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STATE OF WASHINGTON

DEPARTMENT OF ECOLOGY

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MEMORANDUM

October 29, 1986

To: Dave Wright

From: John Bernhardt JB

Subject: Granite Falls Receiving Water Survey

ABSTRACT

The Pilchuck River, Gardener Creek, and Gardener Lake were surveyed during 1980 and 1983 to evaluate water quality benefits resulting from a major sewer rehabilitation project at Granite Falls. Construction of a new wastewater collection system eliminated raw sewage discharges to Gardener Creek. Water quality in the creek improved markedly as a result, as indicated by reductions in fecal coliform bacteria, nutrients, oxygen-demanding substances, and other pollutants. Similar but less apparent improvements were observed in Gardener Lake. The second part of the rehabilitation project involved upgrading the municipal treatment plant from primary to secondary treatment. Chlorine toxicity was eliminated as a problem for aquatic life in the Pilchuck River. Other improvements also were noted.

INTRODUCTION

An Ecology Class II facility inspection performed at Granite Falls wastewater treatment plant (WTP) in 1980 showed the facility was antiquated, experiencing serious operational problems, and producing a poor-quality effluent (Yake, 1980). As a result, over the next two years, some 2.5 million dollars were expended upgrading the treatment plant and constructing new wastewater collection system for the community. The rehabilitation project was completed in late 1982. A follow-up inspection performed by Ecology in 1983 showed substantially improved conditions at the treatment plant (Kiernan, 1983).

Intensive surveys were conducted in the Pilchuck River, Gardener Creek, and Gardener Lake before and after the upgrade and new construction. The purpose was to document environmental benefits resulting from the monies spent. The survey results are presented in this report.

LOCATION AND DESCRIPTION

Granite Falls is a community of 925 located in Snohomish County about 15 miles east of Everett. The treatment plant is located downgradient and about 1/4 mile southwest of town near the Pilchuck River (Figure 1). It discharges to the river at river mile (R.M.) 21.7 (PNRBC, 1969).

The Pilchuck River is classified as Class AA waters according to the state water quality standards (State of Washington, 1982). Such waters should markedly and uniformly exceed the requirements for essentially all beneficial uses: water supply; stock watering; fish spawning, rearing, and migration; wildlife habitat; recreation; and navigation. Gardener Creek and Gardener Lake both fall into the same classification. Further information regarding water quality standards applicable to these waters is given in the appendix.

Water quality indices developed by Ecology for the years 1980 and 1984 provide a general indication of existing conditions in the Pilchuck River:

Table 1. Water quality indices* for the Pilchuck River.

Year	Temp.	Diss. Oxygen	pH	Bac-teria	Troph.	Aesthe-tics	Susp. Solids	Ammonia	Overall
1980	25	8	7	22	7	9	23	3	14
1984	18	8	7	29	6	16	15	1	16

*0 - 20, good; 20 - 60, marginal; greater than 60, unacceptable.
Sources: Singleton, 1981; Anonomous, 1984.

The indices were calculated using routine water quality monitoring data collected by Ecology from the Pilchuck River at Snohomish (Station #07B055), eight miles below Granite Falls. The overall ratings indicate water quality in the river is not pristine, but generally good, and similar to western Washington streams in general. High temperatures periodically are a problem during low summer flows. Bacteria concentrations become elevated during some periods, primarily due to agricultural runoff.

Since water quality for the Pilchuck River at Snohomish is influenced by a number of sources, site-specific sampling data are necessary to evaluate impacts of individual dischargers like the Granite Falls WTP.

At the time of the 1980 survey, two waters other than the Pilchuck River were receiving wastewaters from Granite Falls: Gardener Creek and Gardener Lake (Figure 1).

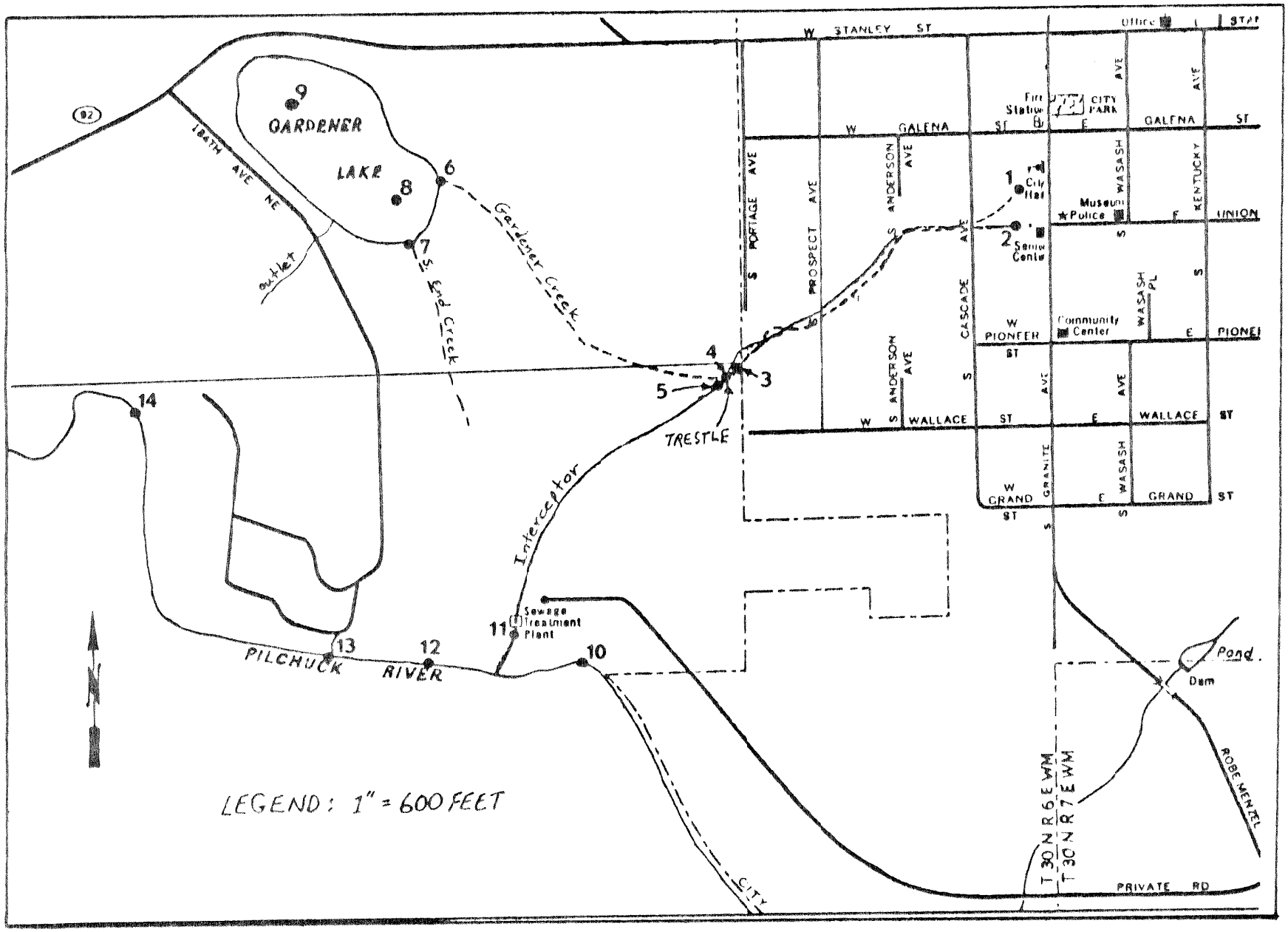


Figure 1. Map of southwest Granite Falls and Pilchuck River showing sites sampled during WDOE intensive water quality survey

METHODS

The receiving water surveys were performed during August 26-27, 1980, and August 2-3, 1983. Sampling was performed at the 14 stations shown in Figure 1. Parametric coverage included:

Field	Laboratory
flow	biochemical oxygen demand
pH	chemical oxygen demand
specific conductivity	fecal coliform
temperature	nutrients (5)
dissolved oxygen	solids (4)
total residual chlorine	turbidity
	chlorophyll a
	pheophytin a

All samples were surface water.

Flow was measured using a Marsh-McBirney magnetic flow meter. Temperature, pH, and specific conductivity were measured in the field by probe. Dissolved oxygen was determined from field samples using the Azide Modification of the Winkler Method (APHA, 1980). A DPD field kit (LaMotte) was used to measure total residual chlorine. Samples for laboratory analyses were packed in ice, as required, and transported to the Ecology Environmental Laboratory. All analyses were performed using procedures outlined in Standard Methods (Ibid.) or Methods for the Examination of Water and Wastes (EPA, 1979).

All analyses were not performed at every station during both surveys. Detailed information concerning the sampling schedule and parametric coverage is given in Table 2.

In addition to the water quality sampling, the Granite Falls interceptor line, Lake Gardener and Creek, and the Pilchuck River were surveyed for visual evidence of pollution.

Effluent loads for selected parameters were calculated for the treatment plant before and after the upgrade.

RESULTS AND DISCUSSION

The results are presented in three sections: (1) visual stream survey, (2) water quality sampling, and (3) pollutant loadings.

Visual Stream Survey

Gardener Creek originates within the city limits of Granite Falls (Figure 1). The creek initially follows the same route as the main interceptor to the treatment plant, but before reaching the plant, arcs to the northwest and

Table 2. Sampling schedule for Granite Falls STP receiving water survey, August 26-27, 1980, and August 2-3, 1983.

Sample	Stn. No.	Date Sampled	Time	Flow	pH	Cond.	Temp.	D.O.	T.R. Chlorine	BOD_5	COD	F. Coli.	Nutr. (5)	TKN	Solids (4)	Turb.	Chl *a*	Pheo *a*
Gardener Creek at Headwaters near City Hall	1	8/27/80	1000	X	X	X	X	X		X	X	X	X	X	X	X		
		8/03/83		*														
Gardener Creek at wet well where three drain tiles converge	2a	8/27/80	0930	X	X	X	X	X		X	X	X	X	X	X	X		
	2b	8/27/80	0930	X	X	X	X	X		X	X	X	X	X	X	X		
	2c	8/27/80	0930	X	X	X	X	X			X	X	X			X		
	2a	8/03/83		*														
	2b	8/03/83		*														
	2c	8/03/83		*														
Gardener Creek above textile pipe leak	3	8/27/80	1210	X	X	X	X	X			X	X	X			X		
		8/03/83	1209			X	X	X										
Textile pipe leak at trestle	4	8/27/80	1212	X	X	X	X	X			X	X	X			X		
Gardener Creek below trestle	5	8/27/80	1215	X	X	X	X	X		X	X	X	X	X	X	X		
Gardener Creek at Gardener Lake	6	8/27/80	1245	X	X	X	X	X		X	X	X	X		X	X		
		8/03/83	1322		X	X	X	X										
South End Creek	7	8/27/80	1230	X	X	X		X			X	X	X			X		
		8/03/83	1334		X	X	X	X										
Gardener Lake near south end	8	8/27/80	1330		X	X	X	X		X	X	X	X	X	X	X	X	X
		8/03/83	1347		X	X	X	X										
Gardener Lake near north end	9	8/27/80	1400		X	X	X	X		X	X	X	X	X	X	X	X	X
		8/03/83	1351		X	X	X	X										
Pilchuck River 400 feet above WTP	10	8/27/80	1430	X	X	X	X	X		X	X	X	X		X	X		
		8/03/83	0908	X	X	X	X	X										
Granite Falls WTP	11	8/27/80	1615	X	X	X	X	X	X	X	X	X	X		X	X		
		8/03/83	0908	X	X	X	X		X									
Pilchuck River 200 feet below WTP	12	8/27/80	1550		X	X	X	X	X	X	X	X	X		X	X		
		8/03/83	1040		X	X	X	X	X									
Pilchuck River 750 feet below WTP	13	8/27/80	1700	X	X	X	X	X			X	X	X			X		
		8/03/83	1002	X	X	X	X	X	X									
Pilchuck River 2,400 feet below WTP	14	8/27/80	1800		X	X	X	X			X	X	X			X		
		8/03/83	1250		X	X	X	X										

*No flow.

continues for approximately 1,500 feet to Gardener Lake. In 1980 the interceptor was buried beneath or along the creek channel, with some sections of pipe exposed, apparently as a result of long-term erosion.

The interceptor between Granite Falls and the treatment plant was a major problem in 1980. A large number of breaks, cracks, and separations were visible along exposed sections of the pipeline, particularly in the vicinity of South Portage Avenue (Figure 1). Raw wastewater was seen intermixing freely with the creek in some areas, indicating grossly polluted conditions and a threat to public health. The odor of sewage was present in some areas. Children were seen playing along the creek near South Portage Avenue, and a well-worn trail followed the route of the interceptor. At times the interceptor essentially became the trail as it provided a convenient walkway for crossing bog areas and wide spots in the creek.

There was no evidence of infiltration/exfiltration problems affecting Gardener Creek during the 1983 inspection. The interceptor was buried for its entire length.

Lake Gardener is relatively small and shallow, with small inflow and outflow streams. Such lakes typically are susceptible to pollution. The lake was visibly enriched in 1980, with algal mats observed in some areas, and poor water clarity. Raw wastewater was observed reaching the lake.

There was no visual evidence of pollution problems in the Pilchuck River during 1980 or 1983. This was an expected outcome since the dilution ratios (river flow:treatment plant flow) during the two surveys were relatively high, at 104:1 and 253:1, respectively. Receiving water impacts usually are not readily visible in such cases, except possibly near the point of discharge.

The fact that some of the wastewaters were not passing through the treatment plant may have minimized visual impacts on the Pilchuck River in 1980. As previously mentioned, a portion of the waste stream was diverted to Gardener Creek. Also, a portion of the influent stream was bypassing to sludge drying beds and subsequently discharging to the river upstream of the outfall (Yake, 1980). This latter circumstance did not change the amount of wastewater discharged to the river, but near-field effects are less apparent in cases where portions of a discharge enter a stream at several locations.

Water Quality Sampling

The results of the water quality sampling data collected during 1980 and 1983 are presented in Tables 3 and 4. These data indicate the new construction and plant upgrade markedly improved the quality of the receiving environment. Specific findings for the three receiving waters follow.

Table 3. Summary of sampling data collected during Granite Falls (Pilchuck River) receiving water survey, August 27, 1980.

Stn. No.	Description		Field							Laboratory																	
			Time	Flow (cfs)	Temperature (°C)	pH (S.U.)	Spec. Cond. (µmhos/cm)	T. Resid. Chlorine (mg/L)	Dissolved Oxygen (mg/L)	pH (S.U.)	Spec. Cond. (µmhos/cm)	Turbidity (NTU)	BOD (mg/L)	COD (mg/L)	Fecal Coliform (col/100 mL)	Ammonia-N (mg/L)	Nitrite-N (mg/L)	Nitrate-N (mg/L)	T. Kjeldahl-N (mg/L)	Orthophosphate-P (mg/L)	T. Phosphate-P (mg/L)	Total Solids (mg/L)	TNVS (mg/L)	T. Susp. Solids (mg/L)	TNVSS (mg/L)	Chlorophyll a (µg/L)	Pheophytin a (µg/L)
1	Gardener Creek at Headwaters near City Hall		1000	0.044	13.0	6.6	129	--	7.1	6.6	130	1	<4	12	280	0.04	<0.01	1.5	0.04	<0.01	0.05	110	82	3	1	--	--
2	Gardener Creek at wet well where three drain tiles converge	Tile A	0930	0.15	15.0	7.0	209	--	4.9	7.1	241	25	32	140	3,000,000 1/	5.8	<0.25	1.2	8.0	1.3	2.2	240	100	<1	<1	--	--
		Tile B	0930	0.02	18.0	7.3	254	--	6.4	7.3	316	36	85	150	5,000,000 1/	10.8	<0.25	1.0	22.0	2.5	4.2	320	140	130	15	--	--
		Tile C	0930	0.004	16.0	--	145	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
3	Gardener Creek below South Portage Avenue		1210	0.14	13.0	7.0	91	--	8.5	7.1	102	25	--	160	2,500	0.06	<0.01	0.59	--	0.08	0.19	--	--	--	--	--	--
4	Textile pipe leak at trestle		1212	0.02	16.0	6.6	65	--	5.0	7.4	110	220	--	14	740,000 1/	2.8	<0.20	1.60	--	<0.01	2.5	--	--	--	--	--	--
5	Gardener Creek below trestle		1215	0.16	13.0	6.9	95	--	6.9	6.8	75	34	14	170	390,000 1/	0.81	0.01	0.65	5.0	0.26	0.67	310	160	200	92	--	--
6.	Gardener Creek at Gardenar Lake		1245	0.32	13.3	7.3	96	--	7.5	7.3	102	15	<10	53	10,700	0.11	<0.01	1.2	--	0.06	0.06	160	100	56	--	--	--
7	South End Creek		1230	0.54	--	6.7	82	--	9.7	6.8	81	3	--	43	2,100	0.03	<0.01	0.01	--	0.02	0.07	--	--	--	--	--	--
8	Gardener Lake near south end		1330	--	20.0	7.0	94	--	8.0	7.5	84	3	5	43	460	<0.01	<0.01	0.01	0.61	<0.01	0.07	99	53	2	<1	78	1.6
9	Gardener Lake near north end		1400	--	20.0	7.1	84	--	7.5	7.2	83	2	<4	37	260	<0.01	<0.01	0.01	0.60	<0.01	0.06	110	62	4	<1	22	3.5
10	Pilchuck R 100 feet above WTP		1430	49.7	15.0	7.2	73	--	11.2	7.8	80	1	<4	4	51	<0.01	<0.01	<0.01	--	<0.01	<0.01	69	32	5	<1	--	--
11	Granite Falls WTP		1615	0.48 2/	14.8	7.0	246	3.4; 2.7	5.8			40	26	141	13; 1460 1/	8.4	<0.01	0.60	--	1.6	3.1	230	142	54	21	--	--
12	Pilchuck River 450 feet below WTP		1550	--	14.7	7.5	80	0.048	10.9	7.8	80	1	<4	10	65 1/	0.05	<0.01	0.08	--	<0.01	0.3	75	39	5	<1	--	--
13	Pilchuck River 750 feet below WTP		1700	50.02 3/	15.0	7.7	81	--	10.7	7.7	80	1	--	6	75 1/	0.08	<0.01	0.11	--	<0.01	0.04	--	--	--	--	--	--
14	Pilchuck River 2,300 feet below WTP		1800	--	15.0	7.4	79	--	10.5	7.7	80	1	--	8	160	0.05	<0.01	0.13	--	<0.01	0.03	--	--	--	--	--	--

1/ Non-ideal count (estimate).
2/ Instantaneous flow measurement made when receiving water samples collected.
3/ Calculated based on Pilchuck River flow 100 feet above Granite Falls WTP + WTP effluent.

Table 4. Summary of sampling data collected during Ecology's Granite Falls (Pilchuck River) receiving water survey, August 2, 1983.

Stn. No.	Description	Field							Laboratory															
		Time	Flow (cfs)	Temperature (°C)	pH (S.U.)	Spec. Cond. (µmhos/cm)	T. Resid. Chlorine (mg/L)	Dissolved Oxygen (mg/L)	pH (S.U.)	Spec. Cond. (µmhos/cm)	Turbidity (NTU)	BOD (mg/L)	COD (mg/L)	Fecal Coliform (col/100 mL)	Ammonia-N (mg/L)	Nitrite-N (mg/L)	Nitrate-N (mg/L)	Orthophosphate-P (mg/L)	T. Phosphate-P (mg/L)	Total Solids (mg/L)	TNVS (mg/L)	T. Susp. Solids (mg/L)	TNVSS (mg/L)
3	Gardener Creek blw S. Portage Ave.	1209	--	14.0	--	137	--	8.1	7.0	119	2	--	14	23	0.02	0.02	0.72	0.02	0.02	90	60	4	2
6	Gardener Creek at Gardener Lake	1322	--	14.2	6.7	96	--	10.6	7.3	92	4	--	23	130	0.02	0.02	0.92	0.02	0.02	120	71	6	4
7	South End Creek	1334	--	14.8	6.3	109	--	2.2	6.7	84	2	--	18	2,700[1/]	0.27	0.01	0.24	0.06	0.07	78	39	4	2
8	Gardener Lake near south end	1347	--	23.0	6.4	98	--	9.7	7.5	68	1	--	32	10[1/]	<0.01	<0.01	0.09	<0.01	0.01	100	43	3	1
9	Gardener Lake near north end	1351	--	23.0	6.2	95	--	9.5	8.0	76	1	--	32	13[1/]	0.01	<0.01	0.07	<0.01	0.01	110	43	4	2
10	Pilchuck River 100 feet above WTP	0830	47.9	13.8	6.5	76	--	10.8	7.5	56	1	--	9	39	<0.01	<0.01	0.21	<0.01	<0.01	59	31	2	<1
11	Granite Falls WTP effluent	0908	0.19[2/]	17.2	6.7	390	0.65	--	7.1	344	6	--	36	3[1/]	0.25	0.10	11.0	5.3	5.3	290	210	6	2
12	Pilchuck River 450 feet below WTP	1040	48.1[3/]	14.0	6.2	66	0.003[4/]	10.7	7.5	57	1	--	9	31	<0.01	<0.01	0.24	0.02	0.02	82	48	3	2
13	Pilchuck River 750 feet below WTP	1002	--	13.9	6.3	75	<0.1	10.7	7.5	58	1	--	9	24	<0.01	<0.01	0.21	<0.01	0.02	75	45	2	<1
14	Pilchuck River 2,300 feet below WTP	1250	--	14.2	6.1	70	--	10.8	7.5	58	1	--	18	23	<0.01	<0.01	0.20	<0.01	0.01	68	54	2	<1

1/ Non-ideal count (estimate).

2/ 0.121 MGD.

3/ Pilchuck River 100 feet above Granite Falls STP + STP effluent.

4/ Calculated value based on effluent measurement (0.65 mg/L) and ≥53:1 dilution ratio (river water:effluent).

Gardener Creek

The creek was grossly polluted at the time of the 1980 survey. About ten percent of the flow appeared to be raw sewage, judging from the observed pollutant concentrations. Exfiltration along the main interceptor appeared to be the primary cause. Fecal coliform counts in the creek were extremely high, constituting a public health hazard. A count of 390,000 (est.) colonies per 100 mL was observed immediately below the "old" trestle (Figure 1). The count dropped to 10,700 by the time the creek reached Lake Gardener.

For reference, Class AA waters in Washington State should not exceed 50 colonies FC bacteria per 100 mL, and not more than 10 percent of the samples should exceed 100 colonies per 100 mL (Appendix). Elevated FC counts indicate a potential for infectious or disease-causing organisms being present.

Concentrations of pollutants other than FC bacteria were elevated. Nutrient levels were high, the stream water was turbid, and excessive oxygen-demanding substances were present, as indicated by the COD, BOD, and solids sampling data.

In 1983, water quality was generally good and within the expected range for a small creek passing through a moderately urbanized area.

Gardener Lake

The lake measures about 500 feet long by approximately 5 feet deep (Figure 1). During the 1980 survey, Gardener Creek was flowing at 0.32 cfs while South End Creek measured 0.54 cfs. In 1983, flow was too low in either creek to accurately measure. The outlet stream on the west side of the lake was too small to measure flow during either year.

In 1980 the quality of the lake water was poor. The FC counts exceeded the Class AA water quality criterion, making the lake unsuitable for water-contact recreation. COD concentrations were elevated and algal productivity was extremely high. However, the poor condition of the lake could not be attributed entirely to Gardener Creek because waterfowl (fecal coliforms) and internal lake processes (algal productivity and chemical recycling) could have contributed.

Conditions improved in 1983 and the lake appeared to be suitable for water-contact recreation. Fecal coliforms were substantially lower than observed during 1980, and well within the water quality criteria. The waters were less turbid, dissolved oxygen was higher, and COD was lower. Again, these improvements could not be attributed solely to the pollution control projects at Granite Falls because of the above-cited limitations. However, judging from the small size and susceptibility of the lake, elimination of the raw wastewater component from Gardener Creek must be considered an important step forward.

Pilchuck River

Water quality improved between the two years, but not to the extent observed in Gardener Creek and Lake. The high dilution capacity of the river probably had a mitigating effect. Also, during 1980, adverse river impacts were probably lessened because some of the raw wastewater was diverted to Gardener Lake.

Fecal coliform counts in the river below the outfall were within acceptable limits during both years. In 1980, this may have been possible because the high concentration of total residual chlorine in the final effluent (3.4 mg/L and 2.7 mg/L for the two grab samples collected) had a disinfection effect. This did not consistently occur, as indicated by two effluent FC samples containing 13 and 1,460 (est.) FC/100 mL, respectively.

The high dose of chlorine in 1980 probably lowered public health concerns in the river. This was beneficial with respect to public health, a primary consideration. However, in achieving this end, total residual chlorine in the stream reached concentrations toxic to aquatic life. A concentration of 0.048 mg/L was detected 450 feet downstream of the outfall, exceeding the 0.019 mg/L acute toxicity criterion by about two-fold (EPA, 1985).

During 1983, total residual chlorine in the river fell within the acceptable range. Also, fecal coliforms were lower than 1980 and well within the water quality standard. Other parameters may have been lower in 1983, but the difference between the two years could be attributed to variance.

Pollutant Loadings

A primary objective of any treatment plant upgrade is to improve treatment efficiency. In doing so, the capacity of the plant to treat wastewaters is increased and the environment is better protected because the wasteload discharged to the receiving water is reduced. Increased treatment efficiency should result in a commensurate decrease in pollutant loads.

BOD and TSS are the two major parameters identified in the National Pollutant Discharge Elimination System (NPDES) waste discharge permit for Granite Falls WTP. The reduction for these two constituents was estimated to exceed 93 percent and 95 percent, respectively (Table 5).

For reference, effluent BOD monitoring provides a means to approximate the quantity of oxygen required to stabilize organic material present in a wastewater discharge. A reduction in BOD translates to a lower oxygen demand which, in turn, translates to higher dissolved oxygen levels in the receiving stream. In theory, the receiving stream is better able to support aquatic life when this is accomplished. Effluent TSS monitoring

Table 5. Comparison of treatment plant performance at Granite Falls STP during 1980 and 1983inspections performed by the Department of Ecology.

Parameter	1980[1/] Effluent[3/] (mg/L)	1980[1/] Effluent[3/] (lbs/day)	1983[2/] Effluent (mg/L)	1983[2/] Effluent (lbs/day)	Estimated Reduction in Effluent Load (lbs/day)	Estimated Reduction in Effluent Load % Change
NPDES Permit						
Biochemical Oxygen Demand	26	67	4.8	4.8	62.2	93
Total Suspended Solids	54	140	7	7.1	132.9	95
Chemical Oxygen Demand	141	364	32	32.3	331.7	91
Total Phosphate (as P)	3.1	8.0	5.6	5.6	7.2	30
Total Nitrogen (as N)	10	25.8	12.5	12.6	--	--
Total Residual Chlorine	3.1	8.0	1.2	1.2	6.8	85

1/ Source: Yake, 1980.
2/ Source: Kiernan, 1983.
3/ Effluent load (lbs/day) = mg/L x effluent flow/0.12.

provides an indication of the amount of organic and inorganic material present in a discharge. Excessive amounts entering a stream may wash up on the bank and decompose, creating odor problems, or settle to the bottom, covering fish spawning areas.

For BOD and TSS discharged from secondary treatment plants, Public Law 92-500 has established minimum effluent requirements for protecting the receiving stream (Table 6).

Table 6. Secondary effluent criteria for publicly owned treatment facilities.

Parameter	Monthly Average	Weekly Average	1983 Observed*
BOD (mg/L)	30	45	4.8
TSS (mg/L)	30	45	7.0

*Source: Composite sampling results; Kiernan, 1983.

Effluent concentrations observed during the 1983 survey were well within the acceptable limits.

SUMMARY AND DISCUSSION

Serious water quality problems existed in 1980 prior to the new construction and upgrade at Granite Falls WTP. The three affected water bodies included Gardener Creek, Lake Gardener, and the Pilchuck River.

In 1980, Gardener Creek was grossly polluted and concern existed with respect to both environmental quality and public health. Fecal coliform bacteria was the main problem with nutrients, turbidity, and other constituents also being concerns.

Gardener Lake appeared to be experiencing adverse environmental impacts similar in nature to the creek, but the impacts were less severe. The extent that wastewater from Granite Falls caused this problem could not be determined.

Chlorine toxicity was the main problem observed in the Pilchuck River. Other impacts were less evident, primarily because the river provides a large volume of water for dilution.

All of the above-cited problems were improved or resolved at the time of the 1983 survey.

Two parameters clearly show receiving water improvements: chemical oxygen demand (COD), and fecal coliform (FC) bacteria. The former is an indicator of the presence of oxygen-demanding substances. As previously stated, fecal coliforms relate to public health. COD and FC data collected from the treatment plant effluent and receiving waters during 1980 and 1983 are shown in Figures 2 and 3. Both parameters declined substantially in the final effluent following the new construction and plant upgrade. Similarly, lower concentrations were obseved in Gardener Creek and, to a lesser degree, Gardener Lake and the Pilchuck River.

JB:cp

Attachments

Figure 2. Chemical oxygen demand (mg/L) observed during Granite Falls receiving survey, 1980 and 1983

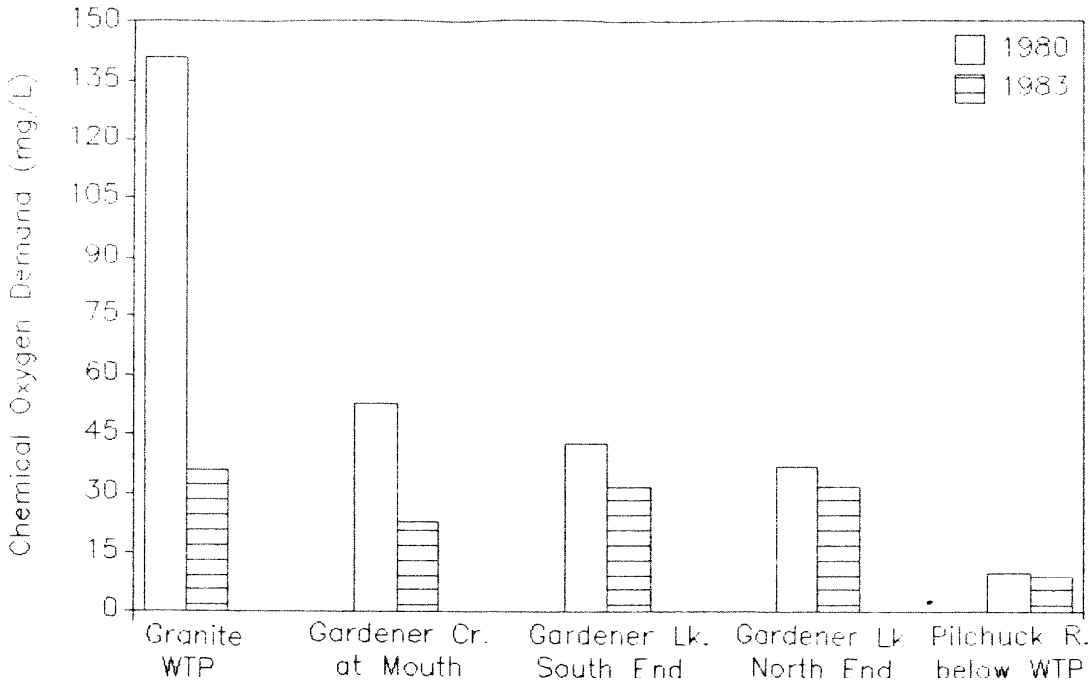
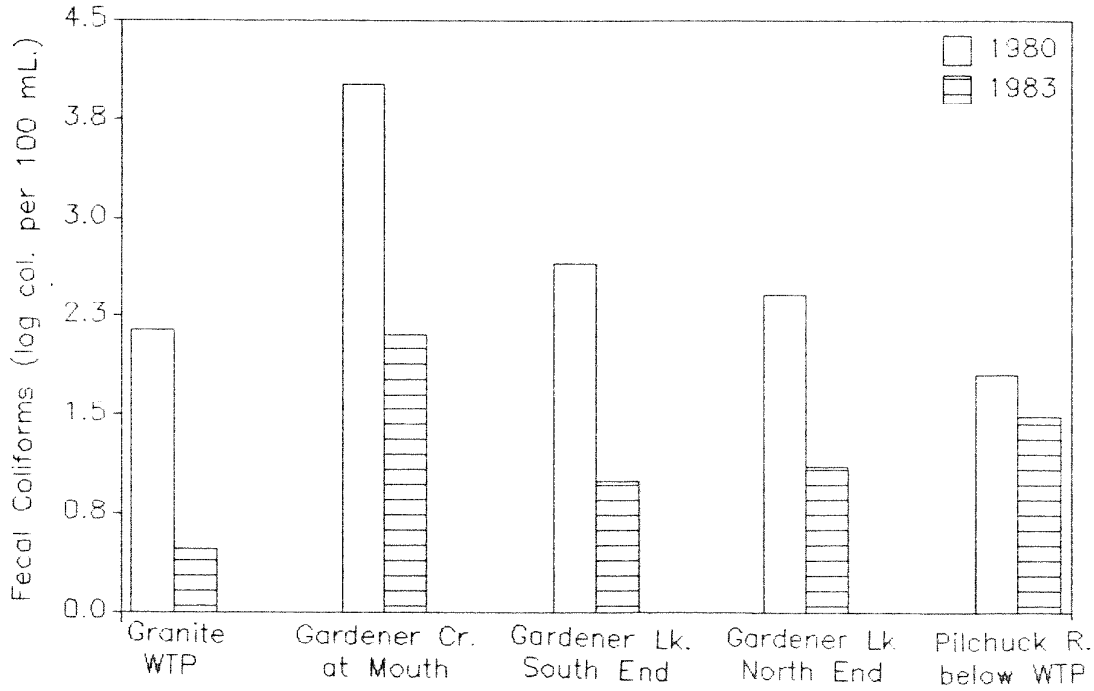


Figure 3. Fecal coliforms (log col. per 100 mL.) observed during Granite Falls recieving water survey, 1980 and 1983



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APPENDIX

Chapter 173-201 WAC
WATER QUALITY STANDARDS FOR WATERS OF THE STATE OF WASHINGTON

WAC

173-201-010 Introduction.
173-201-025 Definitions.
173-201-035 General considerations.
173-201-045 General water use and criteria classes.
173-201-070 General classifications.
173-201-080 Specific classifications—Freshwater.
173-201-085 Specific classifications—Marine water.
173-201-090 Achievement considerations.
173-201-100 Implementation.
173-201-110 Surveillance.
173-201-120 Enforcement.

DISPOSITION OF SECTIONS FORMERLY CODIFIED IN THIS CHAPTER

173-201-020 Water use and quality criteria. [Statutory Authority: RCW 90.48.035. 78-02-043 (Order DE 77-32), § 173-201-020, filed 1/17/78; Order 73-4, § 173-201-020, filed 7/6/73.] Repealed by 82-12-078 (Order DE 82-12), filed 6/2/82. Statutory Authority: RCW 90.48.035.

173-201-030 Water use and quality criteria—General water use and criteria classes. [Order 73-4, § 173-201-030, filed 7/6/73.] Repealed by 78-02-043 (Order DE 77-32), filed 1/17/78. Statutory Authority: RCW 90.48.035.

173-201-040 Water use and quality criteria—General considerations. [Order 73-4, § 173-201-040, filed 7/6/73.] Repealed by 78-02-043 (Order DE 77-32), filed 1/17/78. Statutory Authority: RCW 90.48.035.

173-201-050 Characteristic uses to be protected. [Statutory Authority: RCW 90.48.035. 78-02-043 (Order DE 77-32), § 173-201-050, filed 1/17/78; Order 73-4, § 173-201-050, filed 7/6/73.] Repealed by 82-12-078 (Order DE 82-12), filed 6/2/82. Statutory Authority: RCW 90.48.035.

173-201-060 Water course classification. [Order 73-4, § 173-201-060, filed 7/6/73.] Repealed by 78-02-043 (Order DE 77-32), filed 1/17/78. Statutory Authority: RCW 90.48.035.

173-201-130 Definitions. [Order 73-4, § 173-201-130, filed 7/6/73.] Repealed by 78-02-043 (Order DE 77-32), filed 1/17/78. Statutory Authority: RCW 90.48.035.

173-201-140 Miscellaneous. [Statutory Authority: RCW 90.48.035. 78-02-043 (Order DE 77-32), § 173-201-140, filed 1/17/78; Order 73-4, § 173-201-140, filed 7/6/73.] Repealed by 82-12-078 (Order DE 82-12), filed 6/2/82. Statutory Authority: RCW 90.48.035.

WAC 173-201-010 Introduction. (1) The purpose of this chapter is to establish water quality standards for surface waters of the state of Washington pursuant to the provisions of chapter 90.48 RCW and the policies and purposes thereof.

(2) This chapter shall be reviewed periodically by the department and appropriate revisions shall be undertaken.

(3) The water use and quality criteria set forth in WAC 173-201-035 through 173-201-085 are established in conformance with present and potential water uses of the surface waters of the state of Washington and in consideration of the natural water quality potential and limitations of the same. These shall be the sole criteria for said waters. [Statutory Authority: RCW 90.48.035. 82-12-078 (Order DE 82-12), § 173-201-010, filed 6/2/82; 78-02-043 (Order DE 77-32), § 173-201-010, filed 1/17/78; Order 73-4, § 173-201-010, filed 7/6/73.]

WAC 173-201-025 Definitions. (1) Background conditions: The biological, chemical, and physical conditions of a water body, upstream from the point or nonpoint source of any discharge under consideration. Background sampling location in an enforcement action would be upstream from the point of discharge, but not upstream from other inflows. If several discharges to any water body exist, and enforcement action is being taken for possible violations to the standards, background sampling would be undertaken immediately upstream from each discharge.

(2) Department: State of Washington department of ecology.

(3) Director: Director of the state of Washington department of ecology.

(4) Fecal coliform: That portion of the coliform group which is present in the intestinal tracts and feces of warm-blooded animals as detected by the product of acid or gas from lactose in a suitable culture medium within 24 hours at 44.5 plus or minus 0.2 degrees Celsius.

(5) Geometric mean: The nth root of a product of n factors.

(6) Mean detention time: The time obtained by dividing a reservoir's mean annual minimum total storage by the 30-day ten-year low-flow from the reservoir.

(7) Permit: A document issued pursuant to RCW 90.48.160 et seq. or RCW 90.48.260 or both, specifying the waste treatment and control requirements and waste discharge conditions.

(8) pH: The negative logarithm of the hydrogen ion concentration.

(9) Primary contact recreation: Activities where a person would have direct contact with water to the point of complete submergence, including but not limited to skin diving, swimming and water skiing.

(10) Secondary contact recreation: Activities where a person's water contact would be limited (wading or fishing) to the extent that bacterial infections of eyes, ears, respiratory or digestive systems or urogenital areas would normally be avoided.

(11) Surface waters of the state: Include lakes, rivers, ponds, streams, inland waters, saltwaters, and all other

surface waters and water courses within the jurisdiction of the state of Washington.

(12) Temperature: Water temperature expressed in degrees Celsius (°C).

(13) Turbidity: The clarity of water expressed as nephelometric turbidity units (NTU) and measured with a calibrated turbidimeter.

(14) Upwelling: The annual natural phenomenon where the summer prevailing, northerly winds parallel to Washington's coast produce a seaward transport of surface waters. Cold, deeper more saline waters rich in nutrients and low in dissolved oxygen rise to replace the surface water. The cold, oxygen deficient water flows into Puget Sound and other coastal estuaries replacing the deep water with lower dissolved oxygen concentrations reaching the surface during late summer and fall.

(15) USEPA: United States Environmental Protection Agency.

(16) Wildlife habitat: Waters of the state used by fish, other aquatic life and wildlife for any life history stage or activity. [Statutory Authority: RCW 90.48.035. 82-12-078 (Order DE 82-12), § 173-201-025, filed 6/2/82; 78-02-043 (Order DE 77-32), § 173-201-025, filed 1/17/78.]

WAC 173-201-035 General considerations. The following general guidelines shall apply to the water quality criteria and classifications set forth in WAC 173-201-045 through 173-201-085 hereof:

(1) At the boundary between waters of different classifications, the water quality criteria for the higher classification shall prevail.

(2) In brackish waters of estuaries, where the fresh and marine water quality criteria differ within the same classification, the criteria shall be interpolated on the basis of salinity; except that the marine water quality criteria shall apply for dissolved oxygen when the salinity is one part per thousand or greater and for fecal coliform organisms when the salinity is ten parts per thousand or greater.

(3) The water quality criteria herein established shall not apply within an authorized dilution zone adjacent to or surrounding a waste water discharge.

(4) Generally, waste discharge permits, whether issued pursuant to the National Pollutant Discharge Elimination System or otherwise, shall be conditioned in such manner as to authorize discharges which meet the water quality standards.

(a) However, persons discharging wastes in compliance with the terms and conditions of permits shall not be subject to civil and criminal penalties on the basis that discharge violates water quality standards.

(b) Permits shall be subject to modification by the department whenever it appears to the department the discharge violates water quality standards. Modification of permits, as provided herein, shall be subject to review in the same manner as originally issued permits.

(5) Nonpoint sources and water quality standards.

(a) It is recognized that many activities not subject to a waste discharge permit system are now being performed in the state, which result in conflicts with the water quality standards of this chapter. Further, the department has not developed a program which, in a reasonable or fully satisfactory manner, provides methods or means for meeting such standards. Persons conducting such activities shall not be subject to civil or criminal sanctions for violation of water quality standards if the activities are either:

(i) Conducted in accordance with management practices set forth by rules of the department.

For example, promulgation of regulations by the department which set forth approved management practices or other effluent limits shall be accomplished so that activities conducted within such regulations, (i.e., Forest Practices Rules and Regulations chapter 173-202 WAC and Title 222 WAC) will achieve compliance with water pollution control laws. When the regulations are violated, the water quality standard can be enforced as described in WAC 173-201-045 through 173-201-085; or,

(ii) Subject to a regulatory order issued by the department relating to specific activities as provided for in WAC 173-201-100(2).

(b) Management practices or regulatory orders described in WAC 173-201-035(5) hereof, shall be subject to modification by the department whenever it appears to the department that the discharge violates water quality standards. Modification of management practices or regulatory orders, as provided herein, shall be subject to review in the same manner as the originally issued management practices or regulatory orders.

(6) The water quality criteria herein established for total dissolved gas shall not apply when the stream flow exceeds the 7-day, 10-year frequency flood.

(7) The total area and/or volume of a receiving water assigned to a dilution zone shall be as described in a valid discharge permit as needed and be limited to that which will:

(a) Not cause acute mortalities of sport, food, or commercial fish and shellfish species of established biological communities within populations or important species to a degree which damages the ecosystem.

(b) Not diminish aesthetic values or other beneficial uses disproportionately.

(8) The antidegradation policy of the state of Washington, as generally guided by chapter 90.48 RCW, Water Pollution Control Act, and chapter 90.54 RCW, Water Resources Act of 1971, is stated as follows:

(a) Existing beneficial uses shall be maintained and protected and no further degradation which would interfere with or become injurious to existing beneficial uses will be allowed.

(b) No degradation will be allowed of waters lying in national parks, national recreation areas, national wildlife refuges, national scenic rivers, and other areas of national ecological importance.

(c) Whenever waters are of a higher quality than the criteria assigned for said waters, the existing water quality shall be protected and waste and other materials and substances shall not be allowed to enter such waters which will reduce the existing quality thereof, except, in those instances where:

(i) It is clear that overriding considerations of the public interest will be served, and

(ii) All wastes and other materials and substances proposed for discharge into the said waters shall be provided with all known, available, and reasonable methods of treatment before discharge.

(d) Whenever the natural conditions of said waters are of a lower quality than the criteria assigned, the natural conditions shall constitute the water quality criteria.

(e) The criteria and special conditions established in WAC 173-201-045 through 173-201-085 may be modified for a specific water body on a short-term basis when necessary to accommodate essential activities, respond to emergencies, or to otherwise protect the public interest. Such modification shall be issued in writing by the director or his designee subject to such terms and conditions as he may prescribe. The aquatic application of herbicides which result in water use restrictions shall be considered an activity for which a short-term modification generally may be issued subject to the following conditions:

(i) A request for a short-term modification shall be made to the department on forms supplied by the department. Such request generally shall be made at least thirty days prior to herbicide application.

(ii) Such herbicide application shall be in accordance with state of Washington department of agriculture regulations.

(iii) Such herbicide application shall be in accordance with label provisions promulgated by USEPA under the Federal Insecticide, Fungicide, and Rodenticide Act, as amended. (7 U.S.C. 136, et seq.)

(iv) Notice, including identification of the herbicide, applicator, location where the herbicide will be applied, proposed timing and method of application, and water use restrictions shall be given according to the following requirements:

(A) Appropriate public notice as determined and prescribed by the director or his designee shall be given of any water use restrictions specified in USEPA label provisions.

(B) The appropriate regional offices of the departments of fisheries and game shall be notified twenty-four hours prior to herbicide application.

(C) In the event of any fish kills, the departments of ecology, fisheries, and game shall be notified immediately.

(v) The herbicide application shall be made at times so as to:

(A) Minimize public water use restrictions during weekends.

(B) Completely avoid public water use restrictions during the opening week of fishing season, Memorial Day weekend, July 4 weekend, and Labor Day weekend.

(vi) Any additional conditions as may be prescribed by the director or his designee.

(f) In no case, will any degradation of water quality be allowed if this degradation interferes with or becomes injurious to existing water uses and causes long-term and irreparable harm to the environment.

(g) No waste discharge permit will be issued which violates established water quality criteria, except, as provided for under WAC 173-201-035(8)(c).

(9) Due consideration will be given to the precision and accuracy of the sampling and analytical methods used as well as existing conditions at the time, in the application of the criteria.

(10) The analytical testing methods for these criteria shall be in accordance with the most recent editions of "Standard Methods for the Examination of Water and Wastewater," published by the American Public Health Association, American Water Works Association, and the Water Pollution Control Federation, and "Methods for Chemical Analysis of Water and Wastes," published by USEPA, and other or superseding methods published and/or approved by the department following consultation with adjacent states and concurrence of the USEPA.

(11) Deleterious concentrations of radioactive materials for all classes shall be as determined by the lowest practicable concentration attainable and in no case shall exceed:

(a) 1/100 of the values listed in WAC 402-24-220 (Column 2, Table II, Appendix A, Rules and Regulations for Radiation Protection); or,

(b) USEPA Drinking Water Regulations for radionuclides, as published in the Federal Register of July 9, 1976, or subsequent revisions thereto.

(12) Deleterious concentrations of toxic, or other non-radioactive materials, shall be determined by the department in consideration of the Quality Criteria for Water, published by USEPA 1976, and as revised, as the authoritative source for criteria and/or other relevant information, if justified.

(13) Nothing in this chapter shall be interpreted to be applicable to those aspects of governmental regulation of radioactive wastes which have been preempted from state regulation by the Atomic Energy Act of 1954, as amended, as interpreted by the United States Supreme Court in the cases of Northern States Power Co. v. Minnesota 405 U.S. 1035 (1972) and Train v. Colorado Public Interest Research Group 426 U.S. 1 (1976).

(14) Nothing in this chapter shall be interpreted to prohibit the establishment of effluent limitations for the control of the thermal component of any discharge in accordance with Section 316 of the Federal Clean Water Act (P.L. 95-217 as amended). [Statutory Authority: RCW 90.48.035. 82-12-078 (Order DE 82-12), § 173-201-035, filed 6/2/82; 78-02-043 (Order DE 77-32), § 173-201-035, filed 1/17/78.]

WAC 173-201-045 General water use and criteria classes. The following criteria shall apply to the various classes of surface waters in the state of Washington:

(1) CLASS AA (EXTRAORDINARY).

(a) General characteristic. Water quality of this class shall markedly and uniformly exceed the requirements for all or substantially all uses.

(b) Characteristic uses. Characteristic uses shall include, but not be limited to, the following:

(i) Water supply (domestic, industrial, agricultural).

(ii) Stock watering.

(iii) Fish and shellfish:

Salmonid migration, rearing, spawning, and harvesting.

Other fish migration, rearing, spawning, and harvesting.

Clam, oyster, and mussel rearing, spawning, and harvesting.

Crustaceans and other shellfish (crabs, shrimp, crayfish, scallops, etc.) rearing, spawning, and harvesting.

(iv) Wildlife habitat.

(v) Recreation (primary contact recreation, sport fishing, boating, and aesthetic enjoyment).

(vi) Commerce and navigation.

(c) Water quality criteria.

(i) Fecal coliform organisms.

(A) Freshwater – Fecal coliform organisms shall not exceed a geometric mean value of 50 organisms/100 mL, with not more than 10 percent of samples exceeding 100 organisms/100 mL.

(B) Marine water – Fecal coliform organisms shall not exceed a geometric mean value of 14 organisms/100 mL, with not more than 10 percent of samples exceeding 43 organisms/100 mL.

(ii) Dissolved oxygen.

(A) Freshwater – Dissolved oxygen shall exceed 9.5 mg/L.

(B) Marine water – Dissolved oxygen shall exceed 7.0 mg/L . When natural conditions, such as upwelling, occur, causing the dissolved oxygen to be depressed near or below 7.0 mg/L, natural dissolved oxygen levels can be degraded by up to 0.2 mg/L by man–caused activities.

(iii) Total dissolved gas shall not exceed 110 percent of saturation at any point of sample collection.

(iv) Temperature shall not exceed 16.0° C (freshwater) or 13.0° C (marine water) due to human activities. Temperature increases shall not, at any time, exceed $t=23/(T+5)$ (freshwater) or $t=8/(T-4)$ (marine water).

When natural conditions exceed 16.0° C (freshwater) and 13.0° C (marine water), no temperature increase will be allowed which will raise the receiving water temperature by greater than 0.3° C.

For purposes hereof, "t" represents the permissive temperature change across the dilution zone; and "T" represents the highest existing temperature in this water classification outside of any dilution zone.

Provided that temperature increase resulting from nonpoint source activities shall not exceed 2.8° C, and the maximum water temperature shall not exceed 16.3° C (freshwater).

(v) pH shall be within the range of 6.5 to 8.5 (freshwater) or 7.0 to 8.5 (marine water) with a man–caused variation within a range of less than 0.2 units.

(vi) Turbidity shall not exceed 5 NTU 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.

(vii) Toxic, radioactive, or deleterious material concentrations shall be less than those which may affect public health, the natural aquatic environment, or the desirability of the water for any use.

(viii) Aesthetic values shall not be impaired by the presence of materials or their effects, excluding those of natural origin, which offend the senses of sight, smell, touch, or taste.

(2) CLASS A (EXCELLENT).

(a) General characteristic. Water quality of this class shall meet or exceed the requirements for all or substantially all uses.

(b) Characteristic uses. Characteristic uses shall include, but not be limited to, the following:

(i) Water supply (domestic, industrial, agricultural).

(ii) Stock watering.

(iii) Fish and shellfish:

Salmonid migration, rearing, spawning, and harvesting.

Other fish migration, rearing, spawning, and harvesting.

Clam, oyster, and mussel rearing, spawning, and harvesting.

Crustaceans and other shellfish (crabs, shrimp, crayfish, scallops, etc.) rearing, spawning, and harvesting.

(iv) Wildlife habitat.

(v) Recreation (primary contact recreation, sport fishing, boating, and aesthetic enjoyment).

(vi) Commerce and navigation.

(c) Water quality criteria.

(i) Fecal coliform organisms.

(A) Freshwater – Fecal coliform organisms shall not exceed a geometric mean value of 100 organisms/100 mL, with not more than 10 percent of samples exceeding 200 organisms/100 mL.

(B) Marine water – Fecal coliform organisms shall not exceed a geometric mean value of 14 organisms/100 mL, with not more than 10 percent of samples exceeding 43 organisms/100 mL.

(ii) Dissolved oxygen.

(A) Freshwater – Dissolved oxygen shall exceed 8.0 mg/L.

(B) Marine water – Dissolved oxygen shall exceed 6.0 mg/L . When natural conditions, such as upwelling, occur, causing the dissolved oxygen to be depressed near or below 6.0 mg/L, natural dissolved oxygen levels can be degraded by up to 0.2 mg/L by man–caused activities.

(iii) Total dissolved gas shall not exceed 110 percent of saturation at any point of sample collection.

(iv) Temperature shall not exceed 18.0° C (freshwater) or 16.0° C (marine water) due to human activities. Temperature increases shall not, at any time, exceed $t=28/(T+7)$ (freshwater) or $t=12/(T-2)$ (marine water).

When natural conditions exceed 18.0° C (freshwater) and 16.0° C (marine water), no temperature increase will be allowed which will raise the receiving water temperature by greater than 0.3° C.

For purposes hereof, "t" represents the permissive temperature change across the dilution zone; and "T" represents the highest existing temperature in this water classification outside of any dilution zone.

Provided that temperature increase resulting from nonpoint source activities shall not exceed 2.8° C, and the maximum water temperature shall not exceed 18.3° C (freshwater).

(v) pH shall be within the range of 6.5 to 8.5 (freshwater) or 7.0 to 8.5 (marine water) with a man-caused variation within a range of less than 0.5 units.

(vi) Turbidity shall not exceed 5 NTU 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.

(vii) Toxic, radioactive, or deleterious material concentrations shall be below those of public health significance, or which may cause acute or chronic toxic conditions to the aquatic biota, or which may adversely affect any water use.

(viii) Aesthetic values shall not be impaired by the presence of materials or their effects, excluding those of natural origin, which offend the senses of sight, smell, touch, or taste.

(3) CLASS B (GOOD).

(a) General characteristic. Water quality of this class shall meet or exceed the requirements for most uses.

(b) Characteristic uses. Characteristic uses shall include, but not be limited to, the following:

(i) Water supply (industrial and agricultural).

(ii) Stock watering.

(iii) Fish and shellfish:

Salmonid migration, rearing, and harvesting.

Other fish migration, rearing, spawning, and harvesting.

Clam, oyster, and mussel rearing and spawning.

Crustaceans and other shellfish (crabs, shrimp, crayfish, scallops, etc.) rearing, spawning, and harvesting.

(iv) Wildlife habitat.

(v) Recreation (secondary contact recreation, sport fishing, boating, and aesthetic enjoyment.

(vi) Commerce and navigation.

(c) Water quality criteria.

(i) Fecal coliform organisms.

(A) Freshwater - Fecal coliform organisms shall not exceed a geometric mean value of 200 organisms/100 mL, with not more than 10 percent of samples exceeding 400 organisms/100 mL.

(B) Marine water - Fecal coliform organisms shall not exceed a geometric mean value of 100 organisms/100 mL, with not more than 10 percent of samples exceeding 200 organisms/100 mL.

(ii) Dissolved oxygen.

(A) Freshwater - Dissolved oxygen shall exceed 6.5 mg/L.

(B) Marine water - Dissolved oxygen shall exceed 5.0 mg/L. When natural conditions, such as upwelling, occur, causing the dissolved oxygen to be depressed near or below 5.0 mg/L, natural dissolved oxygen levels can be degraded by up to 0.2 mg/L by man-caused activities.

(iii) Total dissolved gas shall not exceed 110 percent of saturation at any point of sample collection.

(iv) Temperature shall not exceed 21.0° C (freshwater) or 19.0° C (marine water) due to human activities. Temperature increases shall not, at any time, exceed $t=34/(T+9)$ (freshwater) or $t=16/T$ (marine water).

When natural conditions exceed 21.0° C (freshwater) and 19.0° C (marine water), no temperature increase will be allowed which will raise the receiving water temperature by greater than 0.3° C.

For purposes hereof, "t" represents the permissive temperature change across the dilution zone; and "T" represents the highest existing temperature in this water classification outside of any dilution zone.

Provided that temperature increase resulting from nonpoint source activities shall not exceed 2.8° C, and the maximum water temperature shall not exceed 21.3° C (freshwater).

(v) pH shall be within the range of 6.5 to 8.5 (freshwater) and 7.0 to 8.5 (marine water) with a man-caused variation within a range of less than 0.5 units.

(vi) Turbidity shall not exceed 10 NTU over background turbidity when the background turbidity is 50 NTU or less, or have more than a 20 percent increase in turbidity when the background turbidity is more than 50 NTU.

(vii) Toxic, radioactive, or deleterious material concentrations shall be below those which adversely affect public health during characteristic uses, or which may cause acute or chronic toxic conditions to the aquatic biota, or which may adversely affect characteristic water uses.

(viii) Aesthetic values shall not be reduced by dissolved, suspended, floating, or submerged matter not attributed to natural causes, so as to affect water use or taint the flesh of edible species.

(4) CLASS C (FAIR).

(a) General characteristic. Water quality of this class shall meet or exceed the requirements of selected and essential uses.

(b) Characteristic uses. Characteristic uses shall include, but not be limited to, the following:

(i) Water supply (industrial).

(ii) Fish (salmonid and other fish migration).

(iii) Recreation (secondary contact recreation, sport fishing, boating, and aesthetic enjoyment).

(iv) Commerce and navigation.

(c) Water quality criteria - marine water.

(i) Fecal coliform organisms shall not exceed a geometric mean value of 200 organisms/100 mL, with not more than 10 percent of samples exceeding 400 organisms/100 mL.

(ii) Dissolved oxygen shall exceed 4.0 mg/L. When natural conditions, such as upwelling, occur, causing the dissolved oxygen to be depressed near or below 4.0 mg/L, natural dissolved oxygen levels can be degraded by up to 0.2 mg/L by man-caused activities.

(iii) Temperature shall not exceed 22.0° C due to human activities. Temperature increases shall not, at any time, exceed $t=20/(T+2)$.

When natural conditions exceed 22.0° C, no temperature increase will be allowed which will raise the receiving water temperature by greater than 0.3° C.

For purposes hereof, "t" represents the permissive temperature change across the dilution zone; and "T"

represents the highest existing temperature in this water classification outside of any dilution zone.

(iv) pH shall be within the range of 6.5 to 9.0 with a man-caused variation within a range of less than 0.5 units.

(v) Turbidity shall not exceed 10 NTU over background turbidity when the background turbidity is 50 NTU or less, or have more than a 20 percent increase in turbidity when the background turbidity is more than 50 NTU.

(vi) Toxic, radioactive, or deleterious material concentrations shall be below those which adversely affect public health during characteristic uses, or which may cause acute or chronic toxic conditions to the aquatic biota, or which may adversely affect characteristic water uses.

(vii) Aesthetic values shall not be interfered with by the presence of obnoxious wastes, slimes, aquatic growths, or materials which will taint the flesh of edible species.

(5) LAKE CLASS.

(a) General characteristic. Water quality of this class shall meet or exceed the requirements for all or substantially all uses.

(b) Characteristic uses. Characteristic uses shall include, but not be limited to, the following:

(i) Water supply (domestic, industrial, agricultural).

(ii) Stock watering.

(iii) Fish and shellfish:

Salmonid migration, rearing, spawning, and harvesting.

Other fish migration, rearing, spawning, and harvesting.

Clam and mussel rearing, spawning, and harvesting.

Crayfish rearing, spawning, and harvesting.

(iv) Wildlife habitat.

(v) Recreation (primary contact recreation, sport fishing, boating, and aesthetic enjoyment).

(vi) Commerce and navigation.

(c) Water quality criteria.

(i) Fecal coliform organisms shall not exceed a geometric mean value of 50 organisms/100 mL, with not more than 10 percent of samples exceeding 100 organisms/100 mL.

(ii) Dissolved oxygen – no measurable decrease from natural conditions.

(iii) Total dissolved gas shall not exceed 110 percent of saturation at any point of sample collection.

(iv) Temperature – no measurable change from natural conditions.

(v) pH – no measurable change from natural conditions.

(vi) Turbidity shall not exceed 5 NTU over background conditions.

(vii) Toxic, radioactive, or deleterious material concentrations shall be less than those which may affect public health, the natural aquatic environment, or the desirability of the water for any use.

(viii) Aesthetic values shall not be impaired by the presence of materials or their effects, excluding those of natural origin, which offend the senses of sight, smell, touch, or taste. [Statutory Authority: RCW 90.48.035. 82-12-078 (Order DE 82-12), § 173-201-045, filed 6/2/82; 78-02-043 (Order DE 77-32), § 173-201-045, filed 1/17/78.]

WAC 173-201-070 General classifications. General classifications applying to various surface water bodies not specifically classified under WAC 173-201-080 or 173-201-085 are as follows:

(1) All surface waters lying within the mountainous regions of the state assigned to national parks, national forests, and/or wilderness areas, are classified Class AA or Lake Class.

(2) All lakes and their feeder streams within the state are classified Lake Class and Class AA respectively, except for those feeder streams specifically classified otherwise.

(3) All reservoirs with a mean detention time of greater than 15 days are classified Lake Class.

(4) All reservoirs with a mean detention time of 15 days or less are classified the same as the river section in which they are located.

(5) All reservoirs established on preexisting lakes are classified as Lake Class.

(6) All unclassified surface waters that are tributaries to Class AA waters are classified Class AA. All other unclassified surface waters within the state are hereby classified Class A. [Statutory Authority: RCW 90.48.035. 82-12-078 (Order DE 82-12), § 173-201-070, filed 6/2/82; 78-02-043 (Order DE 77-32), § 173-201-070, filed 1/17/78; Order 73-4, § 173-201-070, filed 7/6/73.]

WAC 173-201-080 Specific classifications—Freshwater. Specific fresh surface waters of the state of Washington are classified as follows:

(1) American River.	Class AA
(2) Big Quilcene River and tributaries.	Class AA
(3) Bumping River.	Class AA
(4) Burnt Bridge Creek.	Class A
(5) Cedar River from Lake Washington to Landsburg Dam (river mile 21.6).	Class A
(6) Cedar River and tributaries from Landsburg Dam (river mile 21.6) to headwaters. Special condition – no waste discharge will be permitted.	Class AA
(7) Chehalis River from upper boundary of Grays Harbor at Cosmopolis (river mile 3.1, longitude 123°45'45" W) to Scammon Creek (river mile 65.8).	Class A
(8) Chehalis River from Scammon Creek (river mile 65.8) to Newaukum River (river mile 75.2). Special condition – Dissolved oxygen shall exceed 5.0 mg/L from June 1, to September 15. For the remainder of the year, the dissolved oxygen shall meet Class A criteria.	Class A
(9) Chehalis River from Newaukum River (river mile 75.2) to Rock Creek (river mile 106.7).	Class A