

Skagit County Baseline Water Quality Monitoring Project

Final Report



Samish River at F&S Grade Road



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Washington State Department of Community, Trade, and Economic Development
Citizens of Skagit County

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Introduction

The Baseline Monitoring Project was instituted in July 2001, as part of Skagit County's implementation of Skagit County Code section 14.24.120, *Ongoing Agriculture on Agricultural Lands*. The Project continued through September, 2003, and was primarily funded by a block grant given to Skagit County by the Washington State Department of Community, Trade and Economic Development in early 2001.

The goal of the Baseline Monitoring Project was to characterize streams in Skagit County's agricultural areas to provide a foundation for future comparisons. Many water quality parameters, such as dissolved oxygen, temperature, plant nutrient levels, and fecal coliform were periodically measured in streams throughout the lower Skagit and Samish River basins. Further detail on study goals and objectives can be found in "Skagit County Ag Land Stream Buffer Program: Watershed Scale Baseline Monitoring Plan." (Skagit County 2001).

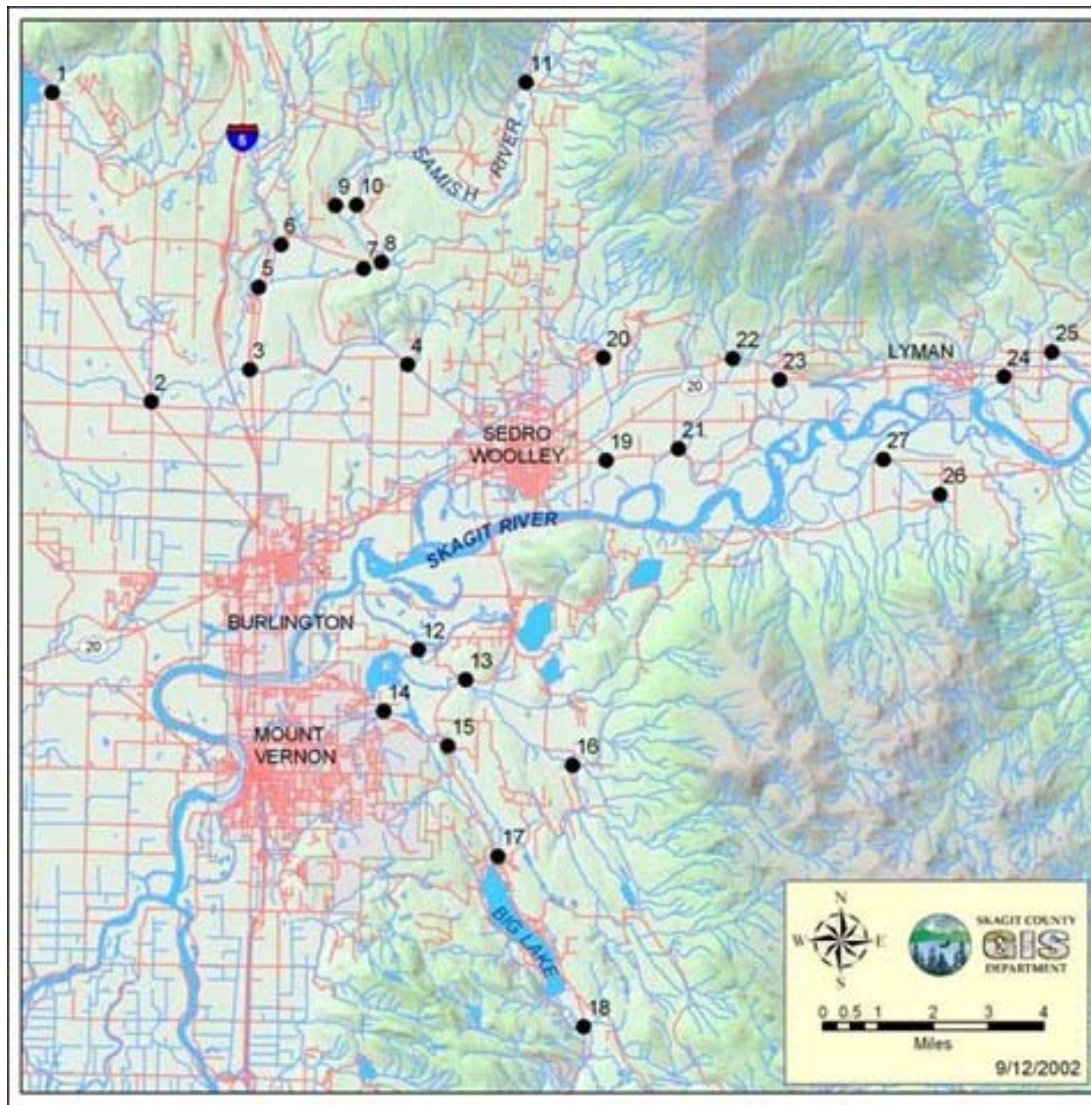
Sampling stations were established on streams in agricultural areas in the Skagit and Samish River basins. Where access permitted, some stations were established where streams entered agricultural lands and further downstream in the agricultural zones. These stations allow some measure of water quality changes as the streams traverse the agricultural areas. A list of sampling stations for the Baseline Monitoring Project is provided in Table 1. A location map for the sample sites is provided in Figure 1.

The Baseline Monitoring Project complimented the Samish Bay Water Quality Monitoring Project. The Samish Project, a Centennial Clean Water Fund grant project instituted in 2000 and completed in June, 2003, was developed in response to shellfish bed closures in Samish Bay in the mid-1990s due to gastrointestinal illness related to shellfish consumption. The goal of the Samish Project was to bracket sources and amounts of fecal coliform bacteria reaching Samish Bay from freshwater sources. In addition to the coliform counts, water quality parameters similar to those measured in the Baseline Monitoring Project were measured at many sites in the Samish Basin. Some Samish sites were incorporated into both studies. Results from the Samish Bay Water Quality Monitoring Project are summarized in "Samish Bay Watershed Water Quality Monitoring Project Final Report" (Skagit County, 2003a).

Raw data from both the Baseline Monitoring Project and the Samish Bay Water Quality Monitoring Project are available from Skagit County Public Works.

Table 1. Sampling locations for the Skagit County Public Works Baseline
Monitoring Project

<u>Site</u>	<u>Stream Name</u>	<u>Location</u>	<u>Longitude</u>	<u>Latitude</u>
1	Colony Creek	Blanchard Road	-122.4185	48.59693
2	Samish River	Chuckanut Drive	-122.3771	48.51693
3	Thomas Creek	Old Hwy 99 North	-122.3384	48.52581
4	Thomas Creek	F&S Grade	-122.2763	48.52798
5	Samish River	Old Hwy 99 North	-122.3356	48.54730
6	Friday Creek	Prairie Road	-122.3270	48.55856
7	Samish River	F&S Grade	-122.2944	48.55269
8	Swede Creek	Grip Road	-122.2874	48.55441
9	Skarrup Creek	Double Creek Lane	-122.3060	48.56904
10	Samish River	Prairie Road	-122.2976	48.56929
11	Samish River	State Route 9	-122.2316	48.60203
12	Nookachamps Creek	Swan Road	-122.2699	48.45376
13	East Fork Nookachamps Cr.	State Route 9	-122.2511	48.44613
14	College Way Creek	College Way	-122.2831	48.43752
15	Nookachamps Creek	Knapp	-122.2577	48.42878
16	East Fork Nookachamps Cr.	Beaver Lake Road	-122.2086	48.42433
17	Nookachamps Creek	State Route 9	-122.2371	48.40017
18	Lake Creek	State Route 9	-122.2023	48.35622
19	Hansen Creek	Hoehn Road	-122.1974	48.50391
20	Hansen Creek	Northern State Hospital	-122.1993	48.53068
21	Coal Creek	Hoehn Road	-122.1690	48.50722
22	Coal Creek	Hwy 20	-122.1481	48.53104
23	Wiseman Creek	Minkler Road	-122.1295	48.52567
24	Mannser Creek	Lyman-Hamilton Highway	-122.0413	48.52750
25	Red Cabin Creek	Hamilton Cemetery Road	-122.0224	48.53410
26	Morgan Creek	South Skagit Highway	-122.0657	48.49652
27	Morgan Creek	Walberg Road	-122.0881	48.50545



Site	Description
1	Colony Cr. at Blanchard Rd.
2	Samish River at Chuckanut Dr.
3	Thomas Cr. at Hwy. 99
4	Thomas Cr. at F&S Grade Rd.
5	Samish River at Hwy. 99
6	Friday Cr. at Prairie Rd.
7	Samish River at F&S Grade Rd.
8	Swede Cr. at Grip Rd.
9	Skarrup Cr. at Double Cr. Ln.
10	Samish River at Prairie Rd.
11	Samish River at Hwy. 9
12	Nookachamps Cr. at Swan Rd.
13	E.F. Nookachamps Cr. at Hwy. 9
14	College Way Cr. at College Way
15	Nookachamps Cr. at Knapp Rd.
16	E.F. Nookachamps Cr. at Beaver Lk. Rd.
17	Nookachamps Cr. at Big Lk. Outlet
18	Lake Cr. at Hwy. 9
19	Hansen Cr. at Hoehn Rd.
20	Hansen Cr. at Northern State
21	Coal Cr. at Hoehn Rd.
22	Coal Cr. at Hwy. 20
23	Wiseman Cr. at Minkler Rd.
24	Mannser Cr. at Lyman-Hamilton Rd.
25	Red Cabin Cr. at Hamilton Cemetery Rd.
26	Morgan Cr. at South Skagit Hwy.
27	Morgan Cr. at Walberg Rd.

Figure 1. Location of Baseline Monitoring Project sample sites.
Map produced by Skagit County GIS

Activities

Sampling for the Baseline Monitoring Project took place once every two weeks at each station and was accomplished by Skagit County Public Works – Surface Water Management personnel with assistance from Planning and Permit Center – Critical Areas personnel. Baseline Monitoring stations in the Samish Basin were sampled in cooperation with Skagit Conservation District personnel. Skagit River basin streams were sampled on one week, with Samish River basin streams sampled on alternate weeks. Field measurements (dissolved oxygen, temperature, conductivity, salinity, pH, and turbidity) and fecal coliform samples were obtained at each site visit. Fecal coliform samples were analyzed by the Skagit County Department of Health. Samples for nutrient analysis and flow measurements were taken once every four weeks at each site and analyzed by private laboratories. Methods for water quality measurement were adapted from Water Quality Monitoring Technical Guidebook, The Oregon Plan for Salmon and Watersheds (Williams 1999).

Data were entered into a specially-constructed database at Skagit County Public Works – Surface Water Management. Data management and analysis was conducted by Skagit County Public Works – Surface Water Management staff.

Data report

Water quality data for each sampling occasion, organized by sample site, is included in Appendix A. A summary of water quality analytes for each station is included in Appendix B. For those stations which were included in both the Samish Bay Watershed Project and the Baseline Project (sites 1-7 and 10-11), data from the earlier Samish Bay samples are included, beginning in April, 2000. For the rest of the sites, data collection began in July or August, 2001. A discussion of the most significant parameters follows.

Dissolved oxygen

Dissolved oxygen (DO) readings were taken at each site during each visit. A summary of DO readings for Baseline Monitoring sites is provided in Table 2. This table maintains recently retired Department of Ecology stream classifications (Class A or AA) to describe their current rating as core salmonid habitat (AA) or non-core habitat (A).

Table 2. Summary of dissolved oxygen (mg/L) readings in streams in
Skagit County, Washington Baseline Monitoring Project

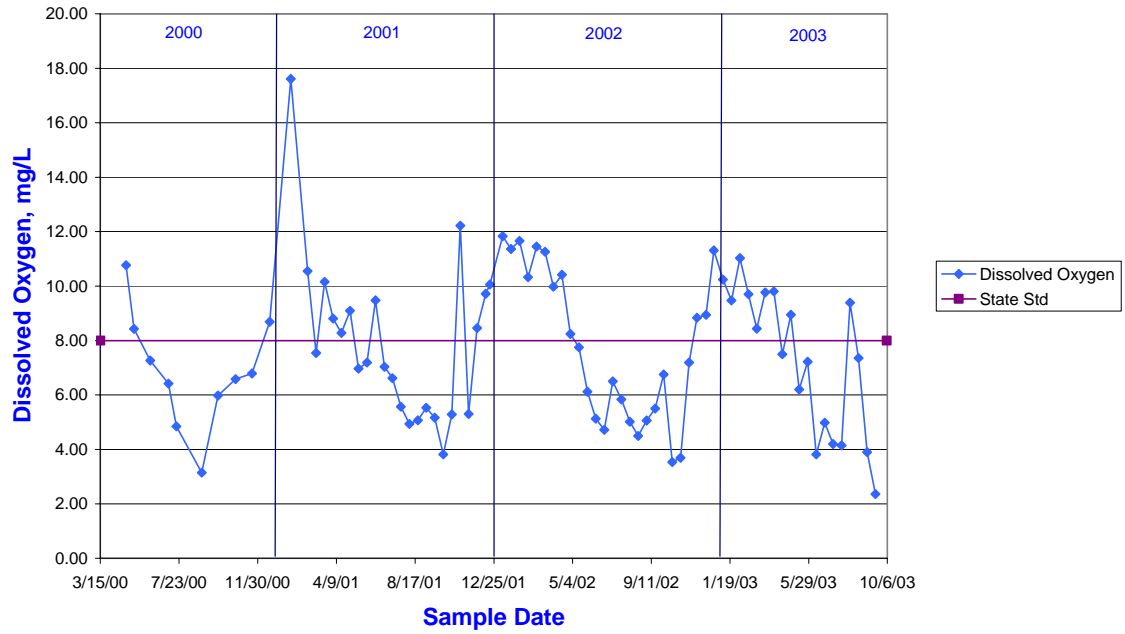
<u>Site Name</u>	<u>Site No.</u>	<u>N</u>	<u>Mean</u>	<u>Max</u>	<u>Min</u>	<u>Stream class</u>	<u>%¹</u>
Colony Creek at Blanchard Rd.	1	79	7.61	17.61	2.36	A	56
Samish River at Chuckanut Dr.	2	88	10.76	16.17	6.30	A	1
Thomas Creek at Hwy. 99	3	84	6.38	13.90	0.98	A	52
Thomas Creek at F&S Grade Rd.	4	88	10.84	16.82	3.52	A	1
Samish River at Hwy. 99	5	85	10.72	15.10	2.87	A	1
Friday Creek at Prairie Rd.	6	86	10.75	14.86	3.17	A	5
Samish River at F&S Grade Rd.	7	84	11.03	15.34	3.56	A	2
Swede Creek at Grip Rd.	8	51	10.19	14.66	5.38	A	10
Skarrup Creek at Double Creek Ln.	9	51	9.37	13.69	4.98	A	24
Samish River at Prairie Rd.	10	53	10.88	13.68	8.41	A	0
Samish River at Hwy. 9	11	49	8.36	12.50	6.24	A	47
Nookachamps Creek at Swan Rd.	12	56	8.83	12.11	4.85	A	38
East Fork Nookachamps Creek at Hwy. 9	13	55	9.85	11.95	6.74	A	11
College Way Creek at College Wy.	14	56	8.26	12.65	3.20	A	48
Nookachamps Creek at Knapp Rd.	15	56	7.16	11.98	0.83	A	50
E. Fork Nookachamps Creek at Beaver Lk. Rd.	16	56	10.96	16.23	8.45	A	0
Nookachamps Creek at Hwy. 9, Big Lake Outlet	17	56	8.98	12.60	2.45	A	36
Lake Creek at Hwy. 9	18	56	10.48	13.50	7.80	A	2
Hansen Creek at Hoehn Rd.	19	53	10.10	12.65	6.92	A	9
Hansen Creek at Northern State	20	56	10.77	13.22	8.31	A	0
Coal Creek at Hoehn Rd.	21	43	10.72	13.51	3.93	AA	21
Coal Creek at Hwy. 20	22	56	11.66	14.37	9.42	AA	4
Wiseman Creek at Minkler Rd.	23	54	11.53	14.00	8.68	AA	7
Mannser Creek at Lyman-Hamilton Rd.	24	56	7.07	9.21	3.72	AA	100
Red Cabin Creek at Hamilton Cemetery Rd.	25	43	11.44	13.38	9.62	AA	0
Morgan Creek at South Skagit Hwy.	26	51	8.83	12.62	3.42	AA	51
Morgan Creek at Walberg Rd.	27	51	8.49	13.13	0.24	AA	41

¹Percent of readings below 8.0 mg/L (Class A) or 9.5 mg/L (Class AA)

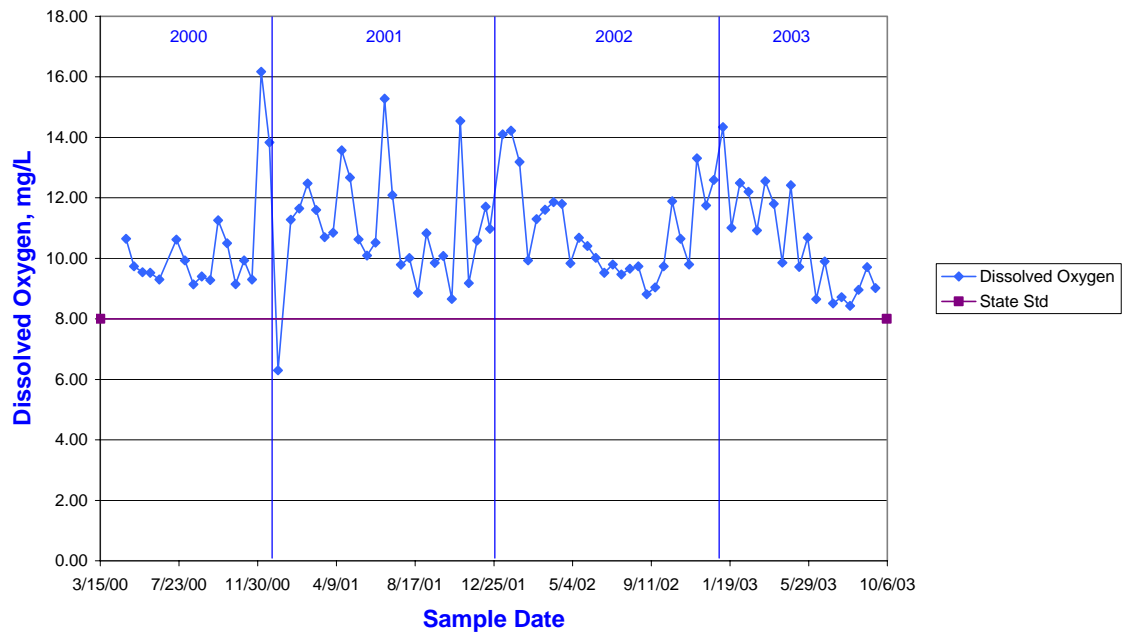
The Washington State Department of Ecology (DOE) standards are a minimum of 8 mg/L for non-core salmonid habitat streams (formerly Class A) (sites 1-20) and 9.5 mg/L for core salmonid habitat streams (formerly Class AA) (sites 21-27). DO minimums were typically found during late summer low flow periods. In Mannser Creek (site 24), DO never met the state standard, while in upper Hansen (site 20) and Red Cabin (site 25) Creeks, DO was above the standard in every measurement.

The graphs on the following pages illustrate DO measurements over the course of the report period for each of the sample sites. The data do not demonstrate any readily discernable trends in DO over the course of the study. Some streams in the Nookachamps basin showed the lowest DOs of the study in the summer of 2003 as they nearly dried up during an extended period without precipitation.

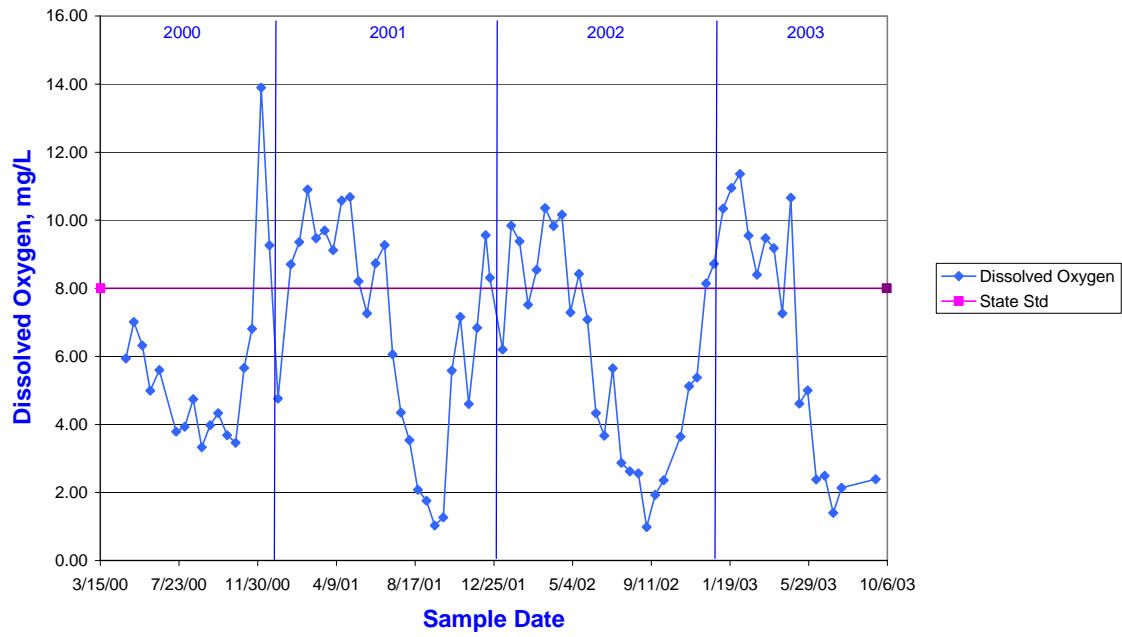
Colony Creek - Site 1 Dissolved Oxygen



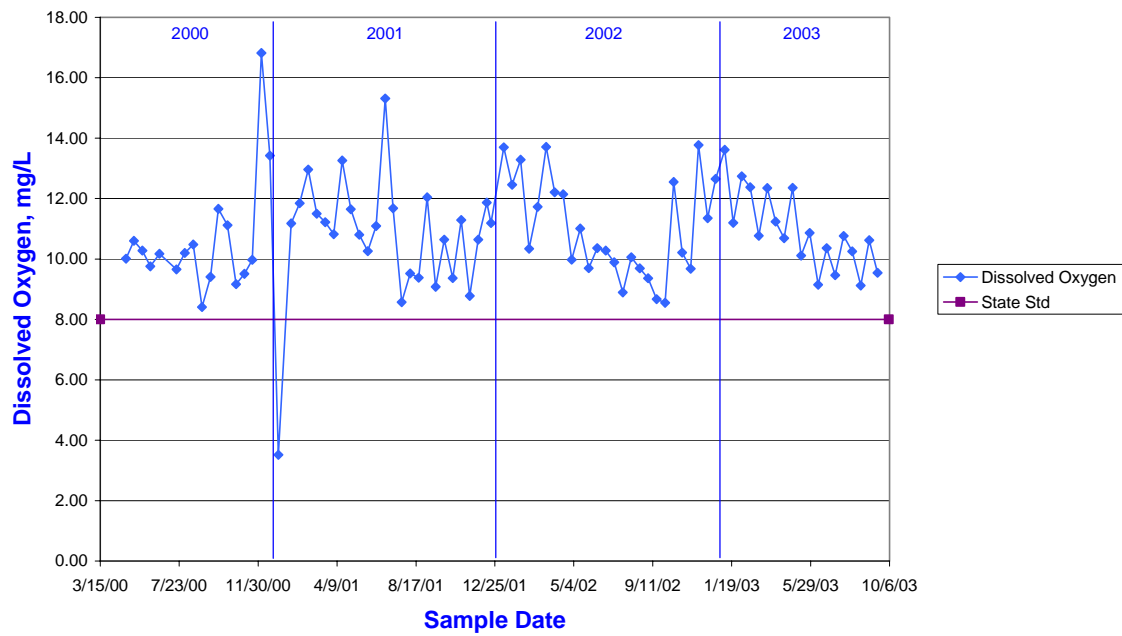
Samish River at Chuckanut Drive - Site 2 Dissolved Oxygen



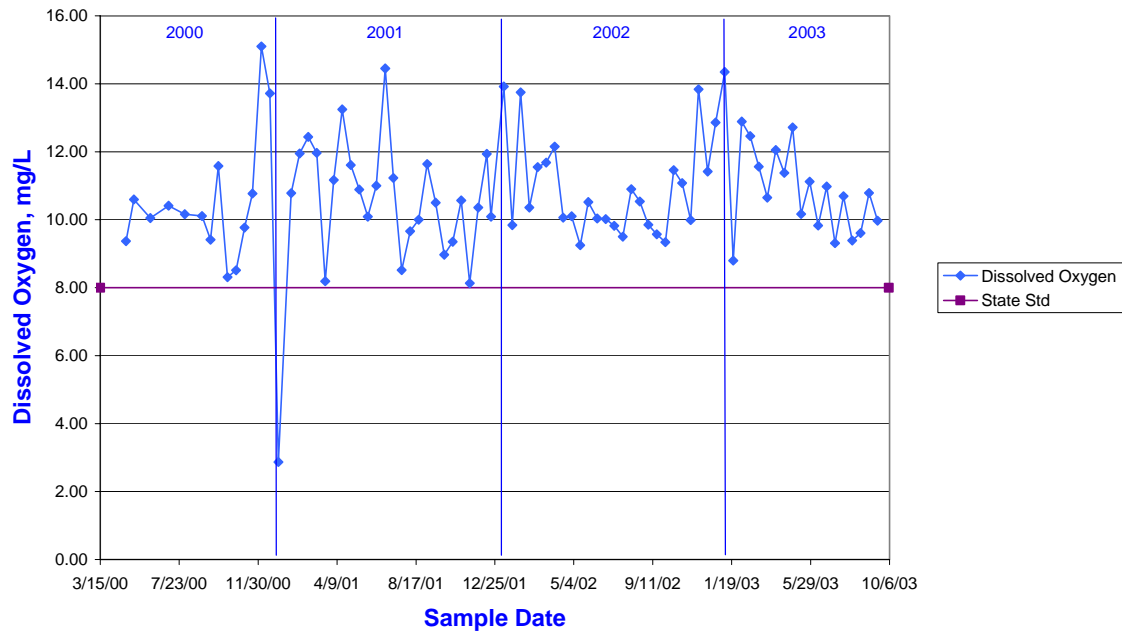
Thomas Creek at Hwy 99 - Site 3 Dissolved Oxygen



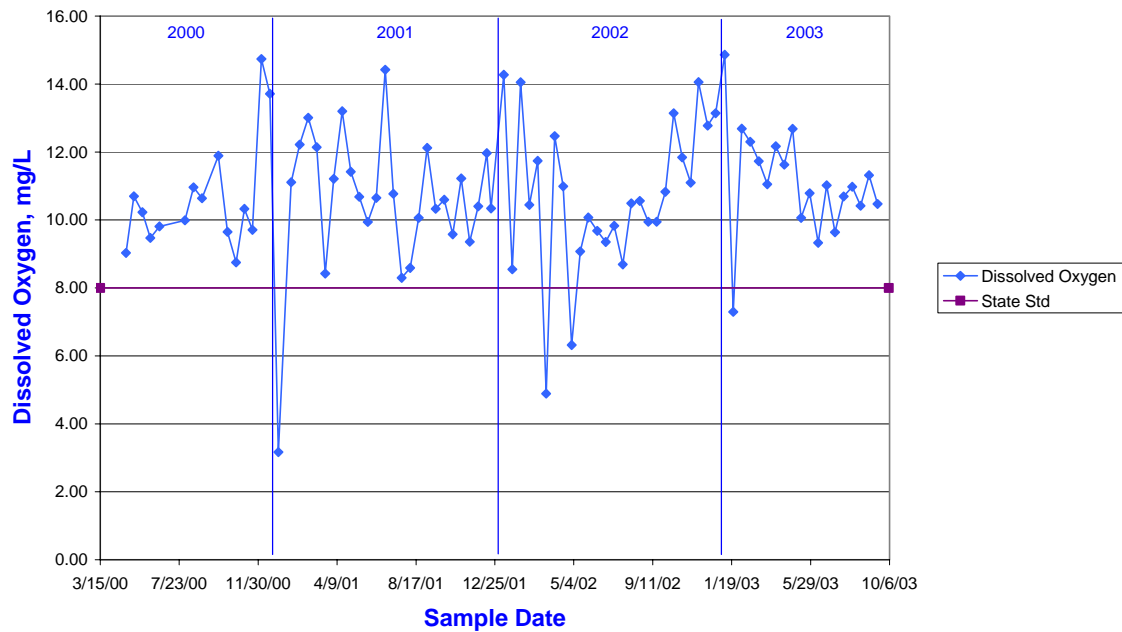
Thomas Creek at F&S Grade Rd - Site 4 Dissolved Oxygen



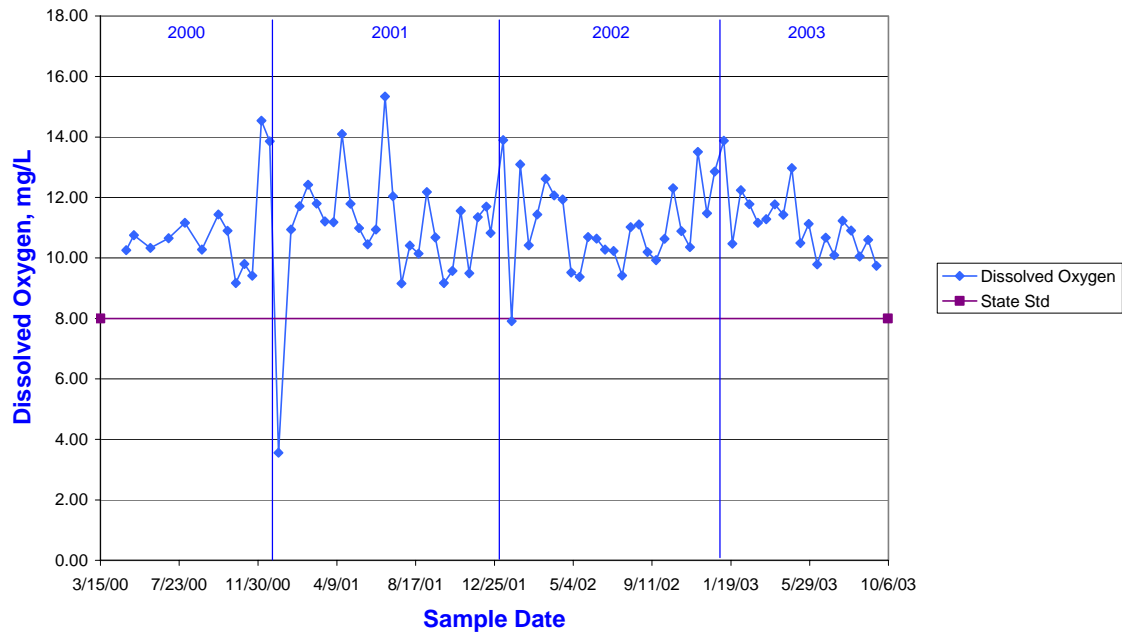
Samish River at Hwy 99 - Site 5 Dissolved Oxygen



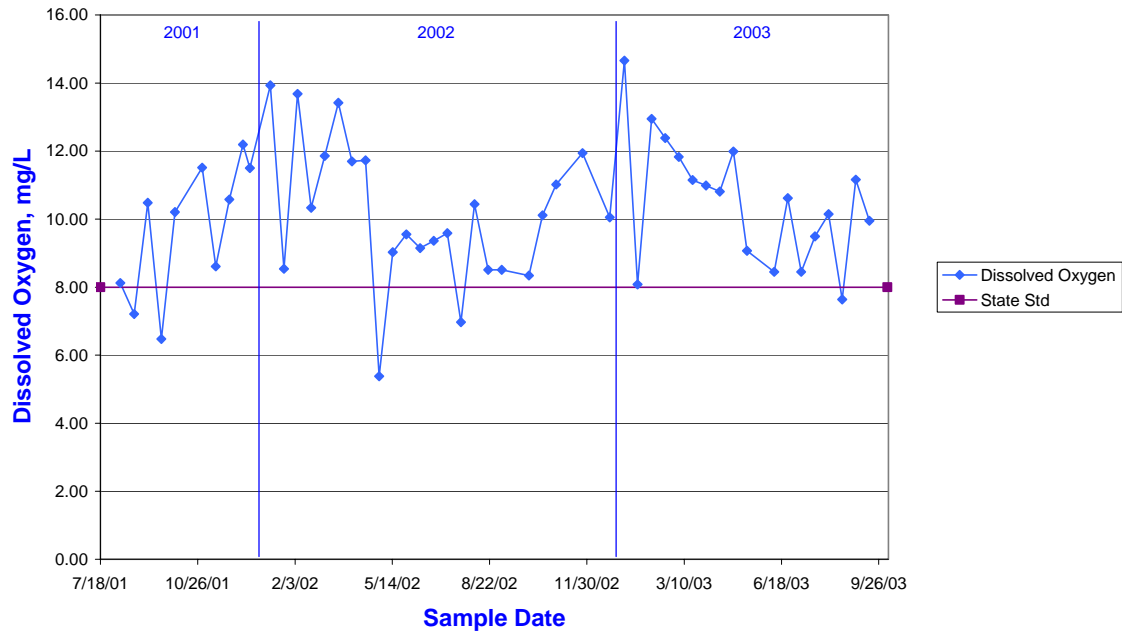
Friday Creek at Prairie Rd - Site 6 Dissolved Oxygen



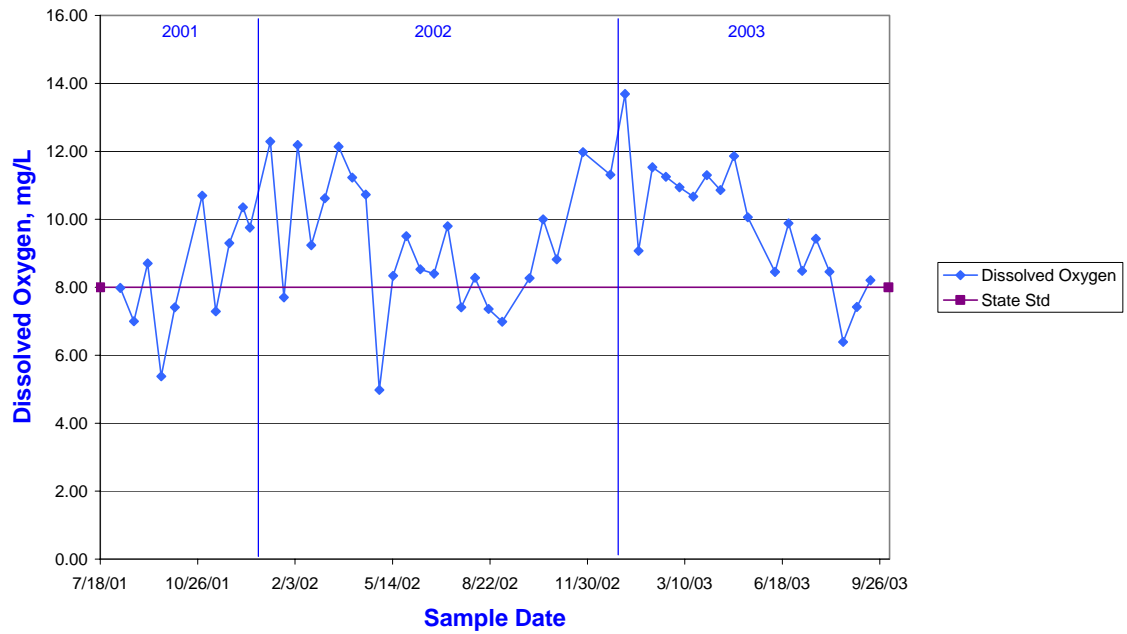
Samish River at F&S Grade Rd - Site 7 Dissolved Oxygen



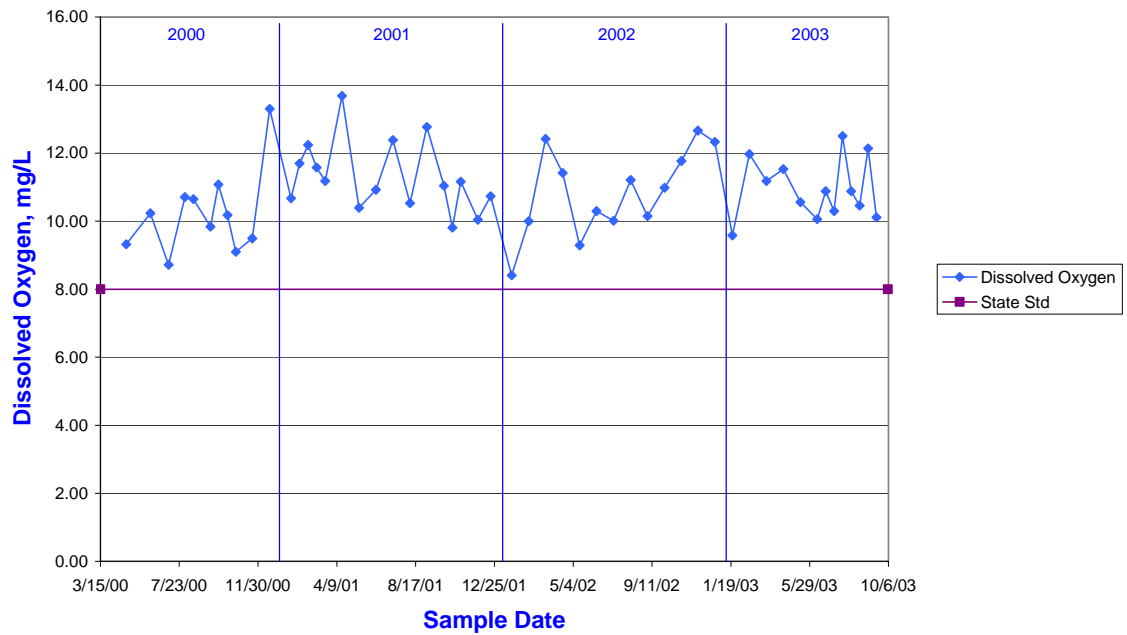
Swede Creek at Grip Rd - Site 8 Dissolved Oxygen



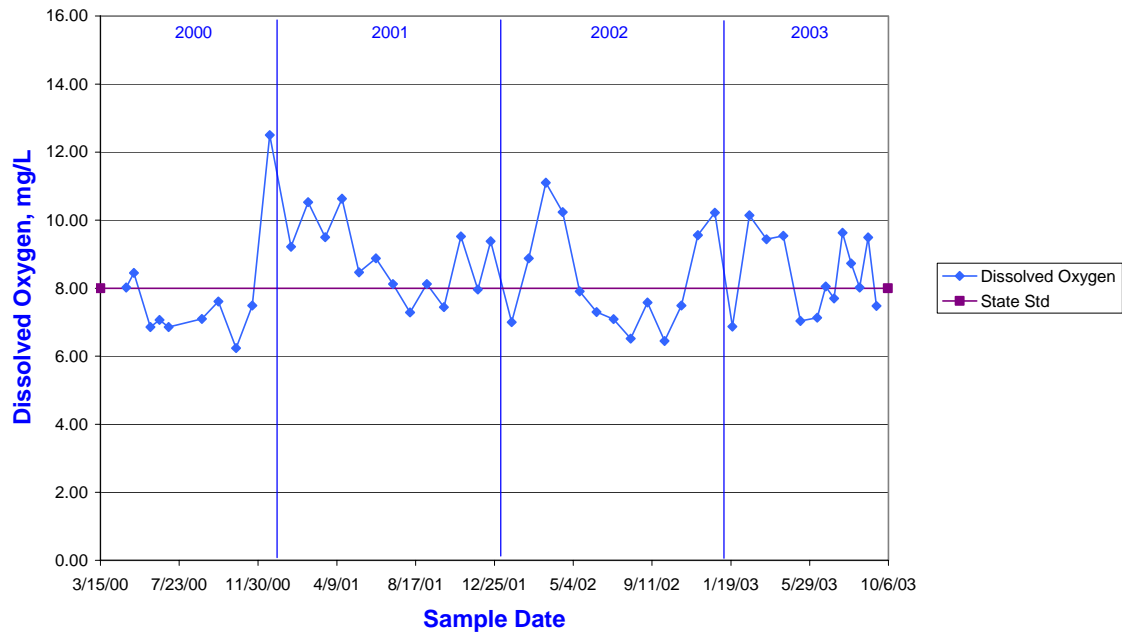
Skarrup Creek at Double Creek Ln - Site 9 Dissolved Oxygen



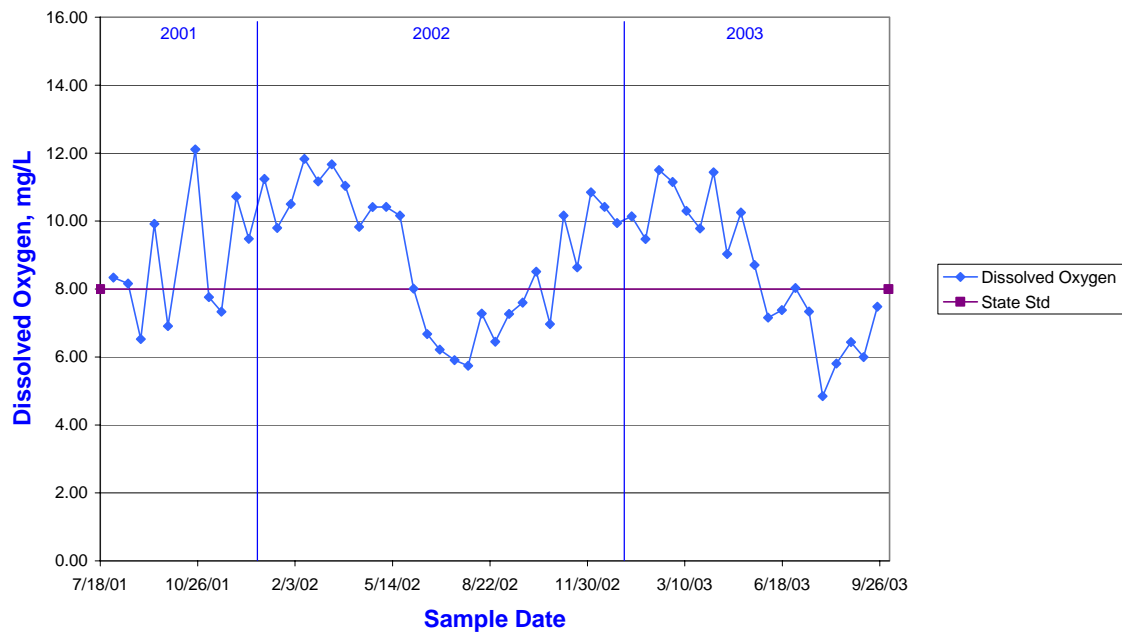
Samish River at Prairie Rd - Site 10 Dissolved Oxygen



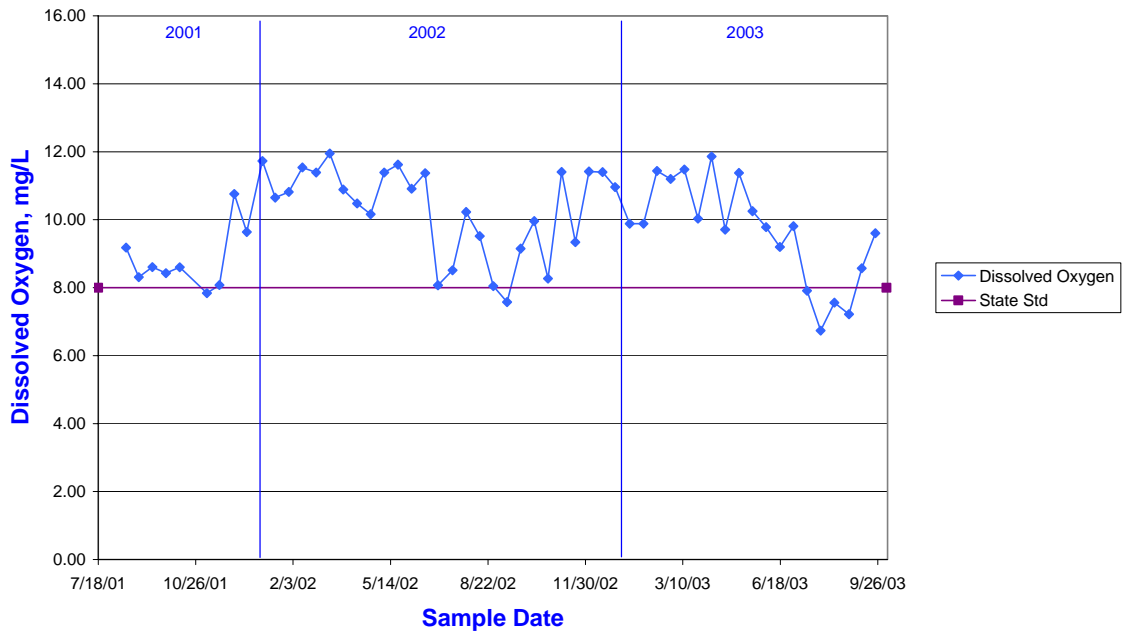
Samish River at Hwy 9 - Site 11 Dissolved Oxygen



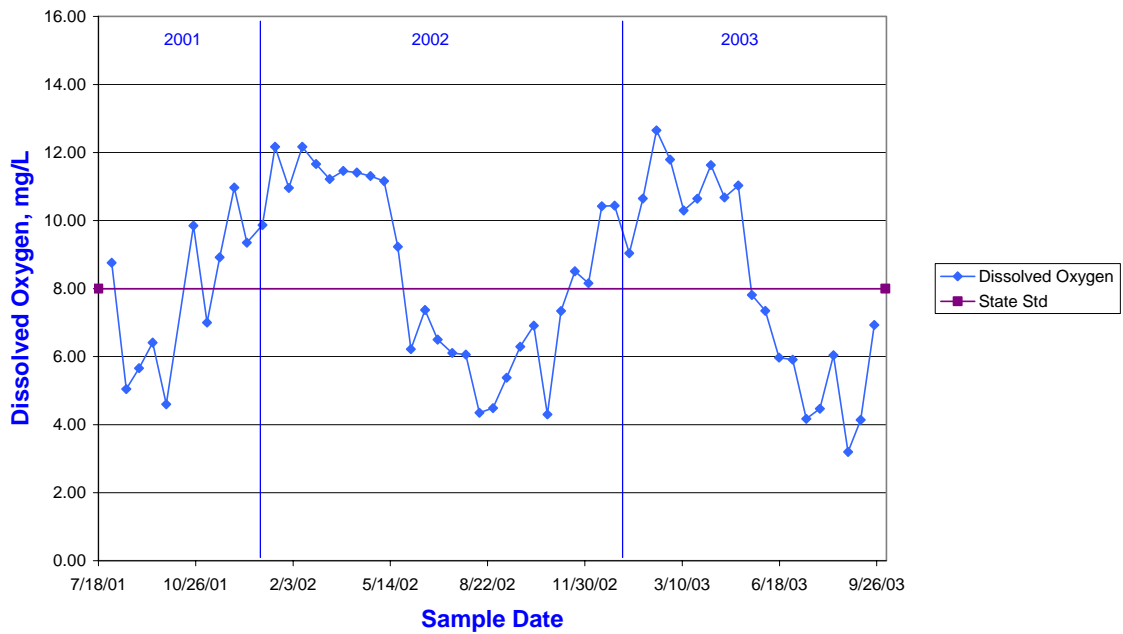
Nookachamps Creek at Swan Rd - Site 12 Dissolved Oxygen



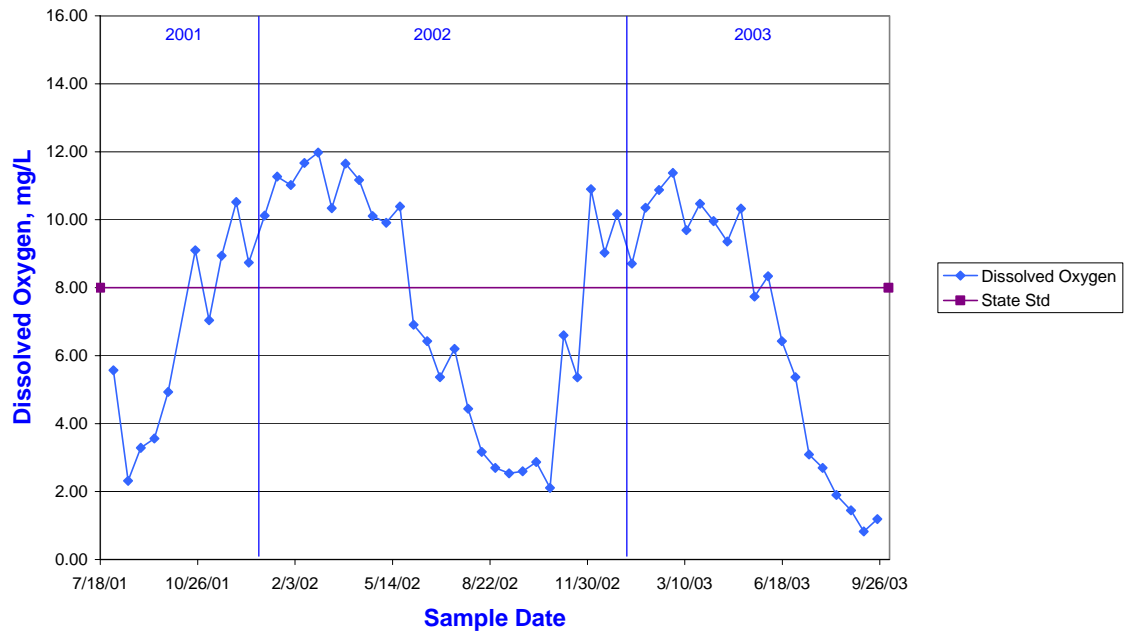
EF Nookachamps Creek at Hwy 9 - Site 13 Dissolved Oxygen



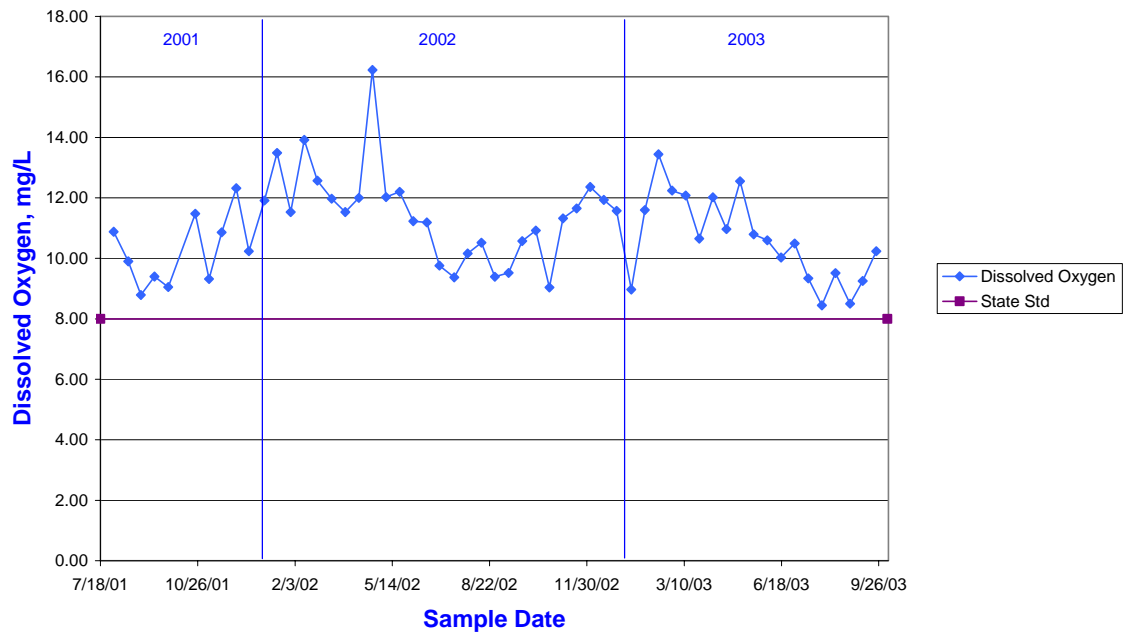
College Way Creek at College Way - Site 14 Dissolved Oxygen



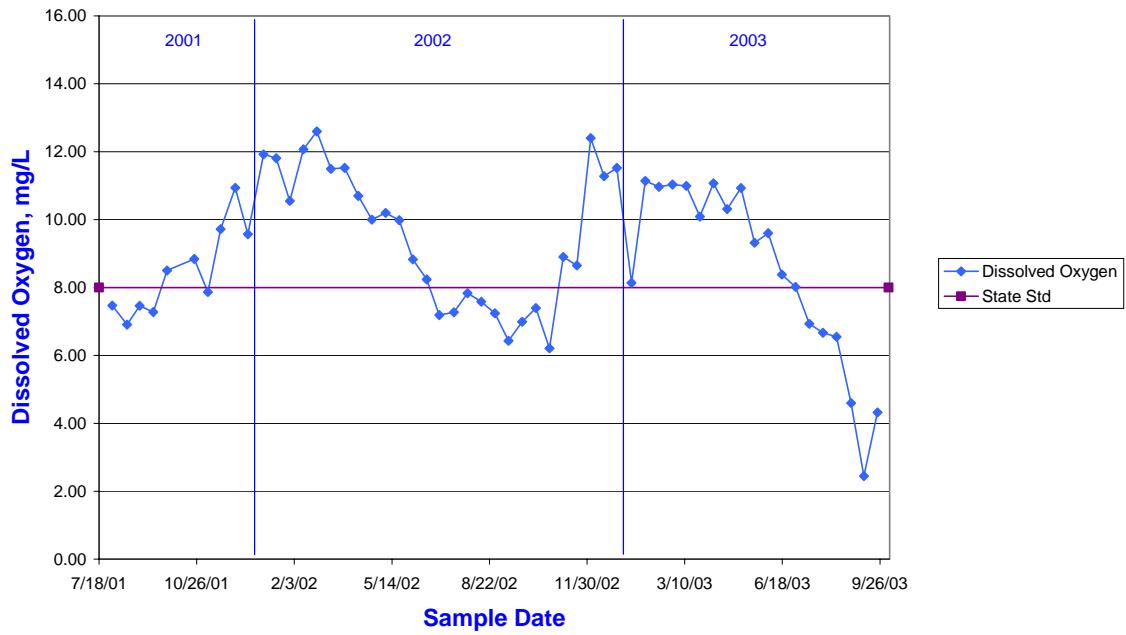
Nookachamps Creek at Knapp Rd - Site 15 Dissolved Oxygen



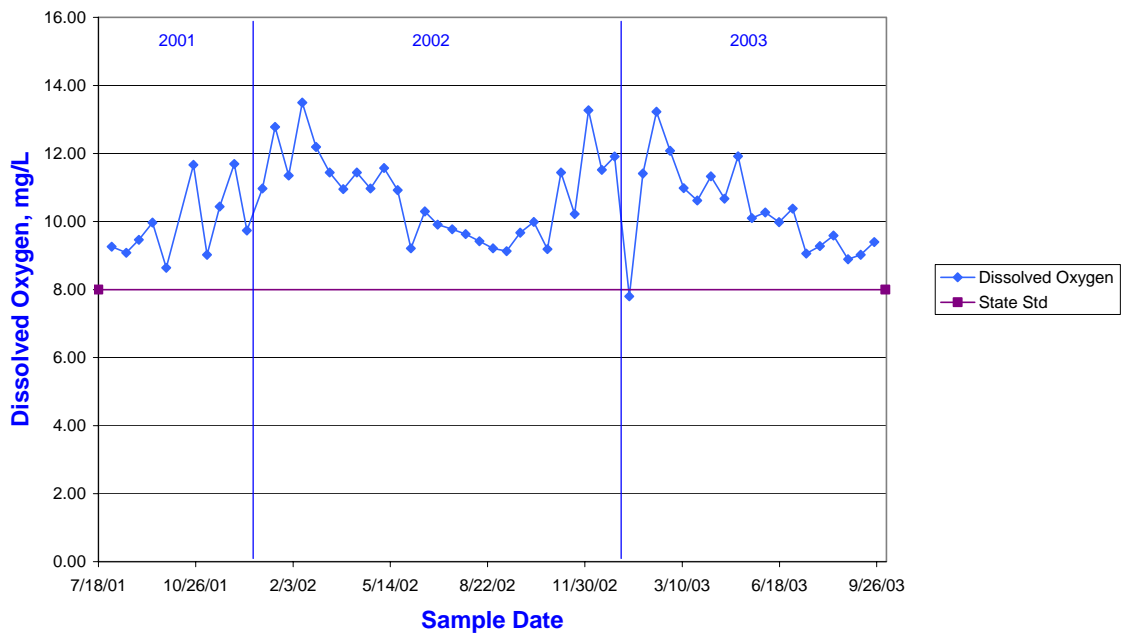
EF Nookachamps Creek at Beaver Lake Rd - Site 16 Dissolved Oxygen



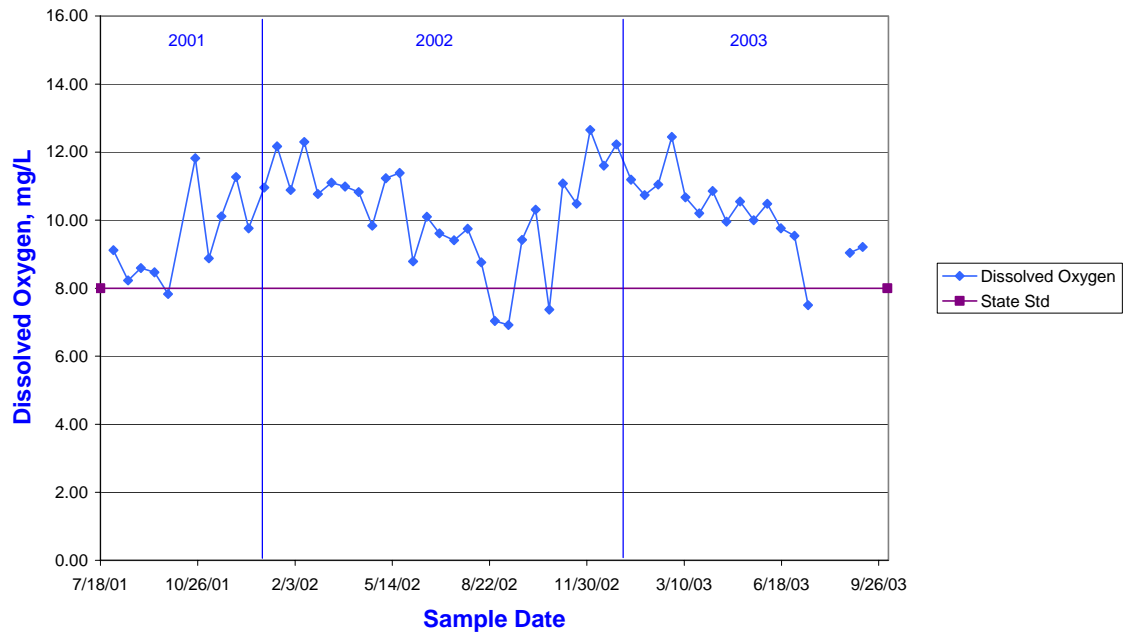
Nookachamps Creek at Big Lake outlet - Site 17 Dissolved Oxygen



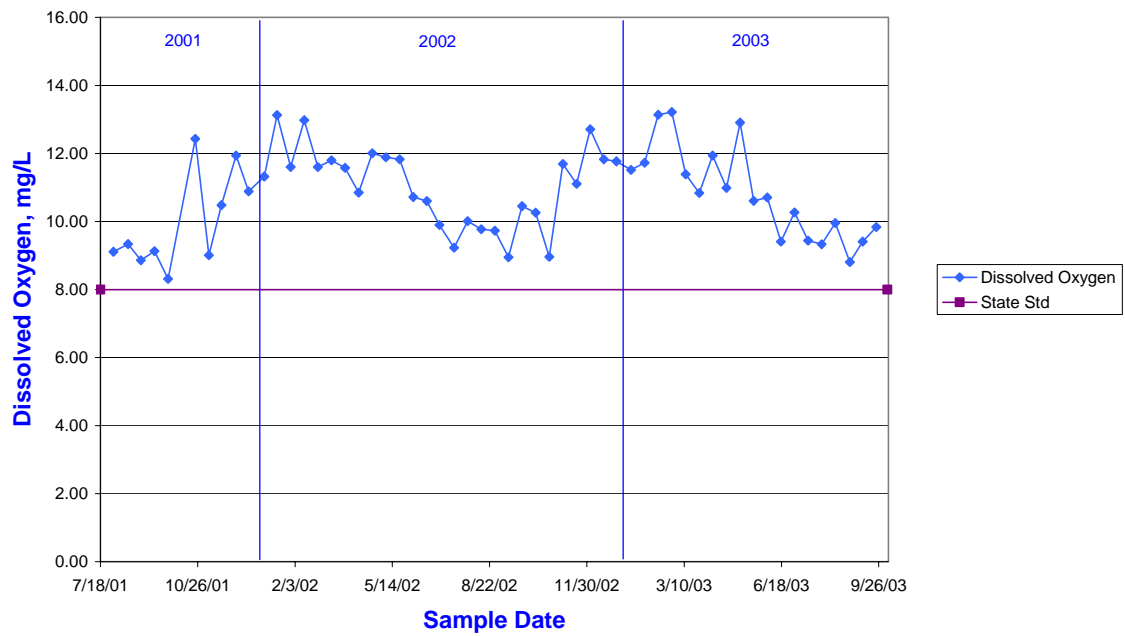
Lake Creek at Hwy 9 - Site 18 Dissolved Oxygen



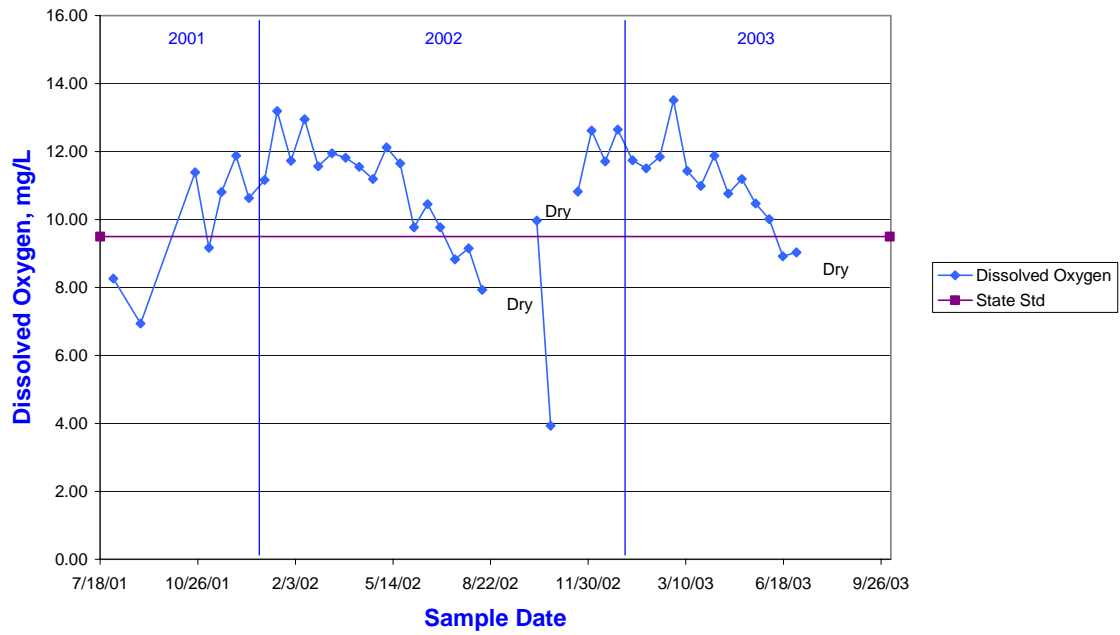
Hansen Creek at Hoehn Rd - Site 19 Dissolved Oxygen



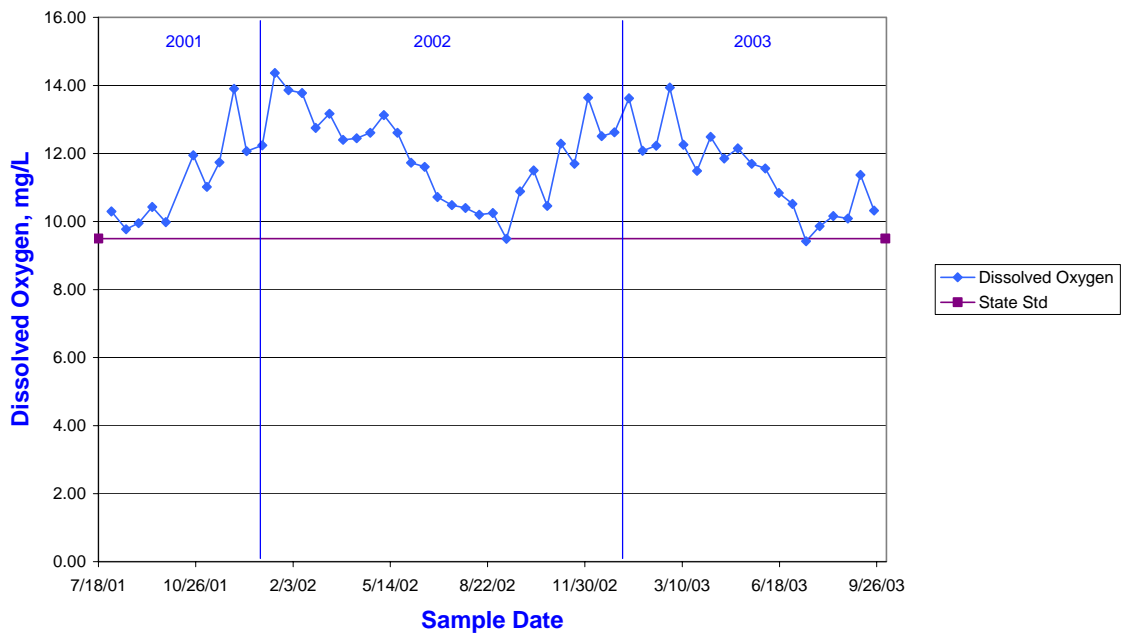
Hansen Creek at Northern State Hospital - Site 20 Dissolved Oxygen



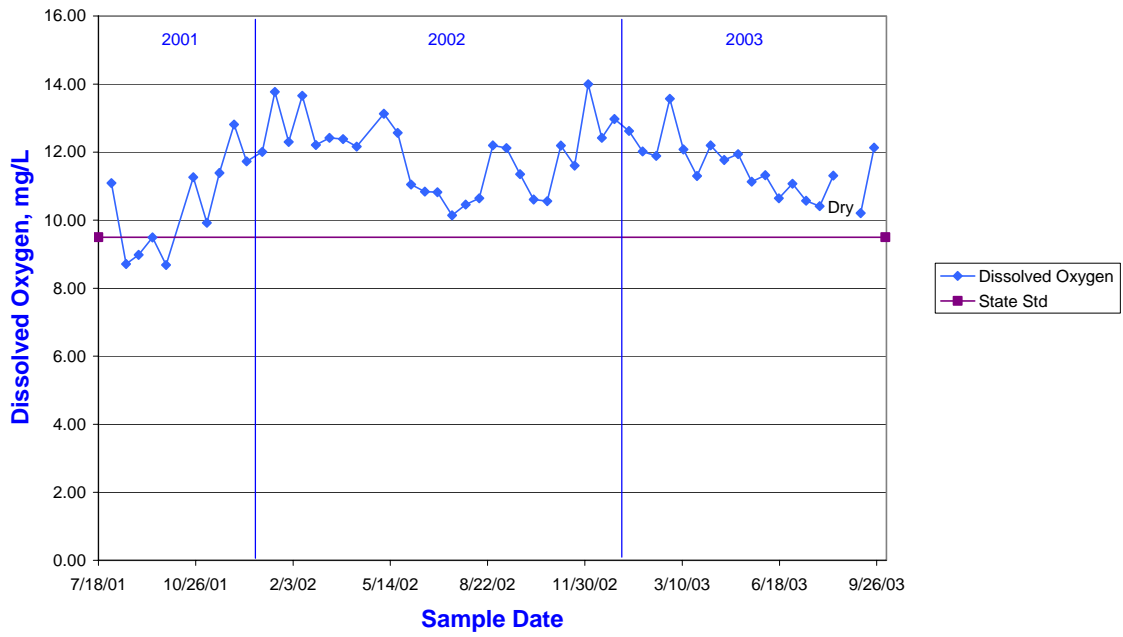
Coal Creek at Hoehn Rd - Site 21 Dissolved Oxygen



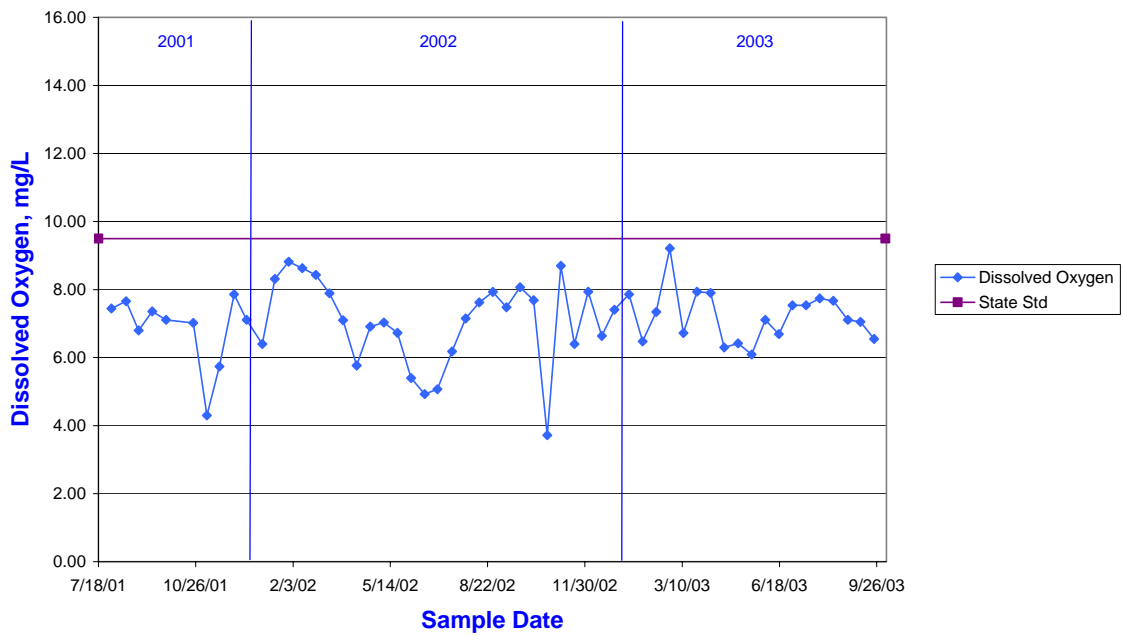
Coal Creek at Hwy 20 - Site 22 Dissolved Oxygen



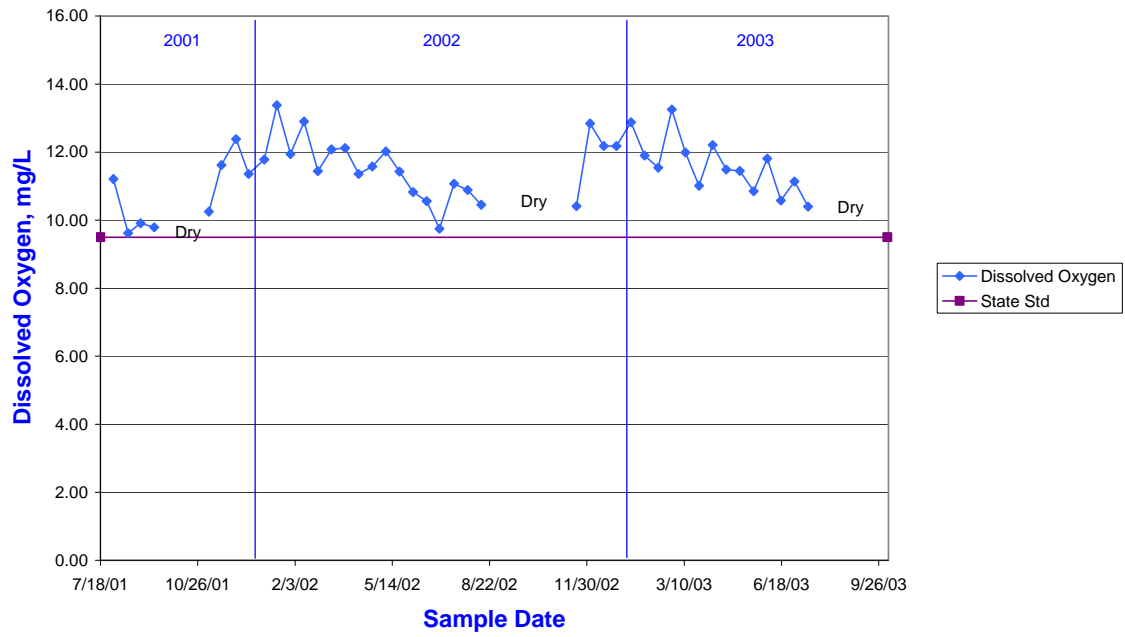
Wiseman Creek at Minkler Rd - Site 23 Dissolved Oxygen



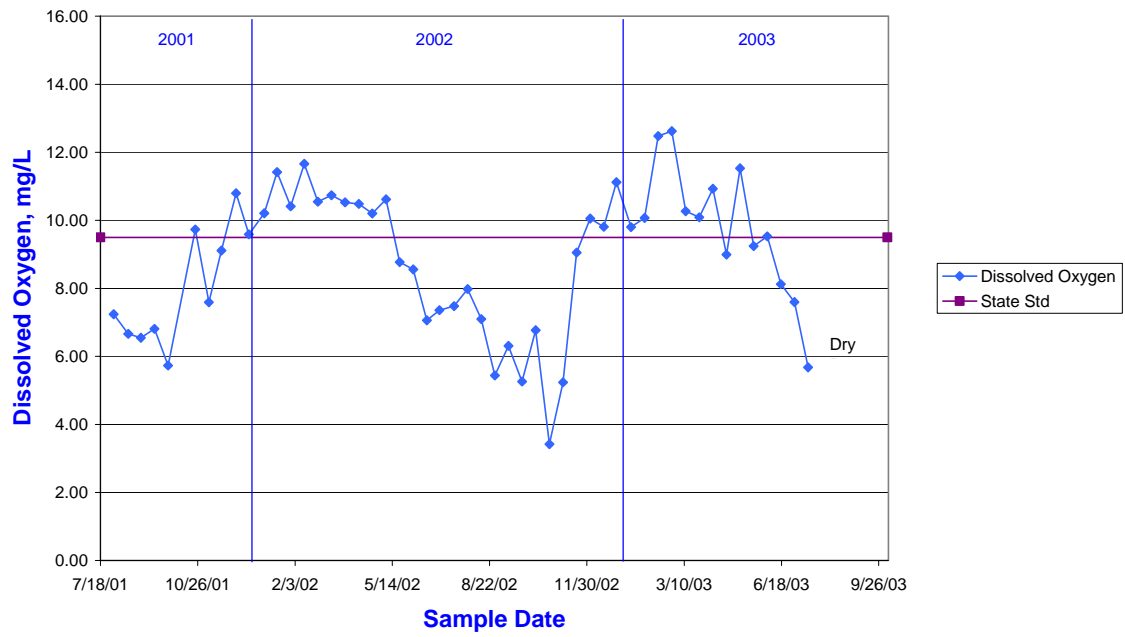
Mannser Creek at Lyman-Hamilton Hwy - Site 24 Dissolved Oxygen



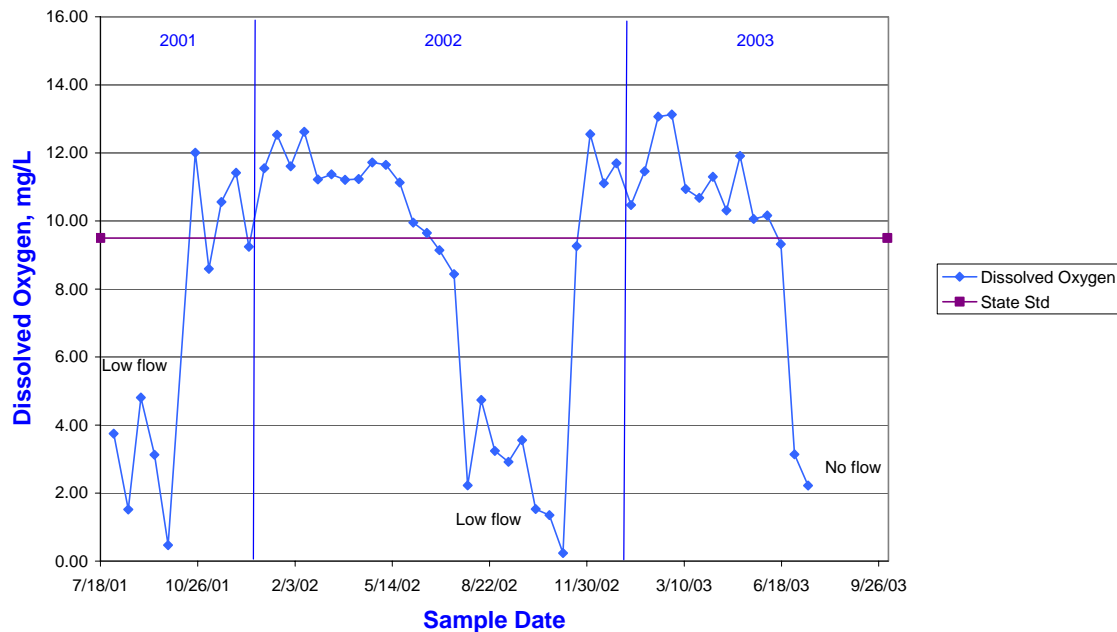
Red Cabin Creek at Hamilton Cemetery Rd - Site 25 Dissolved Oxygen



Morgan Creek at South Skagit Hwy - Site 26 Dissolved Oxygen



Morgan Creek at Walberg Rd - Site 27 Dissolved Oxygen



Temperature

Table 3 provides maximum daily temperatures and seven-day average maximums in Baseline Monitoring Project streams for the study period. State standards have recently changed to incorporate 7-day average maximums rather than daily maximums.

It should be noted that seasonal maximums for some streams in 2001 may have been missed, as temperature recording equipment was placed in some of the streams as late as mid-August. However, for most streams higher temperatures were recorded in 2002 and/or 2003. Temperature monitoring equipment was removed each fall to prevent damage or loss from high winter flows.

Table 3. Maximum temperature and relationship to DOE standards for streams in
Skagit County, Washington Baseline Monitoring Project

<u>Site Name</u>	<u>Site No.</u>	<u>Daily Maximum (°C)</u>	<u>Maximum 7-DAM¹ (°C)</u>	<u>DOE Standard²</u>
Colony Creek at Blanchard Rd.	1	31.8	30.1	17.5
Samish River at Chuckanut Dr.	2	20.5	19.6	17.5
Thomas Creek at Hwy. 99	3	22.7	21.1	17.5
Thomas Creek at F&S Grade Rd.	4	17.3	16.4	17.5
Samish River at Hwy. 99	5	19.5	18.7	17.5
Friday Creek at Prairie Rd.	6	22.3	21.3	17.5
Samish River at F&S Grade Rd.	7	17.5	16.8	17.5
Swede Creek at Grip Rd.	8	18.9	17.8	17.5
Skarrup Creek at Double Creek Ln.	9	18.1	17.1	17.5
Samish River at Prairie Rd.	10	17.2	16.6	17.5
Samish River at Hwy. 9	11	17.3	16.6	17.5
Nookachamps Creek at Swan Rd. ³	12	22.1	20.0	17.5
East Fork Nookachamps Creek at Hwy. 9	13	22.8	21.5	17.5
College Way Creek at College Wy.	14	18.9	17.8	17.5
Nookachamps Creek at Knapp Rd.	15	24.4	23.0	17.5
E. Fork Nookachamps Cr. at Beaver Lk. Rd.	16	22.8	21.6	17.5
Nookachamps Cr. at Hwy. 9, Big Lk. Outlet	17	26.1	24.8	17.5
Lake Creek at Hwy. 9	18	18.9	18.0	17.5
Hansen Creek at Hoehn Rd.	19	20.0	19.2	17.5
Hansen Creek at Northern State	20	20.0	18.9	17.5
Coal Creek at Hoehn Rd.	21	19.0	18.0	16.0
Coal Creek at Hwy. 20	22	18.1	16.9	16.0
Wiseman Creek at Minkler Rd.	23	25.0	23.0	16.0
Mannser Creek at Lyman-Hamilton Rd.	24	15.0	13.9	16.0
Red Cabin Creek at Hamilton Cemetery Rd.	25	17.8	16.3	16.0
Morgan Creek at South Skagit Hwy.	26	18.9	17.4	16.0
Morgan Creek at Walberg Rd.	27	19.6	18.6	16.0

¹7-day average maximum

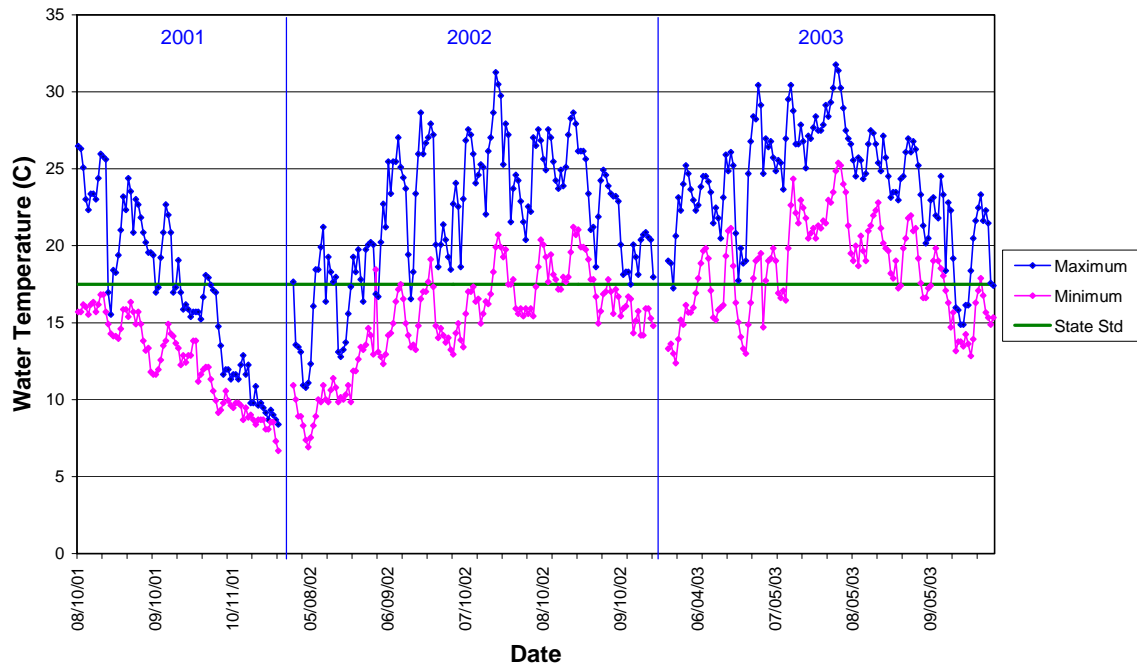
²Based on 7-day average maximum

³Data from 2001 only

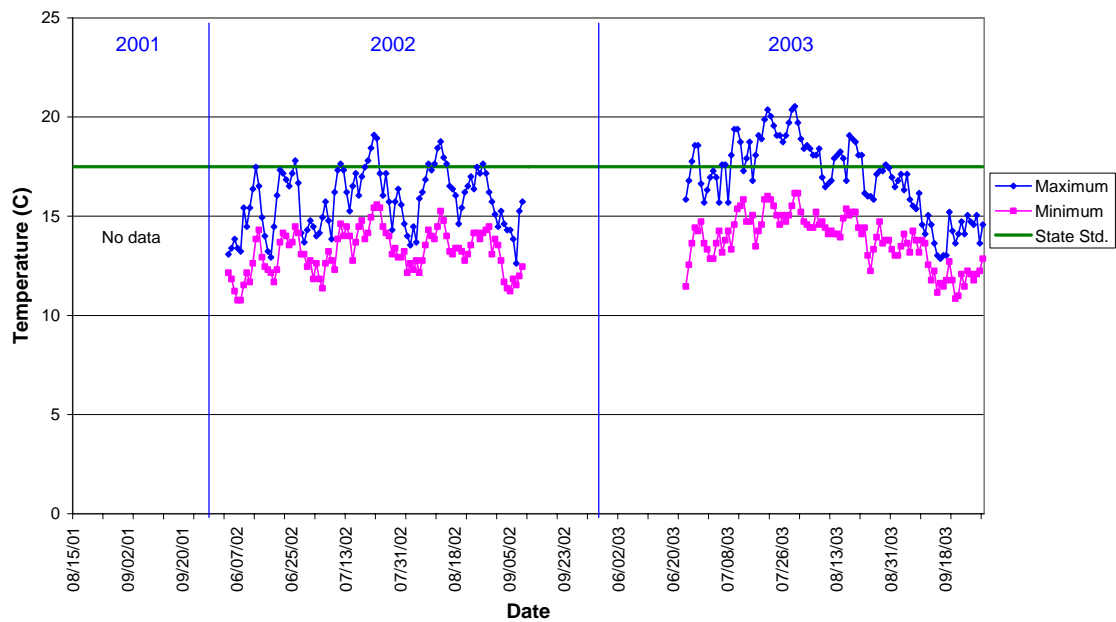
Graphs on the following pages illustrate daily temperature maximums and minimums for each sample station, along with the state standard for 7-day average maximums. In most cases, the data extends over three years, with a gap in the fall/winter months when temperature monitoring was suspended.

Many streams were warmer in 2003 than in previous years. An abnormally warm, dry summer caused several streams to dry up which had not dried up in previous years of the study. Given the variation in climate, it is difficult to determine any long-term trends from three years of data. Many of these sample locations will be monitored in the future and long-term temperature trends may become apparent later.

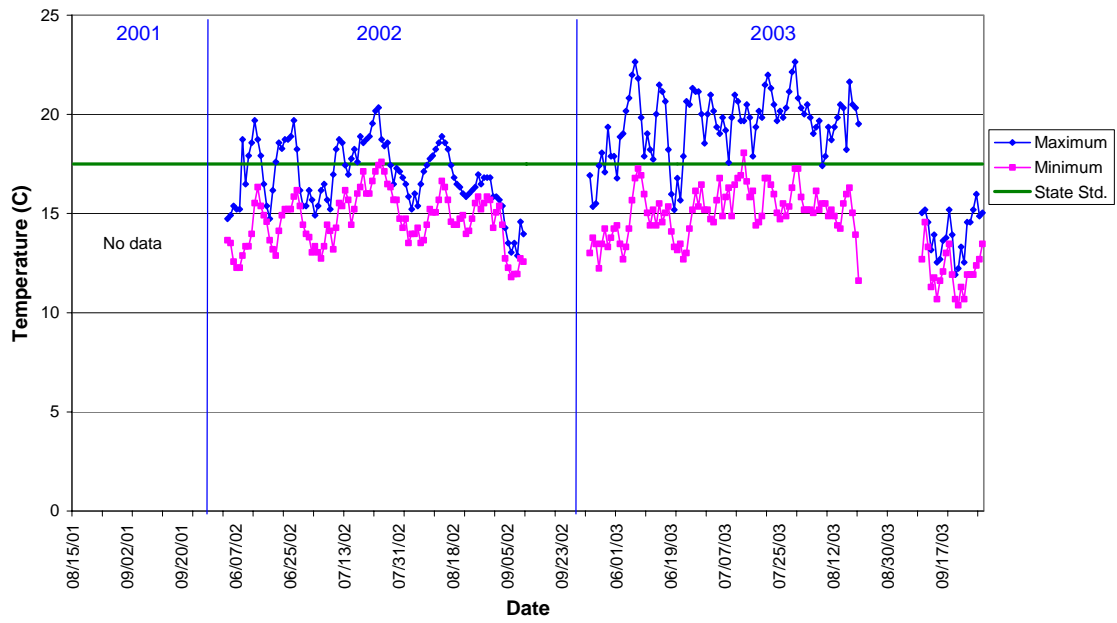
Colony Creek at Blanchard Rd - Site 1 Temperature



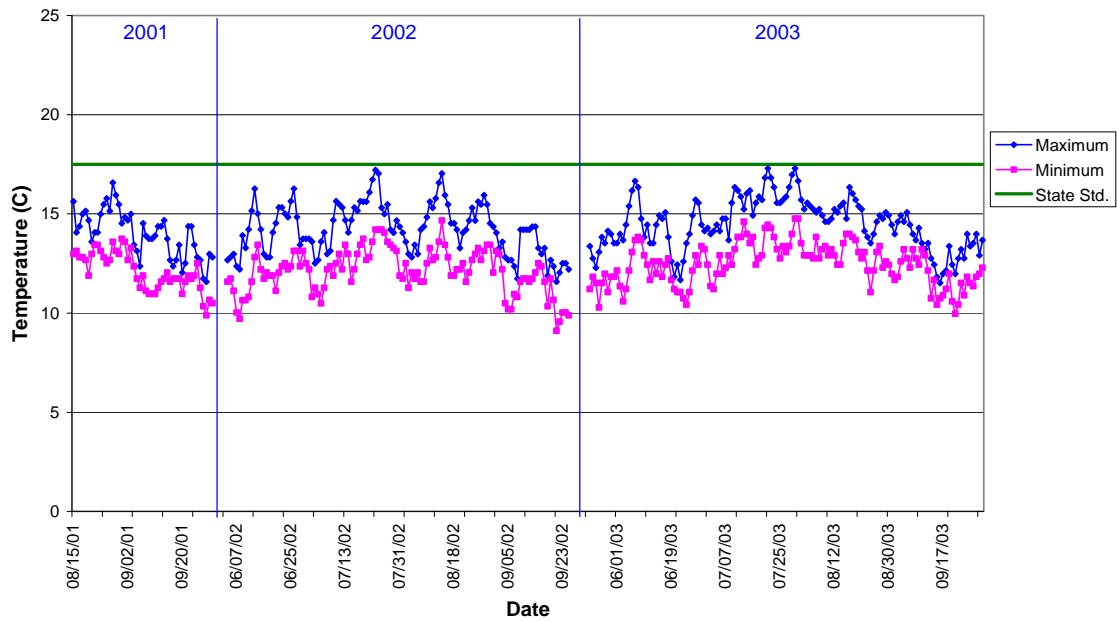
Samish River at Chuckanut Drive - Site 2 Temperature



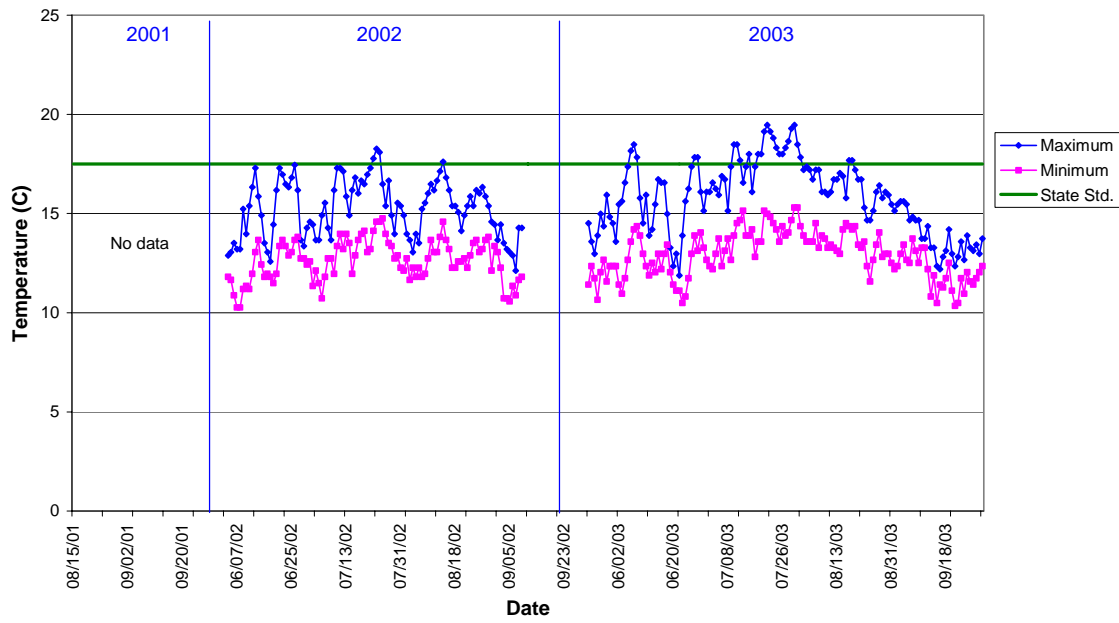
Thomas Creek at Hwy 99 - Site 3 Temperature



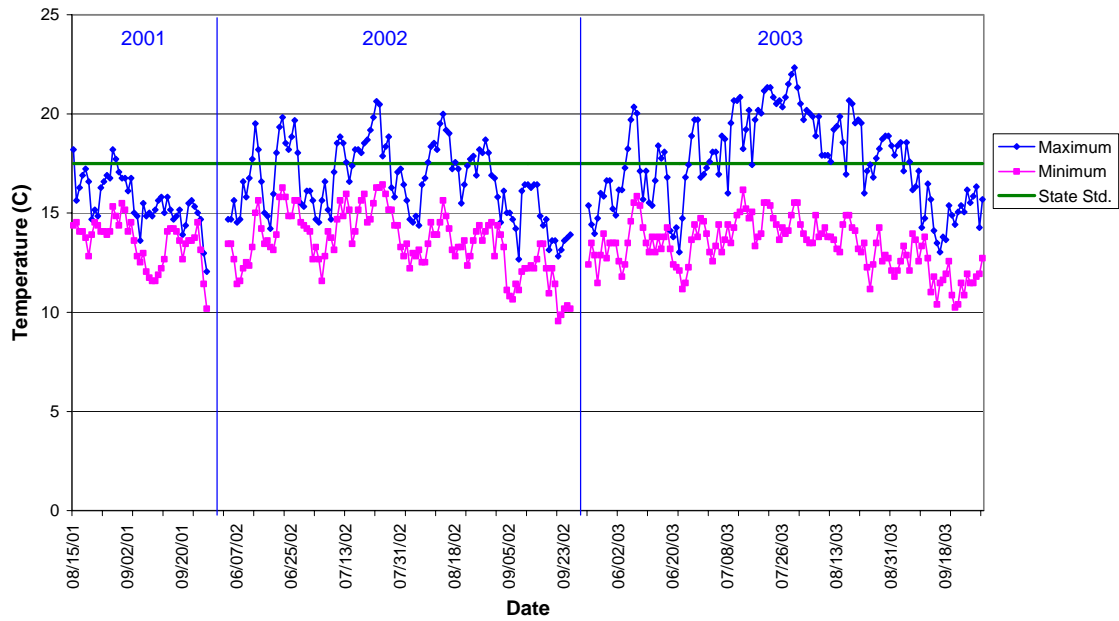
Thomas Creek at F&S Grade Rd - Site 4 Temperature



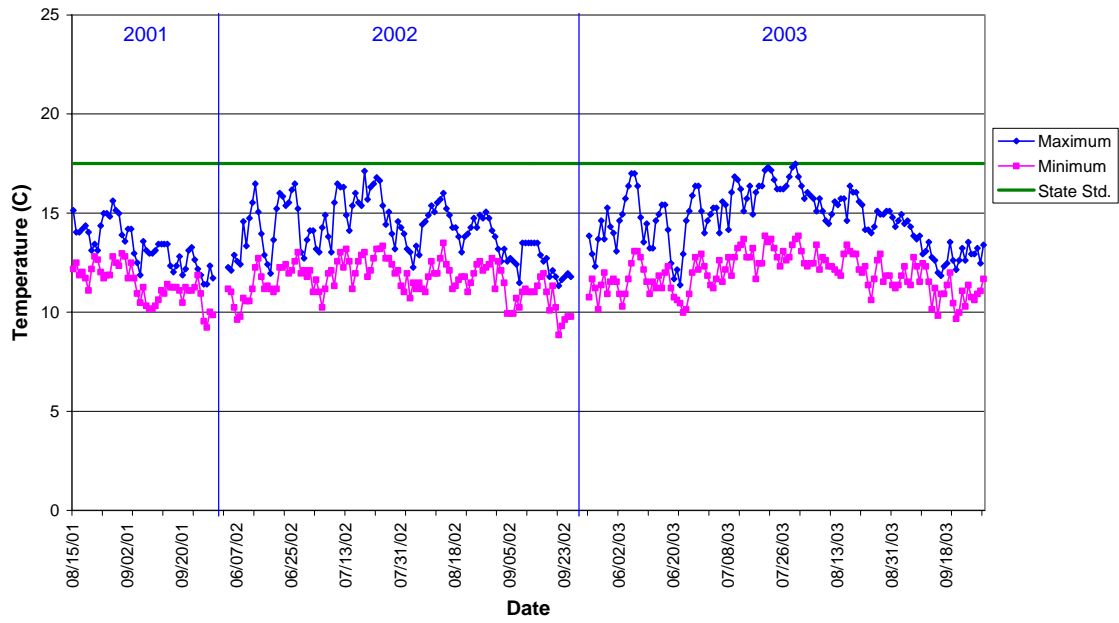
Samish River at Highway 99 - Site 5 Temperature



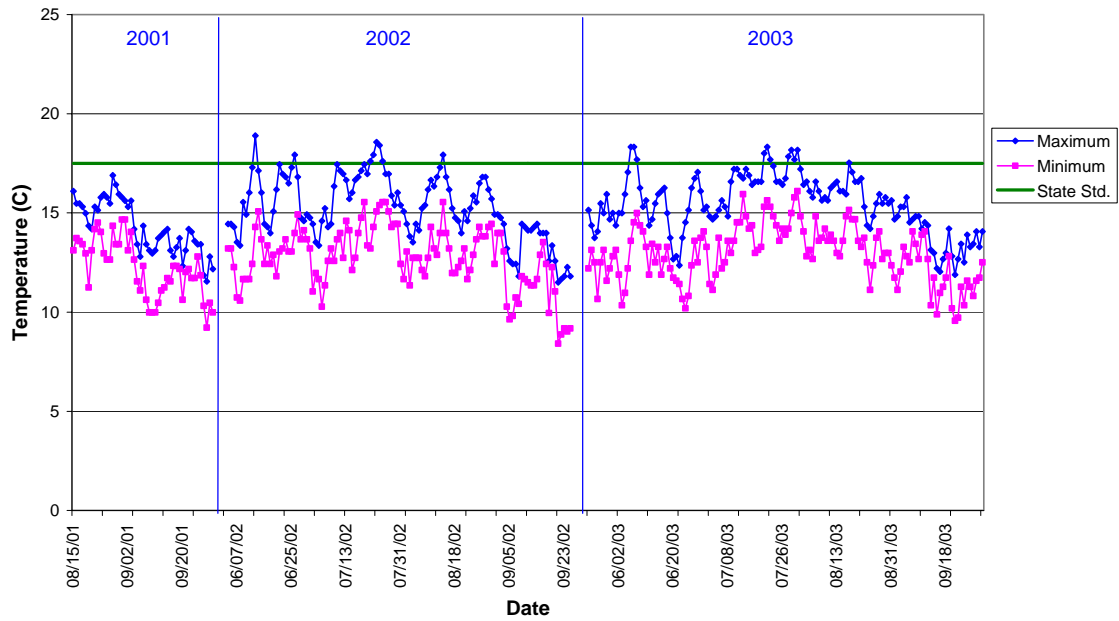
Friday Creek at Prairie Rd - Site 6 Temperature



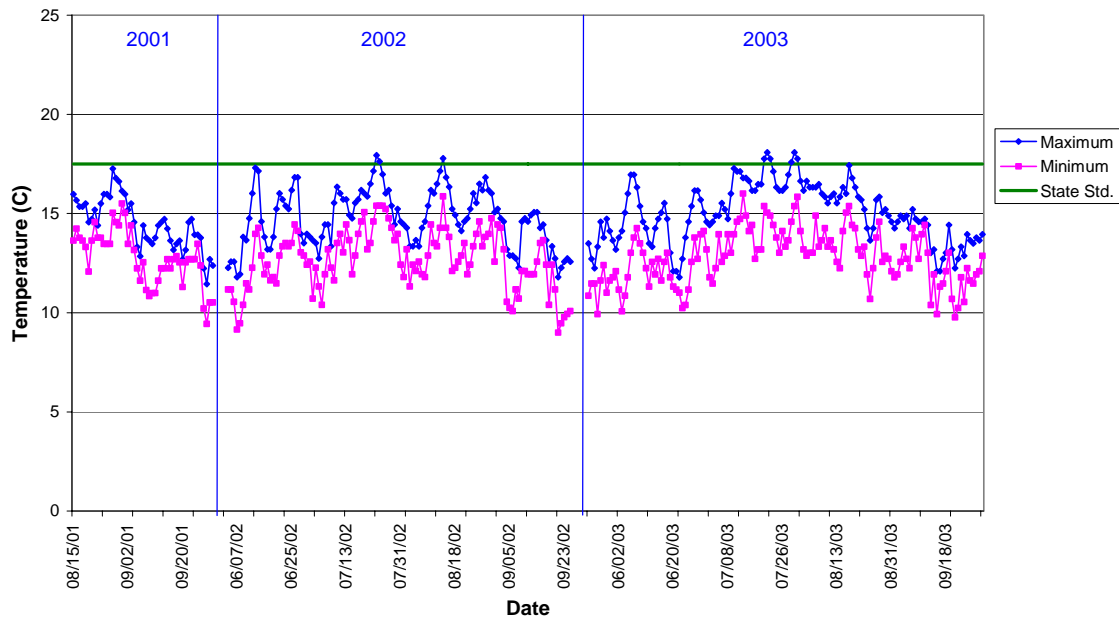
Samish River at F&S Grade Rd - Site 7 Temperature



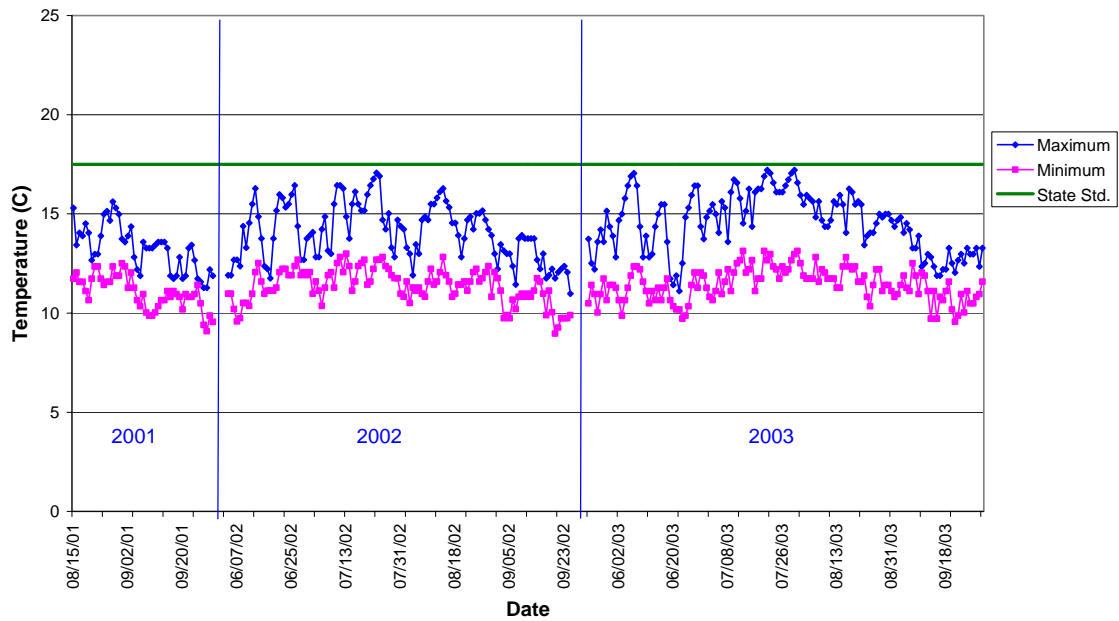
Swede Creek at Grip Rd - Site 8 Temperature



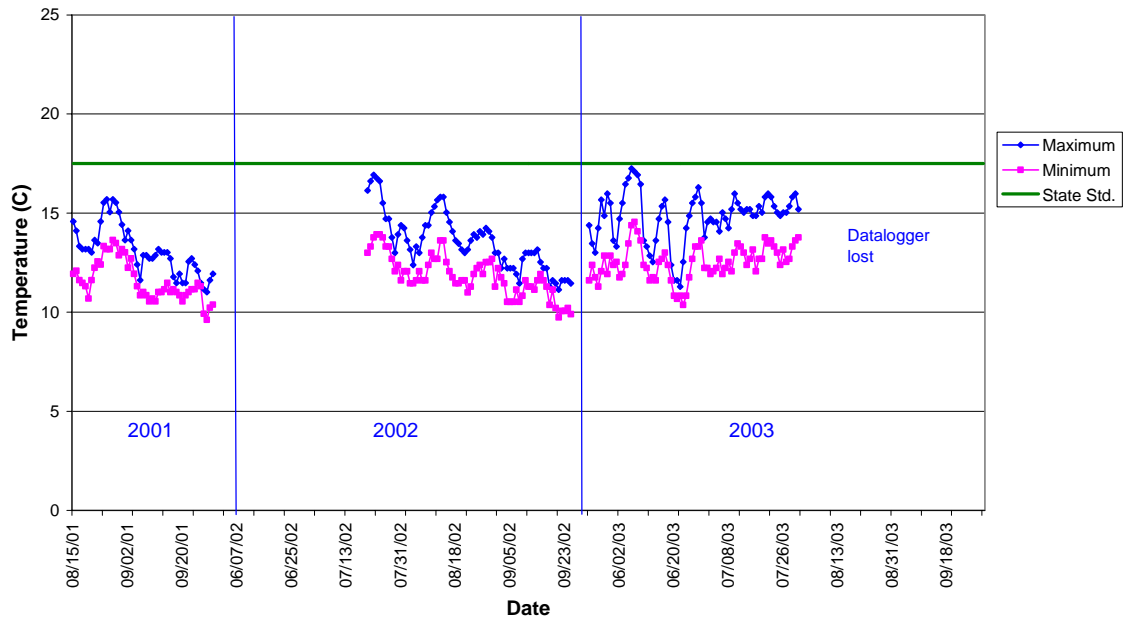
Skarrup Creek at Double Creek Ln - Site 9 Temperature



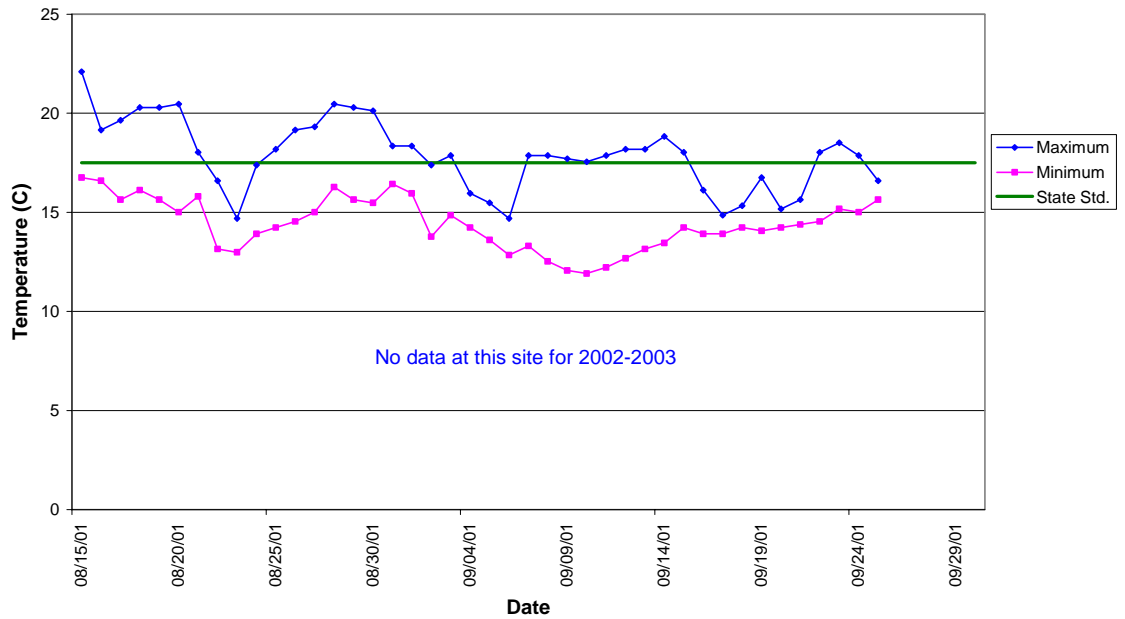
Samish River at Prairie Rd - Site 10 Temperature



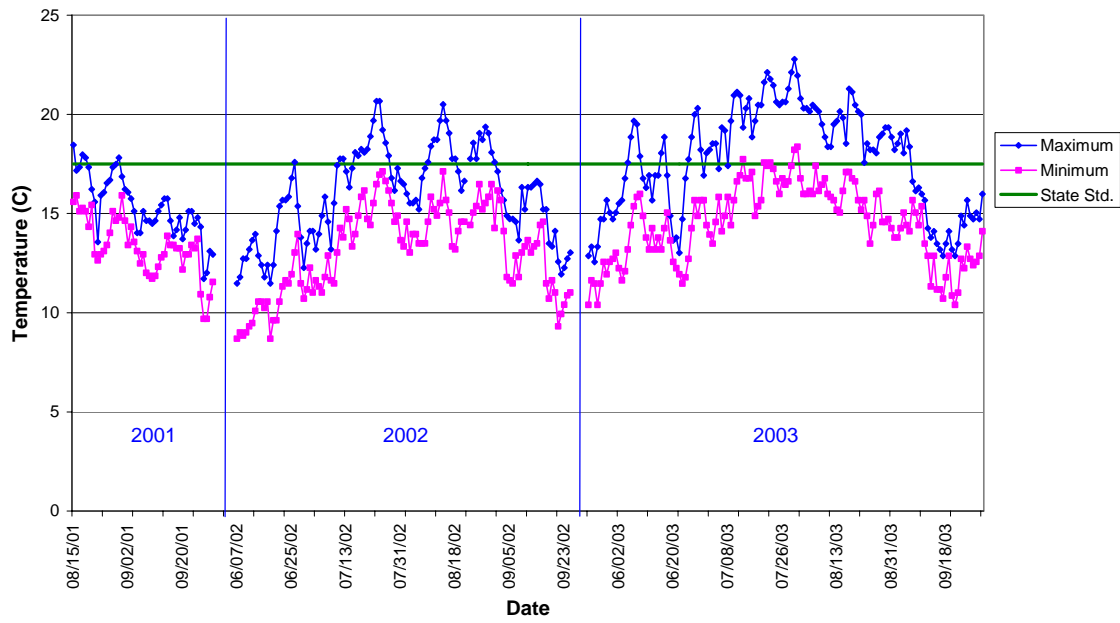
Samish River at Highway 9 - Site 11 Temperature



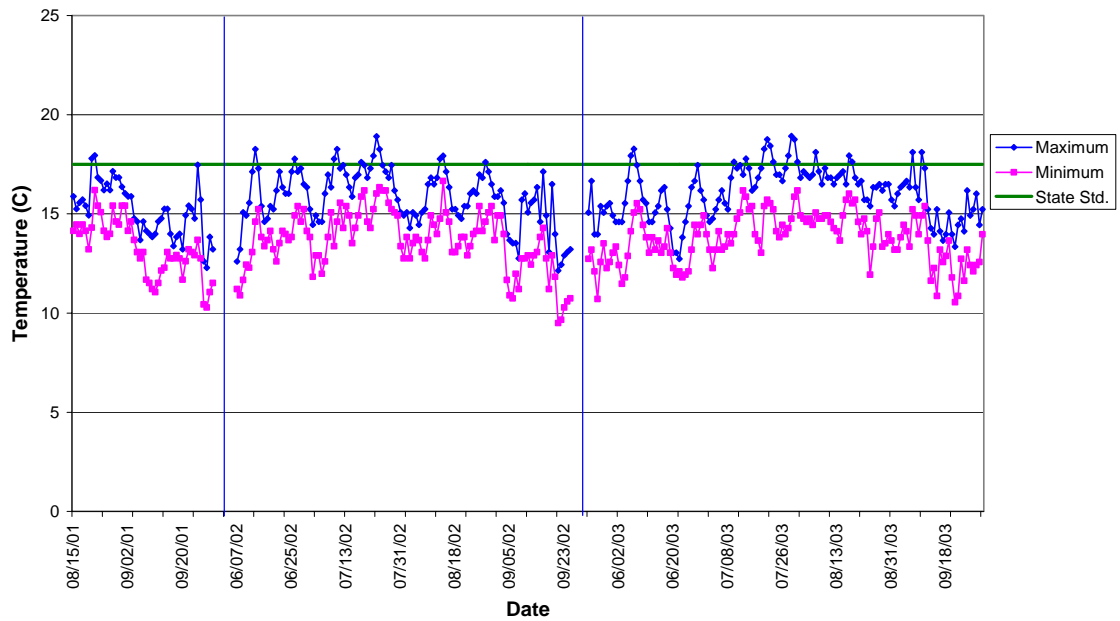
Nookachamps Creek at Swan Rd - Site 12 Temperature



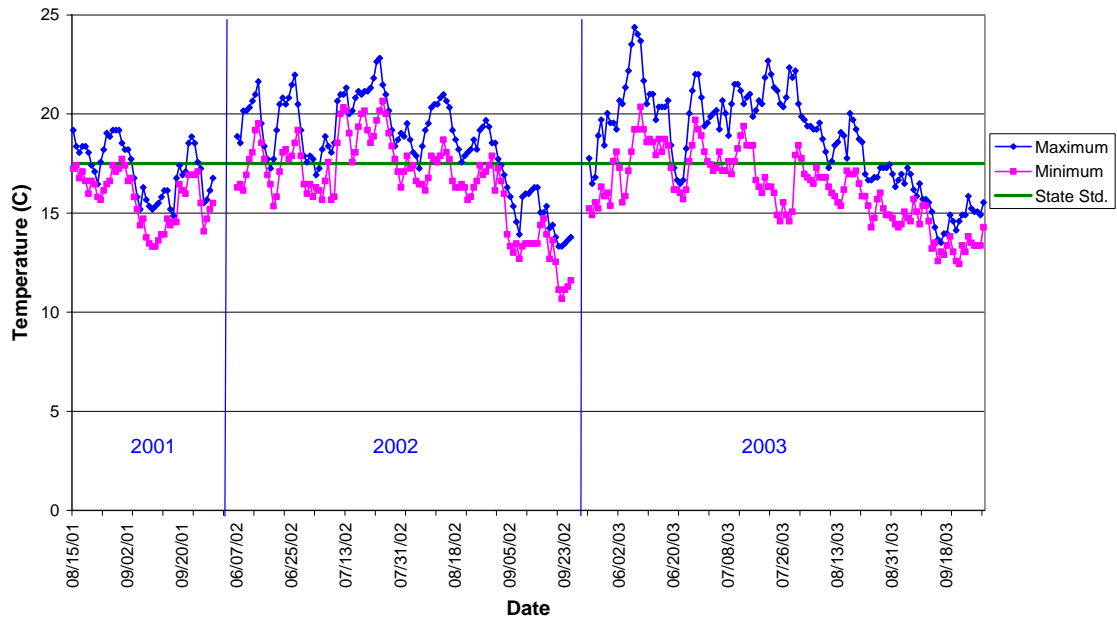
E.F. Nookachamps Creek at Hwy 9 - Site 13 Temperature



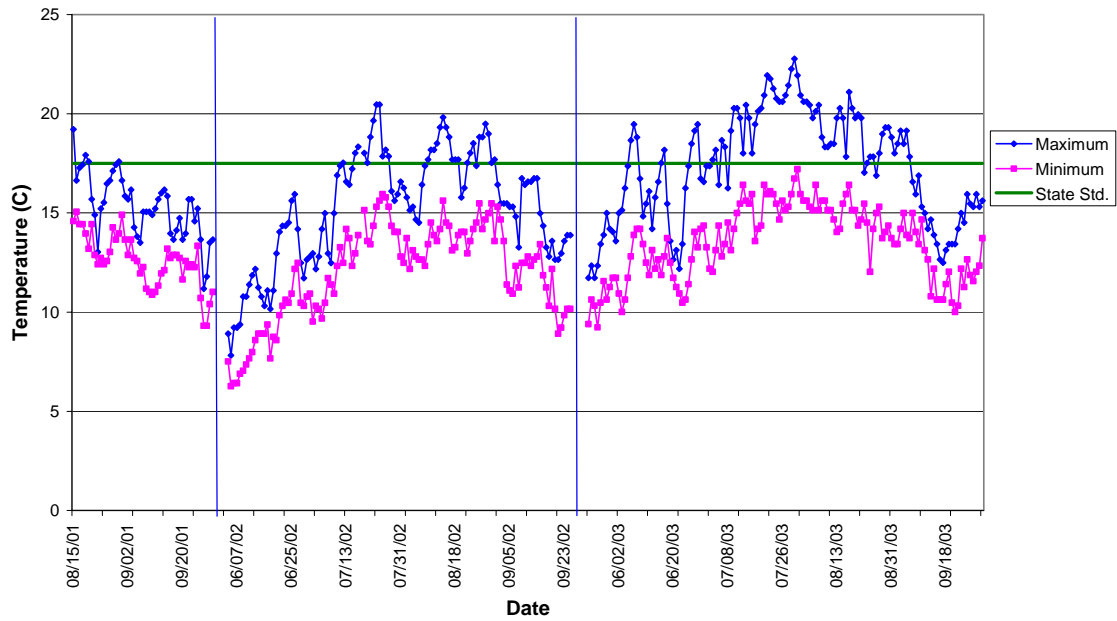
College Way Creek at College Wy - Site 14 Temperature



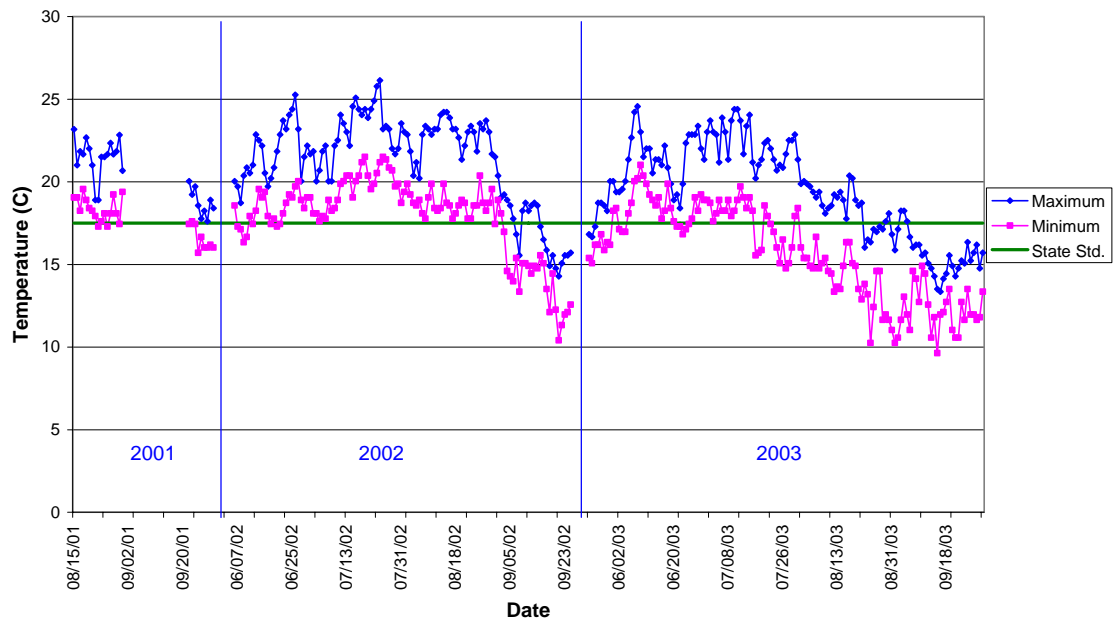
Nookachamps Creek at Knapp Rd - Site 15 Temperature



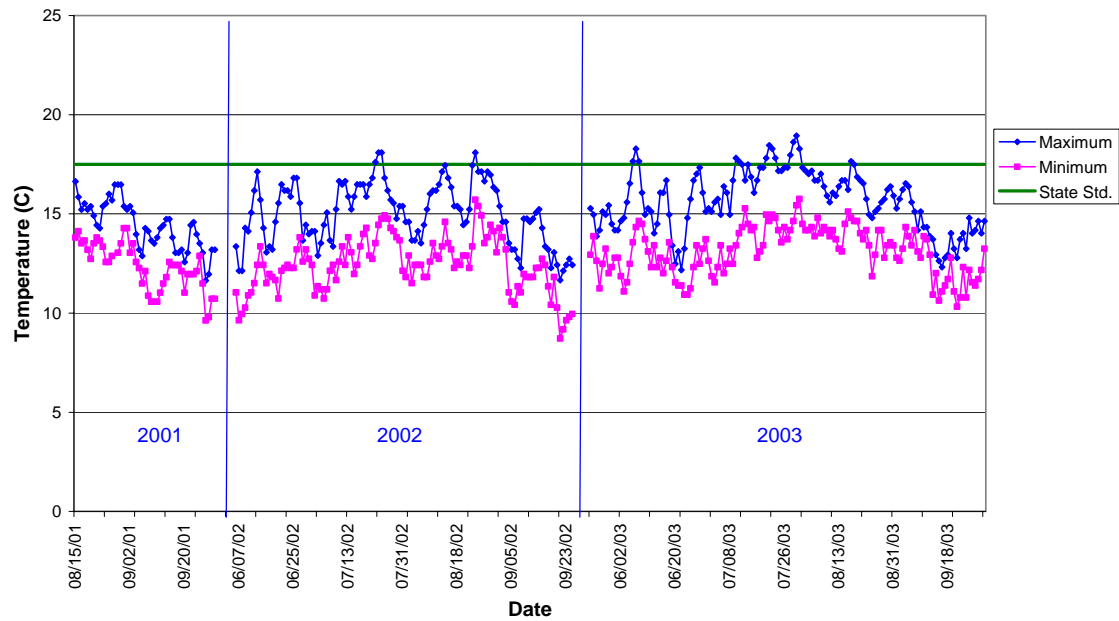
E.F. Nookachamps Creek at Beaver Lk Rd - Site 16 Temperature



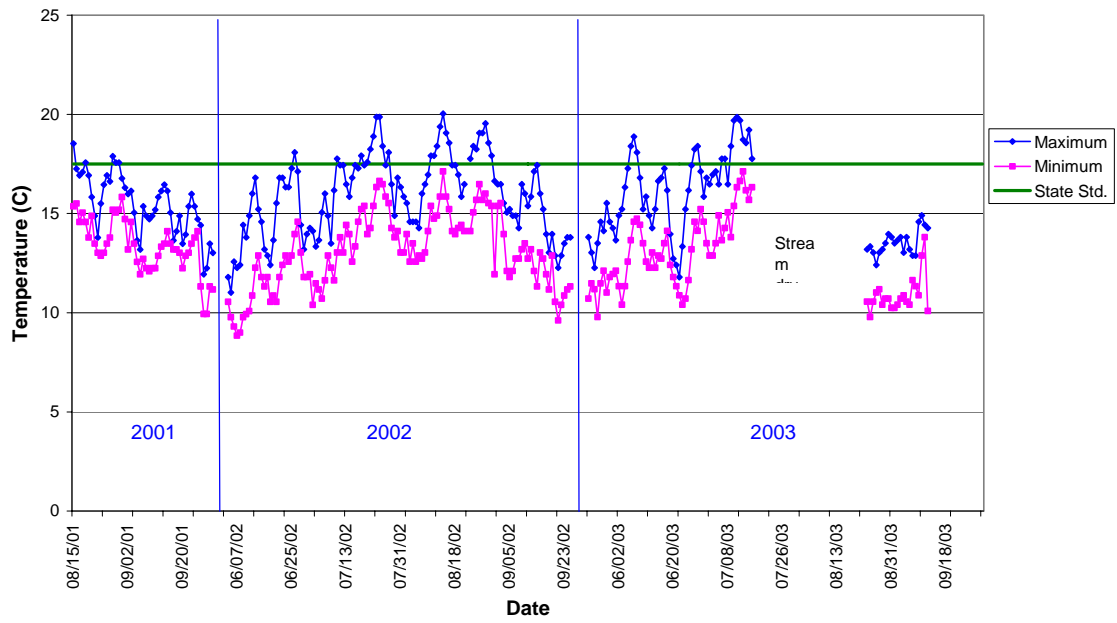
Nookachamps Creek at Big Lake Outlet - Site 17 Temperature



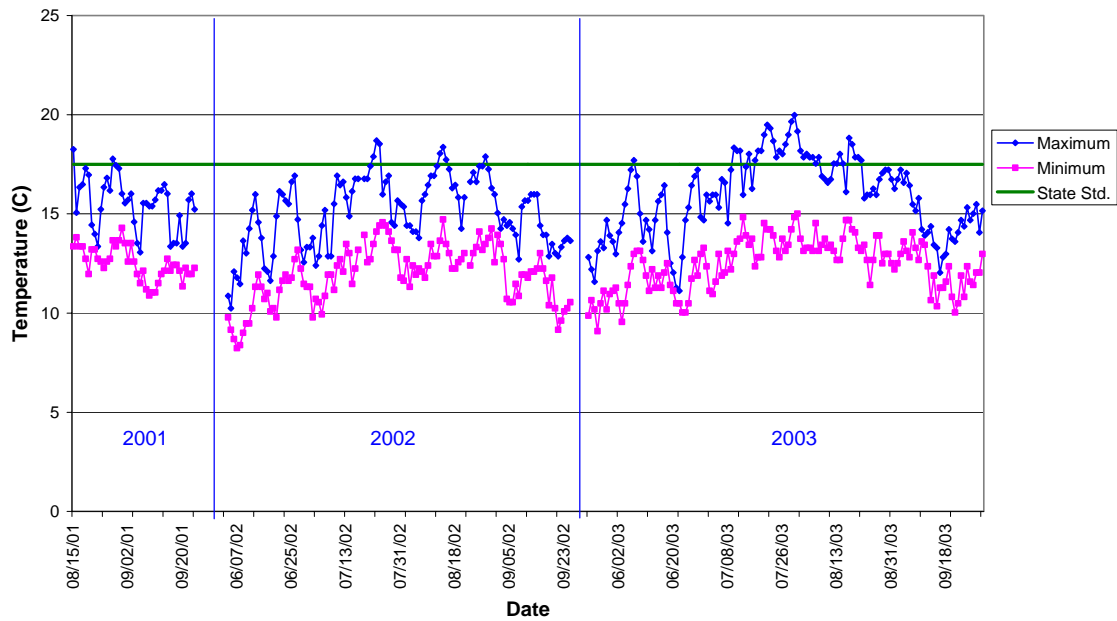
Lake Creek at Hwy 9 - Site 18 Temperature



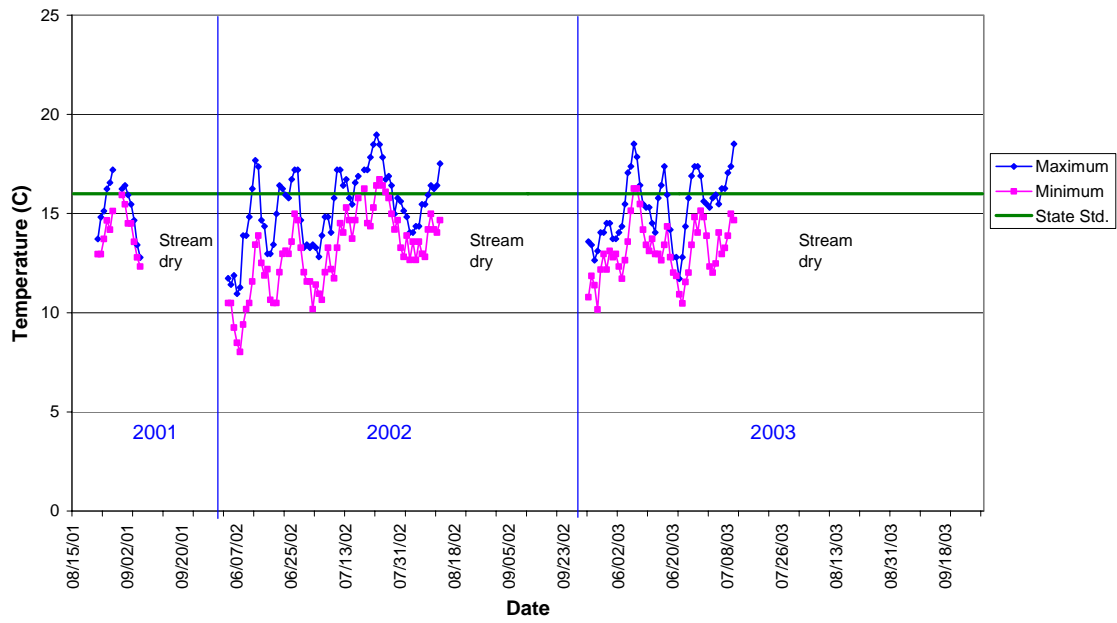
Hansen Creek at Hoehn Rd - Site 19 Temperature



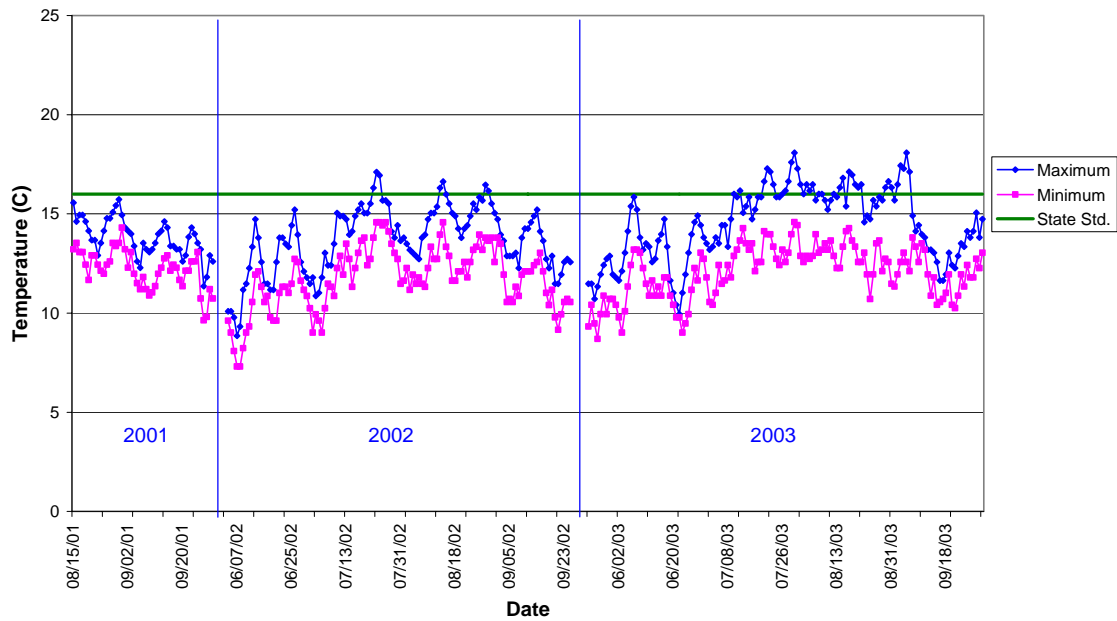
Hansen Creek at Northern State Hospital - Site 20 Temperature



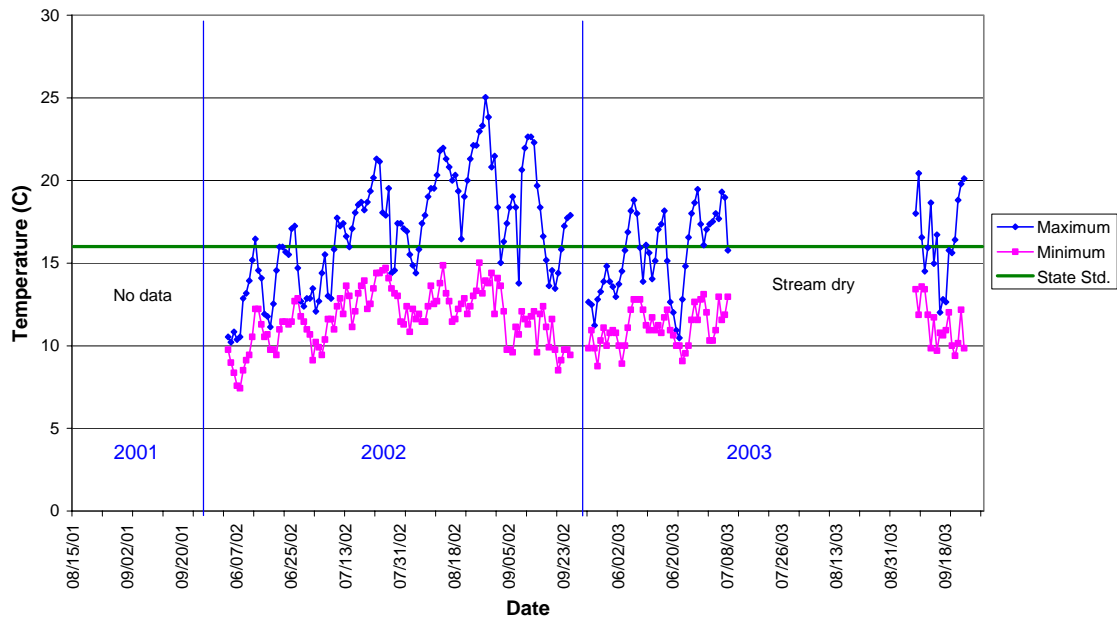
Coal Creek at Hoehn Road - Site 21 Temperature



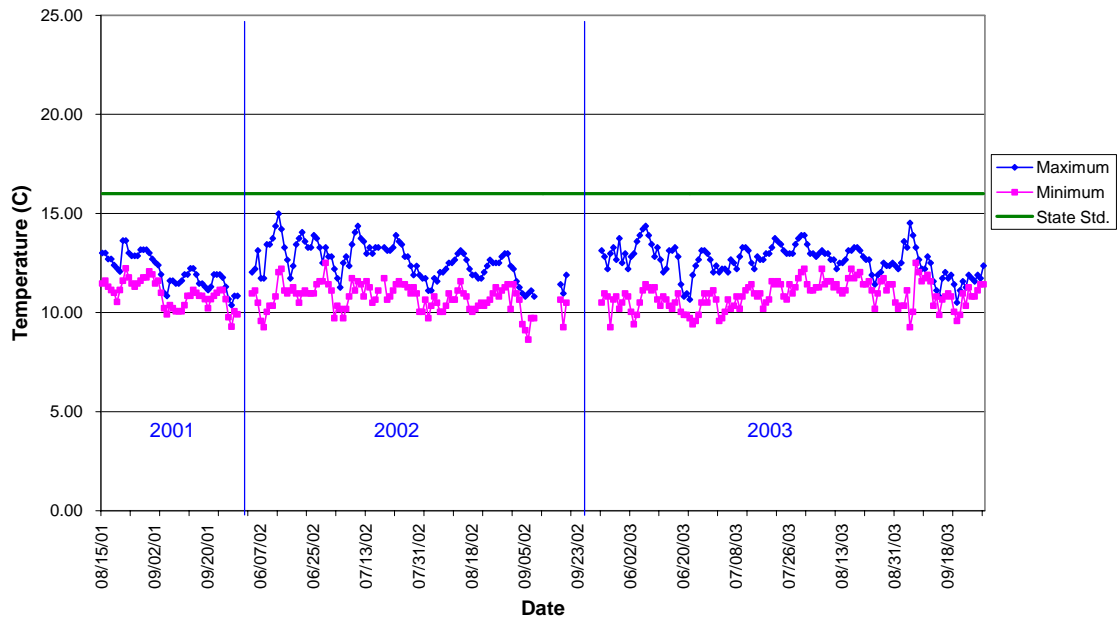
Coal Creek at Hwy 20 - Site 22 Temperature



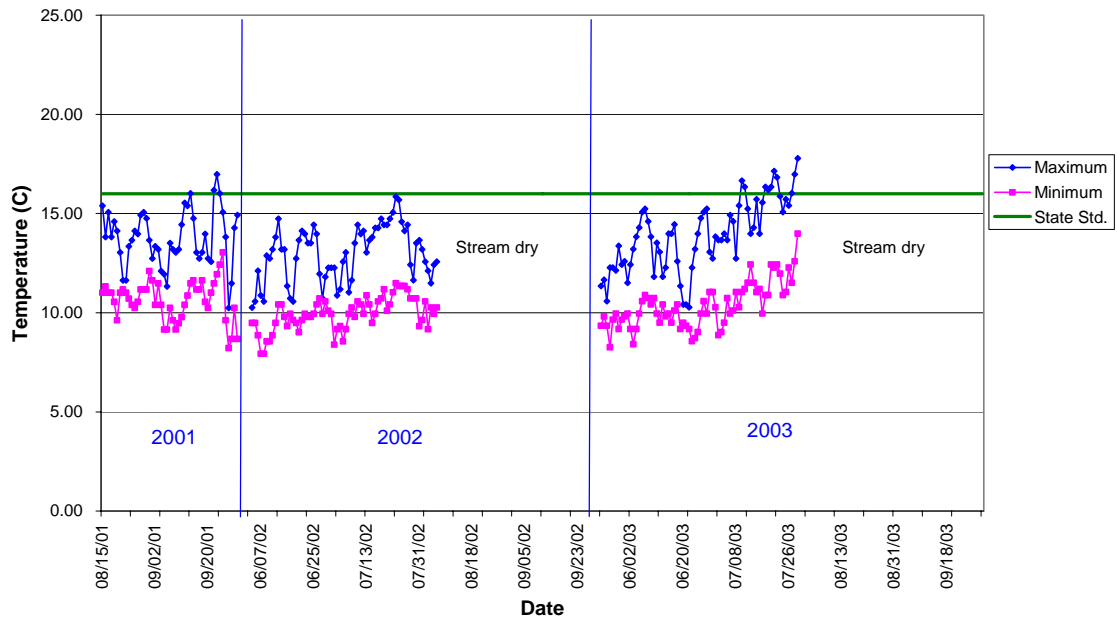
Wiseman Creek at Minkler Rd - Site 23 Temperature



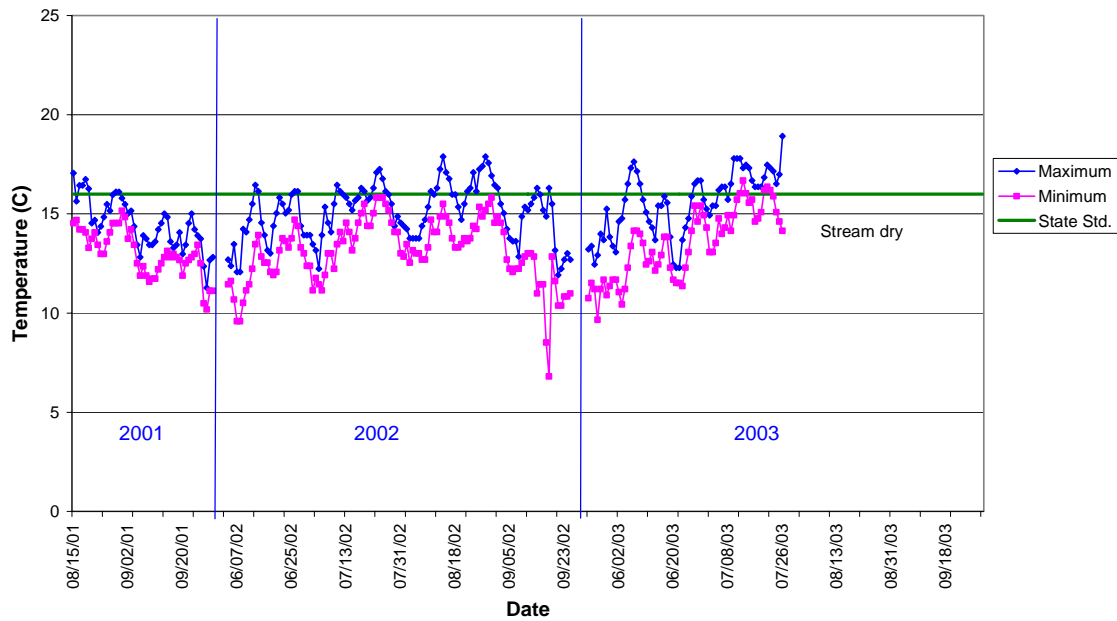
Mannser Creek at Lyman-Hamilton Rd - Site 24 Temperature



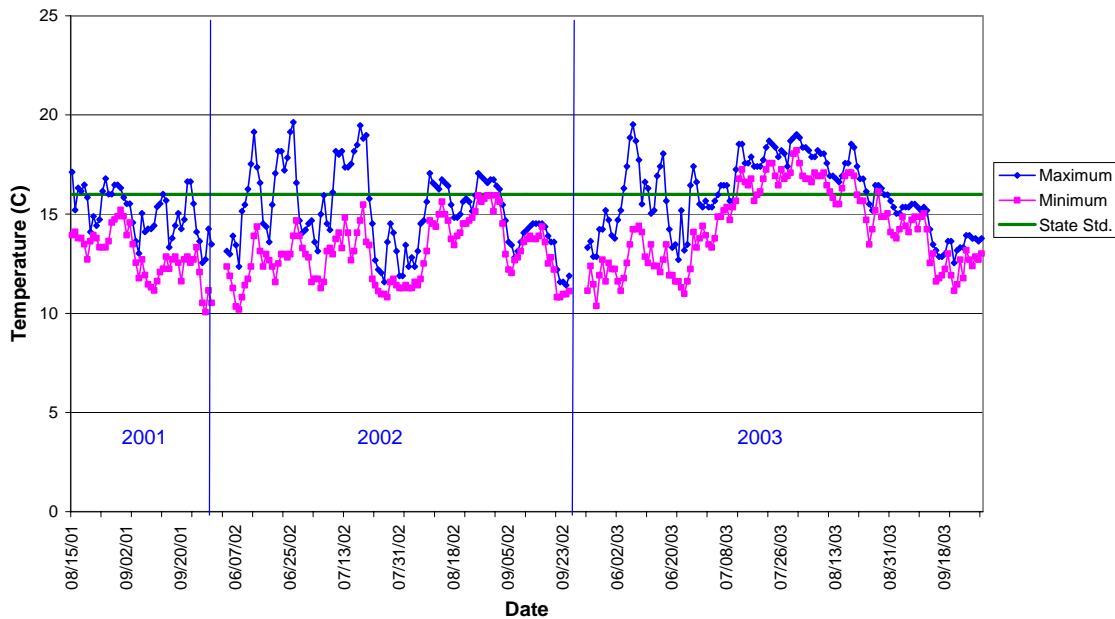
Red Cabin Creek at Hamilton Cemetery Rd - Site 25 Temperature



Morgan Creek at South Skagit Hwy - Site 26 Temperature



Morgan Creek at Walberg Rd - Site 27 Temperature



Fecal coliform

Samples for fecal coliform are taken at each site during each visit. Geometric means of fecal coliform determinations are summarized in Table 4. The table maintains the recently retired state stream classifications in order to indicate which watercourses are listed by the Department of Ecology for “Extraordinary primary contact recreation (the previous AA classification) and “Primary contact recreation (the previous A classification). For AA streams, the fecal coliform limit is a geometric mean not to exceed 50 colony forming units (CFU) per 100 ml, with no more than 10 percent of the readings over 100 CFU. For Class A streams, the standard is a geometric mean not to exceed 100 CFU, with no more than 10 percent exceeding 200 CFU.

The graphs on succeeding pages illustrate fecal coliform levels over time for each of the 27 stations. For most stations, coliform levels tended to be higher in the spring and summer than during fall and winter. Winter peaks also occurred at some stations, but in general, coliform levels were higher during the warmer months.

A comparison of years shows that 17 stations had higher peak coliform levels in 2002, while 9 stations had higher peaks in 2003, and one station had equal peaks for those years. The geometric mean was lower for 2003 in 16 streams and higher in 11 streams. No comparisons were made with 2001 because for most stations, no samples were taken

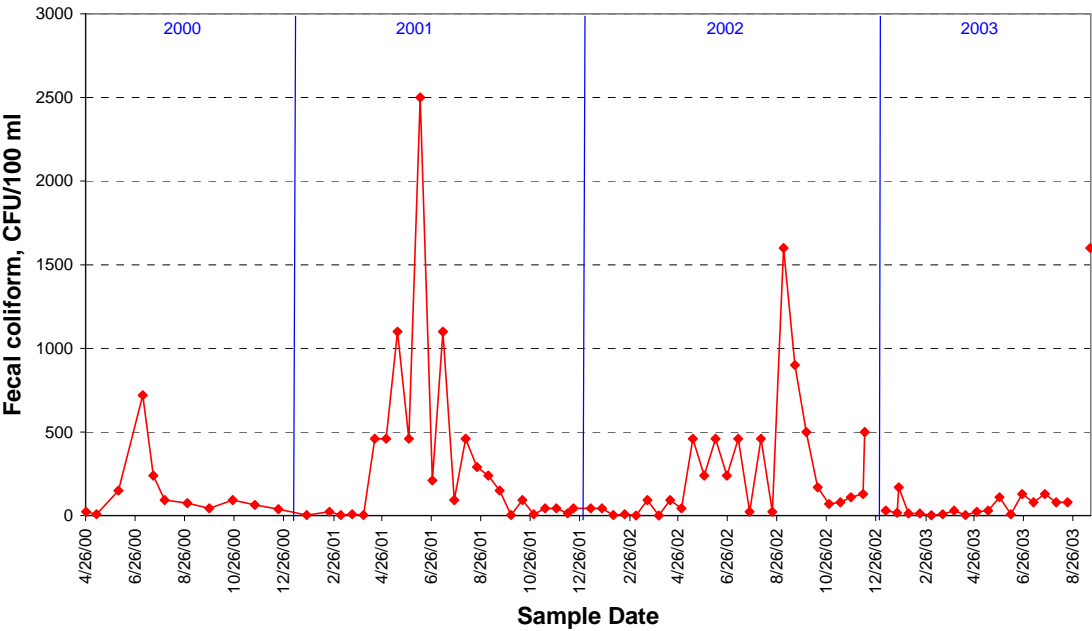
until after the peak season. While these results suggest there may have been some general improvement in fecal coliform levels in the Baseline streams in 2003, this assessment should be treated with caution since it is only one year's comparison and more streams were dry in 2003.

Table 4. Fecal coliform levels in streams in Skagit County, Washington
Baseline Monitoring Project

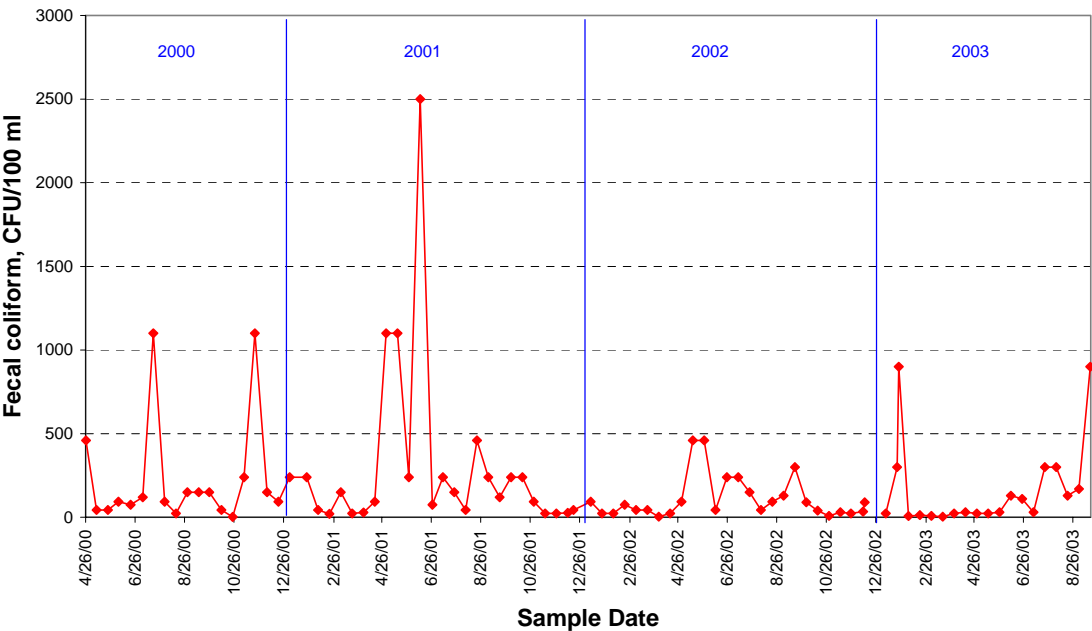
<u>Site Name</u>	<u>Site No.</u>	<u>Stream Class</u>	Geometric <u>Mean (CFU)</u>	<u>% > 100/200¹</u>
Colony Creek at Blanchard Rd.	1	A	66	29
Samish River at Chuckanut Dr.	2	A	83	28
Thomas Creek at Hwy. 99	3	A	79	36
Thomas Creek at F&S Grade Rd.	4	A	134	43
Samish River at Hwy. 99	5	A	78	29
Friday Creek at Prairie Rd.	6	A	43	18
Samish River at F&S Grade Rd.	7	A	56	19
Swede Creek at Grip Rd.	8	A	75	31
Skarrup Creek at Double Creek Ln.	9	A	59	24
Samish River at Prairie Rd.	10	A	62	28
Samish River at Hwy. 9	11	A	27	8
Nookachamps Creek at Swan Rd.	12	A	106	32
East Fork Nookachamps Creek at Hwy. 9	13	A	52	16
College Way Creek at College Wy.	14	A	119	35
Nookachamps Creek at Knapp Rd.	15	A	76	29
E. Fork Nookachamps Cr. at Beaver Lk. Rd.	16	A	49	25
Nookachamps Cr. at Hwy. 9, Big Lk. Outlet	17	A	17	20
Lake Creek at Hwy. 9	18	A	44	27
Hansen Creek at Hoehn Rd.	19	A	54	23
Hansen Creek at Northern State	20	A	35	18
Coal Creek at Hoehn Rd.	21	AA	62	33
Coal Creek at Hwy. 20	22	AA	11	14
Wiseman Creek at Minkler Rd.	23	AA	43	35
Mannser Creek at Lyman-Hamilton Rd.	24	AA	16	4
Red Cabin Creek at Hamilton Cemetery Rd.	25	AA	18	18
Morgan Creek at South Skagit Hwy.	26	AA	40	27
Morgan Creek at Walberg Rd.	27	AA	61	32

¹Percent of readings over 100 CFU/100 ml (class AA streams) or 200 CFU/100 ml (class A streams)(DOE Standards)

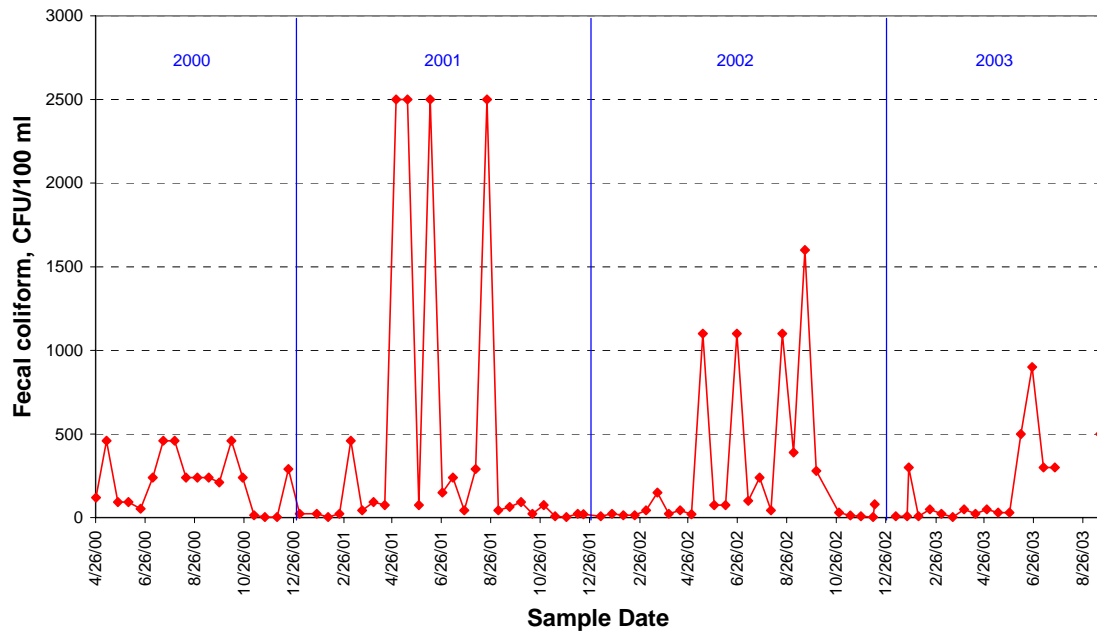
Colony Creek at Blanchard - Site 1
Fecal coliform



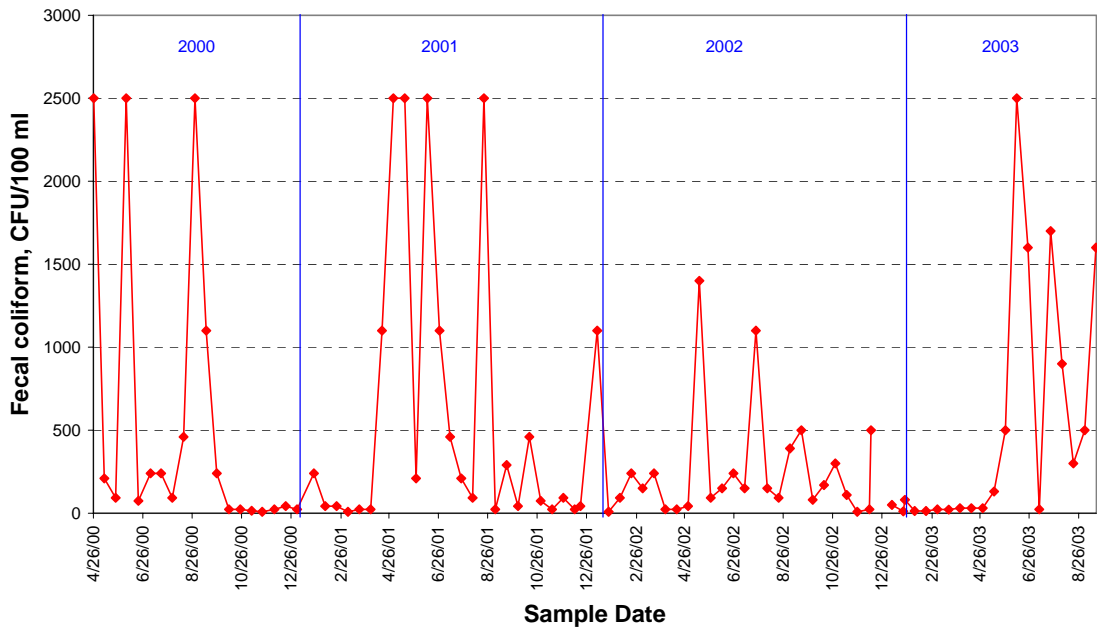
Samish River at Chuckanut Dr - Site 2
Fecal coliform



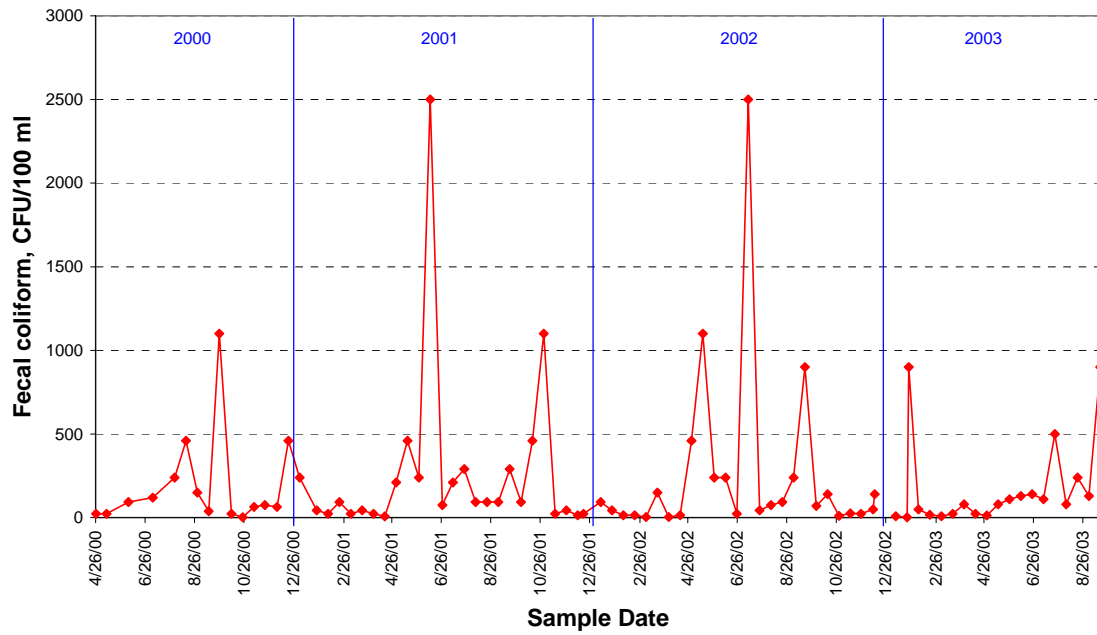
Thomas Creek at Hwy 99 - Site 3 Fecal coliform



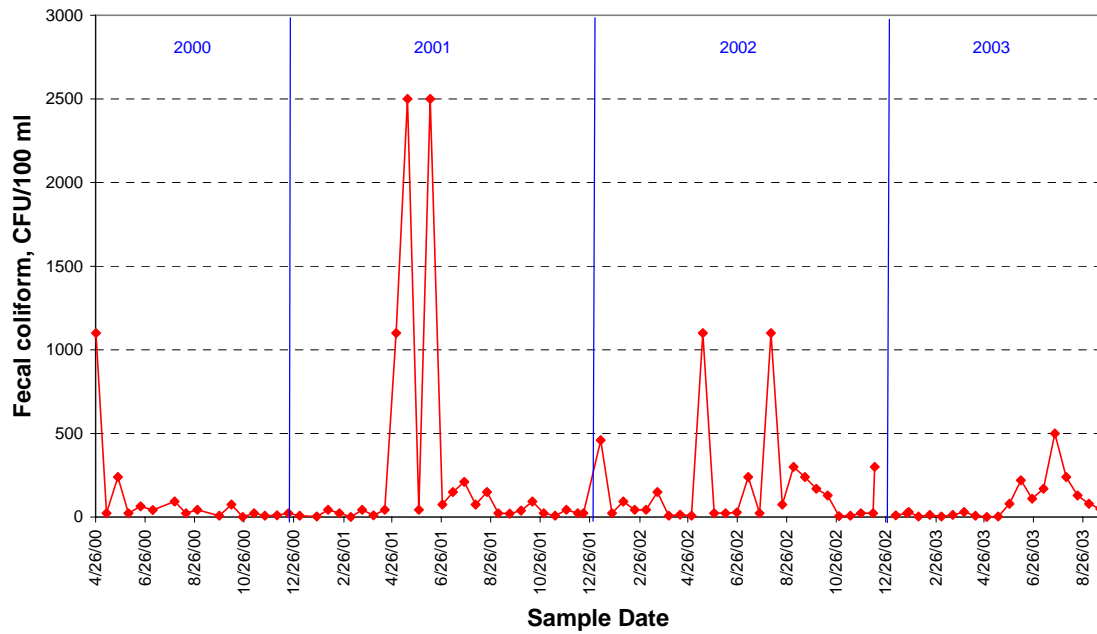
Thomas Creek at F&S Grade Rd - Site 4 Fecal coliform



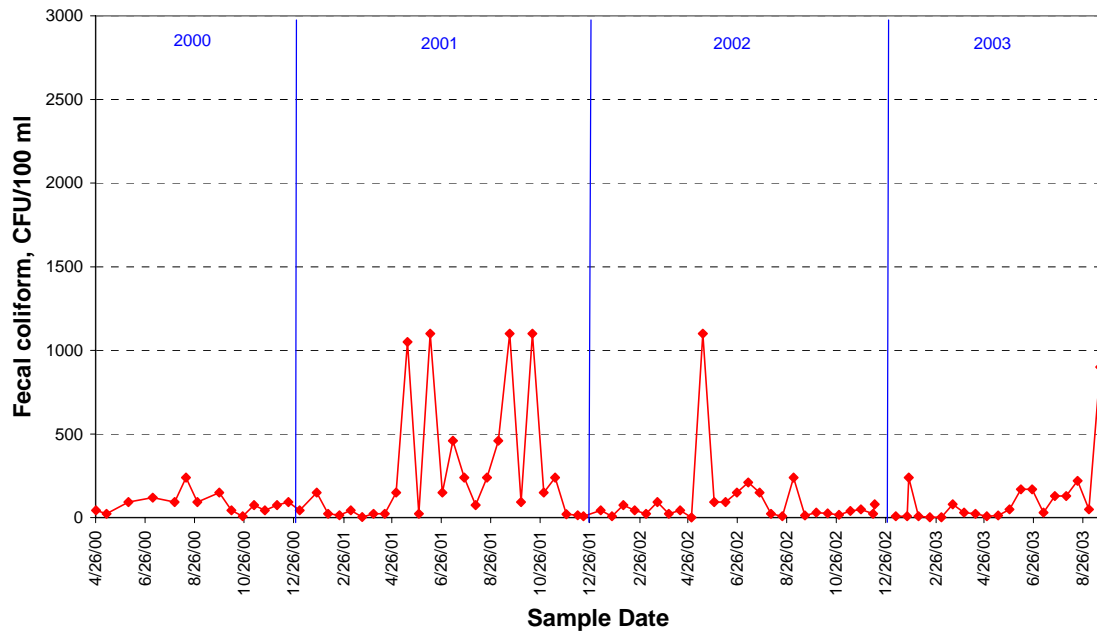
Samish River at Hwy 99 - Site 5
Fecal coliform



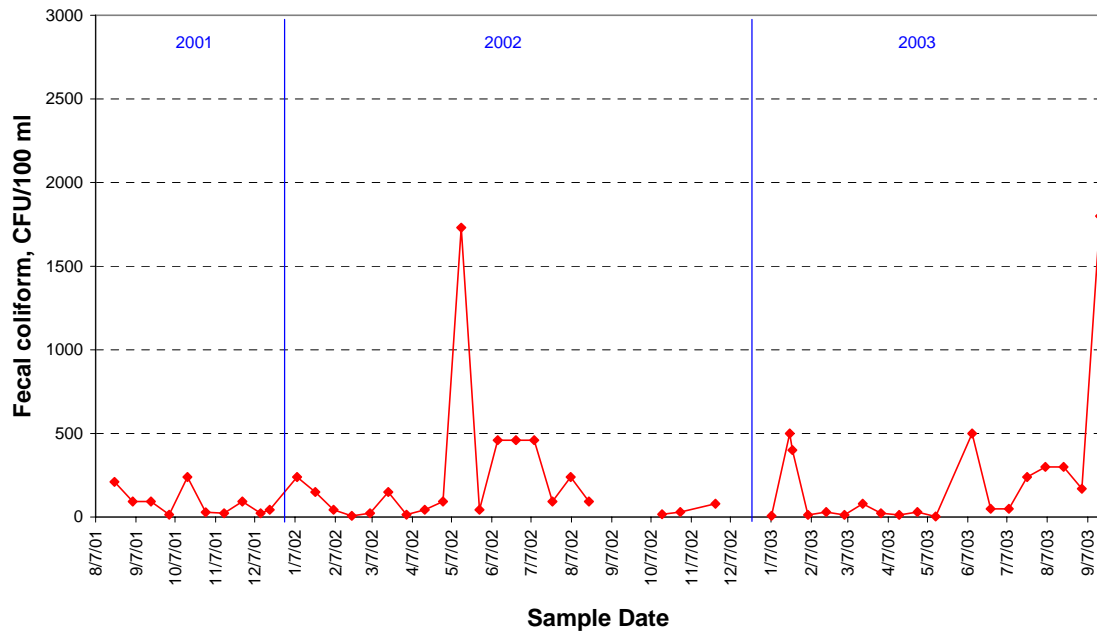
Friday Creek at Prairie Rd - Site 6
Fecal coliform



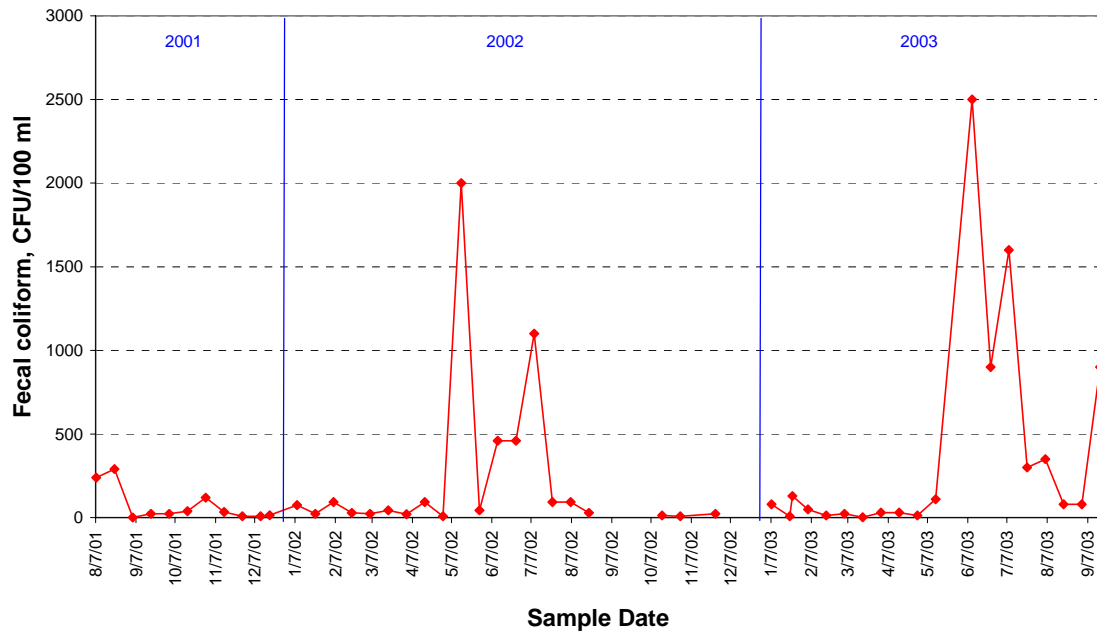
Samish River at F&S Grade Rd - Site 7
Fecal coliform



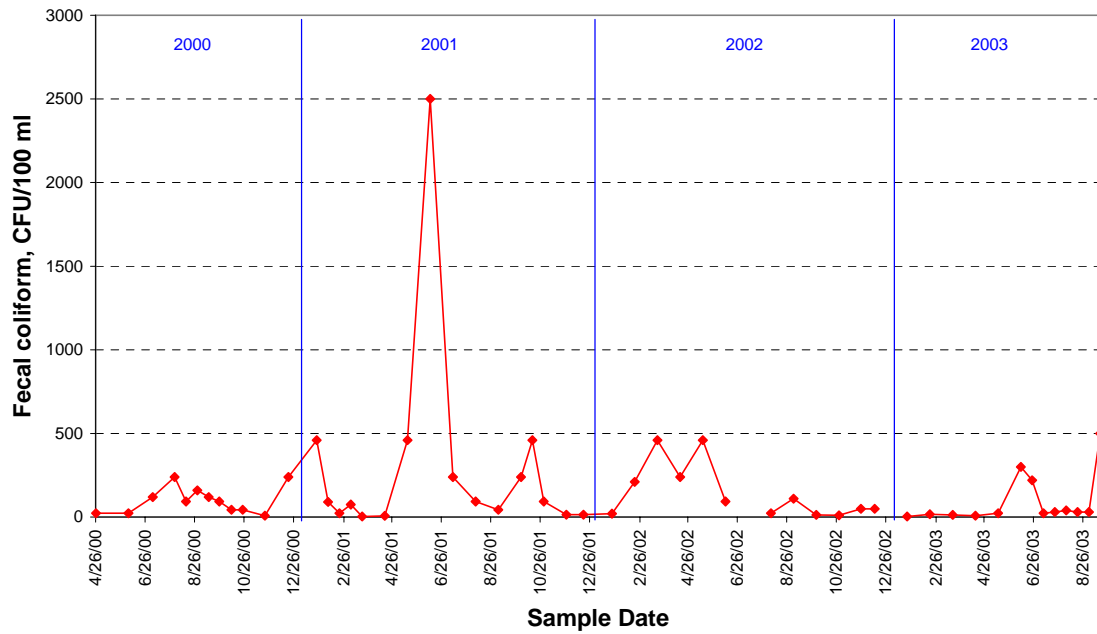
Swede Creek at Grip Rd - Site 8
Fecal coliform



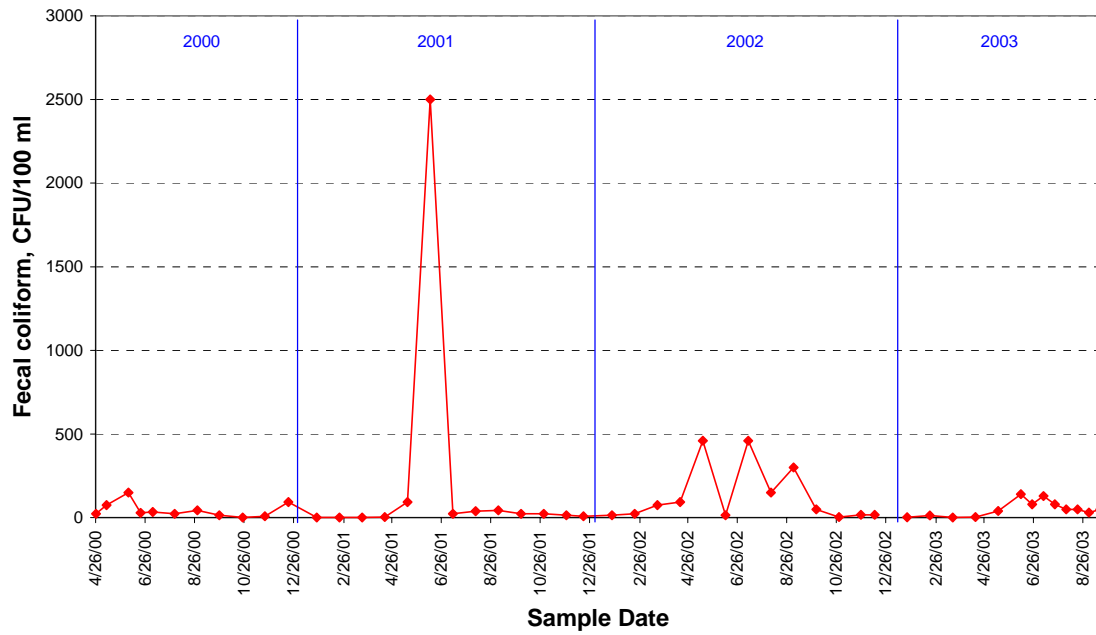
Skarrup Creek at Double Creek Ln - Site 9 Fecal coliform



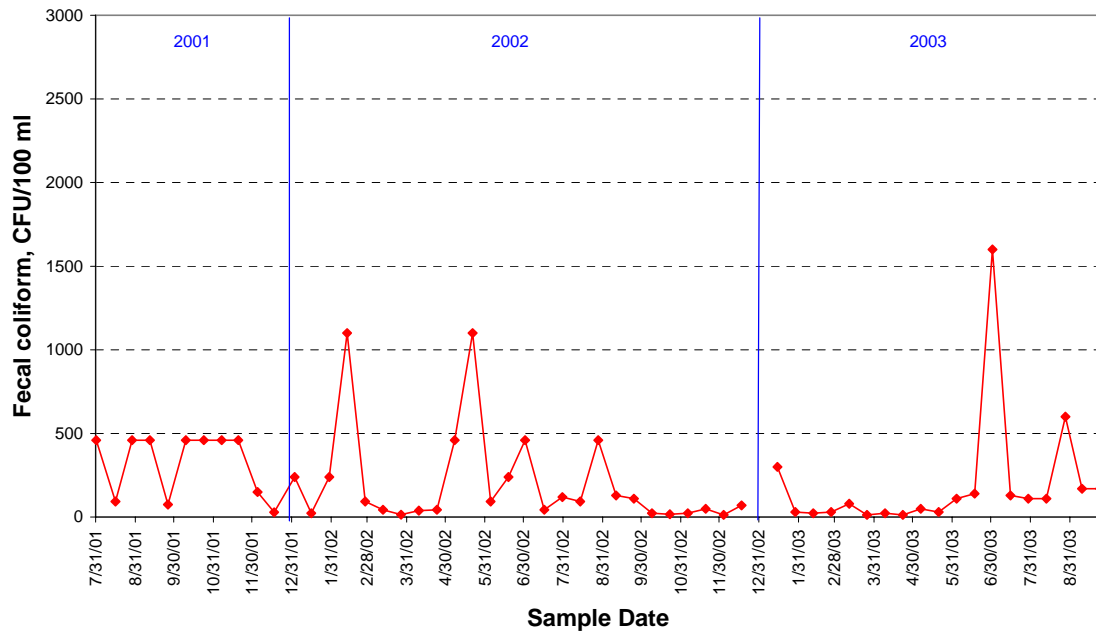
Samish River at Prairie Rd - Site 10 Fecal coliform



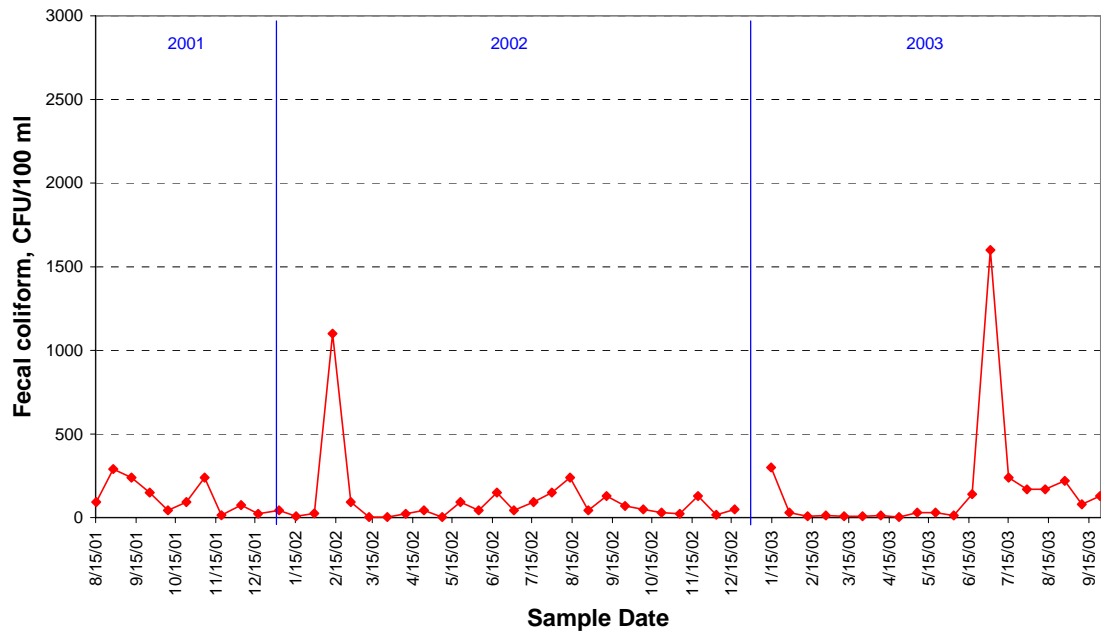
Samish River at Hwy 9 - Site 11 Fecal coliform



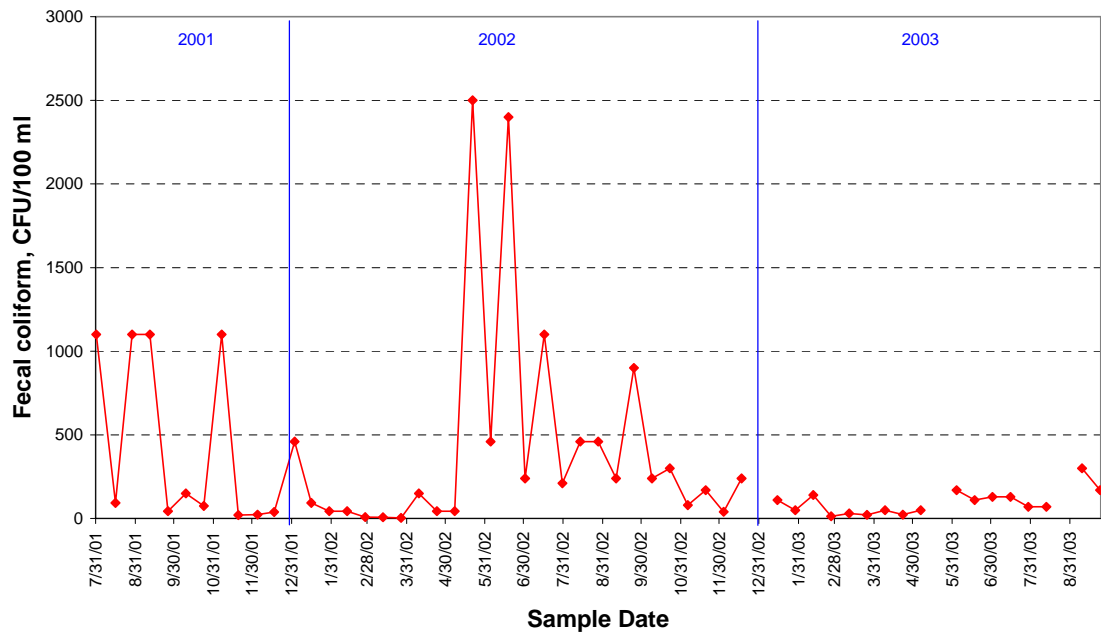
Nookachamps Creek at Swan Rd - Site 12 Fecal coliform



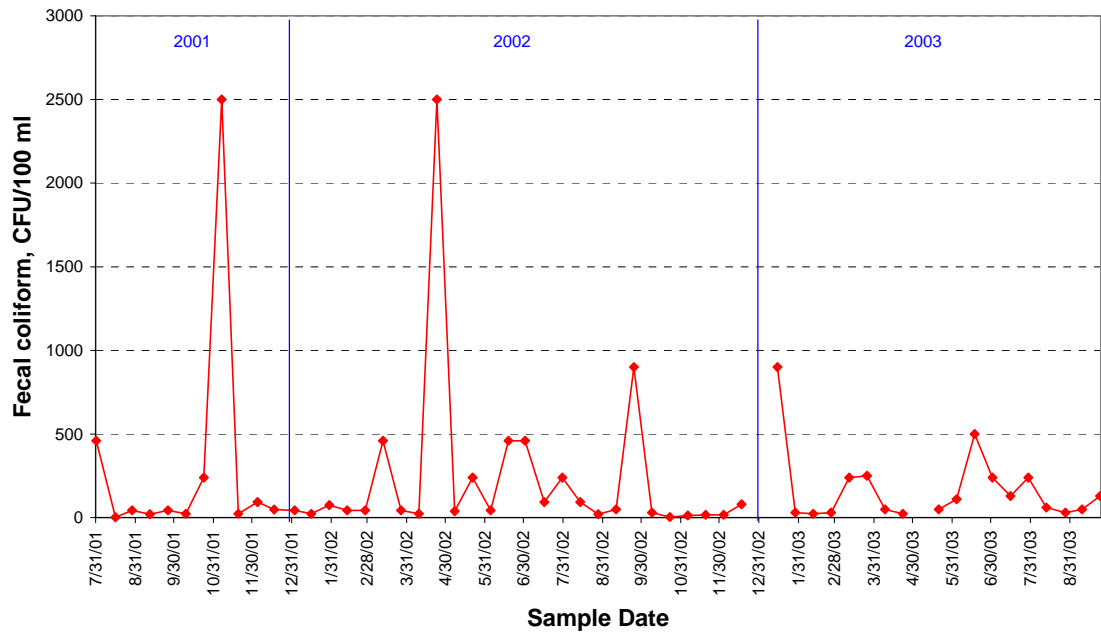
E.F. Nookachamps Creek at Hwy 9 - Site 13
Fecal coliform



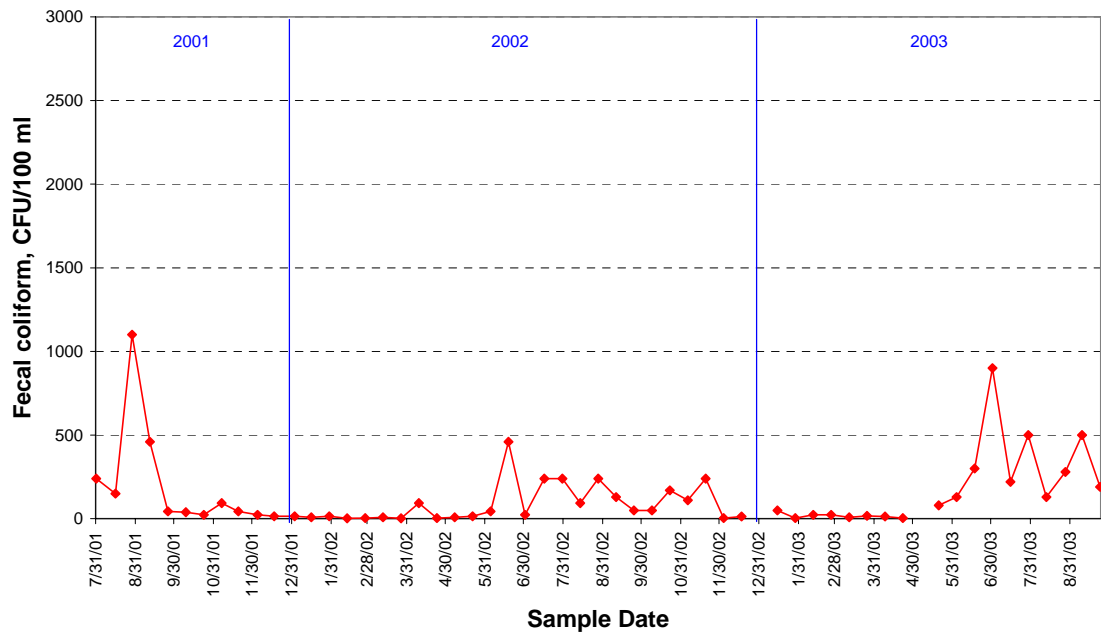
College Way Creek at College Wy - Site 14
Fecal coliform



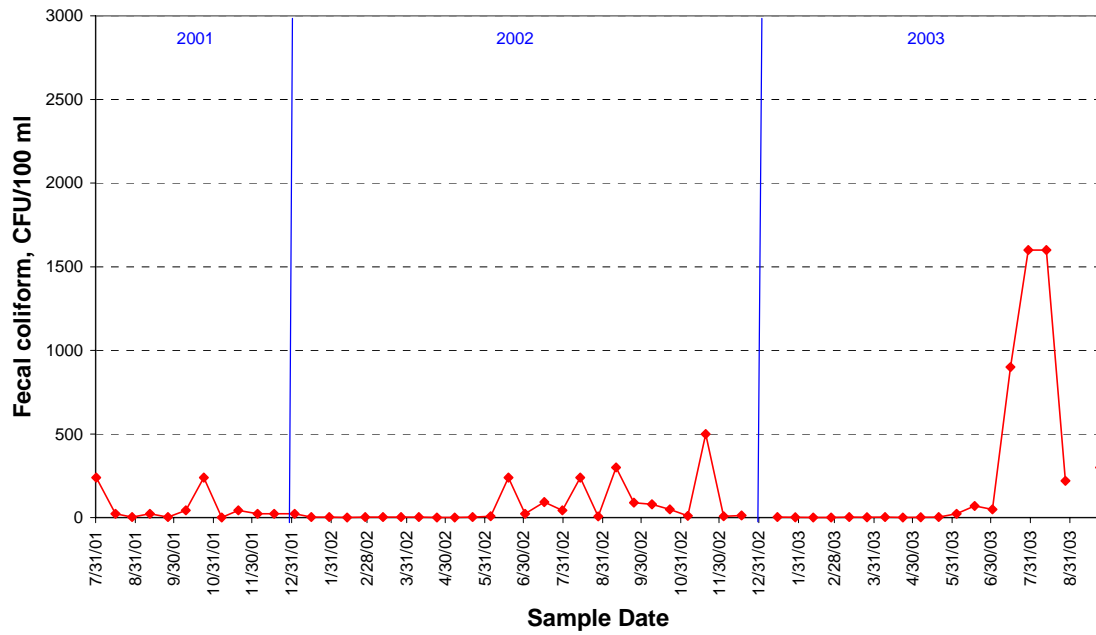
Nookachamps Creek at Knapp Rd - Site 15 Fecal coliform



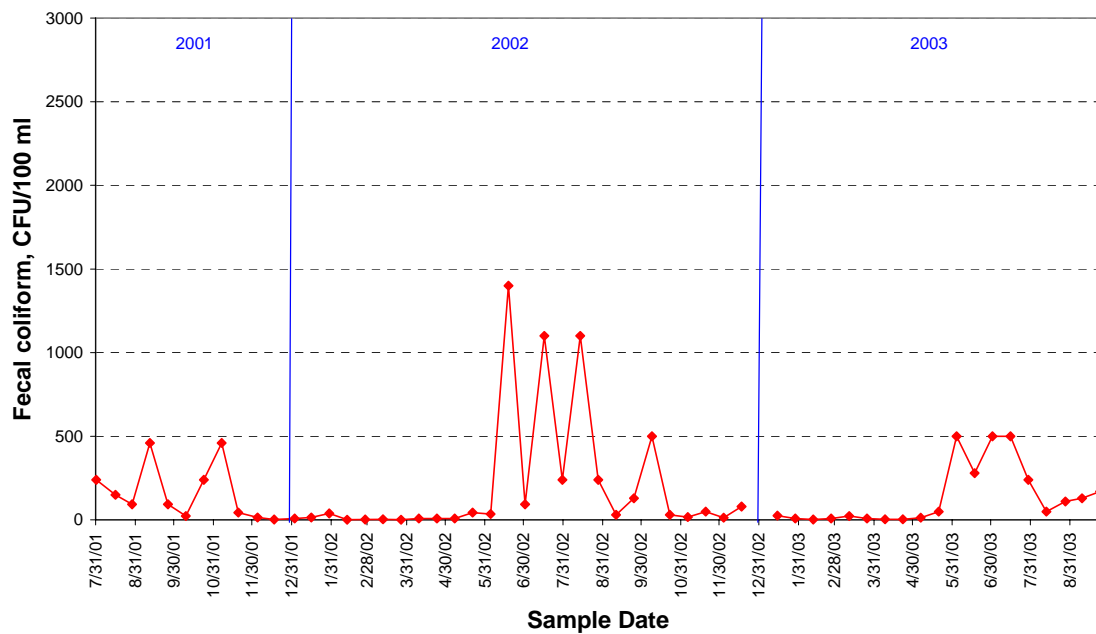
E.F. Nookachamps Creek at Beaver Lk Rd - Site 16 Fecal coliform



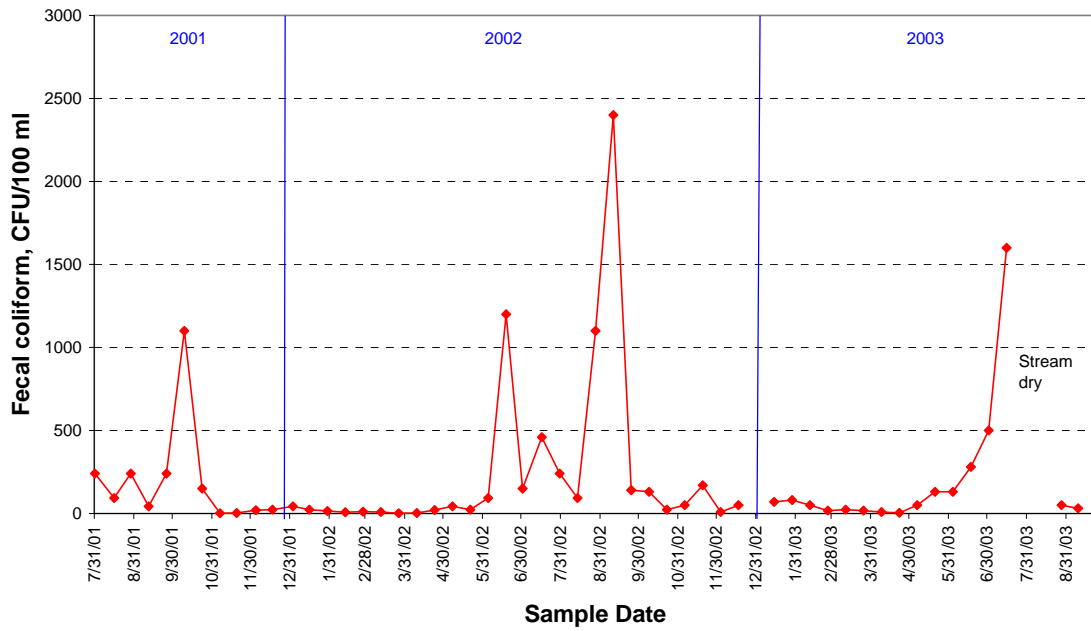
Nookachamps Creek at Big Lake Outlet - Site 17 Fecal coliform



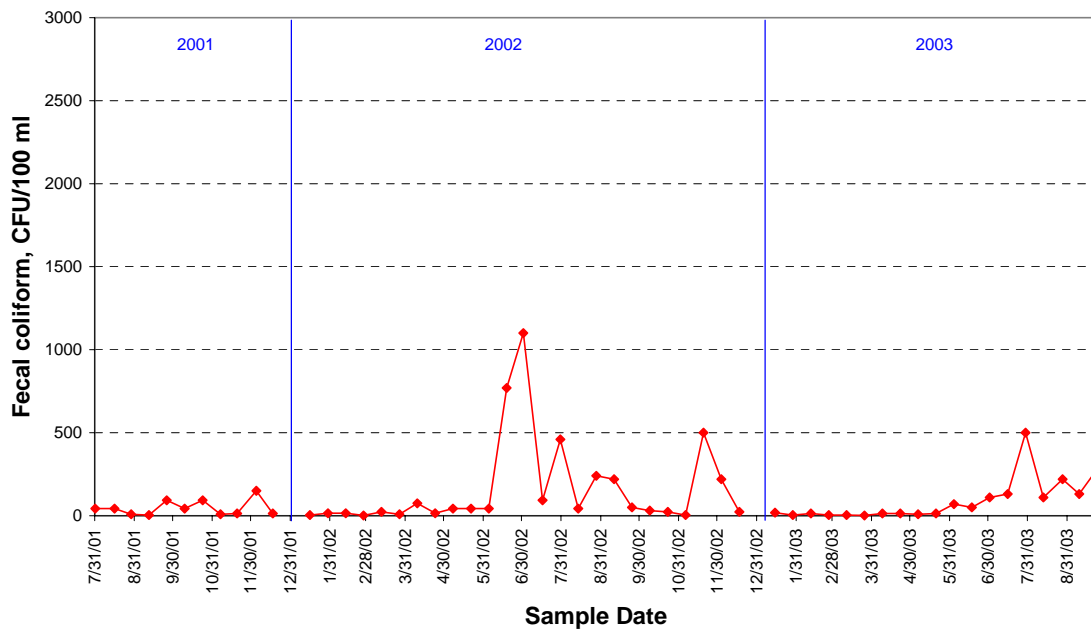
Lake Creek at Hwy 9 - Site 18 Fecal coliform



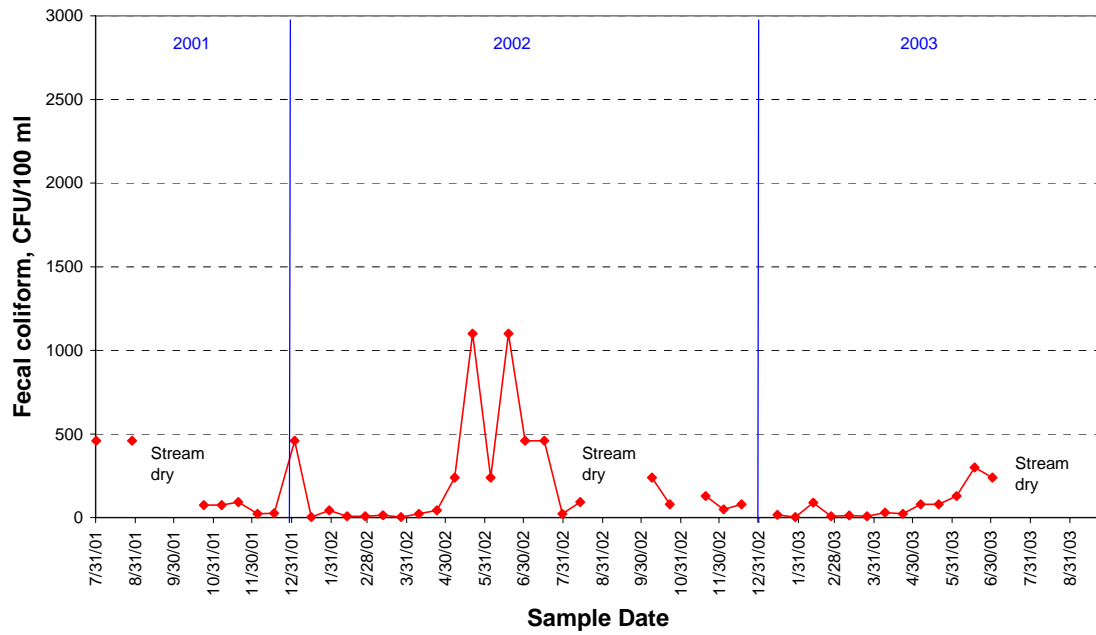
Hansen Creek at Hoehn Rd - Site 19 Fecal coliform



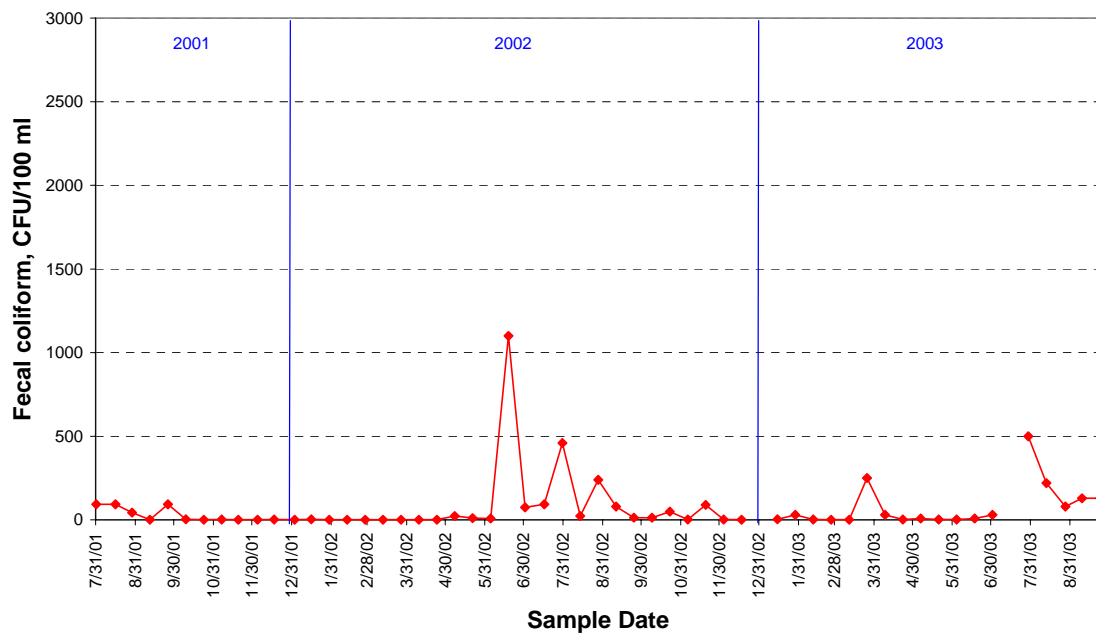
Hansen Creek at Northern State Hospital - Site 20 Fecal coliform



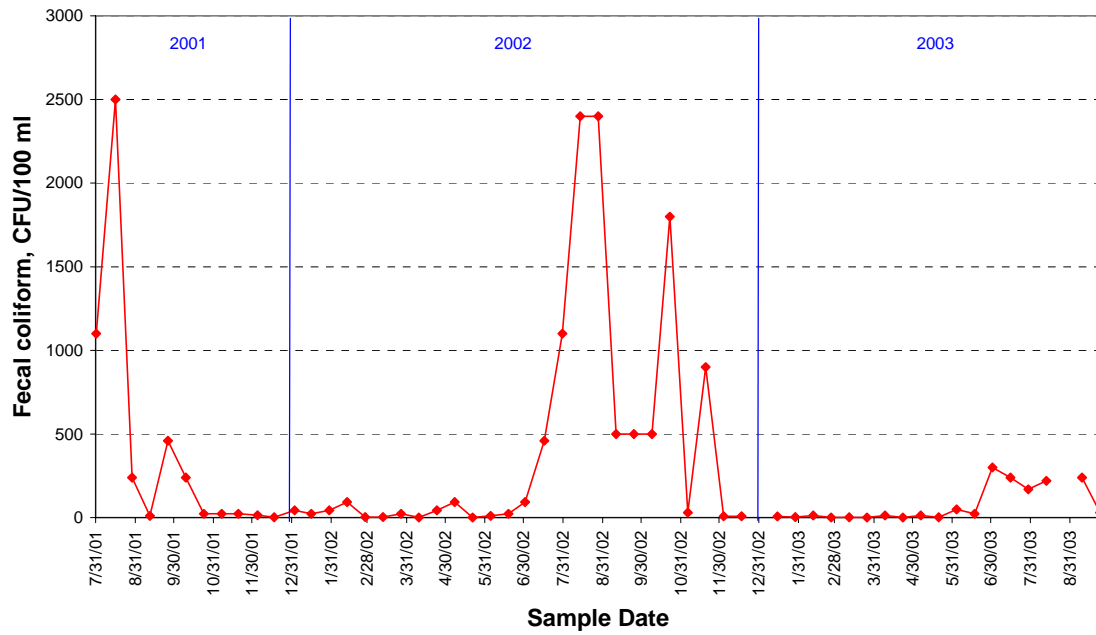
Coal Creek at Hoehn Rd - Site 21 Fecal coliform



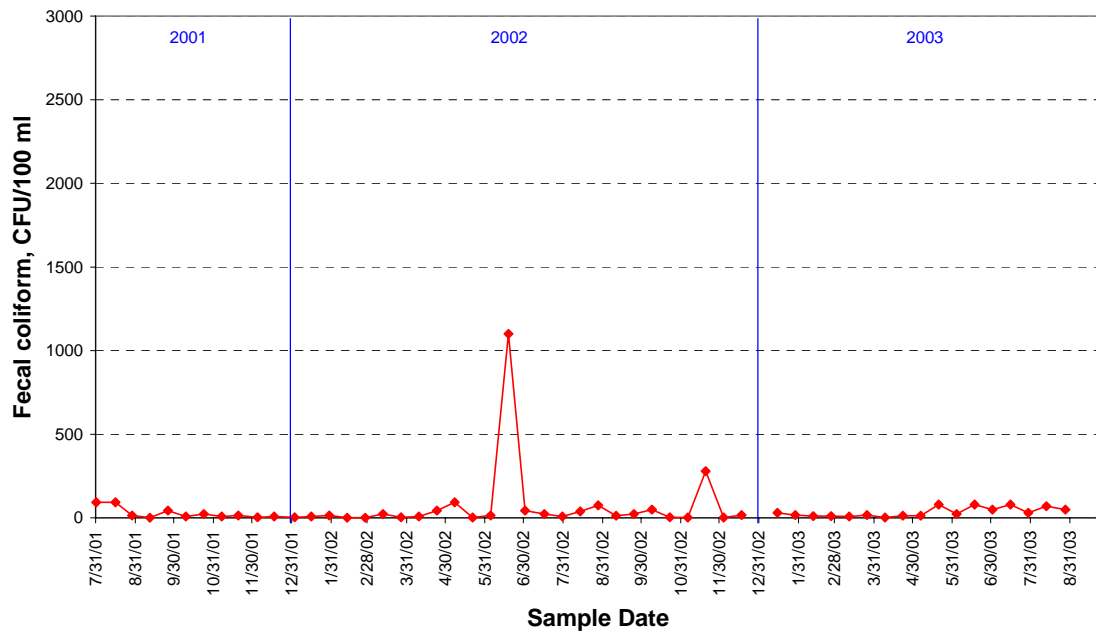
Coal Creek at Hwy 20 - Site 22 Fecal coliform



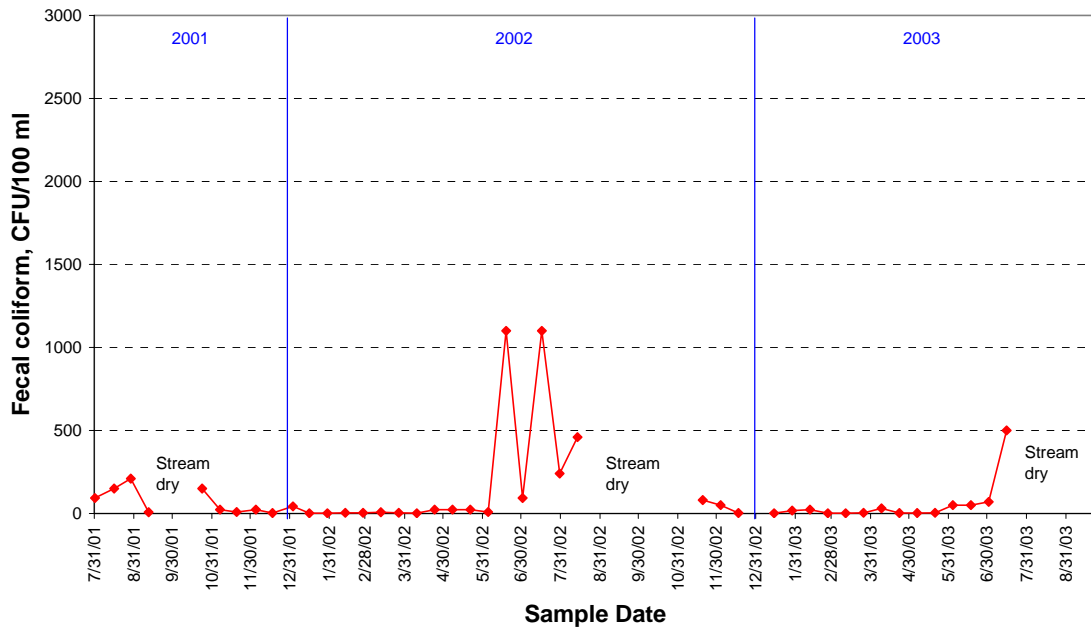
Wiseman Creek at Minkler Rd - Site 23 Fecal coliform



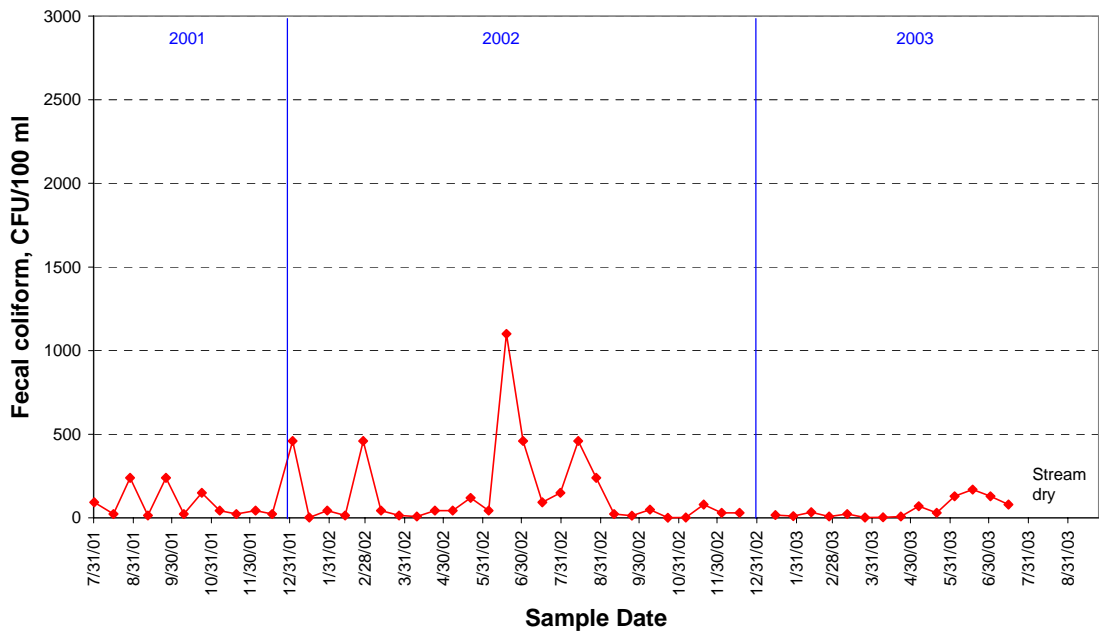
Mannser Creek at Lyman-Hamilton Hwy - Site 24 Fecal coliform



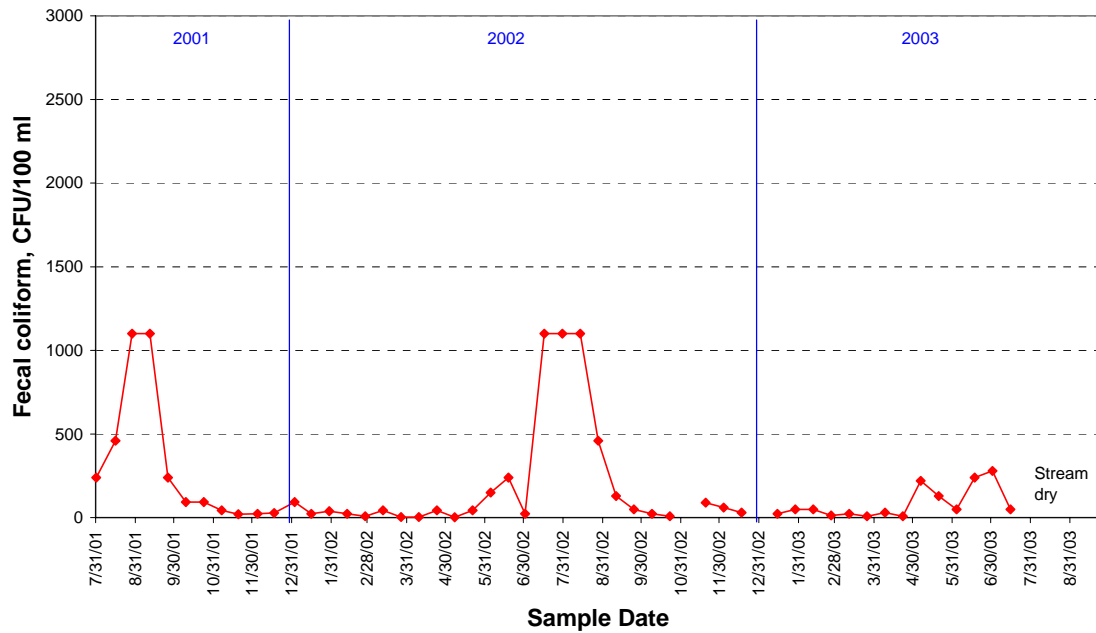
Red Cabin Creek at Hamilton Cemetery Rd - Site 25
Fecal coliform



Morgan Creek at South Skagit Hwy - Site 26
Fecal coliform



Morgan Creek at Walberg Rd - Site 27 Fecal coliform



Nutrients

Samples for determination of plant nutrients were taken once every four weeks at each sample station. Elevated levels of plant nutrients can cause excessive growth of algae and resultant fluctuations in DO and pH that can adversely affect aquatic organisms. There are no state standards for plant nutrients except for ammonia toxicity, but reduction of nutrient levels can be mandated if a stream is subject to a Total Maximum Daily Load (TMDL) study for related parameters. Total nitrogen and phosphorus levels in Baseline Monitoring streams are summarized in Table 5. Detailed nutrient reports can be found for each sample in Appendix A.

Ammonia toxicity standard calculations are complicated and the level considered toxic varies for each combination of temperature and pH. Spot comparisons of a few Baseline data points with state standards revealed that streams in this study may occasionally exceed ammonia standards. Ammonia levels were determined only on streams that were also part of the Samish Bay study.

Table 5. Total nitrogen and phosphorus levels in streams in
Skagit County, Washington Baseline Monitoring Project

<u>Stream</u>	<u>Site No.</u>	<u>Total Nitrogen¹</u>		<u>Total Phosphorus</u>	
		<u>Mean</u>	<u>Max</u>	<u>Mean</u>	<u>Max</u>
Colony Creek at Blanchard Rd	1	0.9	2.0	0.1	0.6
Samish River at Chuckanut Rd	2	0.4	1.8	0.0	0.4
Thomas Creek at Hwy 99	3	0.6	1.4	0.1	0.3
Thomas Creek at F&S Rd	4	0.4	3.3	0.1	0.4
Samish River at Hwy 99	5	0.2	0.9	0.1	0.4
Friday Creek at Prairie Rd	6	0.2	0.7	0.0	0.3
Samish River at F&S Rd	7	0.3	1.0	0.1	0.5
Swede Creek at Grip Rd	8	0.5	1.0	0.0	0.5
Skarrup Creek at Double Creek Ln	9	0.4	0.8	0.0	0.2
Samish River at Prairie Rd	10	0.1	0.6	0.1	0.5
Samish River at Hwy 9	11	0.1	0.7	0.0	0.3
Nookachamps Creek at Swan Rd	12	0.4	1.0	0.0	0.3
E. F. Nookachamps Cr. at Hwy 9	13	0.3	0.7	0.0	0.1
College Way Creek at College Wy	14	0.5	0.9	0.0	0.2
Nookachamps Creek at Knapp Rd	15	0.5	2.4	0.1	0.4
E. F. Nookachamps Cr. at Beaver Lk Rd	16	0.2	0.7	0.1	1.2
Nookachamps Cr. at Hwy 9	17	0.3	0.9	0.0	0.7
Lake Creek at Hwy 9	18	0.2	0.5	0.0	0.4
Hansen Creek at Hoehn Rd	19	0.2	0.8	0.0	0.2
Hansen Creek at Northern State	20	0.2	0.6	0.0	0.2
Coal Creek at Hoehn Rd	21	0.3	1.3	0.0	0.1
Coal Creek at Hwy 20	22	0.2	1.4	0.0	0.3
Wiseman Creek at Minkler Rd	23	0.2	1.1	0.0	0.4
Mannser Creek at Lyman-Hamilton Hwy	24	0.2	0.9	0.0	0.2
Red Cabin Creek at Hamilton Cem Rd	25	0.2	0.6	0.0	0.2
Morgan Creek at Walberg Rd	26	0.3	0.6	0.0	0.2
Morgan Creek at S. Skagit Hwy	27	0.4	0.9	0.0	0.3

¹Total Kjeldahl Nitrogen

Note: All quantities in mg/L

Summary and Conclusions

The Baseline Monitoring Project collected water quality data in and around the agricultural areas of Skagit County for over two years. This information provides a basis for comparison for future assessments of water quality in those areas, and also provides an indication of the current state of water quality in Skagit County's agricultural areas.

The data collected indicated that streams in Skagit County do not always meet state water quality standards. Most streams meet most of the standards most of the time, but during critical low summer flows temperature and dissolved oxygen can fall short of the

standards. Fecal coliform levels fluctuate greatly throughout the year, and only two streams met the state standard for fecal coliform.

The data also indicate that each stream must be considered separately, as blanket statements will not accurately characterize individual streams. For example, Mannser Creek did not exceed the state water quality standard for temperature at any time during this study, yet it consistently did not meet the standard for dissolved oxygen. In Red Cabin Creek, the next stream to the east, the dissolved oxygen standard was met during each visit but the stream occasionally exceeded temperature standards.

There is little evidence of any strong trends in water quality from the Baseline Project. Differences in climate between the years of the study appear to be a major factor in influencing temperature maximums and dissolved oxygen minimums for many streams. A longer period of monitoring and more sophisticated methods will be required to identify trends independent of seasonal variation. Skagit County intends to conduct more formal trends analysis with the recently-implemented Skagit County Monitoring Program (Skagit County 2003b).

Nineteen of the 27 sample locations in the Baseline Project are included in the Skagit County Monitoring Program. This Program will continue to track water quality in Skagit County agricultural areas for at least six years. This body of data, along with the Baseline Project data, should allow an indication of trends in water quality that bridge differences in yearly climate.

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Skagit County. 2001. "Skagit County Ag Land Stream Buffer Program: Watershed Scale Baseline Monitoring Plan." Skagit County Public Works Department, Planning and Permit Center, GIS Department, and Pentec Environmental.

Skagit County. 2003a. "Samish Bay Watershed Water Quality Monitoring Project, Final Report." Skagit County Public Works Department.

Skagit County. 2003b. "Skagit County Water Quality Monitoring Program Quality Assurance Project Plan," Skagit County Public Works Department.

Williams, K. 1999. "Water Quality Monitoring Technical Guide Book, Version 2.0." The Oregon Plan for Salmon and Watersheds.