	
	3-27-09	7.0	9.00	11.94				
	4-11-09	8.5	12.50	13.70	40	51	46	
	4-24-09	7.8	17.40	11.89	69	70	70	
	5-9-09	8.7	17.90	16.50	102	182	142	
	5-22-09	10.6	13.90	12.75	87	125	106	132
Willard Creek								
	10-10-08							
	10-25-08				60	74	67	
	11-7-08	9.8	52.40	9.52	1,220	1,272	1,246	
	11-22-08	7.0	6.80	11.66	10	39	25	
	12-5-08	6.4	6.20	10.12	0	9	5	
	1-2-09	2.8	10.10	11.45	66	78	72	
	1-17-09	4.7	5.60	12.20	5	27	16	
	1-31-09	4.2	6.80	9.96	3	15	9	
	2-14-09	4.4	6.10	13.10	25	45	35	
	2-27-09	4.2	12.90	10.53	81	95	88	
	3-14-09	5.6	9.20	10.71	42	55	49	
	3-27-09	7.5	16.20	11.02				
	4-11-09	8.8	8.50	13.60	80	135	108	
	4-24-09	8.4	7.00	10.84	15	18	17	
	5-9-09	9.5	10.20	14.90	108	215	162	
	5-22-09	12.0	8.30	10.53	159	215	187	51
LOWER SAMISH								
99 Bridge								
	10-4-08	12.9	2.50	8.80	123	130	127	
	10-15-08	7.6	5.10	13.18	55	57	56	
	11-1-08	9.6	2.40	17.59	75	96	86	
	11-12-08	10.1	111.20	19.30				
	11-29-08	8.2	20.90	18.37				
	12-10-08							
	1-24-09	4.3	5.90	14.18	5	12	9	
	2-4-09	4.1	12.20	17.32	9	20	15	
	2-21-09	5.2	2.80	12.26	5	18	12	
	3-4-09	6.6	9.20	11.87	24		24	
	3-21-09	6.0	7.70	11.89	25	33	29	
	4-1-09	5.9	27.70	11.03	100	100	100	
	4-18-09	8.7	7.10	>				

Site	Date	Water Temp (° C)	Turbidity (NTU)	D.O. (mg/l)	FC Low (/100ml)	FC High (/100ml)	FC AVERAGE (/100ml)	FC SITE GEOMEAN (/100ml)
(99 Bridge)	4-29-09	10.2	6.00	10.13	35	39	37	
	5-16-09	11.0	7.00	40.40	66	85	76	
	5-27-09	11.9	8.20	12.40	70	93	82	39
Jolly Rd								
	10-4-08	12.5	5.00	8.53	80	155	118	
	10-15-08	7.7	5.10	12.50	75	90	83	
	11-1-08	9.7	2.30	155.40	102	120	111	
	11-12-08							
	11-29-08	7.7	21.50	17.18				
	12-10-08	7.4	9.80	13.36	15	18	17	
	1-24-09	3.1	6.80	13.89	0	6	3	
	2-4-09	4.1	10.20	15.77	0	21	11	
	2-21-09	4.2	2.80	12.22	25	27	26	
	3-4-09	6.1	7.80	12.48	9	15	12	
	3-21-09	5.5	12.40	12.84	9	15	12	
	4-1-09	5.8	27.70	12.02	90	100	95	
	4-18-09	8.0	7.80	12.07				
	4-29-09	10.1	5.20	10.43	39	70	55	
	5-16-09	10.7	9.50	45.90	395	498	447	
	5-27-09							36
Chuckanut Bridge								
	10-4-08	13.1	5.00	8.60	78	84	81	
	10-15-08	7.9	4.90	12.10	54	66	60	
	11-1-08	9.7	2.70	12.98	25	42	34	
	11-12-08	10.0	101.10	18.11				
	11-29-08	7.7	24.10	14.23				
	12-10-08	7.3	10.90	12.00	20	45	33	
	1-24-09	3.0	6.90	11.97	18	35	27	
	2-4-09	4.4	10.50	13.88	15	81	48	
	2-21-09	4.8	4.30	10.76	18	45	32	
	3-4-09	6.2	9.00	12.18	20	33	27	
	3-21-09	5.7	13.80	12.19	30	40	35	
	4-1-09	5.9	31.60	12.48	125	132	129	
	4-18-09	8.3	8.80	11.51				
	4-29-09	10.5	6.10	10.13	10	30	20	
	5-16-09	11.2	12.10	49.1	70	93	82	
	5-27-09	12.0	8.40	11.18	130	141	136	47
Samish/ Dock								
	10-4-08	14.1		5.30	14	18	16	
	10-15-08	8.4	20.10	10.60	48	62	55	
	11-1-08	9.7	5.90	27.67	87	100	94	
	11-12-08	10.0	66.40	12.54				
	11-29-08	7.7	25.90	12.30				
	12-10-08	7.3	11.70	11.24	30	45	38	
	1-24-09	3.2	15.40	11.64	15	42	29	
	2-4-09	4.8	16.80	11.98	33	50	42	
	2-21-09	5.3	4.60	10.04	6	20	13	
	3-4-09	6.8	6.60	11.21	10	12	11	
	3-21-09	6.6	12.10	11.59	20	33	27	
	4-1-09	6.1	43.70	12.14	102	105	104	
	4-18-09	8.9	16.90	11.43				
z	4-29-09	12.2	9.20	9.33	78	105	92	

Site	Date	Water Temp (° C)	Turbidity (NTU)	D.O. (mg/l)	FC Low (/100ml)	FC High (/100ml)	FC AVERAGE (/100ml)	FC SITE GEOMEAN (/100ml)
(Samish/ Dock)	5-16-09	11.6	11.50	56.60	45	60	53	40
	5-27-09	12.6	9.60	10.28	90	110	100	

GAGES SLOUGH

GS #1 Regent St

Date	Water Temp (° C)	Turbidity (NTU)	D.O. (mg/l)	FC (/100ml)
10-7-08	14.2	27.30		>1600
10-23-08				>1600
11-4-08	9.5	10.89	10.75	1,600
11-20-08	13.8	1.51	4.38	810
12-2-08	13.0	2.35	5.28	>1600
12-30-08		5.13		130
1-15-09	9.8	1.65	4.79	1,600
1-27-09	9.8	1.08	4.90	<2
2-12-09	10.3	0.85	5.72	110
2-24-09	10.2	5.67	7.12	17
3-12-09	10.2	1.16	6.66	70
3-30-09	10.2	1.53	5.45	170
4-9-09	10.2	1.50	6.30	170
4-21-09	10.5	0.93	5.99	130
5-7-09	11.4	24.10	7.32	>1,600
5-19-09	11.9	4.52	8.01	170
6-4-09	13.1	3.64	7.35	4
6-16-09	12.7	1.65	6.70	300
7-2-09	13.6	3.51	4.41	300
7-30-09	17.8	2.01	5.75	>1600

229.9

GS #2 Anacortes St.

Date	Water Temp (° C)	Turbidity (NTU)	D.O. (mg/l)	FC (/100ml)
10-7-08	13.9		4.04	500
10-23-08				23
11-4-08	9.0	11.50	8.44	>1,600
11-20-08	10.7	14.80	8.25	15
12-2-08	11.2	13.80	8.79	900
12-30-08	2.8	27.60		170
1-15-09	5.5	5.52	4.37	13
1-27-09	2.0	4.31	5.61	80
2-12-09	4.4	6.81	7.02	50
2-24-09	7.0	5.83	10.28	130
3-12-09	5.7	3.10	13.50	23
3-30-09	8.6	3.72	9.25	30
4-9-09	10.1	2.28	11.05	23
4-21-09	11.0	4.79	7.93	50
5-7-09	10.9	8.17	6.78	240
5-19-09	12.8	7.80	4.65	500
6-4-09	15.0	4.51	5.30	38
6-16-09	14.1	6.58	7.67	<2
7-2-09	15.7	6.61	3.30	90
7-30-09	18.2	9.84	0.52	900

82

GS #3 S. Spruce St.

Date	Water Temp (° C)	Turbidity (NTU)	D.O. (mg/l)	FC (/100ml)
10-7-08	12.9		0.38	220
10-23-08				2
11-4-08	9.3	4.71	2.00	130
11-20-08	8.0	4.72	0.32	56

Site	Date	Water Temp (° C)	Turbidity (NTU)	D.O. (mg/l)	FC Low (/100ml)	FC High (/100ml)	FC (/100ml)	FC SITE GEOMEAN (/100ml)
(S. Spruce St.)	11-20-08	8.0	4.72	0.32			56	
	12-2-08	9.7	3.07	1.65			2	
	12-30-08		4.72				8	
	1-15-09	9.8	0.93	6.00			4	
	1-27-09	9.2	30.70	7.42			7	
	2-12-09	5.0	5.93	9.30			8	
	2-24-09	9.6	29.60	7.89			8	
	3-12-09	5.1	2.57	15.40			2	
	3-30-09	7.5	1.63	6.30			4	
	4-9-09	9.4	2.20	5.72			13	
	4-21-09	13.4	2.94	11.40			50	
	5-7-09	11.6	18.70	4.83			500	
	5-19-09	14.9	2.51	7.39			900	
	6-4-09	17.2	1.14	4.30			80	
	6-16-09	14.1	error 4	3.51			220	
	7-2-09	13.4	0.67	5.59			8	
	7-30-09	21.9	1.98	0.96			11	21
GS #4 Burlington Blvd								
	10-7-08	15.1		6.60			900	
	10-23-08						110	
	11-4-08	9.1	13.00	10.85			1,600	
	11-20-08	13.0	5.26	0.15			84	
	12-2-08	11.9	25.00	4.20			500	
	12-30-08		226.00				500	
	1-15-09	8.1	130.00	2.30			920	
	1-27-09	8.4	49.30	0.20			2	
	2-12-09	7.6	71.90	5.29			23	
	2-24-09	9.0	87.60	1.24			80	
	3-12-09	8.6	29.20	6.94			<2	
	3-30-09	7.8	14.80	7.65			23	
	4-9-09	8.5	8.32	0.18			2	
	4-21-09	9.5	8.90	4.62			130	
	5-7-09	10.3	7.29	9.14			>1600	
	5-19-09	12.8	9.57	8.32			900	
	6-4-09	12.2	14.90	0.13			50	
	6-16-09	12.6	15.70	0.26			13	
	7-2-09	13.6	10.63	0.12			300	
	7-30-09	15.6	9.06	0.16			170	98
GS #5 Goldenrod Rd								
	10-7-08	15.0		3.66			240	
	10-23-08						50	
	11-4-08	9.3	65.30	10.93			>1600	
	11-20-08	12.5	3.80	6.81			5	
	12-2-08	11.4	19.40	8.09			130	
	12-30-08		10.55				110	
	1-15-09	8.9	2.70	8.82			4	
	1-27-09	8.7	4.33	7.98			<2	
	2-12-09	8.5	3.74	8.64			2	
	2-24-09	8.7	194.00	10.09			<2	
	3-12-09	8.5	2.22	10.63			30	
	3-30-09	8.7	3.16	8.87			50	

Site	Date	Water Temp (° C)	Turbidity (NTU)	D.O. (mg/l)	FC Low (/100ml)	FC High (/100ml)	FC (/100ml)	FC SITE GEOMEAN (/100ml)
(GS #5 Goldenrod)	4-9-09	9.8	2.46	7.97			13	
	4-21-09	10.0	4.21	6.80			2	
	5-7-09	10.7	30.90	9.17			1,600	
	5-19-09	12.6	23.90	8.57			240	
	6-4-09	12.9	10.32	7.47			4	
	6-16-09	13.1	108.80	1.07			500	
	7-2-09	14.2	8.18	3.00			<2	
	7-30-09	17.9	7.21	2.24			130	30
GS # 6 Sportsman's Warehouse								
	10-7-08	14.8		8.37			50	
	10-23-08						23	
	11-4-08	8.9	8.99	10.45			80	
	11-20-08	9.8	11.10	7.46			<1	
	12-2-08	10.6	20.50	10.58			900	
	12-30-08		54.20				300	
	1-15-09	6.2	14.40	9.22			130	
	1-27-09	1.6	4.28	6.77			80	
	2-12-09	6.9	23.10	10.27			300	
	2-24-09	6.9	22.50	11.24			130	
	3-12-09	11.2	3.70	12.15			<2	
	3-30-09	6.0	3.45	9.64			11	
	4-9-09	11.3	10.82	8.52			300	
	4-21-09	12.2	3.66	8.92			50	
	5-7-09	16.1	5.52	6.26			900c	
	5-19-09	14.6	3.57	6.70			500	
	6-4-09	26.0	3.35	7.70			900	
	6-16-09	26.5	2.58	11.20			1,600	
	7-2-09							
	7-30-09							92



					FC Low (/100ml)	FC High (/100ml)	FC AVERAGE (/100ml)		
BAYVIEW	# 1, Walker Rd								
		10-11-08							
		10-24-08							
		11-20-08	7.2	13.50	14.39	15	15	15	
		12-6-08	8.2		14.60	15	18	17	
		3-12-09	1.4	9.50	14.88	0	13	6	
		3-28-09	8.7			9	10	10	
		4-9-09							
		5-7-09	10.9	28.25	8.79	524	570	547	24
		# 2, C Street							
10-11-08	10.2		6.40	10.80	3	10	7		
10-24-08	8.6		10.20	13.21	125	174	150		
11-20-08	6.6		11.90	14.63	9	20	15		
12-6-08	7.4		11.10	14.70	21	45	33		
3-12-09	1.3		98.20	14.78	50	87	69		
3-28-09	8.7		13.70	10.78	15	30	23		
4-9-09	8.8		6.30	11.10	30	35	33		
5-7-09	10.7		22.00	8.48	1,750	2,250	2,000	38	

Site	Date	Water Temp (° C)	Turbidity (NTU)	D.O. (mg/l)	FC Low (/100ml)	FC High (/100ml)	FC AVERAGE (/100ml)	FC SITE GEOMEAN (/100ml)
# 3, Boat Launch	10-11-08	10.2	11.50	10.30	55	60	58	
	10-24-08	9.6	5.80	13.30	100	120	110	
	11-20-08	7.7	16.80	14.14	15	55	35	
	12-6-08	7.8	14.10	14.40	57	65	61	
	3-12-09	2.7	10.80	13.36	33	40	37	
	3-28-09	8.1	28.50	11.13	0	21	11	
	4-9-09	8.8	6.90	10.69	405	575	490	
	5-7-09	10.8	22.00	8.52	3,046	3,150	3,098	97
# 4, Bay View State Park	10-11-08							
	10-24-08							
	11-20-08							
	12-6-08							
	3-12-09							
	3-28-09							
	4-9-09							
	5-7-09							

FISHER CREEK

Site 1

10-9-08	7.3	3.20	8.74	270	280	275	
10-25-08	8.0	1.90	11.34	50	70	60	
11-6-08	7.4	6.40	10.22	270	295	283	
11-22-08	6.4	2.70	11.13	25	40	33	
12-7-08	4.7	3.30	12.27	55	90	73	
1-2-09	2.3	4.60	13.26	20	25	23	
2-26-09	2.7	5.40	13.36	65	70	68	
3-14-09	3.3	6.10	9.57	90	105	98	
3-26-09	3.9	3.50	5.42	140	275	208	
4-11-09	6.6	2.00	6.31	10	15	13	
4-23-09	6.8	3.30	6.33	0	0	1	
5-9-09	8.2	2.10	5.93	30.0	80	55	
5-21-09	8.3	5.60	6.70	800	810	805	62

Site 2

10-9-08	7.5	2.70	9.06	6,100	9,080	7,590	
10-25-08	8.1	2.00	12.03	100	320	210	
11-6-08	7.3	5.00	9.83	1,280	1,400	1,340	
11-22-08	6.2	2.10	11.08	0	40	20	
12-7-08	4.6	5.50	12.17	0	120	60	
1-2-09	2.1	12.00	13.13	0	80	40	
2-26-09	2.6	7.70	13.55	30	60	45	
3-14-09	3.3	6.00	3.72	40	80	60	
3-26-09	4.4	7.10	5.64	20	70	45	
4-11-09	6.7	1.90	6.21	0	10	5	
4-23-09	6.8	3.00	6.27	0	40	20	
5-9-09	8.2	1.60	5.92	100	150	125	
5-21-09	8.5	4.60	6.85	440	445	443	97

Site 3

10-9-08	7.9	2.80	9.49	210	276	243	
10-25-08	7.9	1.60	12.83	60	320	190	

Site	Date	Water Temp (° C)	Turbidity (NTU)	D.O. (mg/l)	FC Low (/100ml)	FC High (/100ml)	FC AVERAGE (/100ml)	FC SITE GEOMEAN (/100ml)
	11-6-08	7.3	4.70	10.36	464	510	487	
	11-22-08	6.0	2.60	11.46	50	68	59	
	12-7-08	4.4	6.10	12.42	52	65	59	
	1-2-09	1.9	6.50	12.88	35	36	36	
	2-26-09	2.4	4.90	13.63	30	52	41	
	3-14-09	3.5	3.00	3.86	48	70	59	
	3-26-09	3.8	5.50	5.60	48	50	49	
	4-11-09	6.9	2.20	6.45	20	55	38	
	4-23-09	7.3	3.70	6.36	180	184	182	
	5-9-09	8.8	2.20	6.04	70	72	71	
	5-21-09	8.9	4.40	6.80	485	640	563	99
Site 4								
	10-9-08	8.7	2.70	10.18	44	45	45	
	10-25-08	9.2	1.00	14.12	12	24	18	
	11-6-08	7.8	7.70	11.48	165	168	167	
	11-22-08	6.5	2.80	12.25	27	28	28	
	12-7-08	4.7	4.00	13.43	9	20	15	
	1-2-09	2.2	8.50	14.53	18	56	37	
	2-26-09	2.9	4.10	14.06	20	21	21	
	3-14-09	4.1	30.10	4.08	129	156	143	
	3-26-09	4.1	5.40	5.80	32	48	40	
	4-11-09	7.3	2.10	6.30	12	40	26	
	4-23-09	7.7	3.20	6.39	52	75	64	
	5-9-09	8.7	2.90	6.41	48	52	50	
	5-21-09	9.0	4.50	7.08	160	170	165	45

**TRUMPETER
BASIN
Site 1. Stonebridge
Adult Community**

					FC (/100ml)	
	8-13-08	18.2	0.55	21.80	350	
	10-8-08	12.4	3.00	10.57	313	
	10-22-08	8.7	0.70	11.33	523	
	11-5-08	9.6	7.30	11.80	750	
	11-19-08	8.7	3.80	11.86	130	
	12-3-08	9.5	5.80	10.67	77	
	12-30-08	4.8	34.00	12.41	60	
	1-14-09	6.5	12.00	11.60	13	
	1-28-09	5.5	2.80	12.18	37	
	2-11-09	5.4	4.80	13.53	93	
	2-24-09	7.3	9.50	13.22	33	
	3-11-09	4.5	4.30	12.55	87	
	3-25-09	7.3	26.00	12.95	703	
	4-8-09	8.7	4.00	12.40	63	
	4-22-09	11.3	3.00	13.81	37	
	5-20-09	13.1	10.00	11.70	680	
	5-6-09	11.9	8.80	11.43	185	
	6-3-09	16.5	2.90	10.25	473	
	6-7-09	14.8	2.40	9.85	173.0	
	7-1-09	13.7	2.30	11.32	273	
	7-15-09	13.8	1.90	10.93	220	147

Site	Date	Water Temp (° C)	Turbidity (NTU)	D.O. (mg/l)	FC Low (/100ml)	FC High (/100ml)	FC (/100ml)	FC SITE GEOMEAN (/100ml)
Site 2. Frazier Home on College Way	8-13-08	18.2	0.85	13.48			110	
	10-8-08	11.9	4.70	9.40			53	
	10-22-08	8.6	4.20	9.29			63	
	11-5-08	8.8	7.90	11.02			320	
	11-19-08	6.6	7.90	11.41			80	
	12-3-08	9.2	7.90	10.08			120	
	12-30-08	4.3	17.00	12.10			10	
	1-14-09	5.8	11.00	11.21			13	
	1-28-09	4.5	5.60	12.43			30	
	2-11-09	4.2	8.60	13.97			13	
	2-24-09	7.2	11.00	13.00			190	
	3-11-09	2.5	7.40	14.01			30	
	3-25-09	7.3	30.00	12.43			1,082	
	4-8-09	8.9	5.40	12.17			17	
	4-22-09	11.8	4.10	12.65			13	
	5-20-09	13.5	13.00	11.01			1,083	
	5-6-09	11.9	8.90	10.56			363	
	6-3-09	15.8	2.70	9.07			396	
	6-7-09	16.0	4.60	7.22			1,110	
	7-1-09	13.8	4.50	8.32			840	
7-15-09	14.9	3.30	7.25			313	106	
Site 3. Summersun Nursery Bridge	8-13-08	17.6	1.50	16.12			190	
	10-8-08	11.2	6.50	10.44			47	
	10-22-08	8.3	2.90	8.96			133	
	11-5-08	8.4	3.60	11.11			83	
	11-19-08	6.5	1.80	11.16			180	
	12-3-08	8.6	3.30	10.04			30	
	12-30-08	4.4	7.40	12.16			35	
	1-14-09	5.5	4.60	11.60			37	
	1-28-09	4.6	2.50	11.82			180	
	2-11-09	4.3	3.50	13.42			53	
	2-24-09	7.2	3.20	12.45			57	
	3-11-09	1.8	4.20	13.74			23	
	3-25-09	6.8	18.00	12.76			659	
	4-8-09	7.9	1.90	12.41			105	
	4-22-09	10.9	2.10	12.87			80	
	5-20-09	11.7	5.60	11.70			533	
	5-6-09	10.5	3.80	11.43			143	
	6-3-09	15.8	1.40	8.52			110	
	6-7-09	15.4	1.00	8.51			30	
	7-1-09	13.6	1.30	9.23			23	
7-15-09	14.1	0.55	8.62			100	84	
Site 4. Kiowa Street	8-13-08							
	10-8-08	11.8	11.00	10.84			23	
	10-22-08	7.8	0.00	11.77			10	
	11-5-08	8.7	4.00	12.08			53	
	11-19-08	6.7	0.50	12.56			70	

Site	Date	Water Temp (° C)	Turbidity (NTU)	D.O. (mg/l)	FC Low (/100ml)	FC High (/100ml)	FC (/100ml)	FC SITE GEOMEAN (/100ml)	
(Site 4. Kiowa Street)	12-3-08	8.3	2.50	10.90			7		
	12-30-08	4.2	10.00	12.67			7		
	1-14-09	5.1	3.60	12.13			7		
	1-28-09	3.9	1.40	12.74			7		
	2-11-09	3.9	2.30	13.97			17		
	2-24-09	7.0	2.60	12.67			30		
	3-11-09	1.1	0.95	13.93			93		
	3-25-09	6.4	12.00	13.18			27		
	4-8-09	7.8	1.40	12.67			60		
	4-22-09	9.7	1.10	12.63			10		
	5-20-09	11.3	7.20	12.02			57		
	5-6-09	10.5	5.60	11.95			33		
	6-3-09	14.5	2.00	10.60			180		
	6-7-09	13.9	0.85	10.36			90		
	7-1-09	12.3	0.45	11.00			780		
									38
	Site 5. Bakerview Park Footbridge	7-15-09	13.1	0.50	10.57			823	
8-13-08									
10-8-08		11.4	1.80	9.52			526		
10-22-08		7.9	1.40	9.68			3		
11-5-08		8.4	4.00	10.45			23		
11-19-08		7.0	0.00	11.43			17		
12-3-08		9.0	3.80	10.70			7		
12-30-08		5.1	5.10	11.80			123		
1-14-09		5.9	3.70	11.40			93		
1-28-09		5.5	2.10	11.72			13		
2-11-09		4.7	2.60	13.17			10		
2-24-09		7.7	2.30	11.88			17		
3-11-09		2.4	2.40	13.06			40		
3-25-09		7.0	17.00	12.63			949		
4-8-09		8.0	2.50	12.02			173		
4-22-09		11.3	2.20	11.78			20		
5-20-09		12.1	7.10	11.02			353		
5-6-09		10.0	3.60	11.28			240		
6-3-09		15.8	3.70	9.92			57		
6-7-09		15.2	0.40	7.47			160		
7-1-09		14.0	8.70	7.40			1,600		
		7-15-09							63

**BRICKYARD CREEK
Site 1. 721
Township**

10-15-08	7.4	11.70	8.20			150
10-29-08						
11-12-08	10.0	31.00	8.98			709
11-26-08	4.5	3.54	10.80			0
12-10-08	6.7	79.50	9.39			54
1-7-09	1.6	98.60	11.61			210
1-21-09	2.5	3.68	8.96			0

Site	Date	Water Temp (° C)	Turbidity (NTU)	D.O. (mg/l)	FC Low (/100ml)	FC High (/100ml)	FC (/100ml)	FC SITE GEOMEAN (/100ml)
(Site 1. 721 Township)	2-18-09	5.6	4.17	8.28			0	
	3-4-09	5.8	16.40	9.89			0	
	3-18-09	6.5	9.62	10.90			380	
	4-1-09	6.0	24.50	10.97			210	
	4-15-09	7.6	0.09	9.30			27	
	4-29-09	10.8	3.77	6.54			440	
	5-13-09	11.3	14.70	7.41			360	
	5-27-09	12.2	5.59	6.91			220	
	6-10-09	13.2	4.82	2.66			36	
	6-24-09	12.2	0.72	2.20			18	
	7-8-09	12.1	2.48	7.13			490	
	7-22-09	10.0	0.56	11.46			250	
	8-5-09	10.6	0.89	10.89			280	57
Site 2. Sapp Rd / Logan Estates								
	10-15-08	7.0	3.73	12.26			63	
	10-29-08							
	11-12-08	10.1	76.30	11.47			340	
	11-26-08	5.2	9.29	12.85			40	
	12-10-08	7.0	13.30	11.30			45	
	1-7-09	3.6	121.50	11.92			182	
	1-21-09	1.5	6.47	12.60			27	
	2-18-09	4.1	5.55	13.80			0	
	3-4-09	5.3	7.83	13.15			27	
	3-18-09	4.8	10.34	14.06			45	
	4-1-09	5.4	17.10	13.43			91	
	4-15-09	6.0	8.28	13.60			45	
	4-29-09	9.0	5.05	12.33			190	
	5-13-09	9.6	13.80	11.87			320	
	5-27-09	10.7	7.86	11.54			36	
	6-10-09	12.9	1.81	10.45			127	
	6-24-09	12.3	1.26	10.38			154	
	7-8-09	12.7	4.15	10.08			390	
	7-22-09	13.8	1.00	9.95			460	
	8-5-09	13.8	1.19	9.25			520	84
Site 3. Sapp Rd / Trestle								
	10-15-08	6.3	6.59	0.89			24	
	10-29-08							
	11-12-08	10.1	45.30	10.20			600	
	11-26-08	4.9	4.98	10.46			10	
	12-10-08	6.7	16.60	9.98			173	
	1-7-09	3.3	156.00	11.42			280	
	1-21-09	2.6	5.94	9.48			45	
	2-18-09	4.6	4.88	11.07			18	
	3-4-09							
	3-18-09	5.3	11.30	12.38			36	
	4-1-09	5.8	28.20	11.81			127	
	4-15-09	7.2	7.41	11.24			36	
	4-29-09	10.0	5.75	9.27			45	
	5-13-09	10.2	14.50	9.68			430	
	5-27-09	11.7	8.92	7.40			270	

Site	Date	Water Temp (° C)	Turbidity (NTU)	D.O. (mg/l)	FC Low (/100ml)	FC High (/100ml)	FC (/100ml)	FC SITE GEOMEAN (/100ml)
	6-10-09	14.8	5.39	2.75			100	
(Sapp Rd / Trestle)	6-24-09	14.2	3.40	5.15			9	
	7-8-09	13.2	1.95	6.83			800	
	7-22-09	14.3	2.39	8.15			982	
	8-5-09	12.1	0.82	9.10			864	106
Site 4. F&S Grade Rd								
	10-15-08							
	10-29-08							
	11-12-08	10.1	47.10	10.19			520	
	11-26-08	4.8	5.42	11.13			30	
	12-10-08	6.7	9.74	10.10			73	
	1-7-09	3.3	139.00	9.35			380	
	1-21-09	2.8	6.07	9.65			18	
	2-18-09	5.1	17.10	12.09			9	
	3-4-09	6.5	8.99	11.74			64	
	3-18-09	5.6	8.92	12.62			18	
	4-1-09	5.9	24.70	11.91			82	
	4-15-09	7.5	8.10	11.59			45	
	4-29-09	11.0	4.79	11.80			27	
	5-13-09	10.5	15.50	10.32			440	
	5-27-09	12.6	5.18	11.06			118	
	6-10-09	15.5	7.86	7.26			173	
	6-24-09							
	7-8-09							
	7-22-09	15.2	2.09	91.15			3,300	
	8-5-09	12.7	0.68	10.10			1,136	84
Site 5. 22431 Cook Rd								
	10-15-08							
	10-29-08							
	11-12-08	10.1	56.00	9.94			645	
	11-26-08	4.3	3.06	9.83			10	
	12-10-08	6.6	7.34	9.70			45	
	1-7-09	3.3	72.50	11.26			340	
	1-21-09	2.4	4.10	9.96			118	
	2-18-09	4.6	16.70	11.95			45	
	3-4-09	6.1	13.10	11.44			18	
	3-18-09	5.7	10.63	12.09			18	
	4-1-09	6.0	22.60	11.85			173	
	4-15-09	7.7	8.07	11.20			64	
	4-29-09	11.1	6.29	9.81			73	
	5-13-09	10.8	15.30	10.24			400	
	5-27-09	12.8	3.82	9.23			182	
	6-10-09							
	6-24-09							
	7-8-09							
	7-22-09							
	8-5-09							
Site 6. Holtcamp Rd								
	10-15-08	7.9	7.46	6.92			37	
	10-29-08							

Site	Date	Water Temp (° C)	Turbidity (NTU)	D.O. (mg/l)	FC Low (/100ml)	FC High (/100ml)	FC (/100ml)	FC SITE GEOMEAN (/100ml)
(Holtcamp Rd)	11-12-08	10.0	84.80	9.88			854	
	11-26-08	5.2	3.12	10.00			100	
	12-10-08	6.8	8.51	9.63			18	
	1-7-09	3.4	59.80	11.60			420	
	1-21-09	3.0	7.43	10.05			127	
	2-18-09	5.1	5.79	12.53			240	
	3-4-09	6.2	6.84	11.96			36	
	3-18-09	5.6	8.17	12.34			27	
	4-1-09	6.1	21.90	11.75			136	
	4-15-09	7.7	5.78	11.44			9	
	4-29-09	11.6	4.79	13.18			0	
	5-13-09	10.9	13.60	10.20			400	
	5-27-09	13.1	5.25	11.55			127	
	6-10-09	17.5	3.41	5.85			18	
	6-24-09	15.0	2.78	3.01			0	
	7-8-09							
	7-22-09							
	8-5-09							48

KULSHAN CREEK
Site 1. S. 14th St.

7-16-08	12.9	1.80	8.87			1,070	
8-12-08	13.7	1.10	8.15			1,180	
8-26-08	14.7	0.80	8.59			440	
10-28-08	8.0	0.85	9.64			263	
11-13-08	10.9	3.80	9.97			509	
11-25-08	8.1	1.00	10.33			137	
12-11-08	7.9	1.90	9.91			140	
12-23-08	11.4	0.60	8.52			440	
1-8-09	7.2	9.50	10.88			373	
1-20-09	3.9	2.40	11.80			110	
2-5-09	6.2	0.80	11.63			80	
2-18-09	5.2	1.10	12.25			20	
3-5-09	7.2	4.90	11.97			53	
3-17-09	6.7	8.00	11.35			73	
4-2-09	7.9	8.80	12.22			47	
4-14-09	8.5	2.00	11.60			90	
4-29-09	10.6	1.60	10.02			23	
5-11-09	11.4	2.30	10.42			120	
5-28-09	12.8	1.30	9.96			53	
6-9-09	13.8	1.60	8.94			970	
6-25-09	13.3	2.70	9.45			506	
7-7-09	13.3	2.30	9.43			370	
8-4-09	15.1	2.00	8.03			700	184

Site 2. Parker Way

7-16-08	15.0	1.80	4.15			113	
8-12-08	15.6	3.60	4.32			63	
8-26-08	16.8	0.95	5.80			90	
10-28-08	8.8	4.50	4.71			390	
11-13-08	11.6	8.00	9.80			33	

Site	Date	Water Temp (° C)	Turbidity (NTU)	D.O. (mg/l)	FC Low (/100ml)	FC High (/100ml)	FC (/100ml)	FC SITE GEOMEAN (/100ml)	
(Parker Way)	11-25-08	8.7	5.70	7.08			30	114	
	12-11-08	8.9	7.40	8.64			47		
	12-23-08	12.8	2.60	4.00			80		
	1-8-09	7.3	15.00	10.81			107		
	1-20-09	4.7	3.60	9.82			10		
	2-5-09	5.5	2.50	10.15			10		
	2-18-09	5.5	33.00	10.56			53		
	3-5-09	7.3	8.50	11.75			83		
	3-17-09	6.8	25.00	10.66			276		
	4-2-09	8.1	12.00	12.03			233		
	4-14-09	8.8	4.70	10.91			260		
	4-29-09	3.0	87.90				283		
	5-11-09	12.2	4.90	8.47			413		
	5-28-09	13.4	3.50	8.26			300		
	6-9-09	15.3	2.20	3.52			300		
	6-25-09	14.8	4.80	3.06			203		
	7-7-09	15.0	2.70	3.12			140		
	8-4-09	17.3	3.00	3.06			890		
	Site 3. Roosevelt Ave								
	7-16-08	14.9	35.00	1.30			50	33	
	8-12-08	16.0	4.80	2.00			33		
	8-26-08	16.3	2.60	2.05			1,120		
	10-28-08	9.4	6.30	1.13			27		
	11-13-08	11.5	11.00	3.03			<1		
	11-25-08	7.0	14.00	0.72			7		
	12-11-08	8.2	4.00	2.72			33		
	12-23-08	13.2	6.60	0.87			43		
	1-8-09	7.2	18.00	7.00			<1		
	1-20-09	4.0	9.30	3.80			10		
	2-5-09	4.9	16.00	3.64			<1		
	2-18-09	4.6	12.00	4.07			7		
	3-5-09	7.6	9.00	8.20			17		
	3-17-09	6.6	7.30	6.59			246		
	4-2-09	7.8	18.00	10.23			47		
	4-14-09	9.2	4.80	8.22			190		
	4-29-09	10.8	16.00	0.90			60		
	5-11-09	12.0	8.30	3.04			47		
	5-28-09	13.0	23.00	0.44			133		
	6-9-09	15.5	37.00	1.32			83		
	6-25-09	14.6	20.00	1.24			203		
	7-7-09	14.8	21.00	3.13			30		
	8-4-09	17.2	40.00	2.50			270		
Site 4. Riverside Dr.									
	7-16-08	14.3	1.80	7.38			466		33
	8-12-08	14.9	0.20	3.30			97		
	8-26-08	16.1	1.60	5.65			143		
	10-28-08	7.6	0.65	8.71			67		
	11-13-08	11.0	6.00	7.94			67		
	11-25-08	6.8	3.30	9.12			23		
	12-11-08	7.8	3.50	8.24			83		
	1-8-09	7.2	19.00	9.31			940		

Site	Date	Water Temp (° C)	Turbidity (NTU)	D.O. (mg/l)	FC Low (/100ml)	FC High (/100ml)	FC (/100ml)	FC SITE GEOMEAN (/100ml)
(Riverside Dr.)	1-20-09	4.2	3.20	9.62			37	104
	2-5-09	5.6	4.80	11.06			37	
	2-18-09	5.8	1.20	10.90			20	
	3-5-09	7.4	11.00	11.44			287	
	3-17-09	6.8	8.10	10.38			7	
	4-2-09	8.0	13.00	11.90			920	
	4-14-09	8.9	4.20	12.24			113	
	4-29-09	11.9	4.20	14.84			23	
	5-11-09	12.0	4.00	8.84			137	
	5-28-09	15.5	3.60	12.43			147	
	6-9-09	17.5	2.80	8.00			83	
	6-25-09	14.6	2.30	8.70			210	
	7-7-09	14.6	2.00	84.80			306	
8-4-09	17.6	4.90	7.30			1,300		
Site 5. Lions Park								38
	7-16-08	14.5	3.10	6.36			27	
	8-12-08	15.9	2.10	6.40			77	
	8-26-08	16.0	2.00	6.58			83	
	10-28-08	10.8	1.50	1.90			7	
	11-13-08							
	11-25-08	9.9	20.00	9.64			23	
	12-11-08	8.4	4.50	9.54			17	
	12-23-08	14.5	1.20	6.30			7	
	1-8-09							
	1-20-09	5.0	3.10	9.48			23	
	2-5-09	5.5	4.60	12.03			<1	
	2-18-09	5.9	4.70	11.52			7	
	3-5-09	6.9	14.00	11.74			853	
	3-17-09	6.6	30.00	10.20			303	
	4-2-09	7.6	13.00	12.02			960	
	4-14-09	8.4	4.70	9.47			40	
	4-29-09	10.7	5.10	10.69			<1	
	5-11-09	11.7	3.80	9.36			283	
	5-28-09	12.4	3.90	84.50			57	
	6-9-09	13.0	3.10	8.99			10	
	6-25-09	14.8	5.90	6.77			tntc	
	7-7-09	15.1	2.00	7.10			100	
	8-4-09	17.4	1.10	6.30			10	

APPENDIX B. STORM TEAM DATA

	6.5.08	6.6.08	6.10.08	11.3.08	11.4.80	11.6.08	11.7.08	11.14.08	12.13.08
Mainstem Samish									
Bayview-Edison Bridge	496	3060	1272						110
Farm-to-Market Rd			123	174	66	850	80	134	
Thomas Road	350	2608	952	193	560	166		63	
Chuckanut Drive			166	820	336	480	76	98	
Jolly Road				176	1907	304	604		48
Hwy 99	340	1846	688	130	2029	440	610	28	46
Grip Road	120	1221	176	180	1064	576	490	18	12
Samish at Parson's Cr			176	748	116	208	28	24	
Prairie Road				32	246	2100	128	8	
Hwy 9				20	168	142	88	14	1
Vernon Creek Forest		12	1	1		32	1	1	
Tributaries									
Vernon Creek			1	16		32	1		
Friday Cr - KOA			160	798		700	24		
Parsons Creek	1740	48	438	632	46	456	248	16	
Thomas Cr - Hwy 99	2872	1544	44	2636	268	2160	44		
Thomas Cr- F&S Grade Rd		1120				2050			
Skarrup Creek									
Swede Creek - Grip Rd							1238		
Willard Cr F & S			840				1246		

continued

	3/31/09	4/1/09	4/17/09	5/6/09	5/12/09	5/14/09	5/19/09	Geomean
Mainstem Samish								
Bayview-Edison Bridge	728	104	122					410
Farm-to-Market Rd	488		196		644	940	640	266
Thomas Road	464		416	328	1680	930	768	481
Chuckanut Drive	796	129	180		3000	1290		356
Jolly Road		95	1700		2100	630		441
Hwy 99		100	600	272	1620	910	580	383
Grip Road	436		1700		1496	600	530	318
Samish at Parson's Cr	178		1500	108	1560	340	290	214
Prairie Road			40	44	88	50	260	90
Hwy 9	6		28		68	20	180	31
Vernon Creek Forest								3
Tributaries								
Vernon Creek	4		2	1	1	1	1	2
Friday Creek - KOA			1700	192	1440	460	900	421
Parsons Creek	172		276	1120	688	340	410	268
Thomas Creek - Hwy 99	582		1700	480	3240	1260	3600	832
Thomas Cr- F&S Grade Rd				450			720	929
Skarrup Creek			1700			1720	2580	1961
Swede Creek - Grip Rd			1700			790		1185
Willard Creek F and S				664			1660	1036

APPENDIX C. WASHINGTON STATE WATER QUALITY STANDARDS

DISSOLVED OXYGEN (DO) – Almost all living organisms depend on oxygen to maintain the metabolic processes that produce energy for growth and reproduction. Salmon and their preferred invertebrate foods inhabit water with DO concentrations consistently above 5 mg/l.

DO is an important factor in determining the type, variety, and density of biological organisms. Its reduction results in lowered metabolism, slower growth, and weakened condition. The absence of DO results in septic conditions and the destruction of most life forms dependent upon free oxygen. DO levels are influenced by a variety of factors, chiefly: oxygen from the atmosphere, velocity of flow, water surface turbulence, turbidity, type of pollutants present, temperature, and the use and production of oxygen by living organisms. The amount of oxygen water can hold varies inversely with temperature. Cold water can contain more oxygen than warm. DO levels can be depressed by: input of organic wastes that increases the activity of aerobic bacteria; aquatic plant growth that results from nutrient (nitrogen, phosphorous) increase; and low flow rates.

State Standard: For Class A freshwater Core summer salmonid habitat, dissolved oxygen shall exceed 9.5 mg/l.

FECAL COLIFORM BACTERIA (FC) - Members of two bacteria groups, coliform and fecal streptococci, are used as indicators of possible sewage contamination because they are commonly found in human and animal feces. Although they are generally not harmful themselves, they indicate the possible presence of pathogenic (disease causing) bacteria, viruses, and protozoa that also live in human and animal digestive systems. Therefore, their presence suggests that pathogenic microorganisms might also be present, and that swimming and eating shellfish might be a health risk. The enumeration tests for fecal coliform can not distinguish between human sewage (which can be a vector for human viruses) and livestock wastes.

Sources of fecal contamination to surface waters include wastewater treatment plants, failing on-site sewage systems, domestic and wild animal feces, livestock, and storm water runoff. In addition to presenting a possible health risk, the presence of elevated levels of fecal bacteria can also cause cloudy water, unpleasant odors, and an increased oxygen demand.

State Standard: For Class A freshwater fecal coliform organism levels shall both; 1) not exceed a geometric mean value of 100 colonies/100 ml, and 2) not have more than 10 percent of samples exceed 200 colonies/100 ml. The geometric mean is a number derived from a calculation of the nth root of n products. The intention behind the use of the geometric mean is to reduce the impact on the average value of a few extreme values.

TEMPERATURE – influences the chemical and biological processes in water. Fish and other aquatic animals have temperature tolerances outside of which they cannot live or reproduce.

Temperature is a primary factor in determining which organisms survive in surface waters. Temperature governs the rate of chemical and biological reactions. Since fish and invertebrates are cold blooded (ectothermic), their activity and survival depend directly upon this parameter. For example, the concentration of oxygen in water, exertion of BOD (Biological Oxygen Demand), and oxygen production by photosynthesis are all functions of temperature. Seasonal variation of temperature causes major changes in dissolved oxygen concentrations: higher concentrations are found in winter when temperatures are lower.

State Standard: For Class A freshwater, Core summer salmonid habitat, the temperature shall not exceed 16 degrees Celsius (freshwater) due to human activities. When natural conditions exceed 16 degrees Celsius, no temperature increases will be allowed which will raise the receiving water temperature greater than 0.3 degrees. Incremental temperature increases resulting from nonpoint source activities shall not exceed 2.8 degrees Celsius.

TURBIDITY – is a measure of the cloudiness of water. Cloudiness is caused by suspended solids (mainly soil particles), and plankton (microscopic plants and animals) that are suspended in the water column. Moderately low levels of turbidity may indicate a healthy, well-functioning ecosystem, with moderate amounts of plankton present to fuel the food chain.

However, higher levels of turbidity pose several problems for stream systems. Turbidity blocks the light needed by submerged aquatic vegetation. It also can raise surface water temperatures above normal because suspended particles near the surface facilitate the absorption of heat from sunlight.

Suspended soil particles may carry nutrients, pesticides, and other pollutants throughout a stream system. Settling particles can bury and suffocate salmon eggs and other bottom (benthic) dwellers. Turbid waters may also be low in dissolved oxygen. High turbidity may result from sediment bearing runoff, or nutrient inputs that cause plankton blooms.

State Standard: For Class A freshwater the turbidity shall not exceed 5 NTU (Nephelometric Turbidity Unit) over background turbidity when the background turbidity is 50 NTU or less, or have more than a 10 percent increase in turbidity when the background turbidity is more than 50 NTU.

APPENDIX D. QUALITY OBJECTIVES

parameter	method	precision (Rel. Std. Dev.)	accuracy	detection level
Dissolved Oxygen (DO)	YSI 55 Probe	Unavailable	± 0.3 mg/l	0-20 mg/l
Total depth	Fixed/hand-held Tape	± 20%	± 0.05 meters	0 - 1 cm
Turbidity	Turbidimeter	Unavailable	0.01 NTU	0-19.9 NTU 0-199.9 NTU
Temperature	YSI 55 Probe	Unavailable	0.2° C	°-5 to 45° C

parameter	method	test equipment	filter type	incubation
Fecal coliform bacteria	Membrane Filtration	Millipore sterilifil aseptic system	47 mm membrane filter .45 um pore space	Millipore single chamber incubator Temp. range 30°c (±0.5) 44.5°c (±0.2)

Standard Operating Procedures (SOP's)

1. Dissolved Oxygen (DO)- Samples will be taken with a bottle placed in an extension pole and dipped using the Standard Methods. DO will be measured using a YSI 55 probe. Results will be recorded as DO mg/l.

DO testing procedure (YSI 55 Probe):

i. Turn probe on and calibrate immediately when picking up equipment. Make sure sponge inside the calibration chamber is wet with distilled water.

ii. Place probe in water below the surface of water and move probe back and forth until the reading stabilizes. Record the result in mg/l. Leave probe on for the rest of the sampling.

2. Temperature will be recorded in °C. When possible, the thermometer will be placed directly in the water and left for approximately 2- 5 minutes, or until the reading has stabilized. If the water is inaccessible, after sampling fill the end of the extended pole with water and place thermometer.

3. Total depth is measured by lowering the meter stick to the bottom and measuring to the nearest centimeter.

4. Water clarity will be determined by placing a sample into a turbidimeter (EPA approved VWR 66120-200)

i. Warm-up Turbidimeter 30 minutes and calibrates w/ 0 NTU polymer standard using the "zero-adjustment".

ii. Thoroughly shake the water sample in a clean sampling jar.

iii. Pour sample into unscratched, clean, and Kim-wiped vial. Mix again

iv. Place in turbidimeter w/ index line facing directly out to the front.

v. Read and record the steady reading after the highest readings settle.

vi. If reading is greater than 200 NTU, dilute the sample by 50%. (x 2).

variable	sampling equipment	sample container	sample preservation	maximum holding time
fecal coliform	Pole w/glass bottle	glass bottle pre-sterilized	ice chest with ice pack	1 hr
<u>d. oxygen</u>	YSI probe	instream	none	immediately
total depth	Fixed/hand-held Tape	instream	none	immediately
temperature	YSI probe	instream	none	immediately
	thermometer	instream	none	immediately
turbidity	turbidimeter	glass bottle, wide-mouth	ice chest	2 hrs

Equipment calibration and maintenance

1. Millipore Sterifil Filtration System calibration/maintenance

Calibration: None necessary

Maintenance: Immediately after use disassemble the apparatus and clean the components to ensure optimum performance.

- i. Remove the cover from the funnel. Carefully remove the O-ring using forceps. Remove the support screen from the base by pushing a short blunt rod through the base outlet.
- ii. Clean all components with a sponge, hot water, and non-alkaline, non-abrasive cleanser (anti-bacterial soap). Remove stubborn residues on the insides of the holder, cover port, and flask side arms using a plastic bristle brush and pipe cleaner dipped in cleanser (do not use any steel wool or abrasive materials that can harm the components).
- iii. Rinse the components with lab water and sterilize.

2. Sample Containers and Equipment calibration/maintenance

Calibration: None necessary

Maintenance: Empty bottles and place in Liquinox and warm water. Wash with a bottlebrush. Double rinse with tap water and final rinse with distilled water. Autoclave all fecal coliform sample bottles and graduated cylinders.

3. Millipore Portable Single Chamber Incubator calibration/maintenance

Calibration: None necessary

Maintenance: Clean the exterior case and interior chamber with a damp cloth and warm water (anti-bacterial soap). Give final spray with rubbing alcohol.

4. VWR Turbidimeter

Calibration: Insert 0 NTU polymer standard with the range control set at "20". Set the "Zero Control" to 0. Set the coarse so that the meter reads as close to zero as possible. Calibrate turbidimeter annually.

5. YSI Meters (DO, Temp)

Calibration: Press and release UP ARROW and DOWN ARROW keys at the same time. Enter "0" for altitude and salinity, and ENTER afterwards. Instrument is calibrated.

Maintenance: Turn YSI 55 off and rinse probe with distilled water after each use. Replace membrane filters and Kim-wipe moisturizers monthly. Replace batteries as needed.

APPENDIX E. SAMPLE DATA SHEET

**Gages Slough
Skagit Stream Team
Water Quality Monitoring**

Field Work By _____
Fax results to: Attn: Kristi, Skagit CD 360-424-6172

Site GS #1. Regent & E. Rio Vista Streets Water Appearance <input type="checkbox"/> Scum/Film <input type="checkbox"/> Foam <input type="checkbox"/> Muddy Brown <input type="checkbox"/> Milky <input type="checkbox"/> Clear <input type="checkbox"/> Oily Sheen <input type="checkbox"/> Frozen <input type="checkbox"/> Other	Time of Sample	Total Depth ft	Water Temp °C	Fecal Coliform Results (from Edge Analytical)
	D.O. saturation %	D.O. mg/L		
	Turbidity NTU's			
Site GS#2. Anacortes Street Water Appearance <input type="checkbox"/> Scum/Film <input type="checkbox"/> Foam <input type="checkbox"/> Muddy Brown <input type="checkbox"/> Milky <input type="checkbox"/> Clear <input type="checkbox"/> Oily Sheen <input type="checkbox"/> Frozen <input type="checkbox"/> Other	Time of Sample	Total Depth ft	Water Temp °C	Fecal Coliform Results (from Edge Analytical)
	D.O. saturation %	D.O. mg/L		
	Turbidity NTU's			
Site GS#3. S. Spruce Street Water Appearance <input type="checkbox"/> Scum/Film <input type="checkbox"/> Foam <input type="checkbox"/> Muddy Brown <input type="checkbox"/> Milky <input type="checkbox"/> Clear <input type="checkbox"/> Oily Sheen <input type="checkbox"/> Frozen <input type="checkbox"/> Other	Time of Sample	Total Depth ft	Water Temp °C	Fecal Coliform Results (from Edge Analytical)
	D.O. saturation %	D.O. mg/L		
	Turbidity NTU's			
Site GS #4. Burlington Blvd. Water Appearance <input type="checkbox"/> Scum/Film <input type="checkbox"/> Foam <input type="checkbox"/> Muddy Brown <input type="checkbox"/> Milky <input type="checkbox"/> Clear <input type="checkbox"/> Oily Sheen <input type="checkbox"/> Frozen <input type="checkbox"/> Other	Time of Sample	Total Depth ft	Water Temp °C	Fecal Coliform Results (from Edge Analytical)
	D.O. saturation %	D.O. mg/L		
	Turbidity NTU's			
Site GS#5. Goldenrod Road Water Appearance <input type="checkbox"/> Scum/Film <input type="checkbox"/> Foam <input type="checkbox"/> Muddy Brown <input type="checkbox"/> Milky <input type="checkbox"/> Clear <input type="checkbox"/> Oily Sheen <input type="checkbox"/> Frozen <input type="checkbox"/> Other	Time of Sample	Total Depth ft	Water Temp °C	Fecal Coliform Results (from Edge Analytical)
	D.O. saturation %	D.O. mg/L		
	Turbidity NTU's			

APPENDIX F. REFERENCES

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