Metro Library-Seattle, WA
88019252

MR
7383
C.1

FOR LIBRARY USE ONLY

WASTEWATER
2020 PLUS

Snoqualmie Valley Wastewater Services

METRO LIBRARY
Municipality of Metropolitan Seattle
821 Second Avenue
Seattle, WA 98104

Prepared by
Arthur Campbell
Nona Diediker
Sheila Gortler
Herrera Environmental Consultants

Gary Bleeker, P.E.
Rudy Vigilia, P.E.
HDR Engineering, Inc.

April 1994

HDR

May 13, 1994

Mr. Ellis McCoy
King County Department of Metropolitan Services
821 Second Avenue
Seattle, WA 98014

Re: Wastewater 2020 Snoqualmie Valley - Wastewater Services Report

Dear Ellis:

Herrera Environmental Consultants and HDR Engineering, Inc. submit the attached final report in accordance with the agreement for services between HDR Engineering and the King County Department of Metropolitan Services (Metro).

The report was prepared in support of the ongoing work for the Wastewater 2020 Plus project, and provides information of the existing wastewater services in the Snoqualmie River Valley.

The goal of this report was to provide background information which can be used to assess the potential roles Metro may play in future wastewater treatment for each of the cities.

Herrera Environmental Consultants and HDR have enjoyed the opportunity to assist Metro in completion of this work.

Sincerely,

HDR ENGINEERING, INC.

Gary Bleeker

Gary L. Bleeker
Senior Vice President

cc: Art Campbell - Herrera

HDR Engineering, Inc.

Suite 1200
500 108th Avenue, N.E.
Bellevue, Washington
98004-5538

Telephone
206 453-1523

CONTENTS

Introduction 1
Existing Wastewater Treatment Facilities and Projected Demand 3
North Bend 3
Existing Facilities 3
Biosolids Handling 6
Projected Demand 7
Snoqualmie 8
Existing Facilities 8
Projected Demand 10
Carnation 11
Existing Facilities 11
Projected Demand 11
Duvall 13
Existing Facilities 13
Biosolids Handling 15
Projected Demand 16
Current Water Quality and Pollutant Loadings in the Snoqualmie River 17
Surface Water: 1989 Base Flow Monitoring 17
Temperature 17
pH 17
Dissolved Oxygen 20
Nutrients 20
Fecal Coliform Bacteria 21
Water Quality Modeling 21
Conclusions of 1989 Study 22
Ground Water 22
Existing and Emerging Regulations Affecting Wastewater Treatment 25
Existing Regulations 25
Emerging Regulations 26
Septic System Regulations 26
Bibliography 28

Appendix A Glossary
Appendix B NPDES Waste Discharge Permits for North Bend, Snoqualmie, and Duvall
Appendix C Wastewater Treatment Plant Design Criteria for North Bend, Snoqualmie, and Duvall
Appendix D Snoqualmie River Base Flow Data

FIGURES

1 Snoqualmie Valley study area 2
2 City of North Bend existing wastewater treatment facility and service area 5
3 City of Snoqualmie existing wastewater treatment facility and service area 9
4 City of Duvall existing wastewater treatment facility and service area 14

TABLES

1 Snoqualmie Valley wastewater treatment facility summary 4
2 Washington Department of Ecology surface water quality standards and characteristic uses for class A freshwaters 18
3 Selected Snoqualmie River 1989 water quality survey data 19
4 Selected contaminant concentrations found in Carnation area well water, 1951-1991 24

Introduction

In support of the wastewater comprehensive plan being developed by King County Department of Metropolitan Services (Metro), this report provides information on existing wastewater services in the Snoqualmie River valley. This is the first of two reports. In the sections below, the existing wastewater treatment facilities of the cities of North Bend, Snoqualmie, Carnation, and Duvall are described, and the projected future demand in each service area is discussed. The goal of this study is to provide information that can assist in the investigation of the potential roles Metro may play in future wastewater treatment for each of the four cities. The second report will discuss potential roles for Metro. Figure 1 illustrates the Snoqualmie River valley study area.

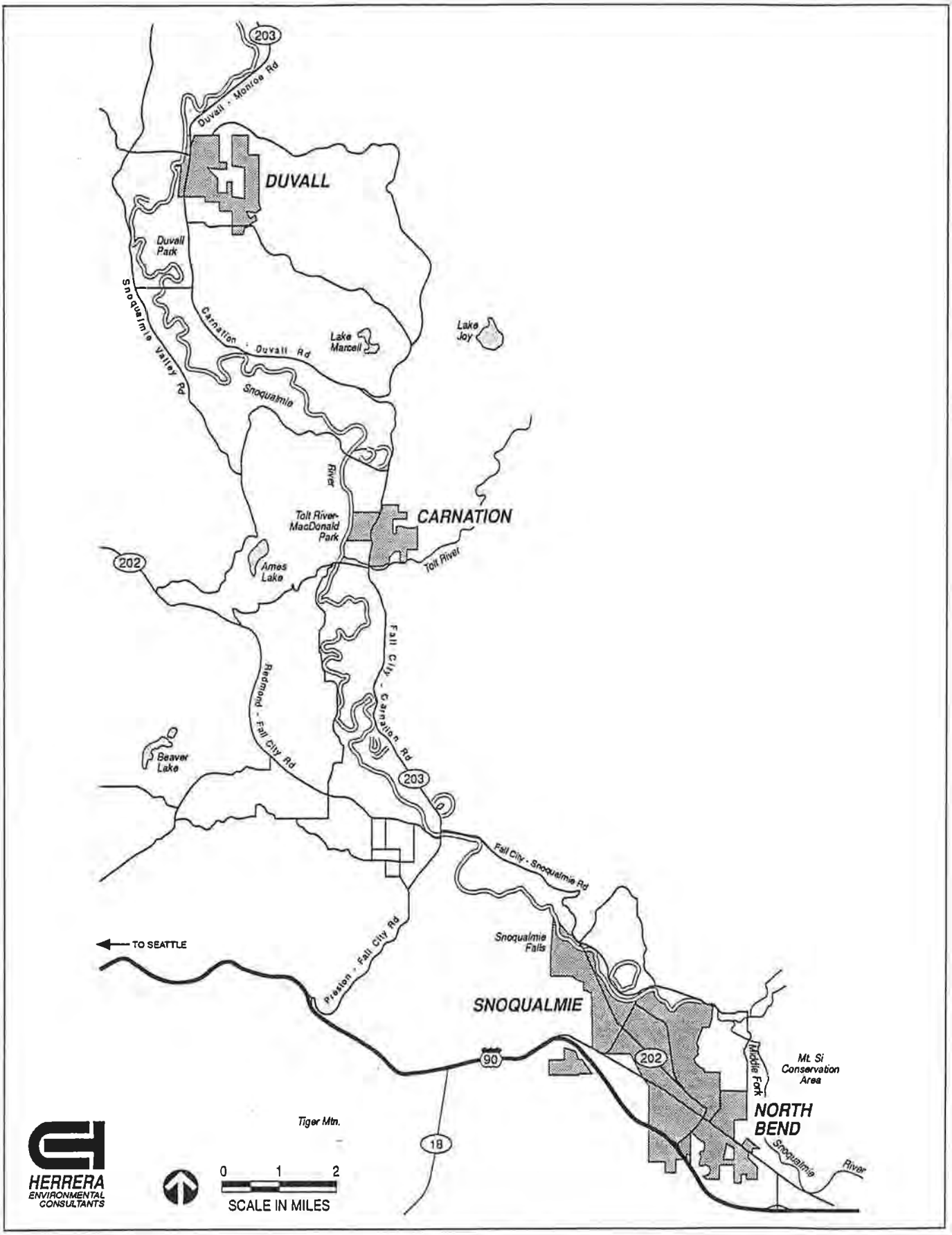

Figure 1. **Snoqualmie Valley study area.**

Existing Wastewater Treatment Facilities and Projected Demand

Table 1 presents a summary of wastewater treatment facility data for the cities of North Bend, Snoqualmie, Carnation, and Duvall. Existing facilities and projected demand are discussed separately below for each of the four municipalities.

North Bend

Existing Facilities

The original North Bend wastewater facility was constructed in 1951. Prior to that time, wastewater was disposed of onsite or was directly discharged into estuaries. The original system provided primary treatment and discharged to the south fork of the Snoqualmie River. In 1978, the facility was modified and an oxidation ditch was constructed for secondary treatment.

The wastewater treatment plant facility is owned and operated by the city of North Bend. The facility is located on 2 acres on the northeastern side of 4th Street and borders the eastern bank of the south fork of the Snoqualmie River. Adjacent property uses include a trailer park and the King County Youth Center. Because the existing site does not allow for facility expansion, two parcels of land are being considered for expansion: the Pendleton Miller site, and city-owned property west of the existing treatment facility, now in use by the city's public works maintenance shops.

Wastewater sources include residences and commercial sites such as retail outlets, restaurants, and automobile service stations. There are no industrial wastewater sources. The existing service area covers 1,920 acres, with a sewered population of 1,426 and 390 customer connections (Figure 2).

Onsite disposal is a common method of wastewater treatment in the North Bend service area, and it is anticipated to continue to be a primary method within the planning area. Many of the onsite systems are failing due to high ground water levels and poorly draining soil.

The existing North Bend treatment facility processes wastewater by use of an oxidation ditch for secondary treatment and aerobic digestion for the stabilization of biosolids. Wastewater is chlorinated and discharged into the Snoqualmie River, which is designated by the Washington Department of Ecology (Ecology) as a class A stream. The current wastewater treatment facility has a design flow of 0.40 million gallons per day (mgd) but consistently treats up to 0.80 mgd and meets National Pollutant Discharge Elimination System (NPDES) requirements. Minimum (dry-weather) daily flow in 1991 was 0.20 mgd, and maximum (wet-weather) peak daily flow was 1.70 mgd.

Table 1. Snoqualmie Valley wastewater treatment facility summary.

	North Bend	Snoqualmie	Carnation	Duvall
Population (1993)	2,700 [a]	1,541 [b]	1,360 [c]	3,200 [d]
Projected population (2010)	15,750 [a]	10,000 [b]	2,447 [g]	9,000 [d]
Sewer service area (acres)	1,920	260	--	860
Can existing facility accommodate projected growth?	No	No	No facility	Yes
Plans for expansion?	Yes	Yes	Yes	No
Number of existing sewer connections	390	525	0	Info not available
Number of onsite systems	Info not available	Few [e]	420 [c]	Approx 4 [d]
Design flow (existing) (mgd)	0.40	0.20	--	0.90
Minimum daily flow (existing)	0.20 mgd [f]	Info not available	0.025 mgd [g]	0.16 mgd, estimated [d]
Maximum daily flow (existing)	1.70 mgd [f]	Info not available	--	0.33 mgd, estimated [d]
Projected minimum daily flow (2010)	2.50 mgd [f]	Info not available	0.037 mgd [g]	Info not available
Projected maximum daily flow (2010)	8.20 mgd [f]	Info not available	Info not available	Info not available
Combined or separated sewer (existing)	Combined	Separated	--	Separated
NPDES Permit status	Expired 1993	Expired 1982	--	Expires 1997

mgd million gallons per day

NPDES National Pollutant Discharge Elimination System

a Semrau (1993 personal communication)

b Gruwell (1993 personal communication)

c Sevy (1993 personal communication)

d Elsasser (1993 personal communication; information from city of Duvall comprehensive plan)

e Hanson (1993 personal communication)

f RH2 (1992)

g Morgan (1994 personal communication)

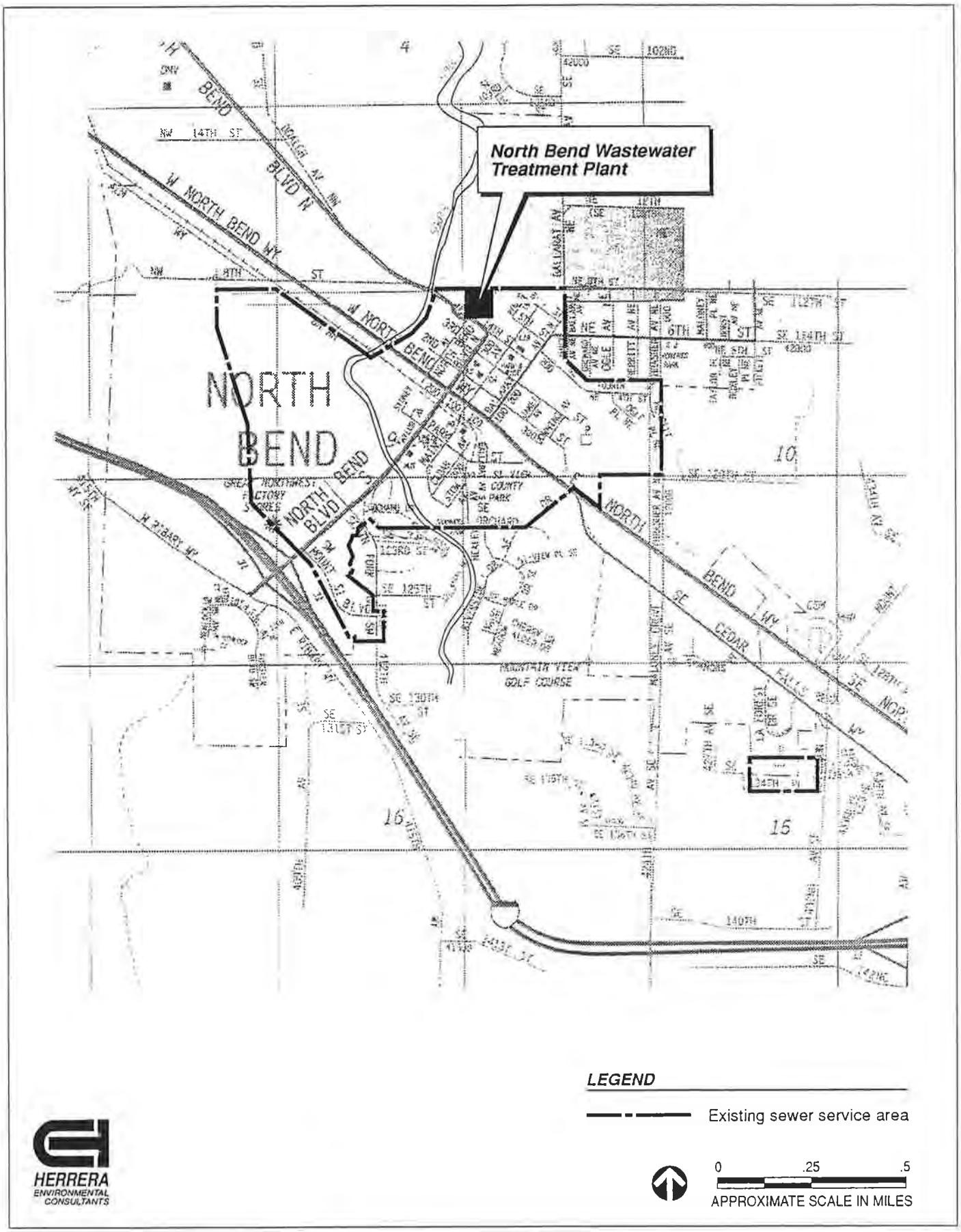

Figure 2. City of North Bend existing wastewater treatment facility and service area.

North Bend is divided into two wastewater collection areas: the core area and the south fork interchange area. The core area, which is located in the center of the city, covers 220 acres, of which 150 acres is sewered. The majority of the sewers were installed in 1950-1951 and are deteriorating. This area is zoned for single-family residential, multifamily residential, and commercial uses. Approximately 40 percent of the population within the core area uses onsite septic systems for wastewater disposal.

The south fork interchange area is located southwest of the core area between the south fork of the Snoqualmie River and Interstate 90. The area consists of 169 acres of which 50 percent is sewered. Zoning is primarily commercial and multifamily residential. The sewer pipes are of polyvinyl chloride (PVC) and are newer than those in the core area. The only necessary renovation in the south fork interchange area may be to enlarge the lift station so that it may handle increased flows.

The original wastewater conveyance system was constructed using corrugated metal pipe, which was perforated prior to installation so that infiltrated water would increase the wastewater flow to produce enough force to transmit the wastewater to the treatment facility. With naturally high ground water levels, this system causes excessive infiltration into the sewer pipelines. Consequently, inflow and infiltration can account for up to six times the average daily flow during the rainy season. The city is now aggressively replacing that portion of the system.

In 1974 and again in 1986, the city hired consultants to perform extensive infiltration studies of the downtown sewer system. The 1974 study found that a majority of the infiltration occurs below the wet-weather ground water table. In 1984, the city conducted a smoke test of the gravity sewer system in the downtown area and identified 24 illegal stormwater connections. The 24 parties were notified, but no follow-up activity or inspections followed the notification.

As stated in the *City of North Bend Comprehensive Sewer System Plan* (1991 draft), inflow and infiltration can be reduced by the following measures:

- Performing infiltration and inflow studies to identify excessive infiltration and inflow as well as illegal connections
- Replacing all corrugated metal sewer pipes
- Installing new large-diameter sewer interceptors to serve developing areas along with the periphery of the existing system.

Biosolids Handling

In 1991, 84,175 pounds of the solids generated at the North Bend treatment plant was hauled by Metro to the Renton wastewater treatment facility, at a cost of 15 cents per gallon. An additional 9,325 pounds generated in 1991 was dried on biosolids drying beds, and the solids cakes were hauled to Groco, Inc. at a cost of $30 per ton, to be used as a soil amendment. The projected 1997 biosolids production rates presented in the RH2 Engineering (1991) draft comprehensive sewer plan indicate that North Bend would spend $550,000 per year to have Metro haul 100 percent of its biosolids. Although the use of biosolids drying beds and recycling by Groco, Inc. is less costly than the current contract with Metro, the North Bend facility is limited by the capacity of its drying beds.

Projected Demand

The *City of North Bend Facility Plan: Wastewater Treatment Plant* (June 1993) is the most recent document describing the planning and expansion of the North Bend wastewater treatment facility. The existing North Bend facility lacks the capacity to handle future growth and has extreme infiltration and inflow problems, as well as structural deficiencies such as aging pipes and grease accumulation. The plan proposes alternatives to accommodate existing residences and extensive projected residential and commercial development along Interstate 90 over the next 5 years.

North Bend currently has a population of 2,700, with a projected growth to 15,750 by the year 2010. The factors affecting growth and the need for wastewater treatment facility expansion include the following:

- Planned large single- and multifamily residential developments
- Growth along Interstate 90
- Sewer connections at sites now using onsite systems in areas with a high ground water table and poorly drained soils
- Expansion of the sewer system to include adjacent land development.

Projected minimum (dry-weather) daily flow for the year 2010 is 2.50 mgd. Projected maximum (wet-weather peak) daily flow in 2010 is 8.20 mgd.

The existing facility is unable to accommodate expansion beyond 5 to 10 years, because the site is located in a residential area.

Various treatment alternatives were analyzed for expansion of the North Bend facility in the *Wastewater Treatment Plan* (1992). Two primary options were outlined. The first option would expand the existing facility to accommodate projected flows through 1997. The second option, involving construction of a new facility using conventional activated biosolids, would handle projected flows through the year 2012.

Snoqualmie

Existing Facilities

The Snoqualmie wastewater treatment plant located at Tokul and Stearns roads was constructed in 1967. The existing service area covers 1,903 acres, 260 acres of which is sewered with 525 connections (Figure 3). Since 1967, there have been several additions to the municipal system, including the hospital and medical center, the Snoqualmie Winery, and the Salish Lodge. The city also provides domestic sewer service to the Weyerhaeuser mill, located outside the service area. Onsite disposal systems are still used in rural areas south of the business district that were incorporated in the 1986 Meadowbrook annexation, as well as in areas north of Northern Street between Burlington Northern Railroad and Kimball Creek.

Wastewater sources in the Snoqualmie service area have been identified as domestic, commercial, and industrial. The only industrial source is the 160-acre Weyerhaeuser mill, which contributes primarily domestic sewage with some inflow and infiltration. The estimated annual flow from the Weyerhaeuser mill in 1990 was calculated at 0.02 mgd (Gray & Osborne Consulting Engineers 1991). Areas within the city to be zoned for future industrial use must first be evaluated for pretreatment requirements prior to connection to the city sewer system.

The existing wastewater treatment plant is a 2-cell aerated facultative lagoon system including headworks, chlorine disinfection, and effluent disposal, with a design flow of 0.20 mgd. The average daily flow is 0.23 mgd, with an annual peak flow of 0.70 mgd. Five pump stations are used to convey wastewater to the facility because the service area is not sloped sufficiently to rely solely on gravitational conveyance.

The NPDES permit for the Snoqualmie treatment plant went into effect in 1977 and expired in 1982. The facility continues to operate under the 1977 limitations, and although the state health department continues to monitor the facility on a regular basis, a new permit has not been issued. The system has exceeded the 1977 NPDES limits six times in the last 5 years for biochemical oxygen demand (BOD) and suspended solids. As stated in the Snoqualmie sewer system comprehensive plan (Gray & Osborne Consulting Engineers 1991), the current lagoon wastewater flows, effluent concentrations, and discharge mass loads have not met the following NPDES interim requirements:

- The permitted average dry-weather flow of 0.213 mgd is currently exceeded by 10 to 40 percent during summer months.

- The permitted peak instantaneous flow of 0.619 mgd has been exceeded by peak wet-weather flows up to 1.09 mgd.

- The permitted monthly average effluent concentration limit for BOD (60 milligrams per liter [mg/L]) was exceeded in August 1987 and December 1986. The mass load discharge limit (107 pounds per day of BOD) was exceeded in January 1990, September 1989, April 1988, August 1987, March 1987, December 1986, and November 1986.

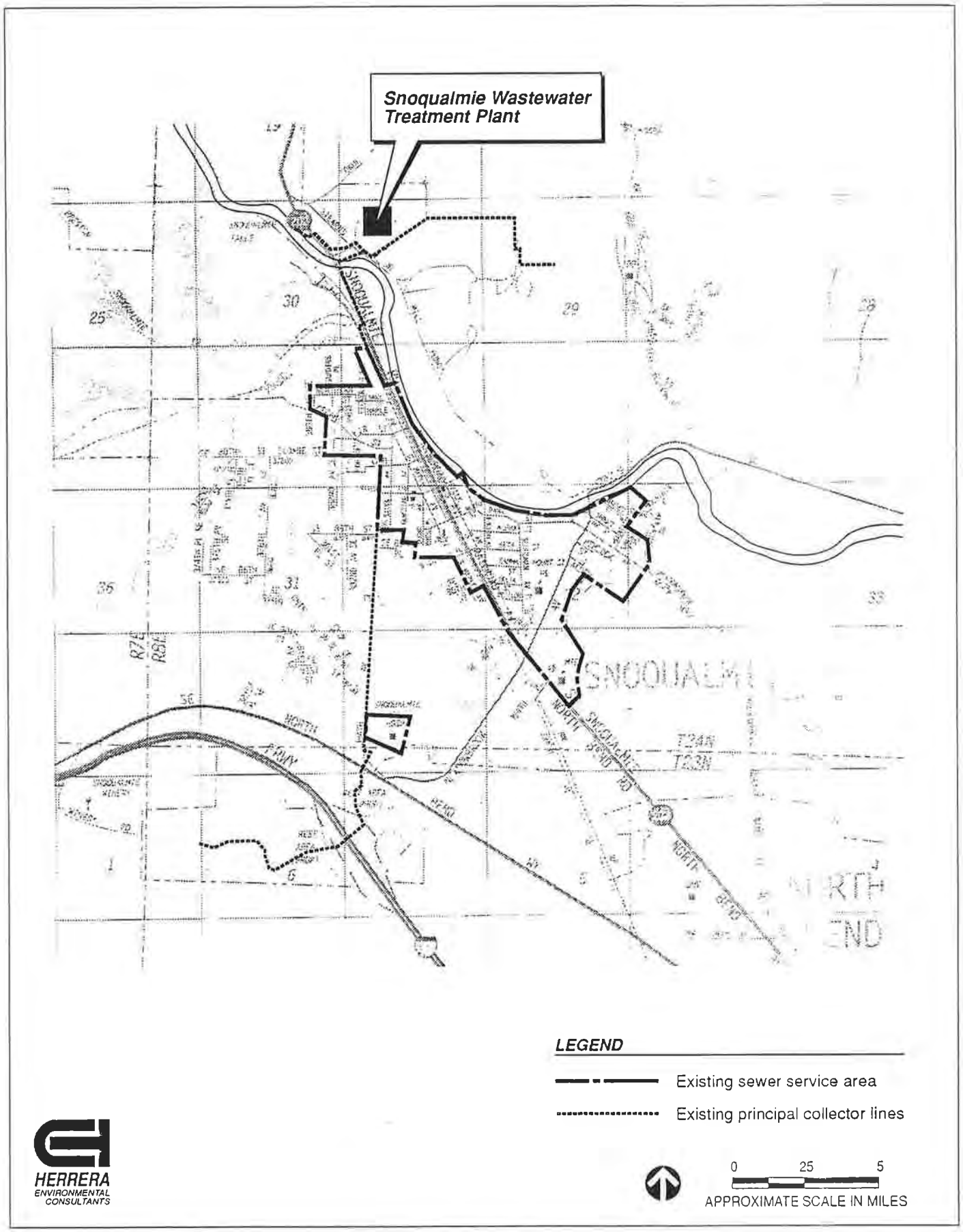

Figure 3. City of Snoqualmie existing wastewater treatment facility and service area.

- The permitted monthly average effluent concentration limit for suspended solids (70 mg/L) was exceeded in August 1987 and nearly exceeded in September 1987. The mass load discharge limit (125 pounds per day of suspended solids) was exceeded in September 1989, September 1987, and August 1987.

Snoqualmie has a modified separated sewer system. One catch basin that drains into the sanitary sewer was constructed under court order 5 to 6 years ago. Stormwater infiltration and inflow during the winter continues to produce up to eight times the influent produced in the average flow. The causes of excessive infiltration and inflow have been identified in the 1975 facilities plan but have not been corrected (Hanson 1993 personal communication).

Projected Demand

The most recent plan addressing expansion of the existing Snoqualmie wastewater treatment plant is the *City of Snoqualmie Sewer System Comprehensive Plan* (Gray & Osborne Consulting Engineers 1991). The plan identifies operational deficiencies and permit violations at the facility as well as growth and development of the future sewer service area.

The original Snoqualmie wastewater treatment facility was designed for 1,100 users and will require expansion to accommodate projected growth. The projected population for the year 2010 is 10,000 people, with an annual average flow rate of 1.65 (high) mgd. Recently an engineering consultant was retained to develop the engineering design of the expanded wastewater treatment facility. As stated in the sewer system comprehensive plan, various treatment alternatives have been analyzed. However, selection of a preferred treatment alternative will be deferred until an engineering report on plant improvements is prepared. Treatment alternatives include expanded lagoons, new lagoons, package plant, oxidation ditch, rotating biological contractor/solids contact, and trickling filter/solids contact. With the exception of the lagoon alternatives, biosolids handling alternatives include gravity thickening, aerobic digestion, dewatering, and biosolids storage. For the lagoon alternatives, biosolids handling includes dredging every 10 years. Contracts for the engineering report and environmental reviews are currently being negotiated. Work will begin on these reports immediately upon receipt of funding.

Ecology has asked Snoqualmie to consider piping wastewater into the Metro system. This alternative is no longer being considered because of costs and long implementation schedules. The estimated costs are summarized in the sewer system comprehensive plan.

Carnation

Existing Facilities

Wastewater sources are described in the *City of Carnation Second Draft Wastewater Facilities Plan* (R.W. Beck 1991) as businesses, schools, parks, and residences. There are approximately 450 to 500 water customers and 420 onsite wastewater treatment systems. Wastewater treatment occurs exclusively through the use of onsite sewage disposal systems. There is no piped stormwater or wastewater system. Stormwater from the commercial district drains into infiltration recharge chambers, and roadway runoff goes into streams and rivers. The current commercial septic tank pumping fee is 14 cents per gallon.

Lot size requirements and the use of onsite disposal systems have been regulated since 1984 by the Washington State Board of Health (onsite sewage system regulations, WAC 248-96) and Seattle/King County Department of Public Health (King County Board of Health rules and regulations #3). These regulations require that onsite sewage treatment be installed only on tracts of land with sufficient area and proper soils in which sewage can be retained and treated. Within the central district of Carnation, sewage disposal areas for existing onsite systems are limited, and replacement is not possible due to lack of contiguous area. In some cases, commercial onsite systems have been reconstructed on city property. Many of the onsite wastewater disposal systems installed prior to 1980 do not meet current U.S. Environmental Protection Agency (U.S. EPA) standards.

The majority of development in Carnation occurred prior to 1984, consisting of subdivisions with small lots ranging between 7,000 and 10,000 square feet. Many of these lots are below the minimum lot size allowed by the state board of health and the county health department for onsite wastewater disposal. Sumps or dry wells, having a vertical orientation that can be accommodated on smaller lots, may comprise 50 percent of the onsite systems currently used in Carnation.

Although Carnation has good soils for the use of onsite systems, the potential exists for ground water contamination from dense utilization. There are a few documented failures of septic systems in Carnation but none that can be directly linked to ground water contamination. Although a 1992 county health department study found no contamination on the aquifer level (Sevy 1993 personal communication), USGS (1993) data on ground water in the Carnation area indicate that levels of lead exceeded standards in one well during testing in 1971, and coliform standards were exceeded in six wells sampled in 1991 (see section on current water quality).

Projected Demand

The city of Carnation, covering approximately 533 acres, is located north of the confluence of the Tolt and Snoqualmie rivers. The 1993 population is 1,360, with a projected population of 2,447 by the year 2010 (Morgan 1994 personal communication).

The *City of Carnation Second Draft Wastewater Facilities Plan* describes a 20-year plan for managing wastewater. The goal of the plan is to provide affordable wastewater treatment that complies with local, state, and federal regulations and minimizes environmental impacts. The following alternatives are being considered:

- Provide sewer service to the central business district, city-zoned areas, and other dense areas of development

- Provide sewer service to the entire city plus the expansion areas.

These alternatives involve the construction of a wastewater treatment facility to treat wastewater and discharge the effluent, following secondary or tertiary treatment, into the Snoqualmie River near the Carnation Farms Road bridge. As stated in the wastewater facilities plan, a wastewater treatment facility serving the business and commercial areas would discharge 100,000 gallons per day into the Snoqualmie River with a permit limitation of 38 pounds of BOD per day. The amount of discharge, if the entire city were sewered, is projected to be a total of 400,000 gallons with 152 pounds of BOD per day. Based on preliminary discharge studies, this discharge would not exceed class A standards for contaminants in the Snoqualmie River.

The recommended action (the preferred alternative) is to provide sewer connections to the entire city plus the expansion area and to provide secondary treatment. As stated in the wastewater facilities plan the alternative would include influent pumping, bar screen, grit chamber, sequencing batch reactor, flow equalization basin, effluent filtration, ultraviolet disinfection, effluent disposal, aerobic digestion, screw press, and biosolids hauling to Metro. The product would be used for land application in the summer and would be discharged to the river during winter high-flow periods.

Several alternative treatment technologies are also discussed in the plan and are compared with the alternative of hauling septage or dewatered biosolids by Metro for further processing. In one treatment alternative, a subsurface community drain field would be provided. This alternative would require a treatment receptacle with a pumping unit at each connection. The effluent would then be pumped into a community drain field.

Another treatment alternative involves constructing a wastewater treatment plant to accommodate the older, commercial part of town, and developing a septic system management program to regulate the onsite systems as a legal utility. Using this alternative, the city would perform inspections to monitor system design and performance. A septic system management program would address the deficiencies and potential health risks of systems not installed and maintained properly and would accommodate expansion of existing facilities as well as future residential and commercial growth.

These alternative approaches would lessen the incidence of hydraulic and treatment failure in onsite systems, reduce the risk of degradation of ground water quality, and provide an adequate wastewater treatment facility.

Duvall

Existing Facilities

The city of Duvall owns and operates the entire municipal sewer system. The wastewater treatment facility is located on the northwest corner of the intersection of Main Street and Northeast 145th Street, bordered by industrially and commercially zoned lands to the north, east, and west and agricultural land to the south (Figure 4). The facility is located at a low elevation in the sewerage collection system and uses mostly gravity flow, with four lift stations that pump into the gravity collection system. A fifth lift station will soon be in operation.

The wastewater treatment facility serves an area of 860 acres, which is described in the *Draft Environmental Impact Statement for Wastewater Treatment Plant Expansion* (Beckwith Consulting Group 1990) as lands between the Snoqualmie River valley on the west, Cherry Creek valley on the north, Novelty Hill Road on the south, and within the possible extension limits of the Duvall sewer service area to the east. All residences within the existing city limits, with the exception of a few that have been recently annexed, are connected to the sewer system. Within the city limits, a 30-acre area is zoned for industrial use, of which 7.5 acres is occupied. A nonferrous metal casting plant, a welding fabricator, and a general contractor are the primary industrial users. Industrial wastewater discharges have never been measured but are thought to comprise less than 5 percent of the total influent (Elsasser 1993 personal communication).

The original Duvall wastewater treatment facility was designed in 1967 and began operation in 1976. Prior to 1976, unauthorized outfalls were used for wastewater disposal. The 1976 facility, which was a 0.20-mgd oxidation ditch wastewater treatment plant, was designed to accommodate 2,000 people. In the 1980s, with population growth in Duvall and the rest of the Snoqualmie River valley, the demands on the wastewater treatment facility surpassed the capacity of the 1967 design. The use of onsite sewer treatment was not considered as an alternative because of the high water table, the underground water supply system, and unsuitable soil characteristics. Additionally, stormwater infiltration and inflow during the rainy season produced two to three times the influent produced during dry-weather flow.

In November 1989, Duvall was prohibited by Ecology from issuing additional sewer connections or reconnections because of NPDES noncompliance events.

In December 1990, the final environmental impact statement for the wastewater treatment plant expansion was submitted, and construction of the new facility was completed in October 1992. The project proposed to improve biosolids recirculation, control of the activated biosolids process, and effluent quality. These improvements were accomplished during the 1992 renovation and expansion by the following additions:

- One 0.47-million-gallon oxidation ditch with one 60-horsepower variable speed drive and one 30-horsepower fixed drive
- Two 40-foot-diameter, 14-foot surface water depth clarifiers
- Three variable speed positive displacement RAS pumps with variable 20 to 300-gallon-per-minute capacity

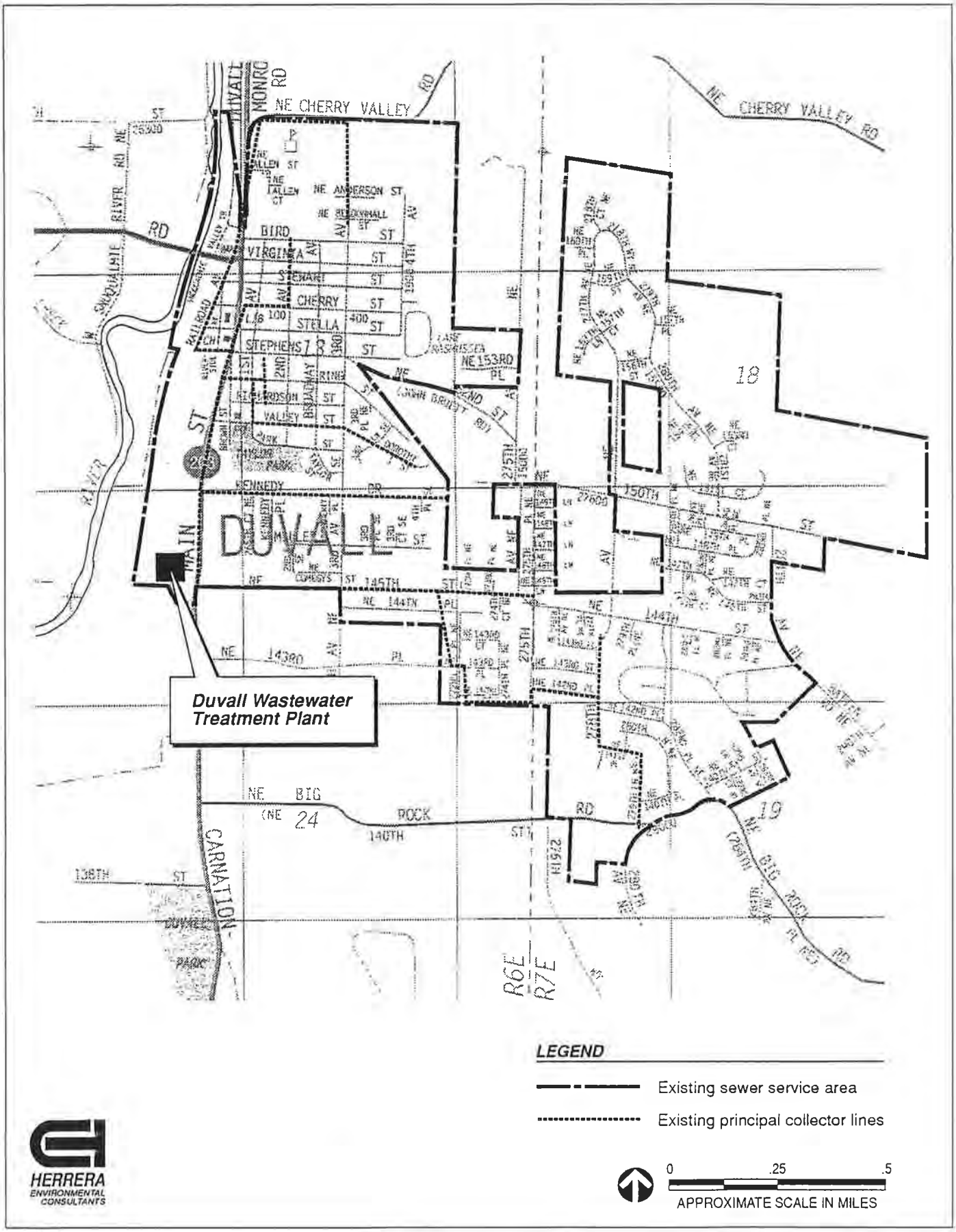

Figure 4. City of Duvall existing wastewater treatment facility and service area.

- New headworks
- An expanded capacity chlorine contact tank at a location above the 100-year floodplain with sufficient elevation for the outfall pipe to discharge at peak flow rates during a 100-year flood condition
- A new laboratory building
- Permanent housing and connection for the emergency generator, fencing, pavement, and landscape improvements.

The existing wastewater treatment process uses an oxidation ditch to provide secondary treatment of wastewater and lime to stabilize sludge. The oxidation ditch is a 0.47-mgd system based on a 150-gallon per capita per day hydraulic load, with a 60-horsepower variable speed drive aerator. A 30-horsepower fixed drive is used as a standby. The two original clarifiers from the 1976 system will be returned to operation once the population reaches 4,000. When the population exceeds 4,000, all three oxidation ditches will be used based on a demand of 150 gallons per capita per day. A pretreatment or intermediate step between secondary and tertiary treatment is used to remove ammonia and nitrate from the effluent and reduce the oxygen demand that would otherwise be discharged into the Snoqualmie River.

The outfall is currently located on the east bank of the Snoqualmie River but will be relocated midstream by 1996 to improve diffusion, as required by Ecology. Dechlorination of effluent will also be required by 1996.

The Duvall NPDES permit was issued on October 9, 1992 and expires August 1, 1997. The wastewater treatment facility is currently in compliance with NPDES standards and has not been out of compliance since 1989 (Elsasser 1993 personal communication). A December 1992 Ecology class II inspection found the Duvall facility to be operating well, with effluent quality within NPDES permit limitations and the facility properly maintained (Das 1992).

Duvall has a separated sewer system but has a substantial infiltration and inflow problem, especially during the rainy season. Infiltration and inflow averaged up to 138 gallons per capita per day until 1989, when a program was instituted to repair gaskets on the sewer connections, repair sewer manhole covers, and videotape sewer lines. Overall, infiltration and inflow have been reduced to an average of 35 gallons per capita per day in 1993.

Biosolids Handling

The city of Duvall is in the process of setting up a dewatering station to produce cake biosolids and is attempting to have the equipment in operation by summer 1994. Alternatives are being explored for reuse or recycling, possibly involving Metro or an independent contractor to compost the cake biosolids (Elsasser 1993 personal communication). Currently the city disposes of 500 gallons per day of waste-activated biosolids for use in agricultural fields in the Snoqualmie valley. Because of trucking costs and more stringent water quality regulations, reuse could possibly be handled more cost-effectively by a four-city biosolids composting site of which each city would have part ownership (Elsasser 1993 personal communication). The assistance of Metro would be needed in further examining this alternative.

Projected Demand

The Duvall wastewater treatment facility was designed to support 6,000 people based on the Ecology design requirement of 150 gallons per capita per day. The existing facility has the capacity to accommodate Duvall's urban growth boundary area with a projected population of 9,000 by 2010, based on 100 gallons per capita per day.

The existing Duvall facility has limited expansion area. There is room for another 470,000-gallon oxidation ditch but not for additional clarifiers. The only available neighboring site is located in a floodplain north of the plant, which would require filling for use as an expansion site (Elsasser 1993 personal communication).

Current Water Quality and Pollutant Loadings in the Snoqualmie River

The Snoqualmie River and its tributaries, from the river mouth to the western boundary of Twin Falls State Park on the south fork upstream of the city of North Bend (9.1 miles upstream of the south fork confluence with the middle fork), are classified by Ecology as class A (excellent) waters (WAC 173-201A). The Snohomish River downstream of the mouth of the Snoqualmie River is also classified as class A. Water quality standards associated with class A freshwaters are presented in Table 2.

Surface Water: 1989 Base Flow Monitoring

Ecology conducted an extensive monitoring program on the Snoqualmie River in July-September 1989 during low-flow conditions (Joy et al. 1991). This study involved in-river sampling as well as sampling of point discharges along the river. Sampled point discharges include those from the Duvall, Snoqualmie, and North Bend wastewater treatment plants. Table 3 presents selected chemical data from that study, and Appendix D presents a more complete set of study results. Study findings are summarized and briefly discussed below.

Temperature

The 1989 low-flow study found that the class A temperature standard was violated below river mile 20.3 (about 3 miles downstream of Carnation) in July. In August, cross-section measurements revealed violations upstream to about river mile 32 (about 9 miles downstream of Snoqualmie and 9 miles upstream of Carnation). The study authors attribute the elevated temperatures to a lack of riparian cover and slow-moving water. By September, water temperatures had fallen below the class A standard of 18°C throughout the study reach.

pH

In the main stem throughout the study reach, pH levels were between 6.5 and 7.5 during each of four sampling rounds, meeting class A standards.

Table 2. Washington Department of Ecology surface water quality standards and characteristic uses for class A freshwaters.

	Standard
Fecal coliform bacteria	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.
Dissolved oxygen	Shall exceed 8.0 mg/L.
Total dissolved gas	Shall not exceed 110 percent saturation at any point of sample collection.
Temperature	Shall not exceed 18.0°C due to human activities. When natural conditions exceed 18°C, no temperature increase will be allowed which will raise the receiving water temperature by greater than 0.3°C. Incremental temperature increases from nonpoint source activities shall not exceed 2.8°C.
pH	Shall be within the range of 6.5 to 8.5 with a human-caused variation within a range of less than 0.5 units.
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.
Toxic, radioactive, or deleterious material concentrations	Shall be below concentrations which have the potential either singularly or cumulatively to adversely affect characteristic water uses, cause acute or chronic conditions to the most sensitive biota dependent on those waters, or adversely affect public health, as determined by the department.
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.
Characteristic uses	Shall include, but not be limited to, the following: domestic, industrial, and agricultural water supply; stock watering; salmonid and other fish migration, rearing, spawning, and harvesting; shellfish rearing, spawning, and harvesting; wildlife habitat; general recreation and aesthetic enjoyment; and commerce and navigation.

Source: WAC 173-201A
mL milliliters
mg/L milligrams per liter
NTU Nephelometric turbidity units

Table 3. Selected Snoqualmie River 1989 water quality survey data*. (see Appendix D for more complete chemical data from this survey)

Location	Station ID	Dissolved Oxygen (mg/L)		Temperature (degrees C)				pH (standard units)				Total Suspended Solids (mg/L)				5-day Biochemical Oxygen Demand (mg/L)				Fecal Coliform Bactena (org/100mL)			
		July 24-25	Aug. 15-16	July 24-25	Aug. 15-16	Sept. 5-6	Sept. 26-27	July 24-25	Aug. 15-16	Sept. 5-6	Sept. 26-27	July 24-25	Aug. 15-16	Sept. 5-6	Sept. 26-27	July 24-25	Aug. 15-16	Sept. 5-6	Sept. 26-27	July 24-25	Aug. 15-16	Sept. 5-6	Sept. 26-27
upstream of North Bend WWTP	M444020L	10.6	10.1	12.1	12.1	11.9	11.3	7.1	6.6	6.9	7.0	1	4	2	4					9	47	18	40
	M444020R	10.6	10.1	12.2	12.0	11.9	11.3	7.0	6.7	6.9	7.0	1	2	2	2	4 E,N	2.0 J	2	2 U,N	14	51	13	27
downstream of North Bend WWTP	M444012C	10.8	10.3	11.9	12.2	12.1	11.5	6.9	6.8	6.9	7.2	1	3	1	2	4 E,N	3.4 J,N	2 U,N		6	35	19	35
	M444012D																						26
upstream of Snoqualmie WWTP	M412R	10.3	9.5	14.8	14.2	13.8	13.7	6.9	6.6	6.8	7.3	2	4	1	2	4 E,N	2.2 J		2 U,N	17	40	7	27
	M412C	10.2	9.5	14.8	14.1	13.8	13.5	6.9	6.7	6.9	7.1												
	M412L	10.3	9.7	14.8	14.2	13.8	13.5	6.8	6.8	6.9	7.1												
downstream of Snoqualmie WWTP	M407R	10.6	9.5	15.3	14.5	14.1	13.8	7.1	6.9	6.9	7.2	2	3	2	3		2.8 J,N	2 U,N		11	27	10	29
	M407C	10.4	9.5	15.1	14.4	14.0	13.9	6.8	6.8	6.9	7.1												
	M407L	10.3	9.4	15.1	14.5	14.1	14.0	6.8	6.8	6.8	7.1	2	2	1	2					20	27	15	44
proposed outfall location of proposed Carnation WWTP	M2301L	10.6	10.1	16.9	16.1	16.1	14.7	7.2	7.1	7.2	7.4	1	1	1 U	1 U					9	84	52	49
	M2301C		9.9		16.0	15.8	14.4		7.1	7.3	7.4												
	M2301R	16.9	10.0	7.1	16.0	15.8	14.8		7.1	7.4	7.4	1	2	1 U	1 U				2 U,N	14	55	41	48
upstream of Duvall WWTP	M147L	10.1		18.4			15.4	7.2		7.3	7.3			1	1 U							33	270
	M147R	10.0		18.4		16.5	15.2	7.0		7.2	7.4	1		2	1 U	4 E			2 U,N	17		39	220
downstream of Duvall WWTP	M098R	10.0	9.7	19.3	16.5	16.5	15.2	7.2	7.0	7.2	7.4	4	2	3	1 U			2 U,N		17	80	47	160
	M098L		9.9		16.5	16.5	15.2		6.9		7.5		1	1	4							31	200

*Source: Joy et al. (1991)
Dissolved oxygen measured by membrane probe
U = below detection limit indicated; J or E = estimated value; N = nitrification inhibited

Dissolved Oxygen

All main stem stations met class A standards for dissolved oxygen during each of four sampling rounds, with values ranging from 9.3 mg/L to 11.4 mg/L. Little variation in dissolved oxygen was observed with depth or horizontal position. Observed diurnal variation ranged up to about 1.4 mg/L. This maximum range was observed in the Snoqualmie vicinity.

Nutrients

State class A stream standards do not include nutrient levels.

Nutrient levels generally increased downstream along the main stem. Using the eutrophication scale of Mills et al. (1985), the study found that the problem threshold of 13 micrograms per liter (µg/L) of total phosphorus and 92 µg/L of total nitrogen was reached below Duvall at the downstream end of the study reach during all four sampling rounds. During the late September round, 71 percent of sampled stations reached the threshold level.

All mean nitrogen:phosphorus ratios exceeded 10, with a substantial majority exceeding 15 during the survey period, indicating that the main stem was phosphorus-limited.

Total phosphorus loads increased by about 40 pounds per day from river mile 42.3 (about 1 mile upstream of Snoqualmie) to the downstream end of the study reach, while total nitrogen loads increased by about 1,000 pounds per day over the same reach.

The existing wastewater treatment plants were significant sources of total phosphorus, with the North Bend facility doubling the south fork load, the Snoqualmie facility contributing 20 to 30 percent of the load observed immediately downstream, and the Duvall facility contributing 10 to 30 percent of the load observed downstream of that facility. Although study data did not allow the authors to fully evaluate total nitrogen loading, the three wastewater treatment plants and the tributary streams appeared to be significant sources. Significant nonpoint sources of nutrients appeared to be concentrated in four reaches:

- Fall City to Griffin Creek
- Tolt River to Carnation Research Road
- Ames/Sikes Creek to NE 124th Street bridge
- Below Cherry Creek to the downstream end of the study area.

The study authors speculated that livestock; septic tank leachate; fertilizer application; and subsurface flow and runoff from farms, residences, and golf courses could be contributing to these nonpoint loads.

Fecal Coliform Bacteria

In the July samples, none of the sampled stations had fecal coliform bacteria levels above the class A standard of 100 organisms per 100 milliliters (mL). In the August and late September samples, 30 percent of the sampled stations had fecal coliform levels above the class A standard. During the early September survey, one of 20 stations showed fecal coliform levels above the 100 organisms per 100 mL standard. All the violations occurred below river mile 32.6. River mile 32.6 is about 8 miles below Snoqualmie and 10 miles upstream of Carnation. Nonpoint loading was suspected to be a significant cause of elevated fecal coliform levels.

Water Quality Modeling

In addition to water quality sampling, the 1989 study included modeling simulations to predict future water quality conditions in the Snoqualmie River under two scenarios:

- Seven-day, once in 10 years low-flow conditions in the river with existing wastewater treatment plants at full design capacity

- Seven-day, once in 10 years low-flow conditions in the river with Fall City and Carnation wastewater treatment plants added to the existing wastewater treatment plants in Duvall, Snoqualmie, and North Bend, and all treatment plants operating at proposed or estimated design capacities.

Water quality parameters modeled were dissolved oxygen, total phosphorus, ammonia, and fecal coliform bacteria. Modeling yielded the following results:

- Additional wastewater treatment plant loads (secondary treatment) of biochemical oxygen demand and chemical oxygen demand are not expected to seriously decrease dissolved oxygen concentrations in the river

- Additional wastewater treatment plant loads (secondary treatment) could result in substantial exceedances of the Mills et al. (1985) problem threshold level of 13 μg/L for total phosphorus at locations throughout the study reach

- Additional wastewater treatment plant loads (secondary treatment) would increase ammonia loads, which could increase productivity in the river but would not create chronic toxicity problems under current pH and temperature conditions

- Nonpoint sources of fecal coliform bacteria predominate over point sources, and additional wastewater treatment plant loads (so long as they remain within permit limits) would not by themselves cause violations of the class A fecal coliform bacteria standard.

In addition to modeling overall chemical water quality in the river, the study also modeled mixing zones at the existing outfalls of the North Bend, Snoqualmie, and Duvall wastewater treatment plants and at the proposed outfall location for the Carnation treatment plant. Assuming implementation of Ecology's (draft) conditions for mixing zones, Joy et al. (1991)

concluded that the existing treatment plants could have difficulty meeting certain mixing zone dimensional requirements.

A subsequent study conducted by Howard Edde, Inc. in September 1990 (Edde 1990 personal communication) revealed that the city of Duvall's outfall would not meet the mixing zone and dimensional requirements.

Conclusions of 1989 Study

Among the conclusions and recommendations reached in the 1989 study, the following are significant in relation to the present study:

- With expansion of the existing wastewater treatment plants and addition of a Carnation treatment plant, cumulative total phosphorus loads may require seasonal phosphorus limits.

- Ammonia toxicity and dissolved oxygen problems could increase in frequency in the future.

- Replacing side-bank outfalls with midstream diffusers at existing wastewater treatment plants would reduce the likelihood of violations of expected NPDES mixing zone conditions for ammonia. However, modeling indicates that mixing zone conditions for other constituents may not be met even with midstream diffusers.

Ground Water

In 1963, the Washington Division of Water Resources in cooperation with the U.S. Geological Survey (USGS) published a study of ground water resources in northwestern King County (Liesch et al. 1963). This study, which included the Snoqualmie River valley, found the quality of ground water to be generally good. Due to substantial changes in land use in the valley over the past 30 years, this study is of limited use for the present report. The USGS is completing an updated study of ground water resources in an area that includes the Snoqualmie River valley (Turney 1993 personal communication).

Local water well data for the Carnation area were obtained from the USGS (1993). The data include sample results from 93 wells. The majority of the samples were collected in 1991. Data are also reported for several wells sampled in 1951, 1960, 1961, 1971, and 1981. The depth of the wells ranges from 23 to 765 feet.

The sample results indicate that ground water in the Carnation area is of good quality in comparison to U.S. EPA (1986) drinking water standards. The only contaminants that exceeded drinking water standards were lead and total coliform bacteria. Lead was exceeded in one well during testing in 1971. Total coliform standards were exceeded in six wells that were sampled

in 1991. Table 4 summarizes the range of well water results provided by USGS (1993) for selected drinking water contaminants, with drinking water standards.

Table 4. Selected contaminant concentrations found in Carnation area well water, 1951-1991.

Contaminant	Maximum contaminant level (mg/L)	Well Data Range (mg/L)
Arsenic	0.05	<0.001 - 0.037
Barium	1.0	<0.002 - 0.075
Cadmium	0.01	<0.001
Chromium	0.05	<0.001 - <0.03
Lead	0.05	<0.001 - <0.1
Mercury	0.002	<0.0001 - 0.0008
Nitrate (as N)	10	0.05 - 4.4
(as NO_3)	44	0.0 - 2.6
Selenium	0.01	<0.001
Silver	0.05	<0.001
Total coliform (colonies per 100 mL)	1	<1 - >60

Source: USGS (1993)

Existing and Emerging Regulations Affecting Wastewater Treatment

Existing Regulations

Section 303 of the federal Clean Water Act outlines the water quality standards program as a joint effort between the individual states and the U.S. EPA. The U.S. EPA develops regulations, policies, and guidance to help states implement the program and oversees state activities to ensure that state standards are consistent with the requirements of the Clean Water Act. The states have the primary responsibility for establishing, reviewing, revising, and enforcing water quality standards. The U.S. EPA can review and approve or disapprove state standards and enforce federal water quality standards where necessary.

The Washington Water Pollution Control Act (RCW 90.48) is the state statute through which the Clean Water Act is implemented and state water quality standards are defined. The Water Pollution Control Act enables control of discharges into surface waters through issuance of waste disposal permits.

The National Pollutant Discharge Elimination System (NPDES) permit program (WAC 173-220) governs the discharge of pollutants and other wastes and materials to surface waters of Washington state. The permit program was developed to operate under state law as part of the NPDES program created under section 402 of the Federal Water Pollution Control Act (FWPCA). Permits issued under the authority of WAC 173-220 are designed to satisfy the requirements of FWPCA section 402(b) and RCW 90.48.

WAC 173-201A defines the water quality standards for surface waters of the state of Washington. This regulation is reviewed periodically by Ecology, and appropriate revisions are made. Criteria for water use and water quality are established in consideration of present and potential water uses of the surface waters and in consideration of natural water quality potential and limitations.

The discharge standards and effluent limitations for domestic wastewater facilities are defined by WAC 173-221. This regulation, which supplements WAC 173-220, establishes discharge standards that represent all known, available, and reasonable methods of prevention, control, and treatment (AKART) for domestic wastewater facility discharges.

WAC 173-224, wastewater discharge permit fees, establishes a fee system for state waste discharges and NPDES permits issued by Ecology. The fees allow Ecology to fully recover (but not exceed) the costs of the permit program based on expenses incurred in issuing the permits. Ecology documents program needs and costs and reevaluates the established fees, adjusting them as appropriate.

The submittal of plans and reports for construction of wastewater facilities (WAC 173-240) establishes requirements for engineering reports, plans and specifications, and general sewer plans (WAC 173-240-020). This regulation also provides for review and approval of proposed methods of operation and maintenance.

The North Bend, Snoqualmie, and Duvall wastewater treatment facilities operate under individual NPDES permits (Appendix B). Each permit specifies water quality standards that must be met by the respective facility.

Emerging Regulations

Through WAC 173-205 Ecology has proposed whole effluent toxicity testing guidelines, which will identify facilities required to conduct effluent toxicity testing, qualifications of technicians who perform the testing, and required testing frequency. The new regulations will be implemented through the permit process.

The federal Clean Water Act mandates that the U.S. EPA establish national standards for the use and disposal of sewage biosolids. These standards have been established (40 CFR 503) as the regulatory framework of the national sewage biosolids program. The regulation applies to generators, treaters, preparers, end users, and disposers of sewage biosolids to be disposed of through land application, incineration, or surface disposal. Compliance with all 40 CFR 503 standards was required by February 19, 1994. A deadline of February 19, 1995 is applicable in cases that require construction of a pollution control facility to comply with the regulation.

Ecology staff in conversations with the author of this section did not speculate on future NPDES limits on wastewater discharges to the Snoqualmie River (Fricke 1993 personal communication). However, water quality modeling discussed in the previous section of this report indicates that regulatory limits on total phosphorus in point source discharges may be forthcoming in the near future.

The existing Duvall NPDES permit has incorporated requirements for the performance of dilution zone analysis and water quality studies to comply with WAC 173-204A.

It is anticipated that future updates of the NPDES permits for the cities of Snoqualmie and North Bend will include similar requirements for dilution zone analysis and water quality studies.

Septic System Regulations

RCW 90.48 governs the disposal of industrial and commercial liquid and solid waste into ground water. A waste disposal permit for any such discharge is required. Under the authority of RCW 90.48, Ecology has adopted water quality standards for ground water as well as regulations governing onsite disposal systems. The state has authority to issue permits for onsite systems receiving flows of 3,500 or more gallons per day. Local health departments issue permits for smaller systems.

Control of individual onsite disposal systems receiving less than 3,500 gallons per day rests with the Seattle/King County Health Department. New residential and nonresidential development projects within the county may use onsite disposal systems if required soil and density criteria are met and no sewer hookup is available within a specified distance. The county reviews

designs for new systems and inspects newly completed systems. Currently the health department has no regular program of monitoring older existing septic systems.

Bibliography

Beckwith Consulting Group. 1990. Draft environmental impact statement for the wastewater treatment plant expansion in Duvall, Washington.

Beckwith Consulting Group. 1992. Comprehensive plan update and final environmental impact statement. Duvall, Washington.

Carnation, City of. 1992. City of Carnation comprehensive plan.

Das, T. 1992. Snoqualmie River basin class II inspections at North Bend, Snoqualmie, and Duvall wastewater treatment plants.

Edde, Howard. November 1990. Personal communication (letter to John Glynn, Department of Ecology). Howard Edde, Inc. Consulting Engineers, Bellevue, WA.

Elsasser, Harlan. August 1993. Personal communication (telephone conversation with Sheila Gortler, Herrera Environmental Consultants). City of Duvall Public Works Department.

Fricke, Laura. September 30, 1993. Personal communication (telephone conversation with Nona Diediker, Herrera Environmental Consultants). Washington Department of Ecology, Northwest Regional Office, Redmond, WA.

Gray & Osborne Consulting Engineers. 1991. City of Snoqualmie sewer system comprehensive plan. Snoqualmie, WA.

Gruwell, Meg. September 1993. Personal communication (telephone conversation with Sheila Gortler, Herrera Environmental Consultants). City of Snoqualmie, WA.

Hammond, Collier & Wade-Livingstone Associates. 1987. Engineering report for city of Duvall.

Hanson, Bob. August 1993. Personal communication (telephone conversation with Sheila Gortler, Herrera Environmental Consultants). City of Snoqualmie, WA.

Joy, J., G. Pelletier, R. Willms, M. Heffner, and E. Aroner. 1991. Snoqualmie River low flow water quality assessment, July - September 1989. Washington Department of Ecology, Environmental Investigations and Laboratory Services Program, Olympia, WA.

Liesch, B.A., C.E. Price, and K.L. Walters. 1963. Geology and ground-water resources of northwestern King County, Washington. Water Supply Bulletin No. 20. Washington Division of Water Resources.

Morgan, Harold. April 1994. Personal communication (telephone conversation with Sheila Gortler, Herrera Environmental Consultants). City of Carnation.

North Bend, City of. 1978. North Bend area community plan. Department of Community Development.

Osborne, Pat. September 1993. Personal communication (telephone conversation with Sheila Gortler, Herrera Environmental Consultants). City of North Bend, WA.

R.W. Beck. 1991. Carnation second draft wastewater facilities plan, environmental impact statement. Carnation, Washington.

R.W. Beck. 1991. City of Carnation second draft wastewater facilities plan, Carnation, Washington.

Repp, Douglas. September 1993. Personal communication (telephone conversation with Sheila Gortler, Herrera Environmental Consultants). North Bend wastewater treatment facility, North Bend, WA.

RH2 Engineering. 1991. City of North Bend comprehensive sewer system plan.

RH2 Engineering. 1992. City of North Bend facility plan, Volume II: Wastewater treatment plan, draft I.

Semrau, Mark. September 1993 Personal communication (telephone conversation with Sheila Gortler, Herrera Environmental Consultants). RH2 Engineering, Redmond, WA.

Sevy, John. September 1993 Personal communication (telephone conversation with Sheila Gortler). City of Carnation, WA.

Turney, Gary. September 22, 1993. Personal communication (telephone conversation with Arthur Campbell, Herrera Environmental Consultants). U.S. Geological Survey, Tacoma, WA.

U.S. EPA. 1985. Water quality assessment: A screening procedure for toxic and conventional pollutants in surface and ground water (revised). EPA-600/6-85/002a. Prepared by W.B. Mills, D.B. Porcella, M.J. Ungs, and others for U.S. Environmental Protection Agency, Athens, GA.

U.S. EPA. 1986. Quality criteria for water, 1986. EPA 440/5-86-001. U.S. Environmental Protection Agency, Office of Water, Regulations and Standards, Washington, D.C.

U.S. EPA. 1989. Is your drinking water safe? EPA publication 570/9-89-005. U.S. Environmental Protection Agency, Office of Water.

USGS. 1993. Data sheets of water well sample results from the Carnation area. Multiple station analyses. Process date September, 29, 1993. U.S. Department of the Interior - Geological Survey.

APPENDIX A

Glossary

GLOSSARY

activated sludge - sludge that has been aerated and subjected to bacterial action; used to speed breakdown of organic matter in raw sewage during secondary waste treatment

aeration - to circulate oxygen through a substance as in wastewater treatment where it aids in purification

aerobic treatment (digestion) - process by which microbes decompose complex organic compounds in the presence of oxygen and use the liberated energy for reproduction and growth; types of aerobic processes include extended aeration, trickling filtration, and rotating biological contactors

ammonia (NH_3) - a nitrogen-containing substance which may indicate recently decomposed plant or animal material

aquifer - an underground geological formation, or group of formations, containing usable amounts of groundwater that can supply wells and springs

base flow - the water which flows in a stream in the absence of rainfall-supplied runoff water. The source of this water may be from lakes, snowmelt in the upper reaches of catchments, or discharge of groundwater into the stream

biochemical oxygen demand (BOD) - a measure of the amount of oxygen consumed in the biological processes that break down organic matter in water

biosolids - a primarily organic product, produced by wastewater treatment processes that can be beneficially recycled

catch basin - open-grated structure used to collect stormwater; sometimes equipped to trap sediment

chemical oxygen demand (COD) - 1) a measure of the oxygen required to oxidize all compounds in water, both organic and inorganic, 2) the amount of oxygen required to oxidize completely the organic and oxidizable inorganic compounds present; the oxidation is accomplished through the use of catalysts or chemicals, rather than bacteria as in BOD

chlorination - the application of chlorine to drinking water, sewage, or industrial waste to disinfect or to oxidize undesirable compounds

chlorine-contact chamber - that part of a waste treatment plant where effluent is disinfected by chlorine before being discharged

chronic toxicity - 1) any adverse effect on an organism that results after exposure of long duration, 2) the end result of a chronic effect can be death although the usual effects are sublethal (e.g., inhibited reproduction or growth)

clarifier - 1) a tank in which solids are settled to the bottom and are subsequently removed as sludge, 2) a settling tank where wastewater is held to allow solids to sink and be removed from the wastewater; also referred to as sedimentation tanks

coliform bacteria (fecal coliform bacteria) - a type of bacteria that is coil- or helix-shaped; fecal coliform bacteria are those coliform bacteria that are found in the intestinal tracts of mammals; the presence of high numbers of fecal coliform bacteria in a water body can indicate the recent release of untreated wastewater and/or the presence of animal feces; these organisms may also indicate the presence of pathogens that are harmful to humans

coliform organisms - microorganisms found in the intestinal tract of humans and animals; their presence in water indicates fecal pollution and potentially dangerous bacterial contamination by disease-causing microorganisms

combined sewer overflows (CSO) - an overflow from a combined sewerage system which occurs when the total wastewater flow exceed the system's capacity

combined sewers - a sewer system that carries both sewage and storm-water runoff

compost - a mixture of garbage and degradable trash with soil in which certain bacteria in the soil break down the garbage and trash into organic fertilizer

concentration - generally a measure by weight of a substance in a given volume of water, as in 5 milligrams per liter (5 mg/L). It can also be used as a number of organisms in a given volume of water, as in 50 organisms per 100 milliliters (50 org/100 mL).

dechlorination - removal of chlorine from a substance by chemically replacing it with hydrogen or hydroxide ion in order to detoxify the substances involved

degradation - the process by which a chemical is reduced to a less complex form

design flow - flow rate used to design the facility based in volume/time

diffuser - pipe structure that spreads flow to lower velocity

discharge, direct or indirect - the release of wastewater or contaminants to the environment; a direct discharge of wastewater flows directly into surface waters while an indirect discharge of wastewater enters a sewer system

dissolved oxygen (DO) - a measure of the amount of oxygen available for biochemical activity in a given amount of water, needed to support aquatic life

diurnal dry weather flow - the daily fluctuating of domestic wastewater flow exhibiting two peaks during the day

drain field - constructed infiltration area downstream of septic tank

effluent - wastewater, treated or untreated, that flows out of a treatment plant, sewer, or industrial outfall

estuary - 1) a coastal water body where ocean water is diluted by out-flowing fresh water, 2) regions of interaction between rivers and nearshore ocean waters where tidal action and river flow create a mixing of fresh and salt water

eutrophication - the slow aging process during which a lake, estuary, or bay evolves into a bog or marsh and eventually disappears

facultative - able to live under different conditions, as in facultative aerobes and facultative anaerobes

flood plain - land adjacent to lakes or rivers that is covered as water levels rise and overflow the normal water channels

ground water - 1) that part of the subsurface water that is in the zone of saturation, 2) underground water supplies stored in aquifers, 3) the supply of fresh water found beneath the earth's surface

headworks - control facilities for plant intake (inlet)

illegal stormwater connection - stormwater pipe tied into the sewer system illegally

infiltration - the water entering a sewerage system and its individual connections from the ground through such means as, but not limited to, defective pipes, pipe joints, pipe connections, or manhole covers

infiltration recharge chamber (dry well) - stormwater disposal system using pervious soils to filter water

inflow - water discharged into a sewer system and its individual connections from such sources as roof leaders, area drains, springs and swampy areas, manhole covers, cross connections from storm or combined sewers, catch basins surface runoff, street wash water, and other surface drainage

influent - the term given to identify water, wastewater or other liquid flowing into a reservoir, basin or treatment plant, or unit thereof

lagoon - 1) a shallow pond where sunlight, bacterial action, and oxygen work to purify wastewater; also used for storage of wastewaters, 2) shallow body of water, often separated from the sea by coral reefs or sandbars

land application - deposit of biosolids onto the ground for treatment or reuse

land use - the way land is developed and used in terms of the types of activities allowed (agriculture, residences, industries, etc.) and the size of buildings and structures permitted

leachate - water or other liquid that may have dissolved (leached) soluble materials, such as organic salts and mineral salts, derived from a solid material

lift station - pumping facility that lifts water from lower elevations through the use of a non-pressurized gravity flow system

limiting nutrient - the nutrient that is exhausted first by algae which require many nutrients and light to grow. As soon as one nutrient is exhausted, growth stops. Phytoplankton growth in lake waters of temperate lowland areas is generally phosphorus limited.

mixing zone - 1) a mixing zone is an allocated impact area where chronic water quality criteria can be exceeded as long as acutely toxic conditions are prevented, 2) an area, specified in a permit, which surrounds an effluent discharge

model - a formal set of relationships that attempt to represent in more simple form some processes of the real work; sometimes used as tools to estimate or project the processes

nitrate - a compound containing nitrogen which can exist in the atmosphere or as a dissolved gas in water

nitrogen - an element that is essential as a nutrient for growth of organisms

non-point source - pollution sources which are diffuse and do not have a single point of origin or are not introduced into a receiving stream from a specific outlet

NPDES Permit - permit issued under the National Pollution Discharge Elimination System, which sets effluent discharge limits, reporting requirements and other enforceable conditions placed on use of the water

nutrient - essential elements or chemical compounds needed by plants or animals for growth; excessive amounts of nutrients can lead to degradation of water quality by promoting excessive growth, accumulation, and subsequent decay of plants

onsite sewage disposal system - consists of a septic tank and drainfield

outfall - 1) the exit point from the wastewater collection system where effluent is discharged into receiving waters, 2) a pipe or pipes leading to the effluent discharge site, which is engineered to ensure dispersion and dilution in the receiving waters

oxidation pond (ditch) - a man-made lake or body of water in which waste is consumed by bacteria; it is used most frequently with other waste-treatment processes

parameter - one of a set of properties whose values determine the characteristics of a system

peak flow - the peak flow rate including base flow and inflow and infiltration that has an occurrence frequency associated with the slated return interval

pH - a measure of the acidity of a solution on a scale of 0 to 14, with 7 representing a neutral solution; a pH value less than 7 is acidic, and a value above 7 is basic (the pH of water influences many of the types of chemical reactions that occur in it)

phosphates - certain chemical compounds containing phosphorus

phosphorus - an essential chemical food element that can contribute to the eutrophication of lakes and other water bodies; increased phosphorus levels result from discharge of phosphorus-containing materials into surface waters

point source - 1) any discernible, confined and discrete conveyance including, but not limited to, any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock, from which pollutants may be discharged, 2) a stationary location or fixed facility form which pollutants are discharged or emitted

point source - a stationary location or fixed facility from which pollutants are discharged or emitted. Also, any single identifiable source of pollution, e.g., a pipe, ditch, ship, ore pit, factory smokestack

pretreatment - processes used to reduce the amount of pollution in water before it enters the sewers

primary treatment - the first stage wastewater treatment; removal of floating debris and solids by screening and sedimentation

pump station - pumps water through a pressurized main

riparian - relating to or living or located on the bank of a natural watercourse

sanitary sewers - underground pipes that carry off only domestic, commercial, or industrial waste, not storm water

secondary treatment - 1) the second step in most publicly owned waste treatment systems in which bacteria consume the organic parts of the waste, 2) biochemical treatment of wastewater after the primary stage using bacteria to consume the organic wastes

separated sewer system - a wastewater collection and treatment system where domestic and industrial wastewater is separated from storm runoff

septage - the sludge and scum material that is pumped out of a septic tank

septic tank - an underground storage tank for wastes from homes having no sewer line to a treatment plant

sewer - a channel or conduit that carries wastewater and storm water runoff from the source to a treatment plant or receiving stream

sewer interceptor (pipe) - intercepts flow for the collection systems

smoke test - test used to locate illegal connections or openings in the piping system

solids cake - solid product from biosolids dewatering

standard - a legally established allowable limit for a substance or characteristic in the water. Enforce actions by the appropriate agencies can be taken against parties who cause violations.

sump - a pit or tank that catches liquid runoff for drainage or disposal

surface water - all water naturally open to the atmosphere; also refers to springs, wells or other collectors which are directly influenced by surface water

suspended solids (SS) - small particles of organic or inorganic solid pollutants that float on the surface of or are suspended in sewage or other liquids and which cloud the water

tertiary treatment - advanced cleaning of wastewater that goes beyond the secondary or biological stage

treatment - chemical, biological, or mechanical procedures applied to an industrial or municipal discharge or to other sources of contamination to remove, reduce or neutralize contaminants

turbidity - a measure of the amount of material suspended in the water

Washington Administrative Code - contains all state regulations adopted by state agencies by a rulemaking process. For example, Chapter 173-201 WAC contains water quality standards.

wastewater - total flow within a sewerage system

water quality criteria - a concentration of a substance which ideally has been determined to result in a certain degree of environmental effect and which when not exceeded will protect an organism, an organism community or a prescribed water use or quality with an adequate degree of safety

water table - the upper surface of groundwater; below this point, the soil is saturated with water

APPENDIX B

National Pollutant Discharge Elimination System
Waste Discharge Permits
for North Bend, Snoqualmie, and Duvall

Permit No. WA-002935-1

Issuance Date: JUN 2 1988
Expiration Date: JUN 0 2 1993

NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM WASTE DISCHARGE PERMIT

State of Washington
DEPARTMENT OF ECOLOGY
Olympia, Washington 98504

In Compliance with the Provisions of
The State of Washington Water Pollution Control Law
Chapter 90.48 Revised Code of Washington
and
The Federal Water Pollution Control Act
(The Clean Water Act)
Title 33 United States Code, Section 1251 et seq.

CITY OF NORTH BEND
Post Office Box 896
North Bend, Washington 98045

Plant Location:

4th Avenue West & Sydney Street
North Bend, Washington 98045

(King County)

Receiving Water:

South Fork of Snoqualmie River

Waterway Segment Number:

03-07-13

Discharge Location:

Latitude: 47° 29' 40" N

Longitude: 122° 46' 50" W

---

is authorized to discharge in accordance with the special and general conditions which follow.

Nancy Ellison, Regional Manager
Northwest Regional Office
Department of Ecology

SPECIAL CONDITIONS

S1. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

Beginning on the issuance date of this permit and lasting through the expiration date of this permit, the Permittee is authorized to discharge treated municipal wastewater to the South Fork of Snoqualmie River at the discharge location specified on page one of this permit subject to the following effluent limitations:

EFFLUENT LIMITATIONS

Parameter	Monthly Average	Weekly Average
Biochemical Oxygen Demand* (5 day)	30 mg/L, 100 lbs/day	45 mg/L, 150 lbs/day
Total Suspended Solids*	30 mg/L, 100 lbs/day	45 mg/L, 150 lbs/day
Fecal Coliform Bacteria	200/100 mL	400/100 mL
pH**	Shall not be outside the range 6.0 - 9.0	

* The monthly average percent removal for BOD_5 and TSS shall not be less than 85 percent.

** Values outside of this range may be allowed if the Permittee demonstrates that such excursions are not the result of inorganic chemical additions to the treatment process or contributions from industrial sources.

The monthly and weekly average effluent limitations for BOD_5 and TSS are the arithmetic mean of the samples taken during a calendar month or week. The average effluent limitations for Fecal Coliform are the geometric mean of the samples taken during a calendar month or week.

Total available (Residual) Chlorine shall be maintained which is sufficient to attain the Fecal Coliform limits specified above. Chlorine concentrations in excess of that necessary to reliably achieve the limits shall be avoided.

S2. TESTING SCHEDULE

The Permittee shall monitor influent wastewater, effluent wastewater and plant operating parameters according to the following schedule:

Tests	Sample Point	Sampling Frequency	Sample Type
Flow	Influent and Effluent	Daily	Continuous Recording
Temperature	Raw Sewage	Daily	
pH	Raw Sewage Final Effluent	Daily Daily	
*Total Available (Residual) Chlorine	Final Effluent	Daily	
Dissolved Oxygen	Raw Sewage Aeration Basin Final Effluent	Daily Daily Daily	
BOD_5	Raw Sewage	Weekly	24 hr. Composite
	Final Effluent	Weekly	24 hr. Composite
Settleable Solids	Raw Sewage Final Effluent	Daily Daily	
Total Suspended Solids	Raw Sewage	Weekly	24 hr. Composite
	Aeration Basin Final Effluent	Weekly Weekly	24 hr. Composite
Volatile Suspended Solids	Aeration Basin	Weekly	
Sludge Volume Index	Aeration Basin	Weekly	
Loading Index (F/M Ratio)	Aeration Basin	Weekly	
Fecal Coliform	Final Effluent	3/Week	

NOTE: Except where otherwise stated, sample type is grab.

* Total available (Residual) Chlorine shall be measured and reported at the same time that Fecal Coliform samples are taken.

S3. MONITORING AND REPORTING

a. Reporting

The Permittee shall monitor the parameters as specified in Condition S1. of this permit and report the results for each calendar month. The reports shall be submitted no later than the 15th day of the month following the completed reporting period and shall be on forms supplied or approved by the Department. Completed forms shall be sent to the Northwest Regional Office of the Washington State Department of Ecology, 4350 - 150th Avenue NE, Redmond, Washington 98052-5301.

In addition, a summary report form (EPA Form 3320-1) covering each calendar month shall be submitted no later than the 15th day of the month following the completed reporting period. This report is limited to the parameters specified in Condition S1.

If the Permittee monitors any pollutant more frequently than required by this permit, such results shall be recorded and reported in accordance with these instructions.

b. Records Retention

The Permittee shall retain for a minimum of three years all records of monitoring activities and results, including all reports of recordings from continuous monitoring instrumentation. This period of retention shall be extended during the course of any unresolved litigation regarding the discharge of pollutants by the Permittee or when requested by the Director of this Department.

c. Recording of Results

For each measurement or sample taken, the Permittee shall record the following information: (1) the date, exact place, and time of sampling; (2) the dates the analyses were performed; (3) who performed the analyses; (4) the analytical techniques or methods used; and (5) the results of all analyses.

d. Representative Sampling

Samples and measurements taken to meet the requirements of this condition shall be representative of the volume and nature of the monitored discharge, including representative sampling of any unusual discharge or discharge condition, such as bypasses, upsets, and maintenance related conditions affecting effluent quality.

e. Test Procedures

All sampling and analytical methods used to meet the monitoring requirements specified in this permit shall, unless approved otherwise in writing by the Department, conform to the Guidelines Establishing

S3. MONITORING AND REPORTING (Continued)

Test Procedures for the Analysis of Pollutants, contained in Title 40 Code of Federal Regulations Part 136.

f. Additional Monitoring

The Department may establish specific treatment plant, receiving water, sediment and biological monitoring requirements beyond those identified in this permit by permit modification or administrative order.

S4. PREVENTION OF FACILITY OVERLOADING

a. Design Criteria

The design criteria for the permitted treatment facility are as follows:

Monthly Average Flow:	0.4 MGD
Influent BOD_5 loading:	1000 lbs/day
Influent TSS loading:	1200 lbs/day

b. Plans for Maintaining Adequate Capacity

When the actual flow or wasteload reaches 85 percent of the design capacity as specified in paragraph A. above, or when the projected increases would reach design capacity within five years, whichever occurs first, the Permittee shall submit to the Department, a plan and a schedule for continuing to maintain capacity at the facility sufficient to achieve the effluent limitations and other conditions of this permit. This plan shall address any of the following actions or any others necessary to meet this objective.

1. Analysis of the present design including the introduction of any process modifications that would establish the ability of the existing facility to achieve the effluent limits and other requirements of this permit at specific levels in excess of the existing design criteria specified in paragraph A. above.

2. Reduction or elimination of excessive infiltration and inflow of uncontaminated ground and surface water into the sewer system.

3. Limitation on future sewer extensions or connections or additional wasteloads.

4. Modification or expansion of facilities necessary to accommodate increased flow or wasteload.

The plan shall specify any contracts, ordinances, methods for financing or other arrangements necessary to achieve this objective.

S5. OPERATION AND MAINTENANCE OF FACILITIES

In accordance with the Washington Administrative Code, Chapter 173-230 (Certification of Operators of Wastewater Treatment Plants), the Permittee shall provide an adequate operating staff qualified to carry out the operation, maintenance and testing activities required to ensure compliance with the conditions of this permit. An operator certified for a Class II plant by the State of Washington shall be in responsible charge of the day to day operations of the wastewater treatment facility.

S6. PROVISION FOR POWER FAILURE

The Permittee is responsible for maintaining adequate safeguards to prevent the discharge of untreated wastes or wastes not treated in accordance with the requirements of this permit during power failure at the treatment facility including sewage lift stations either by means of alternate power sources, standby generation of power, or retention of inadequately treated wastes.

S7. RESIDUAL SOLIDS HANDLING

a. The Permittee shall handle, utilize and dispose of all residual solids in such a manner as to prevent its entry into state ground or surface waters.

b. The Permittee shall not permit leachate from its residual solids to enter state surface waters without providing all known, available and reasonable methods of treatment, nor permit such leachate to violate the State Water Quality Standards, Chapter 173-201, Washington Administrative Code, or cause any adverse effect on state ground waters. The Permittee shall apply for a permit or permit modification as may be required for such discharges.

c. Disposal or utilization of residual solids on land shall be in accordance with the requirements of the jurisdictional health Department.

d. The Department may establish specific sludge management requirements beyond those identified in this permit by permit modification or administrative order.

S8. CONSTRUCTION OR MAINTENANCE RELATED OVERFLOW, BYPASS OR REDUCTION IN LEVEL OF TREATMENT

a. The overflow, bypass or reduction in level of treatment of sewage at the treatment facility or within the sewage collection and transmission system tributary to the treatment facility in excess of that allowed by the effluent limitations of this permit during construction or maintenance shall be avoided if at all possible.

S8. CONSTRUCTION OR MAINTENANCE RELATED OVERFLOW, BYPASS OR REDUCTION IN LEVEL OF TREATMENT

b. If an event as described in paragraph A. above is contemplated which the Permittee could reasonably be expected to have anticipated, the Permittee shall submit to the Department not less than 90 days prior to the contemplated event, a report which describes in detail any construction work which will result in such a discharge of wastewater. The report shall contain: (1) an analysis of all known alternatives which would eliminate, reduce or mitigate the need for bypassing or reducing the level of treatment; (2) a cost effective analysis of alternatives including comparative resource damage assessment; (3) the duration of such events for each alternative; (4) a recommended preferred alternative for the bypass or reduction in level of treatment; (5) the projected date for the event; (6) a statement of compliance with the State Environmental Policy Act; and (7) a request for a water quality modification as provided for in Chapter 173-201-100(2) of the Washington Administrative Code.

c. Final authorization to discharge wastewater as described in paragraph A. above may be granted after review of the above information, in accordance with Condition G5. Authorization to discharge such wastewater will only be by administrative order.

d. If the Permittee expects a reduction in the required level of treatment that would exceed permit effluent limitations on a short-term basis for any reason, and such reduction cannot be avoided without resulting in the discharge of greater quantities of pollutants in the future, and the Permittee could not reasonably be expected to have anticipated the need for such reductions in the level of treatment within the time required for justifying such actions as required in paragraph B. above, the Permittee shall give written notification to the Department in accordance with Conditions G4. and G5.

S9. INDUSTRIAL AND COMMERCIAL SOURCES (PRETREATMENT)

The Permittee shall not allow discharges to their sewer system which would violate the general or specific prohibitions contained in Title 40, Code of Federal Regulations Part 403.5, or categorical standards contained in Title 40 Code of Federal Regulations Subchapter N, or any applicable regulations promulgated under Chapter 90.48 of the Revised Code of Washington.

The permittee shall assist the Department in monitoring commercial and industrial discharges into the sewer system and ensuring that all industrial and commercial users are in compliance with applicable pretreatment regulations.

The permittee shall submit written notice to the Department whenever any new or altered commercial or industrial source proposes to discharge waste into its sewer system which may interfere with the operation of the treatment facility, or interfere with the use or disposal of municipal sludge, or which may pass through the treatment facility causing violations of State Water

S9. INDUSTRIAL AND COMMERCIAL SOURCES (PRETREATMENT)

Quality Standards (Chapter 173-201 of the Washington Administrative Code). Neither connection nor discharge to the sewer system shall be allowed until the commercial or industrial source obtains a State Waste Discharge Permit or such source is otherwise approved by the Department as provided in Chapter 90.48.160 or Chapter 90.48.200 of the Revised Code of Washington.

The permittee shall perform industrial user survey, reporting, and other local assistance activities as specified by the Department in support of the state pretreatment program.

GENERAL CONDITIONS

G1. Discharge Violations:

All discharges and activities authorized by this permit shall be consistent with the terms and conditions of this permit. The discharge of any pollutant more frequently than or at a level in excess of that authorized by this permit shall constitute a violation of the terms and conditions of this permit.

G2. Proper Operation and Maintenance:

The Permittee shall at all times properly operate and maintain all facilities and systems of collection, treatment and control (and related appurtenances) which are installed or used by the Permittee to achieve compliance with the conditions of this permit.

G3. Reduced Production for Compliance:

The Permittee, in order to maintain compliance with its permit, shall control production and/or all discharges upon reduction, loss, failure, or bypass of the treatment facility until the facility is restored or an alternative method of treatment is provided. This requirement applies in the situation where, among other things, the primary source of power of the treatment facility is reduced, lost, or fails.

G4. Non-Compliance Notification:

If, for any reason, the Permittee does not comply with or will be unable to comply with any of the discharge limitations or other conditions specified in the permit, the Permittee shall, at a minimum, provide the Department with the following information:

a. A description of the nature and cause of noncompliance, including the quantity and quality of any unauthorized water discharges;

b. The period of noncompliance, including exact dates and times and/or the anticipated time when the Permittee will return to compliance; and

c. Steps taken or to be taken to reduce, eliminate, and prevent recurrence of the noncompliance.

In addition, the Permittee shall take immediate action to stop, contain, and clean up any unauthorized discharges and take all reasonable steps to minimize any adverse impacts to waters of the state and correct the problem. The Permittee shall notify the Department immediately by telephone so that an investigation can be made to evaluate any resulting impacts and the corrective actions taken to determine if additional action should be taken.

In the case of any discharge subject to any applicable toxic pollutant effluent standard under Section 307 (a) of the Clean Water Act, or which could constitute a threat to human health, welfare, or the environment, 40 CFR Part 122 requires that the information specified in items G4.a., G4.b., and G4.c., above, shall be provided not later than 24 hours from the time the

G4. Non-Compliance Notification (Continued):

Permittee becomes aware of the circumstances. If this information is provided orally, a written submission covering these points shall be provided within five days of the time the Permittee becomes aware of the circumstances, unless the Department waives or extends this requirement on a case-by-case basis.

Compliance with these requirements does not relieve the Permittee from responsibility to maintain continuous compliance with the conditions of this permit or the resulting liability for failure to comply.

G5. Bypass Prohibited:

The intentional bypass of wastes from all or any portion of a treatment works to the extent that permit effluent limitations cannot be met is prohibited unless the following four conditions are met:

a. Bypass is: (1) unavoidable to prevent loss of life, personal injury, or severe property damage; or (2) necessary to perform construction or maintenance related activities essential to meet the requirements of the Clean Water Act and authorized by administrative order;

b. There are no feasible alternatives to bypass, such as the use of auxiliary treatment facilities, retention of untreated wastes, maintenance during normal periods of equipment down time, or temporary reduction or termination of production;

c. The Permittee submits notice of an unanticipated bypass to the Department in accordance with Condition G4. Where the Permittee knows or should have known in advance of the need for a bypass, this prior notification shall be submitted for approval to the Department, if possible, at least 30 days before the date of bypass (or longer if specified in the special condition);

d. The bypass is allowed under conditions determined to be necessary by the Department to minimize any adverse effects. The public shall be notified and given an opportunity to comment on bypass incidents of significant duration, to the extent feasible.

"Severe property damage" means substantial physical damage to property, damage to the treatment facilities which would cause them to become inoperable, or substantial and permanent loss of natural resources which can reasonably be expected to occur in the absence of a bypass. Severe property damage does not mean economic loss caused by delays in production.

After consideration of the factors above and the adverse effects of the proposed bypass, the Department will approve or deny the request. Approval of a request to bypass will be by administrative order under RCW 90.48.120.

G6. Right of Entry:

The Permittee shall allow an authorized representative of the Department, upon the presentation of credentials and such other documents as may be required by law:

a. To enter upon the Permittee's premises where a discharge source is located or where any records must be kept under the terms and conditions of the permit;

b. To have access to and copy at reasonable times any records that must be kept under the terms and conditions of the permit;

c. To inspect at reasonable times any monitoring equipment or method required in the permit;

d. To inspect at reasonable times any collection, treatment, pollution management, or discharge facilities required under the permit;

e. To sample at reasonable times any discharge of pollutants.

G7. Permit Modifications:

The Permittee shall submit a new application or supplement to the previous application where facility expansions, production increases, or process modifications will (1) result in new or substantially increased discharges of pollutants or a change in the nature of the discharge of pollutants, or (2) violate the terms and conditions of the existing permit.

G8. Permit Modified or Revoked:

After notice and opportunity for public hearing, this permit may be modified, terminated, or revoked during its term for cause as follows:

a. Violation of any term or condition of the permit;

b. Failure of the Permittee to disclose fully all relevant facts or misrepresentation of any relevant facts by the Permittee in the application or during the permit issuance process;

c. A change in any condition that requires either a temporary or a permanent reduction or elimination of any discharge controlled by the permit;

d. Information indicating that the permitted discharge poses a threat to human health or welfare;

e. A change in ownership or control of the source; or

f. Other cause listed in 40 CFR Part 122.62 and 122.63.

Permit modification, revocation and reissuance, or termination may be initiated by the Department or requested by any interested person.

G9. Reporting a Cause for Modification:

A Permittee who knows or has reason to believe that any activity has occurred or will occur which would constitute cause for modification or revocation and reissuance under Condition G8. or 40 CFR Part 122.62 must report its plans, or such information, to the Department so that a decision can be made on whether action to modify or revoke and reissue a permit will be required. The Department may then require submission of a new application. Submission of such application does not relieve the discharger of the duty to comply with the existing permit until it is modified or reissued.

G10. Toxic Pollutants:

If any applicable toxic effluent standard or prohibition (including any schedule of compliance specified in such effluent standard or prohibition) is established under Section 307(a) of the Clean Water Act for a toxic pollutant and that standard or prohibition is more stringent than any limitation upon such pollutant in the permit, the Department shall institute proceedings to modify or revoke and reissue the permit to conform to the toxic effluent standard or prohibition.

G11. Plan Review Required:

Prior to constructing or modifying any wastewater control facilities, detailed plans shall be submitted to the Department for approval in accordance with WAC 173-240. Facilities shall be constructed and operated in accordance with the approved plans.

G12. Other Requirements of 40 CFR:

All other requirements of 40 CFR 122.41 and 122.42 are incorporated into this permit by reference.

G13. Compliance with Other Laws and Statutes:

Nothing in this permit shall be construed as excusing the Permittee from compliance with any applicable federal, state, or local statutes, ordinances, or regulations.

Permit No. WA-002240-3 (M)
Issuance Date June 23, 1977
Expiration Date June 23, 1982

JUN 23 1977

NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM
WASTE DISCHARGE PERMIT

State of Washington
DEPARTMENT OF ECOLOGY
Olympia, Washington 98504

In Compliance with the provisions of
Chapter 90.48 RCW as amended
and
The Federal Water Pollution Control Act Amendment of 1972,
Public Law 92-500

TOWN OF SNOQUALMIE
Town Hall
P.O. Box 337
Snoqualmie, Washington 98065

Plant Location:	Receiving Water: Snoqualmie River
East Bank of the Snoqualmie River ½ Mile North of the Snoqualmie City Limits	Discharge Location: 47° 32' 39" N 121° 49' 02" W
	Waterway Segment Number: 03-07-13

---

is authorized to discharge in accordance with the special and general conditions which follow.

Robert K. McCormick

ROBERT K. McCORMICK, Regional Manager
Department of Ecology (2)

SPECIAL CONDITIONS

S1. INTERIM EFFLUENT LIMITATIONS

The plant is designed for an average dry weather flow of 0.213 MGD and a peak flow of 0.619 MGD.

Beginning on the date of issuance of this permit and lasting through June 30, 1977, the permittee is authorized to discharge subject to the following limitations:

EFFLUENT LIMITATIONS

Parameter	Weekly Average	Monthly Average
Biochemical Oxygen Demand (5 day)	90 mg/l, 160 lbs/day	60 mg/l, 107 lbs/day
Suspended Solids	105 mg/l, 187 lbs/day	70 mg/l, 125 lbs/day
Fecal Coliform Bacteria	400/100 ml	200/100 ml
pH	Not outside the range 6.5 - 8.5	

The monthly and weekly averages for BOD_5 and Suspended Solids are based on the arithmetic mean of the samples taken. The averages for Fecal Coliform are based upon the geometric mean of the samples taken.

S2. FINAL EFFLUENT LIMITATIONS

The plant is designed for an average dry weather flow of 0.705 MGD and a peak flow of 1.60 MGD.

Beginning July 1, 1977, and lasting through the expiration date of this permit, the permittee is authorized to discharge subject to the following limitations:

EFFLUENT LIMITATIONS

	Weekly Average		Monthly Average		
	Maximum Concentration	Maximum Quantity	Maximum Concentration	Maximum Quality	Minimum Reduction
Biochemical Oxygen Demand (5 day)	45 mg/l	265 lbs/day	30 mg/l	176 lbs/day	85%
Total Suspended Solids	45 mg/l	265 lbs/day	30 mg/l	176 lbs/day	85%
Fecal Coliform Bacteria	400/100 ml	----	200/100 ml	----	----
pH	Not outside the range 6.0 - 9.0				

NOTE: Pounds per day values reflect current conditions and are not intended for design purposes.

S3. SCHEDULE OF COMPLIANCE

PL 92-500 requires Publicly Owned Treatment works to achieve secondary treatment as defined by 40 CFR Part 133 published in the Federal Register by July 1, 1977.

Failure to comply with the schedule outlined herein will subject the permittee to enforcement action under the provision of RCW 90.48. The permittee shall provide the appropriate regional office of the Department with written notice of compliance or non-compliance with the final requirements not later than 14 days after the date set forth above.

S4. MONITORING AND REPORTING

a. Testing Schedule

The permittee shall monitor the discharge and inplant operations according to the following schedule:

Tests	Sample Point	Sampling Frequency	Sample Type
pH	raw sewage final effluent	daily daily	
Flow	influent/effluent	daily	continuous record
Chlorine Residual	final effluent	daily	
DO	raw sewage final effluent ~~aeration basin~~	daily daily weekly	
BOD	final effluent	2/month	24 hr. composite
Mixed Liquor Temperature	aeration basin	daily	
Settleable Solids	raw sewage final effluent	daily daily	
Suspended Solids	final effluent	2/month	24 hr. composite
SVI	mixed liquor	2/week	
Fecal Coliform	effluent	weekly	
30 Minute Settleability	mixed liquor	daily	

NOTE: Except where otherwise indicated, Sample Type is grab.

S4. MONITORING AND REPORTING (Continued)

b.. Reporting

A monthly report recording each required analysis shall be submitted no later than the 15th day of the following month. The monthly reporting form will be either supplied to the permittee or approved by the Department.

In addition, a summary report form (EPA No. 3320-1) covering a one month period, shall be submitted no later than the 15th day of the following month. This report is limited to the limitations listed in Conditions S1 and S2.

Both monitoring reports shall be sent to the Northwest Regional Office of the Department of Ecology, 4350 - 150th Avenue N.E., Redmond, Washington 98052. Monitoring shall be started on the issuance date of this permit and the first monthly report is due forty-five (45) days after the issuance date of this permit.

If the permittee monitors any pollutant any more frequently than required by the permit, he shall record and report such results.

c. Records Retention

The permittee shall retain for a minimum of three years all records of monitoring activities and results, including all reports of recordings from continuous monitoring instrumentation. This period of retention shall be extended during the course of any unresolved litigation regarding the discharge of pollutants by the permittee or when requested by the Director.

d. Recording of Results

The permittee shall record each measurement or sample taken pursuant to the requirements of this permit for the following information: (1) the date, exact place, and time of sampling; (2) the dates the analyses were performed; (3) who performed the analyses; (4) the analytical techniques or methods used; and (5) the results of all analyses.

e. Representative Sampling

Samples and measurements taken to meet the requirements of this condition shall be representative of the volume and nature of the monitored discharge.

f. Test Procedures

All sampling and analytical methods used to meet the monitoring requirements specified in this permit shall, unless approved otherwise in writing by the Department, conform to the Guidelines Establishing Test Procedures for the Analysis of Pollutants, as contained in the latest revision of 40 CFR Part 136, which references the following publications:

1. American Public Health Association, Standard Methods for the Examination of Water and Wastewaters (latest edition).

2. American Society for Testing and Materials, A.S.T.M. Standards, (latest edition).

3. Environmental Protection Agency, Water Quality Office Analytical Control Laboratory, Methods for Chemical Analysis of Water and Wastes (latest edition).

S5. OPERATION AND MAINTENANCE

The permittee shall provide an adequate operating staff which is qualified to carry out the operation, maintenance, and testing activities required to insure compliance with the conditions of this permit. An operator certified in the appropriate classification by the State of Washington shall be in responsible charge of the day-to-day operation of the wastewater treatment plant.

S6. SOLID WASTE DISPOSAL

a. The permittee shall handle and dispose of all solid waste material in such a manner as to prevent their entry into state ground or surface water.

b. The permittee shall not permit leachate from its solid waste materials to enter state surface waters without providing all known, available and reasonable methods of treatment, nor permit such leachate to cause any adverse effect on state ground waters.

S7. PROVISION FOR ELECTRIC POWER FAILURE

The permittee is responsible for maintaining adequate safeguards to prevent the discharge of untreated or inadequately treated wastes during an electrical power or mechanical failure at the treatment plant or sewage lift stations either by means of alternate power sources, retention of inadequately treated effluent or other methods approved by the Department.

S8. OTHER REQUIREMENTS

a. The following is a list of sanitary sewer overflows and sewage pumping station bypasses which are occasional point sources of pollutants during inclement weather. After June 30, 1977, there shall be no Water Quality Standards violations allowed resulting from discharges from these overflows or bypasses.

S8. OTHER REQUIREMENTS (Continued)

Location	Receiving Water
1. Plant Bypass	Snoqualmie River
2. Lift Station #1 West end of 1st Place North	Snoqualmie River via Kimble Creek
3. Lift Station #2 First Street and Newton Street	Snoqualmie River via Slough
4. Lift Station #3 Newton Street and Park Street	Snoqualmie River
5. Lift Station #4 Spruce Street and Meadowbrook Street	Snoqualmie River

b. The Department may issue waste discharge permits to significant industries discharging wastewater to municipal sewerage systems in accordance with RCW 90.48 as amended. The Department, by use of these permits, requires each industrial user of the permittee's sewerage system to provide pre-treatment in accordance with guidelines promulgated pursuant to Section 307 of the 1972 Federal Water Pollution Control Act.

The permittee shall assist the Department in monitoring and enforcing the pretreatment requirements as specified in the aforementioned Department permits.

c. The permittee shall require any industrial user of the municipal sewerage system to make payment for the waste treatment services as required by Section 204 (b) of the 1972 Federal Water Pollution Control Act.

GENERAL CONDITIONS

G1. All discharges and activities authorized herein shall be consistent with the terms and conditions of this permit. The discharge of any pollutant more frequently than or at a level in excess of that identified and authorized by this permit shall constitute a violation of the terms and conditions of this permit.

G2. Whenever a facility expansion is anticipated which will result in a new or increased discharge, or which will cause any of the conditions of this permit to be exceeded, a new application must be submitted together with the necessary reports and engineering plans for the proposed changes. No change shall be made until plans have been approved and a new permit or permit modification has been issued.

G3. The diversion or bypass of any discharge from the treatment works by the permittee is prohibited, except (a) where unavoidable to prevent loss of life or severe property damage, or (b) where excessive storm drainage or runoff would damage any facilities necessary for compliance with the terms and conditions of this permit. The permittee shall immediately notify the Department of each such diversion or bypass in accordance with the procedure specified in Condition G4.

G4. In the event the permittee is unable to comply with any of the conditions of this permit, the permittee shall:

a. Immediately take action to stop, contain, and clean up the unauthorized discharges and correct the problem.

b. Immediately notify the Department by telephone so that an investigation can be made to evaluate the impact and the corrective actions taken and determine if additional action should be taken.

c. Submit a detailed written report to the Department describing the breakdown, the actual quantity and quality of resulting waste discharges, corrective action taken, steps taken to prevent a recurrence, and any other pertinent information.

Compliance with these requirements does not relieve the permittee from responsibility to maintain continuous compliance with the conditions of this permit or the resulting liability for failure to comply.

G5. The permittee shall at all times maintain in good working order and efficiently operate all treatment or control facilities or systems installed or used by the permittee to achieve compliance with the terms and conditions of this permit.

G6. After notice and opportunity for a hearing, this permit may be modified, suspended or revoked in whole or in part during its term for cause including but not limited to the following:

a. Violation of any terms or conditions of this permit;

b. Obtaining this permit by misrepresentation or failure to disclose fully all relevant facts;

c. A change in the condition of the receiving waters or any other condition that requires either a temporary or permanent reduction or elimination of the authorized discharge.

G7. The permittee shall, at all reasonable times, allow authorized representatives of the Department:

a. To enter upon the permittee's premises for the purpose of inspecting and investigating conditions relating to the pollution of, or possible pollution of, any of the waters of the state, or for the purpose of investigating compliance with any of the terms of this permit;

b. To have access to and copy any records required to be kept under the terms and conditions of this permit;

c. To inspect any monitoring equipment or monitoring method required by this permit; or,

d. To sample any discharge of pollutants.

G8. If a toxic effluent standard or prohibition (including any schedule of compliance specified in such effluent standard or prohibition) is established under Section 307 (a) of the Federal Act for a toxic pollutant which is present in the discharge authorized herein and such standard or prohibition is more stringent than any limitation upon such pollutant in this permit, this permit shall be revised or modified in accordance with the toxic effluent standard or prohibition and the permittee shall be so notified. Section 307 (a) requires that the Administrator of the Environmental Protection Agency shall promulgate effluent standards (or prohibition) for toxic pollutants which he has listed as such.

G9. Nothing in this permit shall be construed as excusing the permittee from compliance with any applicable Federal, State, or local statutes, ordinances, or regulations.

Permit No.: WA-002951-3
Issuance Date: October 9, 1992
Effective Date: October 9, 1992
Expiration Date: Aug. 1, 1997
Revised: November 6, 1992

NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM
WASTE DISCHARGE PERMIT

State of Washington
DEPARTMENT OF ECOLOGY
Olympia, Washington 98504-8711

In compliance with the provisions of
The State of Washington Water Pollution Control Law
Chapter 90.48 Revised Code of Washington
and
The Federal Water Pollution Control Act
-- (The Clean Water Act)
Title 33 United States Code, Section 1251 et seq.

CITY OF DUVALL
P.O. Box 1300
Duvall, Washington 98019

Plant Location:

SR 203 and 145th Street
Duvall, Washington

Waterway Segment Number:

03-07-13

Water Body I.D. No.:

WA-07-1100

Plant Type:

Oxidation Ditch

Receiving Water:

Snoqualmie River

Discharge Location:

Latitude: 47° 43' 20"
Longitude: 121° 59' 37"

---

is authorized to discharge in accordance with the special and general conditions which follow.

John H. Glynn
Water Quality Supervisor
Northwest Regional Office
Department of Ecology

Permit No.: WA-002951-3
Issuance Date: OCT 09 1992
Effective Date: OCT 09 1992
Expiration Date: Aug. 1, 1997

NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM
WASTE DISCHARGE PERMIT

State of Washington
DEPARTMENT OF ECOLOGY
Olympia, Washington 98504-8711

In compliance with the provisions of
The State of Washington Water Pollution Control Law
Chapter 90.48 Revised Code of Washington
and
The Federal Water Pollution Control Act
(The Clean Water Act)
Title 33 United States Code, Section 1251 et seq.

CITY OF DUVALL
P.O. Box 1300
Duvall, Washington 98019

Plant Location:

SR 203 and 145th Street
Duvall, Washington

Waterway Segment Number:

03-07-13

Water Body I.D. No.:

WA-07-1100

Plant Type:

Oxidation Ditch

Receiving Water:

Snoqualmie River

Discharge Location:

Latitude: 47° 43' 20"
Longitude: 121° 59' 37"

---

is authorized to discharge in accordance with the special and general conditions which follow.

John H. Glynn
Water Quality Supervisor
Northwest Regional Office
Department of Ecology

TABLE OF CONTENTS

Page

Summary of Scheduled Permit Report Submittals..... 4

Special Conditions

S1. Effluent Limitations..... 5

A. Effluent Limitations
B. Mixing Zone Description

S2. Testing Schedule..... 6

S3. Monitoring and Reporting..... 9

A. Reporting Requirements
B. Records Retention
C. Recording of Results
D. Representative Sampling
E. Test Procedures
F. Flow Measurement

S4. Prevention of Facility Overloading..... 10

A. Facility Design Criteria
B. Plans for Maintaining Adequate Capacity
C. Notification of New or Altered Sources

S5. Operation and Maintenance..... 12

A. Certified Operator
B. O&M Manual
C. O&M Program
D. Short-Term Treatment Reduction
E. Electric Power Failure
F. Prevent Connection of Inflow

S6. Construction or Maintenance-Related Overflow or Bypass..... 13

S7. Residual Solids..... 14

A. Residual Solids Handling
B. Leachate
C. Land Disposal or Utilization
D. Solids Management Plan
E. Applicable Federal Law
F. Permit Modification, Revocation, Reissuance

TABLE OF CONTENTS
(continued)

Page

S8. Pretreatment..... 15

S9. Acute Biomonitoring Study..... 17

S10. Chronic Biomonitoring..... 18

----------GENERAL CONDITIONS----------

G1. Discharge Violations..... 21
G2. Proper Operation and Maintenance..... 21
G3. Reduced Production for Compliance..... 21
G4. Non-Compliance Notification..... 21
G5. Bypass Prohibited..... 22
G6. Right of Entry..... 23
G7. Permit Modifications..... 23
G8. Permit Modified or Revoked..... 23
G9. Reporting a Cause for Modification..... 24
G10. Toxic Pollutants..... 24
G11. Plan Review Required..... 24
G12. Other Requirements of 40 CFR..... 24
G13. Compliance With Other Laws and Statutes..... 24
G14. Additional Monitoring..... 25
G15. Revocation for Non-payment of Fees..... 25
G16. Removed Substances..... 25
G17. Duty to Reapply..... 25

TABLE OF CONTENTS
(continued)

Page

S8. Pretreatment..... 15

S9. Acute Biomonitoring Study..... 16

S10. Chronic Biomonitoring..... 18

----------GENERAL CONDITIONS----------

G1. Discharge Violations..... 21
G2. Proper Operation and Maintenance..... 21
G3. Reduced Production for Compliance..... 21
G4. Non-Compliance Notification..... 21
G5. Bypass Prohibited..... 22
G6. Right of Entry..... 23
G7. Permit Modifications..... 23
G8. Permit Modified or Revoked..... 23
G9. Reporting a Cause for Modification..... 24
G10. Toxic Pollutants..... 24
G11. Plan Review Required..... 24
G12. Other Requirements of 40 CFR..... 24
G13. Compliance With Other Laws and Statutes..... 24
G14. Additional Monitoring..... 25
G15. Revocation for Non-payment of Fees..... 25
G16. Removed Substances..... 25
G17. Duty to Reapply..... 25

SUMMARY OF SUBMITTALS

Permit Section	Submittal	Frequency	First Submittal Date
S3.A.	Discharge Monitoring Report	Monthly	
S3.A.	Wastewater Treatment Plant Report	Monthly	
S4.D.	Infiltration and Inflow Evaluation	Annual	January 1, 1993
S4.E.	Flow and Wasteload Assessment	Annual	January 1, 1993
S7.D.	Residual Solids Management Plan	1/permit cycle	January 1, 1993
S7.D.	Residual Solids Management Plan Update	1/permit cycle	Febuary 1, 1997
S9.A.	Acute Biomonitoring Characterization	quarterly for one year	March 15, 1993
S9.A.	Acute Biomonitoring Characterization Final Report	one time submittal	January 15, 1994
S9.A.	Acute Biomonitoring (Routine)	quarterly	June 15, 1994
S10.A.	Chronic Biomonitoring Characterization	semi-annually for 1 year	June 15, 1993
S10.A.	Chronic Biomonitoring Characterization Final Report	one time submittal	January 15, 1994
S10.A.	Chronic Biomonitoring (Routine)	semi-annually	June 15, 1994
G17.	Permit Application for Renewal	1/permit cycle	February 1, 1997

S1. EFFLUENT LIMITATIONS:

A. Beginning on the effective date of this permit and lasting through the expiration date, the Permittee is authorized to discharge via outfall 001 subject to meeting the following limitations:

EFFLUENT LIMITATIONS

Parameter	Monthly Average	Weekly Average
Biochemical Oxygen Demand[1] (5 day)	30 mg/l, 225 lbs/day	45 mg/l, 338 lbs/day
Total Suspended Solids[2]	30 mg/l, 225 lbs/day	45 mg/l, 338 lbs/day
Fecal Coliform Bacteria	200/100 ml	400/100 ml
pH	shall not be outside the range 6.0 to 9.0	

	Monthly Average	Daily Maximum
Chlorine	65 µg/L (0.49 lb/d)	169 µg/L
Copper[3]	29 µg/L (.22 lb/d)	43 µg/L
Mercury[3]	1.08 µg/L (.008 lb/d)	1.58 µg/L
Silver[3]	2.29 µg/L (.017 lb/d)	3.34 µg/L
Zinc[3]	221 µg/L (1.66 lb/d)	322 µg/L
Ammonia (NH_3-N)	5 mg/L (37.5 lb/d)	8 mg/L

The monthly and weekly averages for BOD5 and Total Suspended Solids are based on the arithmetic mean of the samples taken. The averages for fecal coliform are based on the geometric mean of the samples taken.

[1]The monthly average effluent concentration limit for BOD_5 shall not exceed 30 mg/L or 25% of the influent concentration, whichever is more stringent.

[2]The monthly average effluent concentration limit for TSS shall not exceed 30 mg/L or 19% of the influent concentration, whichever is more stringent.

[3]Metal limits are total recoverable metals.

S1. EFFLUENT LIMITATIONS: (continued)

B. Mixing Zone Description

The boundaries of the mixing zone are defined as follows:

Outfall 001:

1. The width of the mixing zone is limited to 20 feet and is centered on the mid-river discharge.

2. The length of the mixing zone is limited to 300 feet downstream of the discharge.

3. The length of the zone of acute criteria exceedance is limited to 30 feet downstream of the discharge. The flow of the river available for acute dilution is limited to 2 1/2 percent of 7Q10 flow of 441 cfs; therefore, the flow available for acute dilution is limited to a maximum of 11.025 cfs.

S2. TESTING SCHEDULE:

Beginning on the effective date and lasting through the expiration date, the Permittee shall monitor the wastewater and sludge according to the following schedule:

Tests	Sample Point	Sampling Frequency	Sample Type
COMPLIANCE:			
Flow	Influent	7/week	Continuous
BOD_5	Influent	3/week	24-hr. composite
	Chlorinated Effluent	3/week	24-hr. composite
TSS	Influent	3/week	24-hr. composite
	Chlorinated Effluent	3/week	24-hr. composite
Fecal Coliform*	Chlorinated Effluent	3/week	grab
Total Available (Residual) Chlorine*	Chlorinated Effluent	7/week	grab
pH	Chlorinated Effluent	7/week	grab

S2. TESTING SCHEDULE: (continued)

Tests	Sample Point	Sampling Frequency	Sample Type
Metals Copper Mercury Silver Zinc	Chlorinated Effluent	1/month	24-hr. composite
Ammonia (NH_3-N)	Chlorinated Effluent	1/week	24-hr. composite
Total Phosphorous		1/month	24-hr. composite

* Total availabile (residual) chlorine shall be sampled at the same time fecal coliform samples are taken.

Tests	Sample Point	Sampling Frequency	Sample Type
PROCESS CONTROL:			
Temperature	Influent	daily	grab
pH	Influent	daily	grab
Dissolved Oxygen DO	Aeration Basins Influent	daily	grab
Total Suspended Solids (TSS)	Aeration Basins	weekly	grab
Sludge Volume Index	Aeration Basins	weekly	grab
Volatile Suspended Solids	Aeration Basins	weekly	grab
Loading Index	Aeration Basins	weekly	calculated
SLUDGE:			
Polychlorinated Biphenyls	Digested Sludge	1/year	manual composite

S2. TESTING SCHEDULE: (continued)

Tests	Sample Point	Sampling Frequency	Sample Type
Heavy Metals Cadmium Copper Chromium Lead Nickel Zinc	Digested Sludge	1/year	manual composite
Volatile Solids	Raw Sewage Digested Sludge	1/week 1/week	24-hour composite manual composite
Volatile Solids Reduction		1/week	calculated
Waste Sludge Removed Off-site	Digested Sludge	daily when removal occurs	report
Total Nitrogen Nitrate Nitrite Ammonia Organic	Digested Sludge	1/year	manual composite
WHOLE EFFLUENT TOXICITY:			
Acute Biomonitoring Characterization (S9.A.)	Final Effluent	4/year	24-hour composite
Acute Biomonitoring Routine (S.9.A.)	Final Effluent	4/year	24-hour composite
Chronic Biomonitoring Characterization (S10.A.)	Final Effluent	2/year	24-hour composite
Chronic Biomonitoring Routine (S10.A.)	Final Effluent	2/year	24-hour composite

S3. MONITORING AND REPORTING:

The Permittee shall monitor the operations and efficiency of all treatment and control facilities and the quantity and quality of the waste discharged. A record of all such data shall be maintained. The Permittee shall monitor the parameters as specified in Condition S2. of this permit.

A. Reporting

Monitoring results obtained during the previous month shall be summarized and reported on a form provided, or otherwise approved, by Ecology, to be submitted no later than the 15th day of the month following the completed reporting period. The report shall be sent to the Department of Ecology, Northwest Regional Office, 3190 160th Avenue S.E., Bellevue, Washington 98008. Monitoring shall be started on the effective date of the permit and the first report is due on the 15th day of the following month. In addition to the monthly report, a summary report form (EPA No. 3320-1) shall be submitted no later than the 15th day of the following month. This report is limited to the parameters specified in condition S1A.

B. Records Retention

The Permittee shall retain for a minimum of three years all records of monitoring activities and results, including all reports of recordings from continuous monitoring instrumentation. This period of retention shall be extended during the course of any unresolved litigation regarding the discharge of pollutants by the Permittee or when requested by the Director. The Permittee shall retain for a minimum of five (5) years all records pertaining to the monitoring of sludge.

C. Recording of Results

For each measurement or sample taken, the Permittee shall record the following information: (1) the date, exact place and time of sampling; (2) the dates the analyses were performed; (3) who performed the analyses; (4) the analytical techniques or methods used; and (5) the results of all analyses.

D. Representative Sampling

Samples and measurements taken to meet the requirements of this condition shall be representative of the volume and nature of the monitored discharge, including representative sampling of any unusual discharge or discharge condition, including bypasses, upsets and maintenance-related conditions affecting effluent quality.

S3. MONITORING AND REPORTING: (continued)

E. Test Procedures

All sampling and analytical methods used to meet the monitoring requirements specified in this permit shall, unless approved otherwise in writing by Ecology, conform to the Guidelines Establishing Test Procedures for the Analysis of Pollutants, contained in 40 CFR Part 136.

F. Flow Measurement

Appropriate flow measurement devices and methods consistent with accepted scientific practices shall be selected and used to ensure the accuracy and reliability of measurements of the volume of monitored discharges. The devices shall be installed, calibrated, and maintained to ensure that the accuracy of the measurements are consistent with the accepted industry standard for that type of device. Frequency of calibration shall be in conformance with manufacturer's recommendations or at a minimum frequency of at least one calibration per year.

S4. PREVENTION OF FACILITY OVERLOADING:

A. Design Criteria

Flows or waste loadings of the following design criteria for the permitted treatment facility shall not be exceeded:

Average flow for the maximum month: 0.9 MGD

Influent BOD5 loading for maximum month: 900 lb/day

Influent TSS loading for maximum month: 1200 lb/day

B. Plans for Maintaining Adequate Capacity

When the actual flow or wasteload reaches 85 percent of the design capacity as specified in paragraph A above or when the projected increases would reach design capacity within five years, whichever occurs first, the Permittee shall submit to Ecology, a plan and a schedule for continuing to maintain capacity at the facility sufficient to achieve the effluent limitations and other conditions of this permit. This plan shall address any of the following actions or any others necessary to meet this objective.

S4. PREVENTION OF FACILITY OVERLOADING: (continued)

1. Analysis of the present design including the introduction of any process modifications that would establish the ability of the existing facility to achieve the effluent limits and other requirements of this permit at specific levels in excess of the existing design criteria specified in paragraph A above.

2. Reduction or elimination of excessive infiltration and inflow of uncontaminated ground and surface water into the sewer system.

3. Limitation on future sewer extensions or connections or additional wasteloads.

4. Modification or expansion of facilities necessary to accommodate increased flow or wasteload.

5. Reduction of industrial or commercial flows or waste loads to allow for increasing sanitary flow or waste load.

The plan must meet the requirements of WAC 173-240-060, "Engineering Report," and be approved by Ecology prior to any construction. The plan shall specify any contracts, ordinances, methods for financing, or other arrangements necessary to achieve this objective.

C. Notification of New or Altered Sources

The Permittee shall submit written notice to Ecology whenever any new discharge or increase in volume or change in character of an existing discharge into the sewer is proposed which: (1) would interfere with the operation of, or exceed the design capacity of, any portion of the collection or treatment system; (2) would increase the total system flow or influent waste loading by more than 10 percent; (3) is not part of an approved general sewer plan or approved plans and specifications; or would be subject to pretreatment standards under 40 CFR Part 403 and Section 307(b) of the Clean Water Act. This notice shall include an evaluation of the system's ability to adequately transport and treat the added flow and/or wasteload.

D. Infiltration and Inflow Evaluation

1. The Permittee shall continue its infiltration and inflow evaluation. Plant monitoring records may be used to assess measurable infiltration and inflow.

S4. PREVENTION OF FACILITY OVERLOADING: (continued)

2. A report shall be prepared which summarizes any measurable infiltration and inflow. If infiltration and inflow have increased by more than 15 percent from that found in the first report based on equivalent rainfall, the report shall contain a plan and a schedule for: (1) locating the sources of infiltration and inflow; and (2) correcting the problem.

3. The report shall be submitted by January 1, 1993 and annually thereafter.

E. Annual Assessment

The Permittee shall conduct an annual assessment of their flow and wasteload and submit a report to Ecology by January 1, 1993, and annually thereafter. The report shall contain the following: an indication of compliance or noncompliance with the permit effluent limitations; a comparison between the existing and design monthly average dry weather and wet weather flows, peak flows, BOD, and total suspended solids loadings; and (except for the first report) the percentage increase in these parameters since the last annual report. The report shall also state the present and design population or population equivalent, projected population growth rate, and the estimated date upon which the design capacity is projected to be reached, according to the most restrictive of the parameters above. The requirement for annual review and reporting may be waived by Ecology if the reports do not indicate a need for review at that frequency.

S5. OPERATION AND MAINTENANCE OF MUNICIPAL FACILITIES:

A. Certified Operator

In accordance with WAC 173-230, the Permittee shall provide an adequate operating staff which is qualified to carry out the operation, maintenance, and testing activities required to ensure compliance with the conditions of this permit. An operator certified for a Class II plant by the State of Washington shall be in responsible charge of the day-to-day operation of the wastewater treatment plant. A Group I operator shall be present at the facility during all shifts when operational changes are made to the treatment process.

B. O & M Manual

The approved operation and maintenance manual shall be kept available at the treatment plant. The operation and maintenance shall contain the plant process control monitoring schedule. The operator is responsible for being familiar with, and using, this manual.

S5. OPERATION AND MAINTENANCE OF MUNICIPAL FACILITIES: (continued)

C. O & M Program

The Permittee shall institute an adequate operation and maintenance program for their entire sewage system. Maintenance records shall be maintained on all major electrical and mechanical components of the treatment plant, as well as the sewage system and pumping stations. Such records shall clearly specify the frequency and type of maintenance recommended by the manufacturer and shall show the frequency and type of maintenance performed. These maintenance records shall be available for inspection at all times.

D. Short-term Reduction

If a Permittee contemplates a reduction in the required level of treatmen that would exceed permit effluent limitations on a short-term basis for any reason and such reduction cannot be avoided, the Permittee shall give written notification to Ecology, if possible, 30 days prior to such activities, detailing the reasons for, length of time of and the potentia effects of the reduced level of treatment. If such a reduction involves bypass, the requirements of Condition G5, and the "Construction or Maintenance-Related Overflow or Bypass" conditions must be met.

E. Electrical Power Failure

The Permittee is responsible for maintaining adequate safeguards to prevent the discharge of untreated wastes or wastes not treated in accordance with the requirements of this permit during electrical power failure at the treatment plant and/or sewage lift stations either by means of alternate power sources, standby generator, or retention of inadequately treated wastes.

F. Prevent Connection of Inflow

The Permittee shall strictly enforce their sewer ordinances and not allow the connection of inflow (roof drains, foundation drains, etc.) to the sanitary sewer system.

S6. CONSTRUCTION OR MAINTENANCE - RELATED OVERFLOW OR BYPASS:

Bypasses of untreated or partially treated sewage during construction or maintenance shall be avoided if at all feasible.

If a construction or maintenance-related overflow or bypass is contemplated, the Permittee shall submit to Ecology, not less than 90 days prior to the contemplated overflow or bypass, a report which describes in detail any construction work which will result in overflow or bypass of wastewater.

S6. CONSTRUCTION OR MAINTENANCE - RELATED OVERFLOW OR BYPASS: (continued)

The report shall contain: (1) an analysis of all known alternatives which would eliminate, reduce, or mitigate the need for bypassing; (2) a cost-effective analysis of alternatives including comparative resource damage assessment; (3) the minimum and maximum duration of bypass under each alternative; (4) a recommendation as to the preferred alternative for conducting the bypass; (5) the project date of bypass initiation; (6) a statement of compliance with SEPA; and (7) a request for a water quality modification, as provided for in WAC 173-201-100(2).

For probable construction bypasses, the need to bypass is to be identified as early in the planning process as possible. The analysis required above shall be considered during preparation of the engineering report or facilities plan and plans and specifications and shall be included to the extent practical. In cases where the probable need to bypass is determined early, continued analysis is necessary up to and including the construction period in an effort to minimize or eliminate the bypass.

Final authorization to bypass may be granted after review of the above information, in accordance with Condition G5. Authorization to bypass will be by administrative order.

S7. RESIDUAL SOLIDS:

A. Residual Solids Handling

The Permittee shall handle, utilize, and dispose of all residual solids in such a manner as to prevent its entry into state ground or surface waters.

B. Leachate

The Permittee shall not allow leachate from their residual solids to enter state surface waters without providing all known, available and reasonable methods of treatment, nor allow such leachate to violate the State Water-Quality Standards, Chapter 173-201, Washington Administrative Code, or cause any adverse effect on state ground waters. The Permittee shall apply for a permit or permit modification as may be required for such discharges to state ground or surface waters.

C. Land Disposal or Utilization

Disposal or utilization of residual solids on land shall be in accordance with the requirements of the jurisdictional health department.

S7. RESIDUAL SOLIDS: (continued)

D. Solids Management Plan

The Permittee shall submit a residual solids management plan to Ecology no later than January 1, 1993 for review and approval. The Permittee shall comply with the plan as approved by Ecology. Any proposed revision or modification of the residual solids management plan shall be submitted to Ecology for review and approval. The Permittee shall comply with any approved plan modifications. The Permittee shall submit an update of the residual solids management plan with the application for permit renewal 180 days prior to the expiration date of this permit.

E. Applicable Federal Law

This permit shall be modified, or alternatively, revoked and reissued to comply with any applicable standard or limitation promulgated under Section 405(d) (Disposal of Sewage Sludge) of the Clean Water Act, if the standard or limitation so issued or approved:

1. Contains different conditions or is otherwise more stringent than any condition in the permit; or

2. Controls any pollutant not limited in the permit.

The Permittee shall comply with the standard or limitation by no later than the compliance deadline specified in the applicable regulations as required by Section 405(d)(2)(D) of the Clean Water Act. The permit as modified or reissued under this paragraph shall also contain any other requirement of the Act then applicable.

F. Permit Modification, Revocation, Reissuance

Ecology may establish specific sludge management requirements beyond those identified in this permit by permit modification or administrative order.

S8 PRETREATMENT:

1. The Permittee shall work cooperatively with Ecology to ensure that all industrial users of the wastewater treatment system are in compliance with the pretreatment regulations promulgated in 40 CFR Part 403 and any additional pretreatment regulations that may be promulgated under Section 307(b) and reporting requirements under Section 308 of the Federal Clean Water Act.

2. The Permittee shall perform an industrial user survey, reporting, or other activities (industrial user ordinance and local limits development) as specified by Ecology which are necessary for the proper administration of a state pretreatment program.

S7. RESIDUAL SOLIDS: (continued)

E. Applicable Federal Law

This permit shall be modified, or alternatively, revoked and reissued to comply with any applicable standard or limitation promulgated under Section 405(d) (Disposal of Sewage Sludge) of the Clean Water Act, if the standard or limitation so issued or approved:

1. Contains different conditions or is otherwise more stringent than any condition in the permit; or

2. Controls any pollutant not limited in the permit.

The Permittee shall comply with the standard or limitation by no later than the compliance deadline specified in the applicable regulations as required by Section 405(d)(2)(D) of the Clean Water Act. The permit as modified or reissued under this paragraph shall also contain any other requirement of the Act then applicable.

F. Permit Modification, Revocation, Reissuance

Ecology may establish specific sludge management requirements beyond those identified in this permit by permit modification or administrative order.

S8. PRETREATMENT:

1. The Permittee shall work cooperatively with Ecology to ensure that all industrial users of the wastewater treatment system are in compliance with the pretreatment regulations promulgated in 40 CFR Part 403 and any additional pretreatment regulations that may be promulgated under Section 307(b) and reporting requirements under Section 308 of the Federal Clean Water Act.

2. The Permittee shall perform an industrial user survey, reporting, or other activities (industrial user ordinance and local limits development) as specified by Ecology which are necessary for the proper administration of a state pretreatment program.

3. Significant commercial and industrial operations shall not be allowed to discharge wastes to the Permittee's sewerage system until they have received prior authorization from Ecology in accordance with RCW 90.48 and WAC 173-216, as amended.

4. General Prohibitions - In accordance with 40 CFR Part 403.5(a), non-domestic discharges which would pass through the treatment works or interfere with their operation or performance, shall not be discharged into the sewerage system.

S8. PRETREATMENT: (continued)

3. Significant commercial and industrial operations shall not be allowed to discharge wastes to the Permittee's sewerage system until they have received prior authorization from Ecology in accordance with RCW 90.48 and WAC 173-216, as amended.

4. General Prohibitions - In accordance with 40 CFR Part 403.5(a), non-domestic discharges which would pass through the treatment works or interfere with their operation or performance, shall not be discharged into the sewerage system.

5. Specific Prohibitions - In accordance with 40 CFR Part 403.5(b), the following non-domestic discharges shall not be discharged into the system.

   a. Pollutants which create a fire or explosion hazard in the POTW including, but not limited to wastestreams with a closed cup flashpoint of less than 140 degrees Fahrenheit or 60 degrees Centigrade using the test methods specified in 40 CFR 261.

   b. Pollutants that will cause corrosive structural damage to the POTW, but in no case discharges with pH lower than 5.0, unless the works is specifically designed to accommodate such discharges.

   c. Solid or viscous pollutants in amounts which will cause obstruction to the flow in the sewers or in the POTW resulting in Interference.

   d. Any pollutant, including oxygen demanding pollutants, (BOD, etc.) released in a discharge at a flow rate and/or pollutant concentration which will cause interference with the POTW.

   e. Heat in amounts which will inhibit biological activity in the POTW resulting in Interference, but in no case heat in such quantities that the temperature at the POTW exceeds 40°C (104°F) unless Ecology, upon request of the Permittee approved in writing alternate temperature limits.

   f. Petroleum oil, nonbiodegradable cutting oil, or products of mineral oil origin in amounts that will cause interference or pass through.

   g. Pollutants which result in the presence of toxic gases, vapors, or fumes within the POTW in a quantity which may cause acute worker health and safety problems.

   h. Any trucked or hauled pollutants, except at discharge points designated by the Permittee.

S8. PRETREATMENT: (continued)

5. Specific Prohibitions - In accordance with 40 CFR Part 403.5(b), the following non-domestic discharges shall not be discharged into the system.

a. Pollutants which create a fire or explosion hazard in the POTW including, but not limited to wastestreams with a closed cup flashpoint of less than 140 degrees Fahrenheit or 60 degrees Centigrade using the test methods specified in 40 CFR 261.

b. Pollutants that will cause corrosive structural damage to the POTW, but in no case discharges with pH lower than 5.0, unless the works is specifically designed to accommodate such discharges.

c. Solid or viscous pollutants in amounts which will cause obstruction to the flow in the sewers or in the POTW resulting in Interference.

d. Any pollutant, including oxygen demanding pollutants, (BOD, etc.) released in a discharge at a flow rate and/or pollutant concentration which will cause interference with the POTW.

e. Heat in amounts which will inhibit biological activity in the POTW resulting in Interference, but in no case heat in such quantities that the temperature at the POTW exceeds 40°C (104°F) unless Ecology, upon request of the Permittee approved in writing alternate temperature limits.

f. Petroleum oil, nonbiodegradable cutting oil, or products of mineral oil origin in amounts that will cause interference or pass through.

g. Pollutants which result in the presence of toxic gases, vapors, or fumes within the POTW in a quantity which may cause acute worker health and safety problems.

h. Any trucked or hauled pollutants, except at discharge points designated by the Permittee.

S9. ACUTE BIOMONITORING:

A. <u>Acute Biomonitoring (Effluent)</u>

Acute toxicity testing of dechlorinated final effluent shall be conducted once per quarter for one year for the purpose of characterizing the effluent.

S9. ACUTE BIOMONITORING:

A. Acute Biomonitoring (Effluent)

Acute toxicity testing of dechlorinated final effluent shall be conducted once per quarter for one year for the purpose of characterizing the effluent. Toxicity testing shall be conducted in accordance with protocols, monitoring requirements, and quality assurance/quality control (QA/QC) procedures specified in this section. The testing shall be conducted so as to determine a LC50 (concentration lethal to 50% of the test organisms) and an acute NOEC. These test results are not effluent limits.

Testing shall be conducted using two organisms: 1) Rainbow trout, *Oncorhynchus mykiss* (96 hour static renewal test, method: EPA/600/4-90/027); and 2) Water flea, *Daphnia dubia*, *Daphnia pulex* or *Daphnia magna* (48 hour static test, method: EPA/600/4-90/027).

Ecology will accept whole effluent toxicity data produced in the last two years as fulfillment of this section if it meets the information and quality control requirements of this section.

The permittee may elect to fulfill the requirements of this section by demonstrating the effluent causes less than 20% mortality in 100% effluent with the two species given above, however, if the mortality exceeds 20% in any test the permittee will be subject to the full requirements of this section.

The testing shall begin no later than January 15, 1993. A written report of the toxicity test results shall be submitted to Ecology within 60 days after each sampling interval. A final report on effluent characterization shall be submitted to Ecology within 90 days after the last sample for effluent characterization. This final report shall list the LC50 and acute NOEC data for all species, and submit any information on toxicity source control and treatability developed during the year.

Ecology may issue a order or modify the permit based on the information provided in the final report. In the absence of an order or modification, for the remainder of the permit term, testing shall be conducted quarterly using the most sensitive species, determined by Ecology, in a single dilution screening test at a dilution specified by Ecology. A minimum of three replicates and a control shall be run. If the test cannot statistically detect a 20% difference in mortality between the effluent dilution results and the control, then the number of replicate must be increased in future tests until a 20% or less difference in mortality becomes statistically significant. The mean of these replicates will be compared to the control mean using the method in Appendix H. of Short-Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms (EPA/600/4-89/001) at the 0.05 level of significance.

S9. ACUTE BIOMONITORING: (continued)

Toxicity testing shall be conducted in accordance with protocols, monitoring requirements, and quality assurance/quality control (QA/QC) procedures specified in this section. The testing shall be conducted sc as to determine a LC50 (concentration lethal to 50% of the test organisms) and an acute NOEC. These test results are not effluent limits.

Testing shall be conducted using two organisms: 1) Rainbow trout, *Oncorhynchus mykiss* (96 hour static renewal test, method: EPA/600/4-90/027); and 2) Water flea, *Daphnia dubia*, *Daphnia pulex* or *Daphnia magna* (48 hour static test, method: EPA/600/4-90/027).

Ecology will accept whole effluent toxicity data produced in the last two years as fulfillment of this section if it meets the information anc quality control requirements of this section.

The permittee may elect to fulfill the requirements of this section by demonstrating the effluent causes less than 20% mortality in 100% effluent with the two species given above, however, if the mortality exceeds 20% in any test the permittee will be subject to the full requirements of this section.

The testing shall begin no later than January 15, 1993. A written report of the toxicity test results shall be submitted to Ecology withi: 60 days after each sampling interval. A final report on effluent characterization shall be submitted to Ecology within 90 days after the last sample for effluent characterization. This final report shall lis the LC50 and acute NOEC data for all species, and submit any informatio on toxicity source control and treatability developed during the year.

Ecology may issue a order or modify the permit based on the information provided in the final report. In the absence of an order or modification, for the remainder of the permit term, testing shall be conducted quarterly using the most sensitive species, determined by Ecology, in a single dilution screening test at a dilution specified by Ecology. A minimum of three replicates and a control shall be run. If the test cannot statistically detect a 20% difference in mortality between the effluent dilution results and the control, then the number of replicate must be increased in future tests until a 20% or less difference in mortality becomes statistically significant. The mean of these replicates will be compared to the control mean using the method in Appendix H. of Short-Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms (EPA/600/4-89/001) at the 0.05 level of significance.

S9. ACUTE BIOMONITORING (continued)

B. Monitoring Requirements

1. Testing shall be conducted on composite samples of the effluent except when Ecology or the permittee, with Ecology concurrence, determines that grab samples better represent toxicity. Water from the same source (natural or synthetic) as the water used for culturing the test organisms should be used as dilution water. Samples taken for toxicity testing should be cooled to 4 degrees Celsius and sent to the lab immediately. The lab should begin the toxicity testing as soon as possible but no later than 36 hours after the time that sampling was begun.

2. All tests shall measure the response of the organisms in 0 percent (control) and a sufficient number of effluent dilutions to accurately determine an LC50 and acute NOEC.

3. Each written report shall include all relevant information outlined in Section 9, Report Preparation, of Short-Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms, EPA/600/4-89/001.

C. Protocols

The bioassays shall be conducted in accordance with the following protocols or approved modifications thereof:

Methods for Measuring the Acute Toxicity of Effluents to Freshwater and Marine Organisms, EPA/600/4-90/027.

D. Quality Assurance/Quality Control Procedures

All quality assurance criteria used (including the LC50 calculation method) shall be in accordance with Methods for Measuring the Acute Toxicity of Effluents to Freshwater and Marine Organisms, EPA/600/4-85/013 or approved modifications thereof. Test results which are not valid (e.g., control mortality exceeds acceptable level) will not be accepted and testing must be repeated.

S10. CHRONIC BIOMONITORING:

A. Chronic Biomonitoring (Effluent)

Chronic toxicity testing of dechlorinated final effluent shall be conducted two times per year for one year for the purpose of characterizing the effluent.

S10. CHRONIC BIOMONITORING: (continued)

Toxicity testing shall be conducted in accordance with protocols, monitoring requirements, and quality assurance/quality control (QA/QC) procedures specified in this section.

The testing shall be conducted so as to determine the IC25 (concentration providing a 25% inhibition of growth or reproduction in the test organisms) and a chronic NOEC. These test results are not effluent limits.

Testing shall be conducted on the following two organisms:

Fathead minnow: *Pimephales promelas* and
Water flea: *Ceriodaphnia dubia*

Ecology will accept whole effluent chronic bioassay data produced in the last two years as fulfillment of this section if it meets the information and quality control requirements of this section.

The testing shall begin no later than April 15, 1993. A written report of the toxicity test results shall be submitted to Ecology within 60 days after each sampling interval. A final report on effluent characterization shall be submitted to Ecology within 90 days after the last sample for effluent characterization. This final report shall list the IC25 and NOEC data for all species and tests and detail any information on the results of any source control or treatability efforts during the year.

Ecology may issue a order or modify the permit based on the information provided in the final report. In the absence of an order or modification, for the remainder of the permit term, testing shall be conducted semi-annually using the most sensitive species in a single dilution screening test at a dilution specified by Ecology. A minimum of three replicates and a control shall be run. If the test cannot statistically detect a 20% difference in mortality between the effluent dilution and the control, then the number of replicates must be increased in future tests until a 20% or less difference in mortality becomes statistically significant. The mean of these replicates will be compared to the control mean using the method in Appendix H. of Short-Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms (EPA/600/4-89/001) at the 0.05 level of significance.

B. Monitoring Requirements

1. Testing shall be conducted on composite samples of the effluent except when Ecology or the permittee, with Ecology concurrence, determines that grab samples better represent toxicity. Water from the same source (natural or synthetic) as the water used for culturing the test organisms should be used as dilution water.

S10. CHRONIC BIOMONITORING: (continued)

Samples taken for toxicity testing shall be cooled to 4 degrees Celsius and sent to the lab immediately. The lab should begin the toxicity testing as soon as possible but no later than 36 hours after the time that sampling was begun.

2. All tests shall measure the response of the organisms in 0 percent (control) and a sufficient number of effluent dilutions to accurately determine an IC25 and an NOEC.

3. Each written report shall include all relevant information outlined in Section 9, Report Preparation, of Short-Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms, EPA/600/4-89/001, March 1989.

C. Protocols

The toxicity tests shall be conducted in accordance with the following protocols or approved modifications thereof:

Short-Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms, EPA/600/4 89/001.

Short-Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Marine and Estuarine Organisms, EPA/600/4-87/028.

Annual Book of ASTM Standards, Section 11, Water and Environmenta Technology, Volume 11.04 Biological Effects and Environmental Fate.

D. Quality Assurance/Quality Control Procedures

The Permittee shall follow the quality assurance procedures discussed i the protocols cited in this section, or approved modifications thereof. Test results which are not considered valid (i.e., excessive control mortality, or inadequate control growth or reproduction) will not be accepted by Ecology and the test(s) shall be repeated.

GENERAL CONDITIONS

G1. Discharge Violations:

All discharge and activities authorized by this permit shall be consistent with the terms and conditions of this permit. The discharge of any pollutant more frequently than, or at a concentration in excess of, that authorized by this permit shall constitute a violation of the terms and conditions of this permit.

G2. Proper Operation and Maintenance:

The Permittee shall at all times properly operate and maintain all facilities and systems of collection, treatment, and control (and related appurtenances) which are installed or used by the Permittee for pollution control.

G3. Reduced Production for Compliance:

The Permittee, in order to maintain compliance with its permit, shall control production and/or all discharges upon reduction, loss, failure, or bypass of the treatment facility until the facility is restored or an alternative method of treatment is provided. This requirement applies in the situation where, among other things, the primary source of power of the treatment facility is reduced, lost, or fails.

G4. Non-compliance Notification:

If for any reason, the Permittee does not comply with, or will be unable to comply with, any of the discharge limitations or other conditions specified in the permit, the Permittee shall, at a minimum, provide Ecology of Ecology (Department) with the following information:

A. A description of the nature and cause of non-compliance, including the quantity and quality of any unauthorized waste discharges;

B. The period of non-compliance, including exact dates and times and/or the anticipated time when the Permittee will return to compliance; and

C. The steps taken, or to be taken, to reduce, eliminate, and prevent recurrence of the non-compliance.

In addition, the Permittee shall take immediate action to stop, contain, and clean up any unauthorized discharges and take all reasonable steps to minimize any adverse impacts to waters of the state and correct the problem. The Permittee shall notify Ecology by telephone so that an investigation can be made to evaluate any resulting impacts and the corrective actions taken to determine if additional action should be taken.

G4. Non-compliance Notification: (continued)

In the case of any discharge subject to any applicable toxic pollutant effluent standard under Section 307(a) of the Clean Water Act, or which could constitute a threat to human health, welfare, or the environment, 40 CFR Part 122 requires that the information specified in Sections G4.A., G4.B., and G4.C., above, shall be provided not later than 24 hours from the time the Permittee becomes aware of the circumstances. If this information is provided orally, a written submission covering these points shall be provided within five days of the time the Permittee becomes aware of the circumstances, unless Ecology waives or extends this requirement on a case-by-case basis.

Compliance with these requirements does not relieve the Permittee from responsibility to maintain continuous compliance with the conditions of this permit or the resulting liability for failure to comply.

G5. Bypass Prohibited:

The intentional bypass of wastes from all or any portion of a treatment works is prohibited unless the following four conditions are met:

A. Bypass is: (1) unavoidable to prevent loss of life, personal injury, or severe property damage; or (2) necessary to perform construction or maintenance-related activities essential to meet the requirements of the Clean Water Act and authorized by administrative order;

B. There are no feasible alternatives to bypass, such as the use of auxiliary treatment facilities, retention of untreated wastes, maintenance during normal periods of equipment down time, or temporary reduction or termination of production;

C. The Permittee submits notice of an unanticipated bypass to Ecology in accordance with Condition G4. Where the Permittee know or should have known in advance of the need for a bypass, this prior notification shall be submitted for approval to Ecology, if possible, at least 30 days before the date of bypass (or longer if specified in the special conditions);

D. The bypass is allowed under conditions determined to be necessary by Ecology to minimize any adverse effects. The public shall be notified and given an opportunity to comment on bypass incidents of significant duration, to the extent feasible.

"Severe property damage" means substantial physical damage to property, damage to the treatment facilities which would cause them to become inoperable, or substantial and permanent loss of natural resources which can reasonably be expected to occur in the absence of a bypass. Severe property damage does not mean economic loss caused by delays in production.

G5. Bypass Prohibited: (continued)

After consideration of the factors above and the adverse effects of the proposed bypass, Ecology will approve or deny the request. Approval of a request to bypass will be by administrative order under RCW 90.48.120.

G6. Right of Entry:

The Permittee shall allow an authorized representative of Ecology, upon the presentation of credentials and such other documents as may be required by law:

A. To enter upon the premises where a discharge is located or where any records must be kept under the terms and conditions of this permit;

B. To have access to and copy at reasonable times any records that must be kept under the terms of the permit;

C. To inspect at reasonable times any monitoring equipment or method of monitoring required in the permit;

D. To inspect at reasonable times any collection, treatment, pollution management, or discharge facilities; and

E. To sample at reasonable times any discharge of pollutants.

G7. Permit Modifications:

The Permittee shall submit a new application or supplement to the previous application where facility expansions, production increases, or process modifications will (1) result in new or substantially increased discharges of pollutants or a change in the nature of the discharge of pollutants, or (2) violates the terms and conditions of this permit.

G8. Permit Modified or Revoked:

After notice and opportunity for public hearing, this permit may be modified, terminated, or revoked during its term for case as follows:

A. Violation of any terms or conditions of the permit;

B. Failure of the Permittee to disclose fully all relevant facts or misrepresentations of any relevant facts by the Permittee during the permit issuance process;

C. A change in any condition that requires either a temporary or a permanent reduction or elimination of any discharge controlled by the permit;

G8. Permit Modified or Revoked: (continued)

D. Information indicating that the permitted discharge poses a threat to human health or welfare;

E. A change in ownership or control of the source; or

F. Other causes listed in 40 CFR Part 122.62 and 122.63.

Permit modification, revocation and reissuance, or termination may be initiated by Ecology or requested by any interested person.

G9. Reporting a Cause for Modification:

A Permittee who knows or has reason to believe that any activity has occurred or will occur which would constitute cause for modification or revocation and reissuance under Condition G8 or 40 CFR Part 122.62 must report such plans, or such information, to Ecology so that a decision can be made on whether action to modify or revoke and reissue a permit will be required. Ecology may then require submission of a new application. Submission of such application does not relieve the discharge of the duty to comply with the existing permit until it is modified or reissued.

G10. Toxic Pollutants:

If any applicable toxic effluent standard or prohibition (including any schedule of compliance specified in such effluent standard or prohibition) is established under Section 307(a) of the Clean Water Act for a toxic pollutant and that standard or prohibition is more stringent than any limitation upon such pollutant in the permit, Ecology shall institute proceedings to modify or revoke and reissue the permit to conform to the toxic effluent standard or prohibition.

G11. Plan Review Required:

Prior to constructing or modifying any wastewater control facilities, detailed plans shall be submitted to Ecology for approval in accordance with Chapter 173-240 WAC. Facilities shall be constructed and operated in accordance with the approved plan.

G12. Other Requirements of 40 CFR:

All other requirements of 40 CFR Part 122.41 and 122.42 are incorporated in this permit by reference.

G13. Compliance With Other Laws and Statutes:

Nothing in the permit shall be construed as excusing the Permittee from compliance with any applicable federal, state, or local statutes, ordinances, or regulations.

G14. Additional Monitoring:

Ecology may establish specific monitoring requirements in addition to those contained in this permit by administrative order or permit modification.

G15. Revocation for Non-Payment of Fees:

Ecology may revoke this permit if the permit fees established under Chapter 173-224 WAC are not paid.

G16. Removed Substances:

Collected screenings, grit, solids, sludges, filter backwash, or other pollutants removed in the course of treatment or control of wastewaters shall not be resuspended or reintroduced to the final effluent stream for discharge to state waters.

G17. Duty to Reapply:

The Permittee must reapply, for permit renewal, at least 180 days prior to the specified expiration date of this permit.

APPENDIX C

Wastewater Treatment Plant Design Criteria for North Bend, Snoqualmie, and Duvall

Table 4.2: Summary of Wastewater Treatment Plant Design Criteria

Item Description	Design Criteria			
	1991	1997	2002	2012
Population and Wastewater Characteristics	Existing	Projected	Projected	Projected
Population Served	1,421	6,700	10,600	16,200
Design Period		5 years	10 years	20 years
Wastewater Contribution				
Average Domestic Wastewater Flow	80 gpcd	80 gpcd	80 gpcd	80 gpcd
5-Day BOD per person per day	0.2 lbs	0.2 lbs	0.2 lbs	0.2 lbs
Suspended Solids per person per day	0.2 lbs	0.2 lbs	0.2 lbs	0.2 lbs
Total Wastewater Flow				
Average Daily Flow	0.44 MGD	1.50 MGD	3.00 MGD	5.00 MGD
Maximum Daily Flow	1.70 MGD	3.00 MGD	5.00 MGD	8.20 MGD
Minimum Daily Flow	0.20 MGD	0.90 MGD	1.70 MGD	2.50 MGD
Maximum Hourly Flow	2.20 MGD	4.00 MGD	8.10 MGD	12.30 MGD
Peak Month Average Daily Flow	0.72 MGD	2.30 MGD	4.50 MGD	7.50 MGD
Minimum Month Average Daily Flow	0.23 MGD	0.75 MGD	1.50 MGD	2.50 MGD
Total Wastewater Loadings				
Average 5-Day BOD				
Concentration	130 mg/l	150 mg/l	150 mg/l	150 mg/l
Daily Loading	413 lbs/day	1,900 lbs/day	3,750 lbs/day	6,250 lbs/day
Peak 5-Day BOD				
Concentration	280 mg/l	300 mg/l	300 mg/l	300 mg/l
Daily Loading	1,150 lbs/day	3,750 lbs/day	6,250 lbs/day	10,250 lbs/day
Average Suspended Solids				
Concentration	100 mg/l	130 mg/l	130 mg/l	130 mg/l
Daily Loading	300 lbs/day	1,600 lbs/day	3,250 lbs/day	5,400 lbs/day
Peak Suspended Solids				
Concentration	320 mg/l	350 mg/l	350 mg/l	350 mg/l
Daily Loading	680 lbs/day	3,250 lbs/day	5,420 lbs/day	8,890 lbs/day
Effluent Quality				
Average 5-Day BOD	8 mg/l	20 mg/l	12 mg/l	5 mg/l
Peak 5-Day BOD	24 mg/l	30 mg/l	20 mg/l	10 mg/l
Average Suspended Solids	7 mg/l	20 mg/l	15 mg/l	5 mg/l
Peak Suspended Solids	22 mg/l	30 mg/l	20 mg/l	10 mg/l
Ammonium Nitrogen			2 mg/l	0.5 mg/l

Table E.9
Summary of Flows and Loads for Snoqualmie WWTP with Annexation

Subarea	Year 1990	Year 2000		Year 2010		Year 2020	
		Low	High	Low	High	Low	High
Average Annual Sewage Flow[1]	0.188	0.739	0.899	1.276	1.372	1.946	2.029
Infiltration/Inflow[1]							
Average	0.061	0.147	0.190	0.262	0.280	0.398	0.426
Max. Month	0.184	0.357	0.437	0.581	0.614	0.852	0.905
Peak	0.389	0.610	0.710	0.892	0.936	1.235	1.303
Ann. Average Wastewater Flow[1]							
City of Snoqualmie							
Puget Western	–	0.104	0.125	0.165	0.165	0.165	0.165
City of Snoqualmie (w/o P.W)	0.225	0.288	0.288	0.340	0.340	0.394	0.394
Subtotal	0.225	0.392	0.413	0.505	0.505	0.559	0.559
Lake Alice Plateau	–	0.278	0.385	0.634	0.634	1.241	1.241
Snoqualmie Hills							
N.W. Snoqualmie Hills	–	0.046	0.093	0.093	0.152	0.140	0.186
Snoqualmie Hills (w/o N.W.S.H.)	–	0.053	0.053	0.096	0.096	0.114	0.114
Subtotal	–	0.099	0.146	0.189	0.248	0.254	0.300
Echo Lake Interchange	–	–	–	–	–	–	0.065
Rattlesnake Ridge	0.004	0.025	0.025	0.052	0.052	0.077	0.077
Weyerhaeuser Mill	0.020	0.089	0.117	0.158	0.213	0.213	0.213
TOTAL	0.249	0.883	1.086	1.538	1.652	2.344	2.455
Aver. Daily Max. Mo. Wastewater Flow[1]							
City of Snoqualmie							
Puget Western	–	0.114	0.137	0.182	0.182	0.182	0.182
City of Snoqualmie (w/o P.W.)	0.336	0.405	0.405	0.466	0.466	0.527	0.527
Subtotal	0.336	0.519	0.542	0.648	0.648	0.709	0.709
Lake Alice Plateau	–	0.325	0.457	0.751	0.751	1.467	1.467
Snoqualmie Hills							
N.W. Snoqualmie Hills	–	0.058	0.114	0.114	0.186	0.171	0.227
Snoqualmie Hills (w/o N.W.S.H.)	–	0.065	0.065	0.113	0.113	0.133	0.133

Table E.9 – Continued
Summary of Flows and Loads
for Snoqualmie WWTP with Annexation

Subarea	Year 1990	Year 2000		Year 2010		Year 2020	
		Low	High	Low	High	Low	High
Subtotal	–	0.123	0.179	0.227	0.299	0.304	0.360
Echo Lake Interchange							0.080
Rattlesnake Ridge	0.008	0.029	0.029	0.060	0.060	0.090	0.090
Weyerhaeuser Mill	0.028	0.100	0.129	0.171	0.228	0.228	0.228
TOTAL	0.372	1.096	1.336	1.857	1.986	2.798	2.934
Peaking Factor(2)	5.0	4.0	3.8	3.7	3.6	3.3	3.3
Peak Sewage Flow - mgd	0.940	2.956	3.416	4.721	4.939	6.422	6.696
Peak Wastewater Flow - mgd	1.329	3.566	4.126	5.613	5.875	7.657	7.999
Equivalent Population(1)	2,850	10,720	13,000	18,390	19,750	27,940	29,130
Equivalent Single-Family Connection(1)	1,050	4,080	4,970	7,040	7,560	10,710	11,160
Average Loads - lbs/day(3)							
BOD	570	2,140	2,600	3,680	3,950	5,590	5,830
SS	570	2,140	2,600	3,680	3,950	5,590	5,830
Max. Month Loads - lbs/day(4)							
BOD	740	2,780	3,380	4,780	5,140	7,270	7,580
SS	740	2,780	3,380	4,780	5,140	7,270	7,580
Total Nitrogen as N - lbs/day(5)	83	295	362	513	551	782	819
Ammonia	52	184	226	321	344	489	512
Organic	31	111	136	192	207	293	307

(1) All values in this table are added together from Tables E.1 through E.8.

(2) Based on Figure 5 of ASCE Manuals and Reports on Engineering Practice - No. 37; factor applied to average annual sewage flow.

(3) Based on 0.2 pounds per capita per day for equivalent population.

(4) Based on maximum load to average load ratio of 1.3.

(5) Assume medium-strength influent with monthly average concentrations of 40 mg/l total nitrogen as N, 25 mg/l total ammonia and 15 mg/l organic nitrogen. Each million gallons per day at 1.0 mg/l concentration contains 8.34 pounds per day.

2010 WASTEWATER TREATMENT PLANT DESIGN CRITERIA

Flow criteria	unit flows	flow to treatment
annual average daily	100 gallons/capita/day	0.60 million gallons/day
peak month average daily*	150 gallons/capita/day	0.90 million gallons/day
peak day average	250 gallons/capita/day	1.50 million gallons/day
peak hour average	375 gallons/capita/day	2.25 million gallons/day
summer dry month average daily	75 gallons/capita/day	0.45 million gallons/day

* Average design flow for the design year of the sewage works as defined in Criteria for Sewage Work Design, Washington State Department of Ecology, Revised October 1985.

PROJECTED DESIGN YEAR DISCHARGE LOAD LIMITS

	average concentration (milligrams per liter)		daily average load limits (pounds per day)	
pollutant parameter	30 day	7 day	30 day	7 day averages
Biochemical oxygen demand (BOD5)*	30 mg/L	45 mg/L	225	338
Total suspended solids (TSS)	30 mg/L	45 mg/L	225	338
Fecal coliform	200/100 ml	400/100 ml		
pH**	not outside the range of 6.0-9.0			
Chlorine residual	sufficient to attain specified fecal coliform bacteria standards			

* The monthly average effluent concentration limitations for BOD5 and suspended solids shall not exceed 30 mg/L or 15% of the respective influents concentrations, whichever is more stringent.

** Effluent values for pH shall not exceed the limits 6.0-9.0 where such values are attributable to inorganic chemical addition to the treatment process or to industrial concentrations.

The monthly and weekly averages for BOD5 and suspended solids are based on the arithmetic mean of the samples taken. The averages for fecal coliform bacteria area based on the geometric mean of the samples taken.

Total available residual chlorine shall be maintained which is sufficient to attain the fecal coliform bacteria limits specified above. Chlorine concentrations in excess of that necessary to reliably achieve the limits shall be avoided.

It is possible that effluent discharge limitations for ammonia and chlorine as identified in WAC 173-201 will also be required in future discharge permits.

INFLUENT DESIGN LOADINGS

parameter	per capita load per day	design population 6,000 persons
Design flow	150 gpcd	0.9 mgd
Biochemical oxygen demand	0.15 ppcd (120 mg/L)	900 lbs
Total suspended solids	0.020 ppcd (160 mg/L)	1,200 lbs

gpcd=gallons per capita per day
mgd=million gallons per day
ppcd=pounds per capita per day
mg/L=milligrams per liter

APPENDIX D

Snoqualmie River Base Flow Data, 1989

Source: Joy et al. (1991)

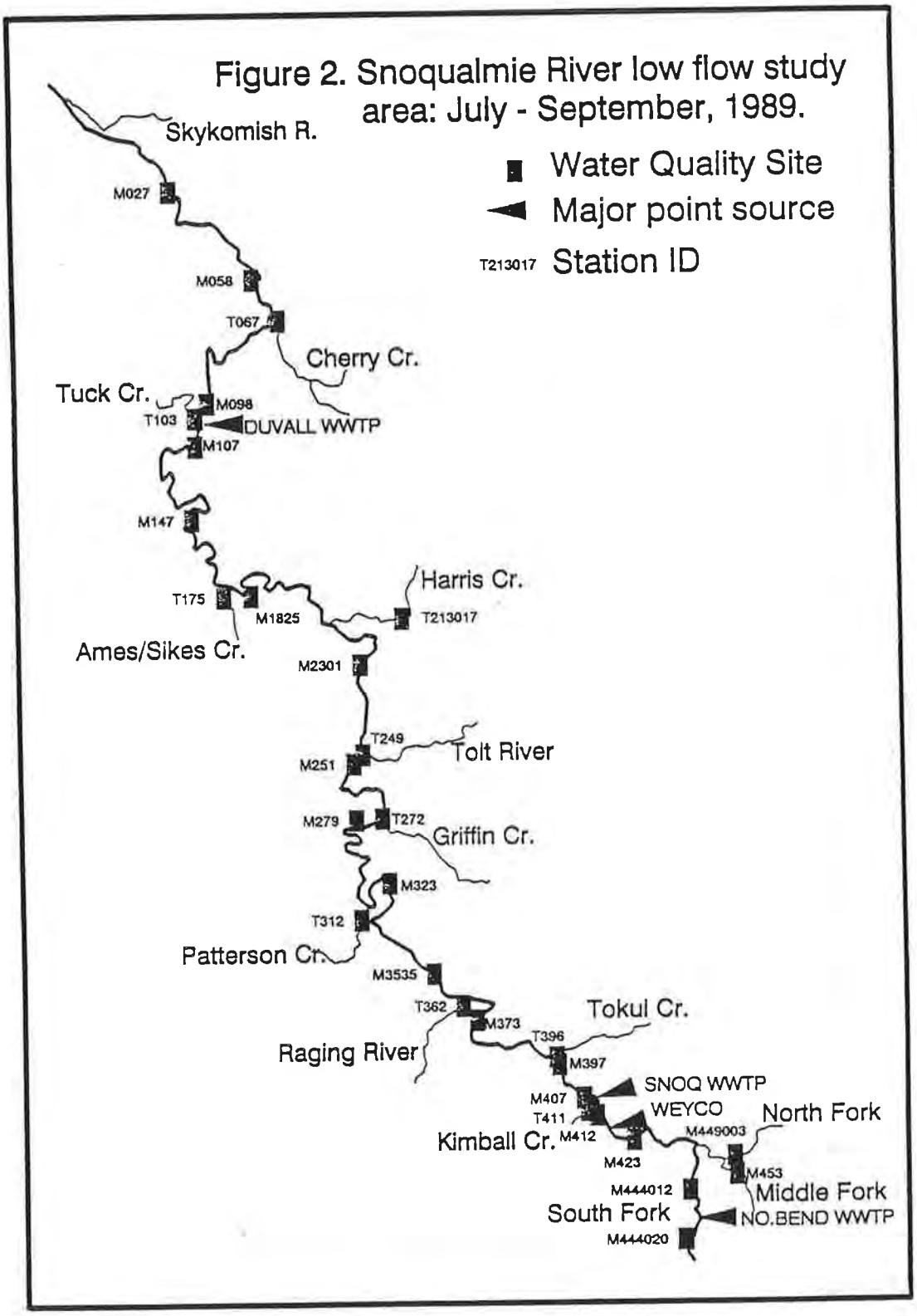

Figure 2. Snoqualmie River low flow study area: July - September, 1989.

Table 1. NPDES Wastewater Permit Dischargers in the Snoqualmie River drainage.

Name/ Permit Number	Issue	Expire	Flow* (MGD)	BOD Monthly	BOD Weekly	TSS Monthly	TSS Weekly	Fecal Coliform** Monthly	Fecal Coliform** Weekly	pH Range
City of Duvall WA-002951-3	1985	1990	0.2	30 mg/L 50 lbs/day 85% removal	45 mg/L 75 lbs/day	30 mg/L 50 lbs/day 85% removal	45 mg/L 75 lbs/day	200	100	6-9
Carnation Farms ST5139			–							
Tokul Creek Rearing Pond WA-003023-6	1986	1991	5.0	–	–	< 3.3 mL/L settleable solids at any time	–	–		
Tokul Creek Hatchery WA-003022-8	1986	1991	1.25	–		TSS: Settleable: Suspended:	15 mg/L daily max. 0.1 mL/L daily ave. 0.2 mL/L daily max. 141 lbs/day average 186 lbs/day maximum	–	–	
City of Snoqualmie WA-002240-3	1977	1982	0.26	30 mg/L 51 lbs/day	45 mg/L 76 lbs/day	75 mg/L 163 lbs/day	110 mg/L 239 lbs/day	200	400	6-9
Weyerhaeuser Mill/ Log Storage WA-000173-2I	1986	1991	1.73	20 mg/L	228 lbs/day	110 mg/L	1585 lbs/day	–	–	6-9
City of North Bend WA-002935-1	1982	1987	0.4	30 mg/L 100 lbs/day 85% removal	45 mg/L 150 lbs/day	30 mg/L 100 lbs/day 85% removal	45 mg/L 150 lbs/day	200	400	6-9

* Average Design Flow, million gallons per day (MGD).

** As colonies/100 mL.

Appendix A-1. Snoqualmie River survey data collected July 24 - 25, 1989 (Survey #1 of 4) as part of the Ecology Snoqualmie River low flow study.

Station Number*	River Mile	Date	Time	Elev. ft.	D.O.2 mg/L	D.O.1 mg/L	Temp °C	pH s.u.	Cond. umhos	DOSat1 %	DOSat2 %	Flow cfs	Staff cfs	Hard. mg/L	Alk. mg/L	Cl- mg/L	TSS mg/L	Solids mg/L	TNVS mg/L	TNVSS mg/L	NH_3-N µg/L	TP µg/L	SP-P µg/L	NO_{2+3}-N µg/L	TN-N µg/L
M444020L		07/24	0807	430		10.6	12.1	7.1	71	99.9			215			1.19	1				12	3	240		
M444020R		07/24	0820	430	10.4	10.6	12.2	7.0	71	100.0	98.4		215	30	29	1.21	1 U	77	56	1 U	18	6	3	240	244
NO.BEND			24-hr.				18.7	7.2	281			0.35		50	73	23	6	165	135	5	360	1496	826	350	
M444012C		07/24	0854	420	10.4	10.8	11.9	6.9	74	101.1	97.8		217	32	31	1.25	1	65	51	1 U	11	5	4	254	283
M453000C	45.3	07/24	0935	411	10.3	10.7	14.5	7.0	31	106.6	102.5		455			0.69	2				10 U	2 U		47	
M449000C		07/24	0950	411	10.3	10.5	14.3	7.0	44	104.2	102.0		236			0.74	1				19	2 U		149	
M423R	42.3	07/24	1022	400	10.3	10.6	14.4	7.0	46	104.9	102.3		895	14	17	0.85	1	40	13	1 U	10 U	2 U	1	118	134
M423C	42.3	07/24	1045	400		10.5	14.4	6.9	46	104.6			895												
M423L	42.3	07/24	1100	400		10.4	14.4	6.8	46	103.5			895			0.84	2				15	2		122	
WEYCO			24-hr.				24.0	7.5	151			0.02		54	59	7	9	100	62	3	170	60		10	
M412R	41.2	07/24	1127	395	10.3	10.3	14.8	6.9	47	103.2	102.8		895	15	18	0.86	2	44	10	1	21	2 U	1	116	108
M412C	41.2	07/24	1135	395		10.2	14.8	6.9	47	102.4			895												
M412L	41.2	07/24	1146	395		10.3	14.8	6.8	47	102.6			895												
T411005		07/24	1208	400	10.1	10.3	15.7	6.8	93	105.2	103.1	1.8				2.14	6				25	18	6	404	429
SNOQWWTP			24-hr.				24.3	7.6	335			0.22		50	100	33	78	310	150	20	1900	4900	2800	590	
M407R	40.7	07/24	1227	390	10.3	10.6	15.3	7.1	45	106.8	103.7		895	16	18	0.89	2	48	39	2	12	5	3	122	264
M407C	40.7	07/24	1243	390		10.4	15.1	6.8	46	104.8			895												
M407L	40.7	07/24	1300	390		10.3	15.1	6.8	46	104.1			895			0.87	2				18	2 U		117	
M397R	39.7	07/24	1342	104	10.2	10.8	15.8	7.0	46	109.7	103.4		895			0.86	3				16	3		115	
T39600		07/24	1405	104	10.6	10.9	15.4	7.8	134	109.4	106.3	35.4				1.45	2				48	34	17	501	473
M363	36.3	07/24	1430	78	11.0	10.7	17.1	7.1	50	110.6	114.2		935			0.92	2	37	19	1 U	10	4	3	120	117
T36200		07/24	1450	78	10.6	10.4	22.6	8.8	82	120.7	122.9	10		27	32	4.36	3				24	3	2	129	173
M3535	35.4	07/24	1510	75	10.9	11.1	17.4	7.3	50	115.8	114.1		950	18	20	0.96	3	47	38	1	18	2	2	117	116
B45		07/24																					2		
T411005D		07/24																					6		
T39600D		07/24																							
T36200D		07/24																							
M407RF	40.7	07/24																			27	2 U		113	
M363D	36.3	07/24																							93
M444018D		07/24																			13	2 U		233	
M412D	41.2	07/24																			16	4		115	
M3535	35.4	07/25	0823	75		10.2	16.0	7.0	50	103.8			950												
M326	32.6	07/25	0840	62	9.3	9.9	16.4	7.0	51	101.6	94.7		950		20	1.00	3				16	5	2	121	80
T312004		07/25	0915	69	9.5	9.9	12.7	7.3	149	93.5	89.9	6.8			67	2.81	1				25	46	26	782	784
M251R	25.1	07/25	1025	58	9.4	10.1	16.7	7.0	52	103.9	96.9		970	24	21	1.01	1 U	86	60	1	29	11	2	154	79
T249		07/25	1055	58		11.3	13.9	7.3	54	109.9			190	23	21	0.94	1 U				11	2 U	1	152	50
T272007		07/25	1120	60	10.3	10.9	14.4	7.3	89	106.9	100.6	3.5			40	1.50	1 U				17	11	8	389	348
M2301L	23.0	07/25	1155	46		10.6	16.9	7.2	53	109.2			1160			1.02	1				15	7	2	136	173
M2301R	23.0	07/25	1210	46	10.6	16.9	7.1		54	109.6			1160	22	21	1.08	1	110	56	1	12	2 U	1	136	104
T213017		07/25	1840	60	10.1	10.4	14.4	7.4	92	102.0	99.0	2.7			39	1.76	1				15	76	42	797	642
M203	20.3	07/25	1255	34	9.8	10.4	18.0	7.2	54	110.1	103.6		1165		22	1.09	2				13	2 U	1	128	101
T175001		07/25	1755	30	9.0	9.2	18.7	7.5	145	98.9	96.5	3.8			66	2.94	7				49	85	63	697	899
M147L	14.7	07/25	1330	25	9.6	10.1	18.4	7.2	54	107.2	101.9		1170												
M147R	14.7	07/25	1340	25		10.0	18.4	7.0	54	107.0			1170			1.12	1				32	2 U	2	134	56
DUVALL			24-hr.				20.7	7.3	450			0.25		41	108	40	50	350	180	12	1300	2300		660	
T103001		07/25	1430	22	7.8	8.0	17.5	7.1	121	84.1	81.6	0.6				1.99	32				88	460	16	72	339
M098R	9.8	07/24	1430	21	9.5	10.0	19.3	7.2	55	108.2	102.5		1175	21	22	1.18	4	83	63	3	24	15	3	131	110
M027R	2.7	07/25	1600	17	9.5	9.9	19.3	7.1	55	107.8	103.1		1195	23	23	1.24	7	110	71	6	19	6	3	133	225
T067002		07/25	1645	20	9.3	9.8	17.4	7.1	96	102.0	96.5	6.8			41	2.38	7				62	27	5	502	606
M251D	25.1	07/25														1.10					24	2 U	2	125	60
T175001D		07/25																							
B01		07/25																			15	15	4	74	50
M147RF	14.7	07/25																			11	20		108	
M251RD	25.1	07/25																							

Appendix A-1. (Continued)

Station Number*	River Mile	Date	Time	COD mg/L	TOC mg/L	BOD_5 mg/L	BOD_5-NI mg/L	BOD_{20} mg/L	F.COLI org/100	%Klob. %	ENTERO org/100	Chl *a*. mg/m³	Pheo *a* mg/m³
M444020L		07/24	0807						9				
M444020R		07/24	0820		2.94		4 E		14		17		
NO. BEND			24-hr.	18		5			100				
M444012C		07/24	0854		2.31		4 E		6		9		
M453000C	45.3	07/24	0935		1.68				11				
M449003C		07/24	0950		1.74				6				
M423R	42.3	07/24	1022	4.0 U	2.38		4 E		3	0		0.10 U	0.10 U
M423C	42.3	07/24	1045										
M423L	42.3	07/24	1100	5.0					6	0	9		
WEYCO			24-hr.	21					7				
M412R	41.2	07/24	1127	4.1	1.99		4 E		17	0			
M412C	41.2	07/24	1135										
M412L	41.2	07/24	1146										
T411005		07/24	1208	10.0	4.38	4 E			460	0			
SNOQWWTP			24-hr.	138		42			3				
M407R	40.7	07/24	1227	4.0 U	1.73			4 E	11	0		0.10 U	0.10 U
M407C	40.7	07/24	1243										
M407L	40.7	07/24	1300	4.0 U					20				
M397R	39.7	07/24	1342										
T39600		07/24	1405		4.40	4 E			11		6		
M363	36.3	07/24	1430		2.15		4 E		3 U		3	0.10 U	0.10 U
T36200		07/24	1450			4 E			6		11		
M3535	35.4	07/24	1510		2.01			4 E	3 U		9	0.10 U	0.10 U
B45		07/24											
T411005D		07/24											
T39600D		07/24							17		6		
T36200D		07/24							31		6		
M407RF	40.7	07/24											
M363D	36.3	07/24											
M444018D		07/24											
M412D	41.2	07/24		4.0 U									
M3535	35.4	07/25	0823										
M326	32.6	07/25	0840		1.47	4 E			29				
T312004		07/25	0915		2.58	4 E			200				
M251R	25.1	07/25	1025	7.5	2.77			4 E	26			0.10 U	0.10 U
T249		07/25	1055		1.94	4 E			3		3 U		
T272007		07/25	1120		3.70	4 E			140				
M2301L	23.0	07/25	1155						9		3		
M2301R	23.0	07/25	1210		1.84				14		17	0.10 U	0.10 U
T213017		07/25	1840		3.45	4 E			49				
M203	20.3	07/25	1255		1.92				9			0.10 U	0.10 U
T175001		07/25	1755	13.0	7.87		4 E		320				
M147L	14.7	07/25	1330										
M147R	14.7	07/25	1340		1.79	4 E			17		3 U	0.10 U	0.10 U
DUVALL			24-hr.	78		14			6000				
T103001		07/25	1430		7.82	4 E			84				
M098R	9.8	07/24	1430	4.3	1.94			4 E	17		3 U	0.10 U	0.10 U
M027R	2.7	07/25	1600	4.2	1.99			4 E	29			0.10 U	0.10 U
T067002		07/25	1645		4.38	4 E			390				
M251D	25.1	07/25							17				
T175001D		07/25							410				
B01		07/25		4.0 U	0.66								
M147RF	14.7	07/25											
M251RD	25.1	07/25											

Appendix A-1. (Continued).

Station coding: R = right bank, L = left bank, C = center, F = filtered, D = duplicate field sample, M = mainstem, T = tributary, B = blank.

Sample qualifiers:

U	=	below detection limit indicated
J or E	=	estimated value
Flow	=	Field measured discharge
Staff	=	rating curve estimated flow (USGS, 1990) and interpolated for some stations.
BOD_5-NI	=	Five-day biochemical oxygen demand, nitrification inhibited.
D.O.1, D.O.Sat1	=	measurement of D.O. by membrane probe
D.O.2, D.O.Sat2	=	measurement of D.O. by Winkler-Azide titration

Appendix A-2. Snoqualmie River survey data collected August 15 - 16, 1989 (Survey #2 of 4) as part of the Ecology Snoqualmie River low flow study.

Station Number	River Mile	Date	Time	D.O.2 mg/L	D.O.1 mg/L	Temp °C	pH s.u.	Cond. umhos	DOSat1 %	DOSat2 %	FLOW cfs	STAFF cfs	Hard. mg/L	Alk. mg/L	Cl- mg/L	TSS mg/L	Solids mg/L	TNVS mg/L	TNVSS mg/L	NH_3-N ug/L	TP ug/L	SP-P ug/L	NO_{2+3}-N ug/L	TN-N ug/L
M444020L		08/15	0850		10.1	12.1	6.6	71	95.1			161			1.42	4	70	35	3	10 U	7	4	215	
M444020R		08/15	0840	10.4	10.1	12.0	6.7	71	95.1	97.7		161	34	32	1.34	2				13	8	2	218	154
NO.BEND			24-hr.			17.5	7.0	311			0.37		57	39	25	3	240	160	1	920	5400	4200	8500	
M444012C		08/15	0950	10.4	10.3	12.2	6.8	74	97.1	98.4	163	163	36	32	1.47	3	73	30	3	10	19	16	226	181
M453000C	45.3	08/15	1025	10.2	10.1	14.7	6.7	33	101.1	101.7		301			0.84	3				10 U	6		46	
M449003C		08/15	1038	10.1	9.9	13.4	6.7	51	96.1	97.6		168			0.86	1				10 U	4		156	
M423R	42.3	08/15	1128	10.0	9.8	13.8	6.7	52	95.7	97.6		613	23	21	1.72	2	41	26	2	11	10	2	127	78
M423C	42.3	08/15	1122		9.8	13.8	6.8	52	95.8			613												
M423L	42.3	08/15	1117	9.9	9.9	13.9	6.8	52	97.2	97.3		613			1.39	2				32	15	2	120	
WEYCO	41.6		24-hr.			20.6	7.1	144			0.004		56	57	7	4	120	60	1	20 J	50	10 U	50	
M412R	41.2	08/15	1200	9.6	9.5	14.2	6.6	53	93.5	95.2		613	25	22	1.42	4	75	30	4	15	11	1	121	56
M412C	41.2	08/15	1155		9.5	14.1	6.7	53	93.6			613												
M412L	41.2	08/15	1150		9.7	14.2	6.8	52	95.6			613												
T411005		08/15	1205	10.8	10.6	14.4	7.0	82	105.1	107.4	2.7				1.79	2				12	13	2	304	217
SNOQWWTP	40.8		24-hr.			19.9	7.2	350			0.25		55	83	31	78	350	190	14	480 J	5000	3400 J	3400	
M407R	40.7	08/15	1300	9.6	9.5	14.5	6.9	54	94.1	95.3		617	23	24	1.20	3	55	24	2	16	14	5	123	63
M407C	40.7	08/15	1305		9.5	14.4	6.8	53	93.8			617												
M407L	40.7	08/15	1310		9.4	14.5	6.8	53	93.7			617			1.22	2				12	14	2	122	
M397R	39.7	08/15	1402	10.0	10.0	14.9	7.0	53	99.8	99.8		617			1.10	2				11	12	3	119	
T39600		08/15	1416	10.8	10.8	14.2	7.4	130	105.7	105.3	31				1.62	2				50	39	15	361	421
M373C	37.3	08/15	1530	10.7	10.6	15.7	7.2	57	107.4	108.2		648			1.16	3	79	28	2	11	13	2	120	68
M373L	37.3	08/15	1535		10.5	15.6	7.2	57	105.8			648												
M373L	37.3	08/15	1540		10.7	15.8	7.1	54	108.0			648												
T36200		08/15	1610	10.8	10.7	18.1	8.7	82	113.3	114.3		12			5.56	2				10	9	2	78	229
M3535	35.4	08/15	1630	10.8	11	16.4	7.2	58	108			660			1.33	4	58	25	2	37	14	2	119	65
M3535RD	35.4	08/15	1635	10.7								660			1.22	4	54	28	3	14	15	1	119	237
T39600D		08/15	1418																					
M412F	41.2	08/15	2030																					
B44		08/15	2035																	15	5	6	127	
M3535	35.4	08/16	0910		9.6	14.9	6.8	57	94.9			660												
M326	32.6	08/16	0950	9.7	10.5	14.8	6.8	57	103.9	96.8		660		22	1.21	1				45	71	1	133	174
T312004		08/16	1028	9.6	9.3	13.0	7.1	142	88.0	91.3	8.1				3.16	1 U				34	82	40	736	960
M279	27.9	08/16	1220	9.9	9.7	15.0	7.0	58	96.0	98.4		668		23	1.25	1 U				21	13	2	147	111
T27200		08/16	1250	11.8	11.8	15.2	7.9	88	118.2	118.2	2.9				1.84	7				41	30	4	232	324
M251R	25.1	08/16	1340	9.8		16.4	8.0			100.3		671	31	24	1.42	2	49	36	2	21	11		139	105
M251L	25.1	08/16	1335			17.1	7.7					671			1.44	1				22	18	2	124	117
T249		08/16	1430	10.8		13.9	7.7			104.9		165	24	18	0.86	1 U				29	11	1 U	107	75
M2301L	23.0	08/16	1535		10.1	16.1	7.1	59	102.2			825			1.38	1 U				17	26	1 U	120	94
M2301C	23.0	08/16	1539		9.9	16.0	7.1	59	100.6			825												
M2301R	23.0	08/16	1542	9.8	10.0	16.0	7.1	59	101.4	99.4		825	30	23	1.42	2	71	36	1	10 U	29	1 U	117	81
T213017		08/16	1723	11.2	10.4	13.3	7.3	88	99.5	107.4	3.5			36	2.38	1				11	43	8	458	638
M203	20.3	08/16	1627	10.	10.	16.	7.1	61	103.4	104.5		830		24	1.27	1 U				17	97	1	138	119
T175001		08/16	1645	9.0	8.9	14.7	7.1	147	87.4	89.0	4.2			64	3.53	4				125	221	120	627	1272
M109	10.9	08/16	1840	9.6	9.8	16.5	6.7	63	100.0	98.3		835	31	24	1.29	3	98	47	3	32	16	2	129	152
T103001		08/16	1858	8.2	8.1	15.9	6.8	122	82.4	82.6	1	1			3.42	5				29	89	28	24	311
DUVALL			24-hr.			19.0	7.6	560			0.23		35	183	36	42	360	215	16	18500 J	4500	3200 J	338	152
M098R	9.8	08/16	1920	9.8	9.7	16.5	7.0	63	98.8	100.4		838	29	24	1.29	2	68	43	2	27	19	2	132	148
M098L	9.8	08/16	1915		9.9	16.5	6.9	63	100.9			838			1.29	1				23	18	1	128	191
T067004		08/16	2100		9.7	15.2	6.9	92	97.1		3				2.92	1				35	51	8	418	659
M058L	5.8	08/16	2015	10.5	9.4	16.8	6.9	64	96.5	108.2		845		25	1.33	2				28	17	2	146	146
M027R	2.7	08/16	2120	9.9	9.2	17.2	7.0	67	96.0	102.8		860	28	25	2.08	6	58	42	5	32	13	2	131	151
B01		08/16	2300																			1 U		

Appendix A-2. (continued).

Station Number	River Mile	Date	Time	COD mg/L	TOC mg/L	BOD_5 mg/L	BOD_5-NI mg/L	BOD_{20} mg/L	F.coli org/100	Entero org/100	% Kleb. %	Chl *a*. mg/m^3	Pheo *a* mg/m^3
M444020L		08/15	0850						47				
M444020R		08/15	0840		3.66	2.0 J			51				
NO.BEND		08/15	24-hr.	24		4 J			5				
M444012C		08/15	0950		2.94		3.4 J		35				
M453000C		08/15	1025		1.83				10				
M449003C		08/15	1038		2.71				16				
M423R	42.3	08/15	1128	4.0U	2.32	2.2 J			33	7	0	0.1 L	0.1 L
M423C	42.3	08/15	1122										
M423L	42.3	08/15	1117						28				
WEYCO	41.6	08/15	24-hr.	22		4 U			5				
M412R	41.2	08/15	1200	4.0U	2.05	2.2 J			40		7		
M412C	41.2	08/15	1155										
M412L	41.2	08/15	1150										
T411005		08/15	1205	6.5	2.71	2.2 J			1100		0		
SNOQWWT	40.8			158		23 J			22				
M407R	40.7	08/15	1300	4.0U	2.92		2.8 J		27	7	0	0.1 U	0.1 U
M407C	40.7	08/15	1305										
M407L	40.7	08/15	1310						27				
M397R	39.7	08/15	1402						40	1 U			
T39600		08/15	1416		5.06	2.2 J			10	2			
M373C	37.3	08/15	1530		2.19	2.2 J			37	3		0.1 U	0.1 U
M373L	37.3	08/15	1535										
M373R	37.3	08/15	1540										
T36200		08/15	1610		3.26	2.2 J			77	19			
M3535	35.4	08/15	1630		1.86				18			0.1 U	0.1 U
M3535RD	35.4	08/15	1635		2.56				13			0.1 U	0.1 U
T39600D		08/15	1418						11	3			
M412F		08/15	2030										
B44		08/15	2035										
M3535	35.4	08/16	0910										
M326	32.6	08/16	0950		2.50	2.2 J			130				
T312004		08/16	1028		7.05		2.2 J		240				
M279	27.9	08/16	1220		2.45				140			0.1 U	0.1 U
T27200		08/16	1250	13.8	4.04		2.2 J		240				
M251R	25.1	08/16	1340		2.69			2 J	88	5		0.1 U	0.1 U
M251L	25.1	08/16	1335						130				
T249		08/16	1430		2.56	2.2 J			15	6			
M2301L	23.0	08/16	1535						84				
M2301C	23.0	08/16	1539										
M2301R	23.0	08/16	1542		2.33				55			0.1 U	0.1 U
T213017		08/16	1723		4.15	2.2 J			95				
M203	20.3	08/16	1627	5.5	2.18				67				
T175001		08/16	1645	17.7	6.77		2.2 J		2000				
M109	10.9	08/16	1840	7.0	2.23		2.2 J		130		4	0.1 U	0.1 U
T100001		08/16	1858	18.2	6.66	2.2 J			80				
DUVALL				152		38 J			9300				
M098R	9.8	08/16	1920	4.0U	1.76			1.7J	80		3	0.1 U	0.1 U
M098L	9.8	08/16	1915		1.65								
067004		08/16	2100		5.36	2.2 J			360				
M058L	5.8	08/16	2015		3.11				290			0.1 U	0.1 U
M027R	2.7	08/16	2120	4.0U	3.11			2 J	130			0.1 U	0.1 U
B01		08/16	2300										

Appendix A-2. (continued).

* = Station coding: R:right bank, L:left bank, C:center, F:filtered, B:blank, M:mainstem, T:tributary, D:duplicate.

Sample qualifiers:

U	=	below detection limit indicated
J or E	=	estimated value
DO1	=	Dissolved oxygen by membrane probe
DO2	=	Dissolved oxygen by Winkler titration

Appendix A-3. Snoqualmie River data collected on September 5 - 6, 1989 (Survey #3 of 4) as part of the Snoqualmie River low flow study.

Station Number*	River Mile	Date	Time	D.O.2 mg/L	Temp °C	pH s.u.	Cond. umhos	DOSat2 %	Flow cfs	Staff cfs	Hard. mg/L	Alk. mg/L	Cl- mg/L	TSS mg/L	Solids mg/L	TNVS mg/L	TNVSS mg/L	NH_3-N ug/L	TP ug/L	SP-P ug/L	NO_2+_3-N ug/L	TN-N ug/L
M444020L		09/05	0820		11.9	6.9	75			161			1.34	2	99	44	1	10 U	6	4	264	
M444020R		09/05	0813	9.8	11.9	6.9	75	92.1		161	37	32	1.35	2				11	6	3	259	202
NO BEND			24-hr.		17.1	7.2	288		0.37		57	72	26	60	100	90	10	210	5900	5000	1200	
M444012C		09/05	0945	10.2	12.1	6.9	79	96.3	163	163	35	34	1.47	1	53	33	2	11	19	14	259	201
M453000C	45.3	09/05	1015	10.3	13.9	6.8	32	101.2		274			0.75	1				10 U	5		57	
M449003C		09/05	1030	10.1	13.7	6.8	43	98.8		182			0.71	1				10 U	2		149	
M423R	42.3	09/05	1100	10.1	13.2	7.0	49	97.7		615	22	20	0.91	2	34	26	1	10 U	5	4	119	90
M423C	42.3	09/05	1105		13.5	6.9	49			615												
M423L	42.3	09/05	1110	9.9	13.5	6.8	50	96.4		615			0.90	2				25	7	3	124	
WEYCO	41.7		24-hr.		19.5	7.3	141		0.009		58	62	7					40	50	50	20	
M412R	41.2	09/05	1150	9.9	13.8	6.8	50	97.0		615	21	20	1.00	1	34	26	1	13	6	3	123	100
M412C	41.2	09/05	1155		13.8	6.9	50			615												
M412L	41.2	09/05	1200		13.8	6.9	50			615												
T411005		09/05	1219	10.2	14.4	7.1	95	101.3	1.3				2.33	3				24	14	5	344	357
SNOQWWTP	40.8	09/05	24-hr.		18.6	7.7	333		0.41		52	88	25	100	280	88	11	330	5900	3300	2800	
M407R	40.7	09/05	1300	10.1	14.1	6.9	50	99.6		618	21	20	0.98	2	87	20	1	12	13	10	140	343
M407C	40.7	09/05	1305		14.0	6.9	50			618												
M407L	40.7	09/05	1310	10.0	14.1	6.8	50	98.6		618			0.93	1				23	6	3	137	
M407D	40.7	09/05	1300							618												
M397R	39.7	09/05	1420	10.8	14.4	7.5	50	106.1		618			0.95	3				11	8	4	128	
T39600		09/05	1430	11.0	13.7	7.6	145	105.9	28				1.63	2				42	40	28	397	561
M373C	37.3	09/05	1525	11.3	15.4	7.3	54	112.9		646		22	0.98	1	39	24	2	12	10	6	129	143
M373D	37.3	09/05	1530	11.3	15.4	7.4	53	112.9		646	23	22	0.99	2				12	21	6	158	373
T36200		09/05	1711	10.2	20.6	9.0	89	113.8		12			5.44	3				13	9	5	100	249
M3535	35.4	09/05	1604	11.4	16.2	7.3	55	115.8		658	23	23	1.09	4	63	36	2	10	9	5	118	90
M323	32.3	09/05	1627	10.7	16.4	7.2	56	109.6		658			1.15	3				13	8	5	118	103
T312004		09/05	1751	9.3	14.6	7.4	128	91.7	6.5				3.05	3				28	52	40	708	1079
B44		09/05	1800											1 U				10 U 5		2	20	50
M323	32.3	09/06	0840		14.0	7.0	56			658												
M279	27.9	09/06	0953	9.9	14.1	7.1	58	96.5		690	23	24	1.17	1 U				18 14		6	148	165
T27200		09/06	1024	11.9	12.7	7.6	101	112.4	3.70			43	1.79	1				23		21	9	281330
M251R	25.1	09/06	1105	10.1	15.7	7.2	58	101.9		696	26	24	1.21	1 U		62	30	2 13		11	3	131126
M251L	25.1	09/06	1110		16.0	7.1	60			696			1.20	1 U				14 11		3	127	172
T249		09/06	1147	11.4	12.7	7.4	56	107.7		158		22	0.86	1 U				10 U 2		3	127	86
M2301L	23.0	09/06	1305		16.1	7.2	61			854			1.14	1 U				20 8		14	125	324
M2301C	23.0	09/06	1310		15.8	7.3	59			854												
M2301R	23.0	09/06	1255	10.6	15.8	7.4	57	107.1		854	25	24	1.19	1 U		100	52	3 10 U		8	5	145196
T213017		09/06	1214	10.8	11.4	7.4	99	99.1	2.9			39	1.90	1 U				17 24		14	618	713
M1825	18.3	09/06	1330	10.4	16.1	7.1	59	105.7		857		24	1.19	1 U				20 11		5	144	150
M1825D	18.3	09/06	1335							857												
T175001		09/06	1350	9.4	14.1	7.4	168	91.5	4.50			69	3.62	66				246		2900	81	7631849
M147R	14.7	09/06	1435	10.0	16.5	7.2	63	102.5		862	26	25	1.23	2		78	32	3 20		19	13	166430
M147L	14.7	09/06	1440			7.3	61			862			1.20	1				18		11	4	145
M107	10.7	09/06	1545		16.4	7.3	56			862	28	25	1.22	2		150	76	4 25		11	5	147188
M107D	10.7	09/06	1550	9.8	16.4	7.2	56	100.2		862	25	25	1.24	1				16		11	4	146116
DUVALL	10.6		24-hr.		19.2	7.6	492		0.26		37	144	36	140		230	150	31 9700		11000	7800	190
M105R	10.5	09/06	1625							863												
T103001		09/06	1640	8.4	15.4	7.2	123	84.1	0.90				2.44	7				41	68	20	37	382
M10	10.0	09/06	1649							863												
M098R	9.8	09/06	1657	9.8	16.5	7.2	56	100.4		864	26	25	1.21	3		82	26	5 26	14	8	145	163
M098L	9.8	09/06	1653		16.5					864			1.22	1				22	16	7	144	
T06700		09/06	1745	10.3	13.8	7.2	97	99.6	5.60				2.63	1				26	29	10	456	574
M058	5.8	09/06	1815	9.9	16.3	7.1	59	101.0		870		25	1.22	2				22	14	7	162	208
M027R	2.7	09/06	1940	9.7	16.7	7.3	60	99.8		870	28	25	1.23	3		150	1	3 31	19	6	140	216
M027L	2.7	09/06	1950	9.8	16.7	7.3	60	100.8		870			1.27	1	U			25	17	6	153	375
B01		09/06	2300										0.10					11	4	1	15	64

Appendix A-3. (continued).

Station Number*	River Mile	Date	Time	COD mg/L	TOC mg/L	BOD_5 mg/L	BOD_5-NI mg/L	BOD_{20} mg/L	F.Coli org/100	Enteroc org/100	% Kleb. %	Chl a. mg/m³	Pheo a mg/m³
M444020L		09/05	0820						18				
M444020R		09/05	0813		3.36	2			13				
NO.BEND		09/05	24-hr.	81		35 J			25				
M444012C		09/05	0945		2.26		2 U		19	8			
M453000C	45.3	09/05	1015		1.84				8				
M449003C		09/05	1030		2.68				15				
M423R	42.3	09/05	1100	8	2.03				14	3	0	0.1 U	0.1 U
M423C	42.3	09/05	1105										
M423L	42.3	09/05	1110	8					13				
WEYCO	41.7		24-hr.	23		4 U			7				
M412R	41.2	09/05	1150	5	2.47				7		0		
M412C	41.2	09/05	1155										
M412L	41.2	09/05	1200										
T411005		09/05	1219	12	4.51	2 U			730		0		
SNOQWWTP	40.8		24-hr.	189		56	24		10		0		
M407R	40.7	09/05	1300	7	2.06		2 U		10	2		0.1 E	0.1 E
M407C	40.7	09/05	1305										
M407L	40.7	09/05	1310	7					15	3			
M407D		09/05	1300						14	6			
M397R	39.7	09/05	1420						18				
T39600		09/05	1430	9	5.39				7				
M373C	37.3	09/05	1525		2.11				9	5		0.1 U	0.1 U
M373D	37.3	09/05	1530		1.85	2 U			12				
T36200		09/05	1711	11	3.57				35	7			
M3535	35.4	09/05	1604		2.47				13	1		0.1 U	0.1 U
M323	32.3	09/05	1627		2.54				120				
T312004		09/05	1751	13	5.50				290				
B44		09/05	1800		0.31				1 U				
M323	32.3	09/06	0840										
M279	27.9	09/06	0953		3.23				96			0.1 U	0.1 U
T27200		09/06	1024		5.63				140				
M251R	25.1	09/06	1105	6	2.27		2 U		92	6		0.1 U	0.1 U
M251L	25.1	09/06	1110						60				
T249		09/06	1147		2.54				11	1 U			
M2301L	23.0	09/06	1305						52				
M2301C	23.0	09/06	1310										
M2301R	23.0	09/06	1255	6	3.38				41				
T213017		09/06	1214		5.37				36				
M1825	18.3	09/06	1330		2.11				45				
M1825D	18.3	09/06	1335						33	1 U			
T175001		09/06	1350	26	8.47				12000				
M147R	14.7	09/06	1435	6	2.34				39	1		0.1 U	0.1 U
M147L	14.7	09/06	1440		2.63				33				
M107	10.7	09/06	1545	6	3.07				33	2		0.1 U	0.1 U
M107D	10.7	09/06	1550		3.50				51				
DUVALL	10.6	09/06	24-hr.	152			25		50000				
M105R	10.5	09/06	1625						31				
T103001		09/06	1640	11	6.31				20				
M10	10.0	09/06	1649						31				
M098R	9.8	09/06	1657	6	3.16		2 U		47	1		0.1 U	0.1 U
M098L	9.8	09/06	1653						31				
T06700		09/06	1745	10	5.00				180				
M058	5.8	09/06	1815	8	2.45				63			0.1 U	0.1 U
M027R	2.7	09/06	1940	9	2.20		2 U		55			0.1 U	0.1 U
M027L	2.7	09/06	1950		2.77				48				
B01		09/06	2300		0.44				1 U	1 U			

Appendix A-3. (continued).

* = Station coding: R:right bank, L:left bank, C:center, F:filtered, B:blank, M:mainstem, T:tributary, D: duplicate

Sample qualifiers:

U =below detection limit indicated
J or E=estimated value
DO1 =Dissolved oxygen by membrane probe
DO2 =Dissolved oxygen by Winkler titration

Appendix A-4. Snoqualmie River data collected on September 26 - 27, 1989 (Survey #4 of 4) as part of the Ecology low flow study.

Station Number*	River Mile	Date	Time	D.O.2 mg/L	D.O.1 mg/L	Temp °C	pH s.u.	Cond. umhos	DOSat1 %	DOSat2 %	Flow cfs	Staff cfs	Hard. mg/L	Alk. mg/L	Cl- mg/L	TSS mg/L	Solids mg/L	TNVS mg/L	TNVSS mg/L	NH_3-N µg/L	TP µg/L	SP-P µg/L	NO_{3+2}-N µg/L	TN-N µg/L
M444020L		09/26	0810	9.8		11.3	7.0	84		90.9		113			1.59	4	57	53	2	10 U	14	4	270	
M444020R		09/26	0815	9.8		11.3	7.0	85		90.9		113	40	35	1.58	2				15	31	4	264	358
NO.BEND						16.2	7.4	265			0.36		58	68	24	160	400	180	4	660	6000	2500	290	
M444012C		09/26	0925	10.1		11.5	7.2	89		94.0	114	114	39	36	1.62	2	40	52	1	10	17	9	245	350
M444012D		09/26										114												
M453000C		09/26	0945	10.3		13.1	7.4	39		99.4			183		1.09	4				10 U	6		66	
M449003C		09/26	1003	10.1		12.8	7.3	57		96.8		102			1.07	2				10	8		178	
M423R	42.3	09/26	1025	9.8		13.2	7.5	62		94.3		430	26	24	1.34	2	40	36	1	10	8	4	144	195
M423C	42.3	09/26	1029			13.2	7.4	62				430												
M423L	42.3	09/26	1032	9.8		13.2	7.2	62		94.3		430			1.27	2				21	10	4	143	
WEYCO	41.7					17.9	7.3	146			0.004		58	61	8	1 U	130	78	1	80	80	10	10	
M412R	41.2	09/26	1110	9.4		13.7	7.3	63		91.9		430	27	25	1.34	2	50	44	1	17	10	4	128	204
M412C	41.2	09/26	1117			13.5	7.1	62				430												
M412L	41.2	09/26	1125			13.5	7.1	62				430												
T411005		09/26	1138	9.6		13.1	7.1	97		92.6	1.3				2.19	2				10	19	4	295	453
SNOQWWTP	40.8					17.4	7.5	325			0.36		51	89	30	44	350	180	1	550	7100	3700	2500	
M407R	40.7	09/26	1220	9.5		13.8	7.2	64		93.0		433	31	24	1.32	3	41	31	1	31	22	8	148	207
M407C	40.7	09/26	1215			13.9	7.1	61				433												
M407L	40.7	09/26	1209	9.4		14.0	7.1	61		92.5		433			1.32	2				14	14	4	135	
M397R	39.7	09/26	1353	10.1		13.9	7.4	64		98.1		433			1.33	1				22	17	6	139	
M397RD	39.7	09/26	1354	10.0		13.9	7.2	62		97.2		433			1.33	1				17	19	7	153	
T39600		09/26	1405	11.1		12.3	7.6	152		104.1	25				1.77	3				25	54	22	357	501
M373C	37.3	09/26	1455	11.0		14.3	7.5	70		107.7		458		27	1.41	2	41	37	1	14	17	7	136	191
T34200		09/26	1519	11.2		15.5	9.4	95		112.6		12			6.01	1				12	14	5	36	128
M3535	35.4	09/26	1643	10.9		14.5	7.4	72		107.2		470	29	28	1.45	3	71	41	2	12	16	6	131	214
M323	32.3	09/26	1700	10.8		14.2	7.3	71		105.5		470			1.54	3				12	13	5	147	229
M323F		09/26										470								14	8		142	
T312004		09/26	1550	10.2		12.4	7.5	159		95.3	8	6.8			0.34	3				35	71	41	746	854
B01F		09/27	2110																			5		
B40F		09/26																				2		
B35		09/26													0.10					10 U	4	3	10	30
M323	32.3	09/27	0755			13.6	6.8	70				470												
M279	27.9	09/27	0844	9.9		14.2	7.5	65		96.7		479	32	28	1.49	1 U				40	18	7	153	346
T27200		09/27	0900	9.6		12.9	7.3	102		91.1	3.4	3.7		41	2.14	4				43	24	9	443	836
M251R	25.1	09/27	0935	10.1		14.2	7.3	75		98.6		482	32	30	1.61	1 U	81	55	1	20	14	4	164	530
M251L	25.1	09/27	0940	10.2		14.2	7.3	74		99.6		482			1.55	1 U				21	10	4	156	362
T249		09/27	1034	10.8		13.3	7.6	56		103.4		127		21	1.02	1 U				12	3	3	114	189
M2301L	23.0	09/27	1158	10.7		14.7	7.4	71		105.1		609			1.46	1 U				14	10	4	128	326
M2301C	23.0	09/27	1205			14.4	7.4	71				609												
M2301R	23.0	09/27	1210	10.5		14.8	7.4	70		103.8		609	32	28	1.47	1 U	66	46	1	25	10	4	145	252
T213017		09/27	1119	10.7		11.8	7.5	101		99.0		2.9		40	1.91	1 U				21	30	16	569	883
M1825	18.3	09/27	1220	10.4		14.8	7.4	74		102.8		612		29	1.49	1 U				18	12	4	146	283
M1825D	18.3	09/27	1222	10.3		14.8	7.4	71		101.3		612		29	1.51	1 U				18	10	3	141	346
T175001		09/27	1244	9.1		13.3	7.4	169		87.0	3.8			68	3.88	48				330	269	117	602	1456
M147R	14.7	09/27	1316	10.2		15.2	7.4	74		101.7		616	31	29	1.55	1 U	120	72	1	26	26	9	139	380
M147L	14.7	09/27	1323			15.4	7.3	73				616			1.55	1 U				46	20	7	128	
SNOQ5**	14.7											616								53	24		123	
M107	10.7	09/27	1430	10.5		15.2	7.3	70		104.2		616	31	29	1.53	1 U	70	49	1	21	12	5	136	328
DUVALL	10.6					18.4	7.6	474			0.23		40	137	33	101	445	215	2	13500	16800	8800	105	
T104		09/27	1451			14.5					0.4					6						24		
T103001		09/27	1456	8.6		14.1	7.1	126		83.7	0.6				2.50	4				47	130	20	26	366
M098R	9.8	09/27	1510	10.4		15.2	7.4	72		103.7		618	30	29	1.54	1 U	77	43	1	23	16	7	129	319
M098L	9.8	09/27	1517	10.2		15.2	7.5	73		101.2		618			1.58	4				23	16	6	138	
SNOQ6**	9.8											618								31	12		120	
T06700		09/27	1601	9.6		13.5	7.3	101		92.2	8.9				2.76	14				42	39	11	517	1044
M058	5.8	09/27	1619	10.7		15.3	7.5	74		106.9		627		30	1.62	1 U				32	14	6	130	702
M058D	5.8	09/27	1620									627												
M027R	2.7	09/27	1728	10.1		15.5	7.3	76		101.3		635	31	30	1.64	1 U	61	28	1	27	17	5	115	997
M027RF	2.7	09/27	2115									635								24	7		100	
M027L	2.7	09/27	1735	10.2		15.5	7.4	72		102.3		635			1.62	1 U				32	19	6	115	304
B030		09/27	2100												0.10					10	1	2	10	79

Appendix A-4. (continued).

Station Number*	River Mile	Date	Time	COD mg/L	TOC mg/L	BOD_5 mg/L	BOD_5-NI mg/L	BOD_{28} mg/L	F.Coli org/100	Entero org/100	% Kleb. %	Chl a. mg/m^3	Pheo a mg/m^3
M444020L		09/26	0810						40				
M444020R		09/26	0815		3.60		2 U		27				
NO.BEND				249		64			1400				
M444012C		09/26	0925		5.72			4	35	20			
M444012D		09/26							26	21			
M453000C		09/26	0945		2.20				10				
M449003C		09/26	1003		3.02				47				
M423R	42.3	09/26	1025	5.4	4.87				32	15	4	0.1 U	0.1 U
M423C	42.3	09/26	1029										
M423L	42.3	09/26	1032	7.9					41				
WEYCO	41.7			20		6 J			4				
M412R	41.2	09/26	1110	4.9	5.42		2 U		27		17		
M412C	41.2	09/26	1117										
M412L	41.2	09/26	1125										
T411005		09/26	1138	11.0	8.26		2 U		3500 E				
SNOQWWTP	40.8			169		21			20				
M407R	40.7	09/26	1220	6.5	4.64			4	29	35	18	0.1 U	0.1 U
M407C	40.7	09/26	1215										
M407L	40.7	09/26	1209	5.8					44	41			
M397R	39.7	09/26	1353						28	24			
M397RD	39.7	09/26	1354						33	25			
T39600		09/26	1405	8.5	8.90		2 U		6	19			
M373C	37.3	09/26	1455		4.43		2 U		26	4		0.1 U	0.1 U
T36200		09/26	1519		5.52		2 U		8	37			
M3535	35.4	09/26	1643		4.09				16	4		0.1 U	0.1 U
M323	32.3	09/26	1700		4.61		2 U		29				
M323F		09/26											
T312004		09/26	1550	8.7	5.66		2 U		96				
BO1F		09/27	2110										
B40F		09/26											
B35		09/26			2.26				1 U				
M323	32.3	09/27	0755										
M279	27.9	09/27	0844		5.34		2 U		220			0.1 U	0.1 U
T27200		09/27	0900		9.45		2 U		430				
M251R	25.1	09/27	0935	7.2	5.47			2 U	88	17 E		0.1 U	0.1 U
M251L	25.1	09/27	0940						70				
T249		09/27	1034		4.73			2 U	29	1 U			
M2301L	23.0	09/27	1158						49				
M2301C	23.0	09/27	1205										
M2301R	23.0	09/27	1210		5.18		2 U		48			0.1 U	0.1 U
T213017		09/27	1119		6.57		2 U		20				
M1825	18.3	09/27	1220		5.77				45				
M1825D	18.3	09/27	1222		5.05				55				
T175001		09/27	1244	26.6	12.00		2 U		18000				
M147R	14.7	09/27	1316	6.8	6.55		2 U		220	24 E		0.1 U	0.1 U
M147L	14.7	09/27	1323		5.41				270				
SNOQ5**	14.7								200				
M107	10.7	09/27	1430	4.0 U	5.25		2 U		220	19 E		0.1 U	0.1 U
DUVALL	10.6			212		54			1700				
T104		09/27	1451						57				
T103001		09/27	1456	13.8	9.06		2 U		110				
M098R	9.8	09/27	1510	7.3	2.61			2 U	160	31 E		0.1 U	0.1 U
M098L	9.8	09/27	1517		5.04				200				
SNOQ6**	9.8								170				
T06700		09/27	1601	12.0	7.56		2 U		1200				
M058	5.8	09/27	1619	6.6	5.03				83			0.1 U	0.1 U
M058D	5.8	09/27	1620						100	1 U			
M027R	2.7	09/27	1728	8.2	5.51			2 U	100	8 E		0.1 U	0.1 U
M027RF	2.7	09/27	2115										
M027L	2.7	09/27	1735		5.52				140				
B020		09/27	2100		3.64				1 U				

Appendix A-4. (continued).

* = Station coding: R:right bank, L:left bank, C:center, F:filtered, B:blank, M:mainstem, T:tributary, D:duplicate
** = Sample taken by Tulalip Tribes staff at location indicated-see Tulalip Tribes, 1988.

Sample qualifiers:

U	=	below detection limit indicated
J or E	=	estimated value
DO1	=	Dissolved oxygen by membrane probe
DO2	=	Dissolved oxygen by Winkler titration