regional Wastewater Services Plan

Bob Peterson

Wastewater 2020 Plus Snoqualmie Valley Cities

Task 6.2.6 Final Report

HDR Engineering, Inc.

Herrera Environmental Consultants

King County Department of Natural Resources

February 1996

KING COUNTY

Clean Water – A Sound Investment

HDR

February 19, 1996

Mr. Ellis McCoy, Project Manager
King County Department of Natural Resources
821 Second Avenue, M/S 81
Seattle, WA 98104

Re: Wastewater 2020 Plus Task 6.2.6 -- Snoqualmie Valley Cities Final Report

Dear Ellis:

Transmitted herewith is our final report summarizing work performed for the Snoqualmie Valley cities as part of King County's Wastewater 2020 Plus planning study process. The following subtask reports and memoranda have been bound together in this single document:

- *City of Carnation Preferred Wastewater Treatment Alternatives*
- *Role of Metropolitan Services Department Under Current Snoqualmie Valley Cities Planning*
- *Snoqualmie Valley Wastewater Treatment Facilities and Operations*
- *Snoqualmie Valley Biosolids Management Alternatives*
- *Review of Current and Anticipated Regulations*
- *NPDES Permit Process*

We wish to thank all those at King County, the cities of Carnation, Duvall, North Bend, and Snoqualmie, and the Echo Glen Children's Center who provided valuable assistance during this effort.

Very truly yours,

HDR ENGINEERING, INC.

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Wastewater 2020 Plus
Snoqualmie Valley Cities

Task 6.2.6 Final Report

King County Department of Natural Resources
Water Pollution Control Division
Capital Facilities Planning and Program Management
821 Second Avenue, M.S. 81
Seattle, WA 98104-1598

February 1996

This information is available on request in accessible formats by calling (206) 684-2046 (voice) or (206) 689-3413 (TTY).

The Water Pollution Control Department of the King County Department of Metropolitan Services, formerly the Municipality of Metropolitan Seattle (Metro), became the Water Pollution Control Division in the new King County Department of Natural Resources, Jan. 1, 1996. This change is reflected on the cover, but not in the text.

City of Carnation Preferred Wastewater Treatment Alternatives

Prepared by
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October 1995

King County Department of Metropolitan Services
Water Pollution Control Department
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INTRODUCTION

This report presents a conceptual design for a wastewater treatment plant to serve the City of Carnation. The treatment technologies evaluated for this study were selected based on the 1991 Draft Wastewater Facilities Plan and a workshop attended by representatives of the City of Carnation, the King County Department of Metropolitan Services, and their consultants. The purpose of this report is to assess the feasibility and cost of providing a wastewater collection and treatment system for a small portion of the City of Carnation, with the intent to ultimately provide sewer service to most portions of the city. The flow rates identified for the small and ultimate treatment facilities are 0.04 million gallons per day (mgd) and 0.3 mgd, respectively.

Two treatment technologies were identified in the May 11, 1995 workshop to be evaluated under this task. The first alternative consists of a facultative lagoon treating the initial flows of 0.04 mgd. Under this alternative the ultimate sewer capacity of 0.3 mgd would be treated by an extended aeration system. The second alternative includes a sequencing batch reactor to treat the initial and ultimate wastewater flows. For each alternative a conceptual design and layout for the small and ultimate treatment plants is provided, followed by a discussion concerning the operational requirements of each system, how the facility can be scaled up to a 0.3 mgd plant, and conceptual costs. In addition, preliminary sizing and costs are presented for a wastewater collection system serving only the initial sewer area and sized to accommodate the ultimate capacity of the plant.

The intent of this report is to provide the City of Carnation with sufficient information concerning treatment technologies and associated costs to implement a sewer system at a smaller scale than that proposed in the 1991 facilities plan. This analysis does not attempt to evaluate all treatment options available to the City of Carnation. This study was completed under the 1991 facilities plan, which serves as a basis for this effort.

BACKGROUND INFORMATION

This section presents a summary of previous reports and studies related to the City of Carnation's proposed sewer service. Information pertinent to the development of a public sewer service and conceptual design of a wastewater treatment plan is included in the discussion. In particular, quantities for projected wastewater flow rates and pollutant loadings developed in previous reports are used in this analysis for the design of the wastewater treatment processes.

Current land use and population characteristics are summarized in a letter report to the King County Department of Metropolitan Services (Bleeker 1995 personal communication). In general, the City of Carnation is a residential community, incorporating approximately 533 acres. As of 1994, the population was 1,430. The city contains a central commercial area; however it does not have any industry within the city limits. Surrounding areas are primarily agricultural except for two local industries. Wastewater from the entire community is currently disposed of by onsite systems.

In 1991, a Draft Wastewater Treatment Facilities Plan was prepared for the City of Carnation, to determine what portions of the city required a public sewer system as a means of protecting public health and/or environmental quality, and to determine the most cost-effective technology for providing wastewater service where it was required (R.W. Beck 1991). A review of private onsite systems was made to assess where wastewater service was required. The analysis determined that many of the existing systems do not meet the current design criteria for onsite systems established by the Department of Health. In addition, many of the lots within central Carnation are smaller than the minimum lot sizes prescribed under the regulations. New onsite systems are not being permitted, and failing systems cannot be replaced. Therefore, it was determined that the city required a public wastewater treatment facility.

The facilities plan established wastewater flow characteristics for the City of Carnation based on population projections and land use. Wastewater flow rates and organic loads were determined for three different service areas. The analysis determined that the most economical alternative for the city was to construct a wastewater treatment facility sized to treat flows from the ultimate service area. The facilities plan presented a preferred treatment option, phasing evaluation, initial site screening, and conceptual cost. The preferred alternative was a tertiary treatment plant sized for a capacity of 0.33 mgd. The components of the proposed treatment plant included screens, grit removal equipment, sequencing batch reactors, sand filters, and ultraviolet disinfection. However, the plan has never been implemented, primarily due to the perceived high cost of the recommended alternative.

Several subsequent studies have been conducted since the draft facilities plan. In 1992, the city hired a consultant to prepare a comprehensive plan, which estimated a population growth lower than the estimate presented in the facilities plan (Henigar and Ray, Inc. 1992). The city also revised the proposed phasing of the sewer system (Jensen and Morgan 1995a personal communication). The new plan calls for three phases, with the initial sewer system serving only the central business district and immediately adjacent residential lots. The city also compiled a list of potential sites for a wastewater treatment plant within the immediate vicinity of the city

limits (Jensen and Morgan 1995b personal communication). Five sites were identified, ranging in size from 2 to 16 acres.

FLOW RATES

Two capacities are used to size the treatment process equipment for each alternative (HDR Engineering 1995). For the initial service area the average day peak month flow is estimated to be 0.04 mgd. This flow rate is based on the city's intent to initially provide sewer service only to the central business district and immediately adjacent residential lots. The ultimate capacity used for each alternative is assumed to be 0.3 mgd. The service area for this flow consists of the central business district; neighborhoods consisting of older, smaller lots; and the northern growth area (which also consists of smaller lots). The flow rate is based on population estimates for the year 2010.

For the purposes of sizing conveyance facilities, the peak hour flow rate was assumed to be 3.33 times the average day peak month. This peak factor is used in the 1991 facilities plan (R.W. Beck).

WASTEWATER CHARACTERISTICS

The wastewater characteristics are based on the pollutant loading determined in the 1991 facilities plan. The facilities plan assumed a biological oxygen demand (BOD) and total suspended solids (TSS) loading rate of 0.2 pounds per capita per day (ppcd) for residential flows and 0.26 ppcd for commercial flows. For the ultimate capacity the estimated concentrations for BOD and TSS were 238 milligrams per liter (mg/L) for each parameter. For the small service area that consisted of the central business district, the estimated concentrations for BOD and TSS were 257 mg/L. Therefore, for the purposes of this study,.BOD and TSS concentrations are estimated to be 250 mg/L for the initial and ultimate flow rates.

The 1991 facilities plan did not provide an analysis of expected nutrient loading in the domestic wastewater. Therefore, for the purposes of sizing the reactor tanks and aeration equipment, an influent concentration for ammonia in the range of 20 to 40 mg/L as nitrogen is used.

EFFLUENT DISCHARGE REQUIREMENTS

The Washington Department of Ecology (Ecology) governs the permitting of domestic wastewater treatment facilities. Table 1 lists the minimum discharge standards for domestic wastewater facilities (WAC 173-221).

Table 1. Effluent discharge standards for domestic wastewater facilities.

Parameter	Standard
BOD	
30-day average	30 mg/L
7-day average	45 mg/L
30-day average removal	85 percent of the influent concentration
TSS	
30-day average	30 mg/L
7-day average	45 mg/L
30-day average removal	85 percent of the influent concentration
Fecal Coliform	
Monthly geometric mean	200/100 mL
Weekly geometric mean	400/100 mL
pH	6 to 9

Furthermore, WAC 173-221 sets less restrictive standards for facilities which rely on stabilization ponds as the primary treatment process and have a design capacity of less than 2 mgd. The effluent restrictions for these facilities are shown in Table 2. TSS standards can be adjusted by Ecology based on concentrations achievable through proper operation and maintenance of the facility.

Although regulations allow domestic wastewater to be treated with waste stabilization ponds, it may be difficult to get a lagoon system permitted in western Washington. Stabilization ponds do not perform optimally in cooler and wetter climates, which are typical of western Washington. In addition, Ecology may be less likely to permit a waste stabilization pond system for facilities that discharge to Class A surface waters such as the Snoqualmie River.

The City of Carnation facility would also be subject to regulations under the National Pollutant Discharge Elimination System (NPDES) permit program for effluent discharges to surface waters. The NPDES permit is specific for each facility. Discharge limitations are dependent on the quality and quantity of the receiving water, the receiving water uses, and the presence or absence of other pollutant sources in the same watershed. The Department of Ecology has allotted the Carnation treatment plant pollutant loadings for low flow periods of the Snoqualmie River (August through October). The anticipated effluent limits for a flow of 0.2 mgd are 2 to 2.5 mg/L for soluble reactive phosphorus, 5 to 9 mg/L for ammonia as nitrogen, and 15 mg/L for

BOD during the low flow periods (HDR Engineering 1995). During non-low flow periods, the anticipated treatment requirements are secondary treatment with no nutrient removal specified.

Table 2. Effluent discharge standards for waste stabilization ponds.

Parameter	Standard
BOD	
30-day average	45 mg/L
7-day average	65 mg/L
30-day average removal	65 percent of the influent concentration
TSS	
30-day average	45 mg/L
7-day average	65 mg/L
30-day average removal	65 percent of the influent concentration
Fecal Coliform	
Monthly geometric mean	200/100 mL
Weekly geometric mean	400/100 mL
pH	6 to 9

The anticipated regulatory requirements for discharging the treatment facility effluent to the Snoqualmie River provide the basis for the conceptual design of the wastewater treatment facilities. The discharge requirements for non-low flow periods are used because the city will initially provide storage during low flow periods. Although higher effluent limits are allowed for waste stabilization ponds, it is assumed that ponds used at Carnation would be required to meet the more stringent requirements to address Ecology's concern about nutrient loadings to the Snoqualmie River. Therefore, the conceptual design is based on effluent concentrations of 30 mg/L or less for BOD and TSS.

WASTEWATER TREATMENT SYSTEM ALTERNATIVES

Two alternatives are considered for the City of Carnation wastewater treatment plant:

- Alternative 1: Stabilization ponds for the initial capacity of 0.04 mgd and extended aeration system for the ultimate capacity of 0.3 mgd
- Alternative 2: Sequencing batch reactors for both the initial and ultimate capacities.

For each alternative, typical unit processes found in a small municipal facility, such as screening, grit removal, biological treatment, clarification, and disinfection, are included as needed in order to develop a conceptual layout and cost for the treatment facility. Cost estimates also consider summer storage.

The first alternative is evaluated because lagoon systems typically have lower capital costs and operational requirements than activated sludge systems. Extended aeration is considered for the ultimate capacity under this alternative because it is realized that the stabilization lagoons cannot meet the stringent effluent requirements under an NPDES permit. Sequencing batch reactors are included as the second alternative because they were the preferred alternative in the 1991 facilities plan (but were proposed at a larger capacity). A description of each of these biological treatment processes is presented, followed by a description of each alternative and costs.

WASTE STABILIZATION PONDS

Stabilization ponds, or lagoons, are one of the earliest recorded systems for treatment of wastewater. Nearly 7,000 lagoon systems are currently used in the United States for treating municipal and industrial wastewater in a wide variety of climates. Stabilization ponds rely on natural physical and biological processes for treatment. Suspended solids are removed by physical settling, while BOD is satisfied by biological activity and oxidation. The four primary types of lagoons are facultative (aerobic-anaerobic), aerated, aerobic, and anaerobic (Middlebrooks et al. 1982).

The lagoon system considered for the City of Carnation is proposed as facultative lagoons (also called oxidation ponds, sewage lagoons, or photosynthetic ponds). In this type of lagoon, an aerobic layer overlies an anaerobic layer. In the upper layer, photosynthetic algae and surface reaeration produce oxygen that is used by the aerobic bacteria in stabilizing the organic material. Anaerobic fermentation occurs at the bottom of the lagoon along with sludge accumulation. Between the two layers is a facultative zone that ranges from aerobic near the top to anaerobic at the bottom. Enhanced oxidation in the ponds can be provided with mechanical aerators (Metcalf & Eddy 1991).

The efficiency of the lagoon in biological activity is dependent on climate. The presence of algae in the upper layer is essential to the performance of the pond. The algae flourish under warm

sunny conditions, resulting in oxygen concentrations near saturation near the surface. In the presence of sunlight, the algae take up carbon dioxide, resulting in pH levels near 10. The high pH levels promote the removal of ammonia by volatilization. In addition, the biological activity by aerobic bacteria and anaerobic fermentation occurs at higher rates at warmer temperatures. For this reason larger ponds are required in colder climates to allow for greater detention times.

Typical detention times range between 20 and 180 days. Optimal designs consist of three cells to maximize the use of the entire design volume. Effluent BOD concentrations of less than 30 mg/L can typically be achieved; however TSS concentrations may range from less than 30 to 100 mg/L. TSS concentrations are highly dependent on algae concentrations (Middlebrooks et al. 1982).

The major advantages to stabilization ponds are the low capital costs, simple operational requirements, and sludge disposal required only at 10- to 20-year intervals. Major disadvantages include large land area requirements and difficulty in meeting stringent effluent standards during the warm season. Also, odor problems may occur as ponds turn over in the fall (U.S. EPA 1992).

EXTENDED AERATION

Extended aeration is a modification of the activated sludge process characterized by low loading rates and long hydraulic and solids retention times. Activated sludge processes rely on microbiological degradation of organic compounds to reduce the BOD concentration of the wastewater. Because of the low BOD loading (and resulting limited food supply), the extended aeration process operates in the endogenous phase of microbial growth, in which the microorganisms are forced to metabolize their own protoplasm. The high solids retention times allow for nitrification to occur. Also, under longer aeration times, biodegradable toxic compounds are more likely to be removed (Metcalf & Eddy 1991).

Extended aeration processes have been in wide used since the 1950s. Many of the facilities treat wastewater flows of less than 50,000 gallons per day (gpd); however facilities up to 5 mgd are currently in use. The process occurs in a tank-like reactor and is rarely preceded by primary sedimentation. Effluent from the extended aeration tank requires final clarification. In a well-operated facility, BOD and TSS removals of 85 to 95 percent can be achieved (U.S. EPA 1992).

Major advantages to the extended aeration process include:

- Lowest sludge production of any activated sludge process
- Relatively minimal land requirements
- Available as pre-engineered package plants
- High quality effluent
- Good reliability with adequate operator attention
- Nitrification occurs when wastewater temperatures are greater than 15 degrees Celsius

- Relatively low capital cost
- Handles moderate shock hydraulic loadings with minimal problems.

Major disadvantages to the extended aeration process include:

- Higher energy costs compared to land-based systems
- Requires skilled operater and greater operation and maintenance (O&M) costs
- High flow variations and operator inattention may result in BOD and TSS slugs in the effluent
- Potential freezing in cold climates
- Possible formation of pinpoint floc resulting in poor settleability
- Potential for rising sludge in final clarifier during warmer months due to denitrification.

SEQUENCING BATCH REACTOR

A sequencing batch reactor (SBR) is a form of the activated sludge process in which aeration and clarification occur in the same physical unit. The process employs a five step cycle: fill, react, settle, decant, and idle. During the fill stage, raw wastewater enters the reactor, which is already one-third to one-half full with the settled sludge from the previous cycle. Aeration and mixing do not start until the reactor is approximately 80 percent full. During the react stage, vigorous aeration occurs, causing oxidation of organic matter. The react stage may last up to 4 hours, allowing for long term stability of the process and nitrification. Aeration and mixing stops during the settle stage, allowing quiescent sedimentation conditions. After settling, the clarified effluent is decanted from the reactor, and the reactor remains idle until it is ready to fill again. During the idle stage, solids are wasted from the bottom of the reactor (Wun-Jerg and Droste 1989).

Major components of an SBR include the aeration/mixing system, decant system, and control system. The most common aeration/mixing system is jet aeration, which has the advantage of being able to mix independently of aeration. Other methods of aeration include fine and coarse bubble diffusers and mechanical turbine aerators. The decant system is critical to achieving a high quality effluent by avoiding discharge of the mixed liquor suspended solids. Numerous decanting methods have been employed with varying degrees of success. Several vendors of SBR technologies have developed different decant designs, and the technology has undergone significant development in the last decade. Process control systems are also typically provided by the manufacturer of the SBR system (U.S. EPA 1992).

A SBR system includes screening, grit removal, biological treatment and clarification in the SBR, and disinfection. Primary sedimentation is usually not included. The clarification phase of an SBR allows for truly quiescent conditions, and the problems associated with short circuiting in conventional, continuous flow processes is eliminated. The SBR process may also include an equalization basin to reduce the size of the disinfection facilities.

A key advantage to SBRs is their simplicity. The mechanical requirements for the plant are reduced because there is no return sludge equipment; biological treatment and clarification occur in the same reactor. Other advantages of the SBR include high and consistent effluent quality due to quiescent batch settling in the reactor, capability to handle wide flow variations under most shock hydraulic loadings, and flexibility in the duration of the SBR cycles to allow for nutrient removal and filamentous growth control.

The major drawback to the SBR process is continuing problems with the decant system. Good performance of the decant system is critical for achieving a high quality effluent. If the mixed liquor suspended solids is drawn off during the decant cycle, effluent BOD and TSS concentrations may exceed discharge criteria because there is no method to remove solids from the effluent downstream of the SBR. These problems can be avoided by carefully selecting a decant system design that has a good performance record (U.S. EPA 1992).

ALTERNATIVE 1 - WASTE STABILIZATION PONDS

The first alternative considered for the City of Carnation wastewater treatment facility is a facultative lagoon system for the initial capacity of 0.04 mgd and an extended aeration plant for the ultimate capacity of 0.3 mgd. The 0.04 mgd facility would consist of influent pumping, screening, facultative lagoons, chlorination and dechlorination, and storage and effluent pumping. The land requirement for this facility is approximately 9 acres. The only site of the five potential sites identified by the City of Carnation large enough for this facility is located at the southern end of the city along the Carnation-Fall City Road. A conceptual plan of the proposed facility is shown in Figure 1.

The conceptual design criteria for each unit process are shown in Table 3. Screening would be accomplished using a manually cleaned bar screen placed in a concrete channel. A bypass channel around the screen is provided to allow the screen to be serviced. The waste stabilization pond system consists of three equally sized cells approximately 2.0 acres in area and 5 feet deep. The cells are plumbed so that they can be operated in series or in parallel. The ponds are lined with a synthetic geomembrane to prevent groundwater contamination.

Effluent from the 0.04 mgd plant would be discharged to the Snoqualmie River during non-low flow periods. During low flow periods in the Snoqualmie (August through October), the effluent would be stored in an onsite reservoir until conditions in the Snoqualmie River permit discharge. The volume of the reservoir required for the 0.04 mgd facility is 3.1 million gallons. The reservoir would be 8 feet deep with a surface area of approximately 1.4 acres.

Disinfection would be accomplished using chlorine, with a total chlorine requirement of approximately 2.8 pounds per day. Dechlorination would be required during periods of discharge to the Snoqualmie River to meet the permitted chlorine concentrations downstream of

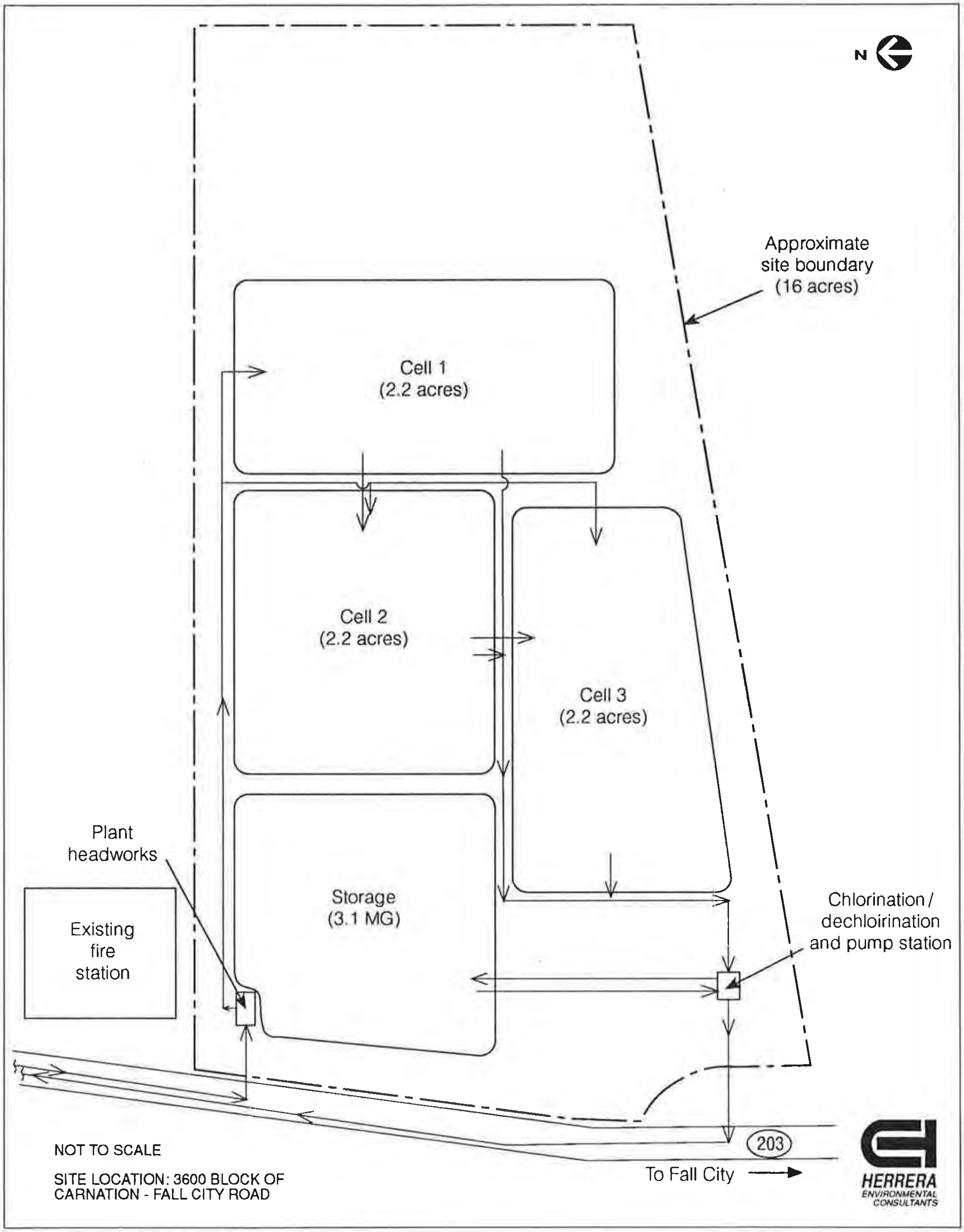

Figure 1. **Conceptual layout of 0.04 MGD treatment facility for alternative 1.**

the mixing zone. In addition, dechlorination may also be required if land application of the effluent is employed. Dechlorination would be accomplished with sulfur dioxide.

Table 3. Design criteria for alternative 1: treatment plant capacity of 0.04 mgd.

Process	Ecology Requirements	Design Criteria
Influent Pumping		
Number of pumps	2 minimum	2
Capacity, each	peak design flow with one pump off-line	95 gpm
Screening		
Type		mechanically cleaned bar screen
Size	1/2-inch or larger	1/2-inch spacing between bars
Flow rate		0.13 mgd
Stabilization Ponds		
Process Parameters		
Maximum loading rate	20 lb/ac/d	20 lb/ac/d
Maximum loading rate for any cell	50 lb/ac/d	50 lb/ac/d
Detention time		180 days
Physical Characteristics		
Number of ponds	3	3
Surface area	0.5 to 40 acres per cell	2.02 acres per cell
Pond depth	between 3 and 5 feet	5 feet
Sludge storage		1 foot
Chlorination		
Disinfection level	200/100 mL	200/100 mL
Dosage capacity	6-12 mg/L	5-15 mg/L
Contact time	20 minutes minimum	30 minutes
Dechlorination		
Method		sulfur dioxide
Dosage		1.5-4 mg/L per mg/L of chlorine residual
Contact time		45 seconds
Storage		
Volume		3.1 million gallons
Effluent Pumping		
Number of pumps	2 minimum	2
Capacity, each	peak design flow with one pump off-line	300 gpm

Anaerobic degradation of sludge deposited in the lagoon system would prevent excessive sludge accumulation. Typical sludge accumulations in this type of system amount to less than 12 inches over 25 years and are concentrated near the influent point in the primary ponds. It is expected

that the sludge would have to be removed from the ponds when the treatment facility is converted to an extended aeration plant.

The 0.3 mgd facility would consist of influent pumping, screening, grit removal, extended aeration, secondary clarification, chlorination and dechlorination, and effluent pumping, as shown in Figure 2. The conceptual design criteria for the 0.3 mgd treatment facility are shown in Table 4. Screening would be accomplished using a mechanically cleaned bar screen placed in an 18-inch wide bar screen. As with the smaller plant, a bypass would be provided so that the screen can be taken out of service. Grit would be removed using a screw-type grit collector. The grit collector would be installed in a 1.5-foot wide concrete channel approximately 20 feet long.

The proposed extended aeration and clarification processes would be provided as a package plant. The package would be configured with one concrete tank consisting of two aeration tanks, two clarification basins, and a surge tank for peak flows. Also supplied with the package plant would be the necessary piping, aeration equipment (including coarse air diffusers and centrifugal blowers), solids transfer pumps and piping, and process controls. The aeration tank and equipment are sized to allow for nitrogen removal in addition to BOD removal. The projected effluent concentrations of BOD would be approximately 11 mg/L. Suspended solids concentration in the effluent would be approximately 15 mg/L, and ammonia concentrations would be 1 mg/L as nitrogen. Overall dimensions of the aeration and clarification unit would be 69 feet by 72 feet.

Storage was considered for periods of low flow in the Snoqualmie River. The required storage is estimated to be approximately 70 acre-feet (23 million gallons) based on a dry weather flow of 0.25 mgd over a 92 day period. It is estimated that an impoundment with a 10-foot water depth would require approximately 10 acres. Therefore, the city may want to pursue alternatives for wastewater disposal, such as land application, or additional treatment for nutrient removal. Conceptual design and costs for these processes are not included in this analysis. Costs for disposal of wastewater effluent by land application are provided in the 1991 facilities plan (R.W. Beck 1991).

Disinfection would also be accomplished using chlorine. The expected chlorine requirement for the 0.3 mgd plant is approximately 21 pounds per day averaged over the year. Dechlorination would be required during periods of discharge to the Snoqualmie River to meet the allowed chlorine concentrations. In addition, dechlorination may also be required if land application of the effluent is employed. Dechlorination would be accomplished with sulfur dioxide.

It is proposed that the wastewater solids removed from the extended aeration tanks be stabilized and stored in a sludge lagoon. One of the wastewater stabilization lagoons from the 0.04 mgd facility can be converted to a sludge stabilization basin with simple modifications. It is anticipated that one of the 2 acre ponds can be used for up to 5 years for sludge stabilization and storage before additional capacity is required. Using the lagoons for sludge stabilization would also reduce the capital costs and annual operational costs of the new facility because the solids handling requirements are greatly reduced. Once the lagoon is full, it is assumed that the solids would be hauled to Metro for disposal.

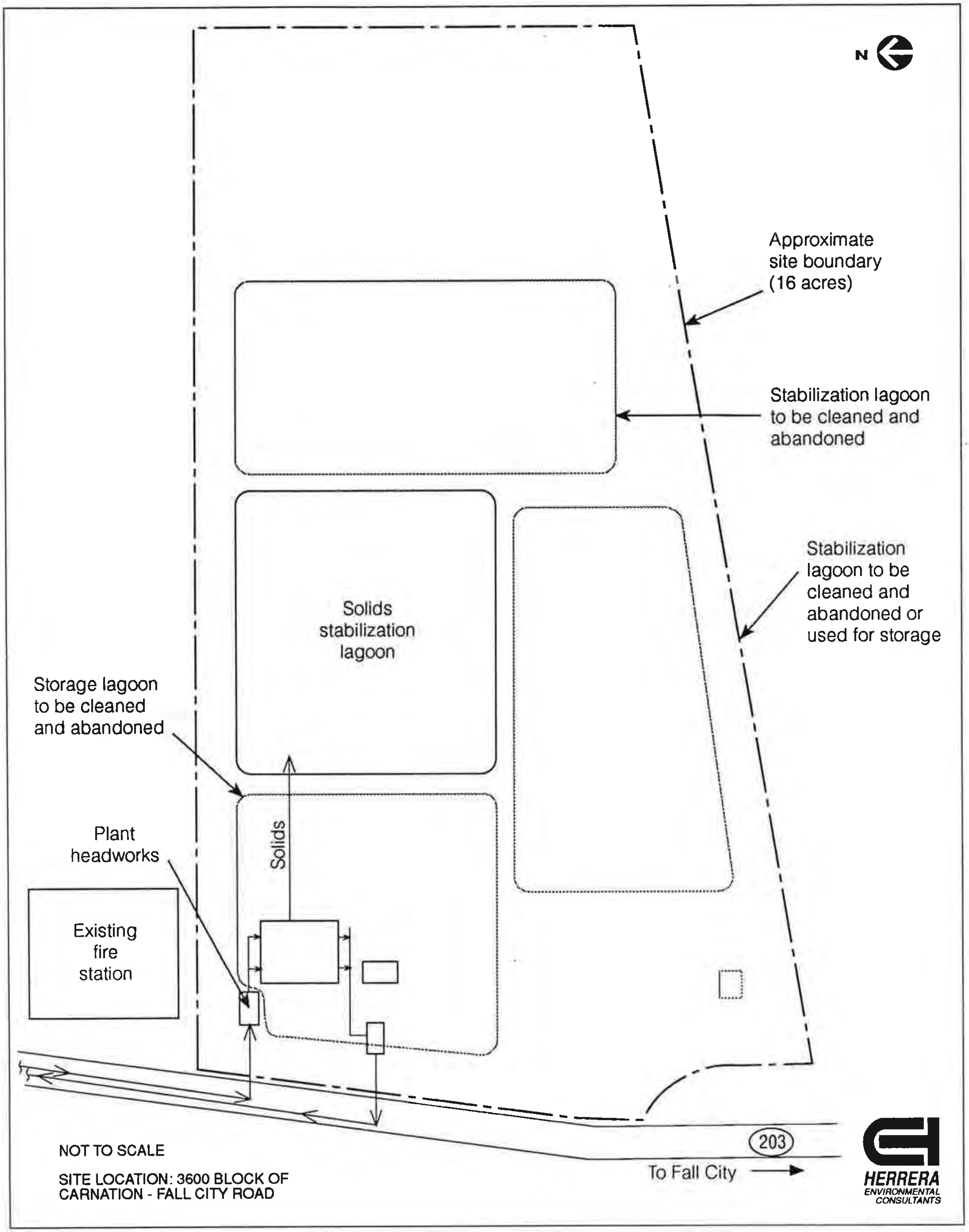

Figure 2. **Conceptual layout of 0.3 MGD treatment facility for alternative 1.**

Table 4. Design criteria for Alternative 1: treatment plant capacity of 0.30 mgd.

Process	Ecology Requirements	Design Criteria
Influent Pumping		
Number of pumps	2	2
Capacity, each	peak design flow with one pump	
Screening		
Type		mechanically cleaned bar screen
Size	1/2-inch or larger	1/2-inch spacing between bars
Flow rate		1.0 mgd
Grit Chamber		
Type		channel
Flow rate		1.0 mgd
Removal efficiency		90 percent
Grit Size		65-mesh
Extended Aeration		
Process Parameters		
F/M ratio	0.05-0.15 lb BOD/lb MLSS	0.09 lb BOD/lb MLSS
Organic loading	10-25 lb BOD/1,000 cf/day	15 lb BOD/1,000 cf/day
Retention time	10-24 hours	24 hours
Sludge age	10-30 days	25 days
Mixed liquor suspended		
Oxygen requirements	2,100 cf/lb BOD	2,100 cf/lb BOD
Physical Characteristics		
Number of tanks		2
Dimensions, each tank		
Depth		
Secondary Clarification		
Process Parameters		
Flow rate		0.3 mgd
Overflow rate	200-500 gpm/sf[1]	446 gpm/sf
Physical Characteristics		
Number of tanks		2
Surface area, each tank		336 sf
Chlorination		
Disinfection level	200/100 mL	200/100 mL
Dosage capacity		5-15 mg/L
Contact time	20 minutes minimum	30 minutes
Dechlorination		
Method		sulfur dioxide
Dosage		1.5-4 mg/L per mg/L of chlorine
Contact time		45 seconds
Effluent Pump Station		
Number of pumps	2	4
Capacity, each	peak design flow with one pump	2 @ 300 gpm

[1]Suggested values.

Operational Considerations

Facultative Lagoons

Lagoon systems are typically simpler to operate than activated sludge systems. Less maintenance is required because there are fewer mechanical components. The most complicated operational aspect of this system is the need to operate the lagoons so that they attain minimum storage at the end of the spring, providing maximum storage capacity when wastewater cannot be discharged to the Snoqualmie River because of low flow conditions. At the same time, the water level in the lagoons should not be allowed to drop below 3 feet, or inadequate treatment and excessive algae buildup can occur. Operators must be aware of proper system operation for each season of the year.

Algae buildup in the lagoons could become a problem during the warmest summer months. If allowed to remain in the effluent, algae could clog pumps in the conveyance system. The outlet of the treatment facility would be screened to prevent this problem, but additional chemical treatment or operational changes may also be required. Some studies have reported that chlorination causes algae to flocculate and settle. This mechanism could be used when the effluent is held in the storage lagoon; however algae scum accumulation in the chorine contact basin would be a problem. Other options include adding small amounts of copper sulfate to the system to kill algae, or providing a small slow-rate sand filter between the lagoon outlet and the chlorination basin.

Extended Aeration

Operational requirements of an extended aeration plant are higher than those for a lagoon system. As is typical with activated sludge plants, extended aeration plants require a skilled operator to provide regular supervision of the treatment processes and maintain mechanically complex equipment. Regular supervision is required because the short processing time of the plant requires quick adjustments to respond to changing conditions. The package plant comes equipped with simple process controls and timers to facilitate the operation of the plant; however oversight is still required.

Extended aeration plants have a history of being very reliable. However, they incorporate a number of mechanisms that can malfunction. The system requires careful monitoring and maintenance to ensure reliable operation over long periods of time.

Phasing

Under this alternative, facultative lagoons are proposed only for the initial capacity of 0.04 mgd. When the city needs to expand the treatment facility, it would be converted to an extended aeration system. The size of the upgraded system would be largely dependent on the rate of population growth and the extent to which the city expands its sewer service area. An intermediate size that the city may consider for converting to an extended aeration plant is in the range of 0.10 to 0.15 mgd capacity. A treatment plant of this size can ultimately be built to a

capacity of 0.3 mgd by adding treatment units to the original plant. The extended aeration package plant is especially suitable because of its modular configuration. However, expanding the capacity of the plant from 0.04 mgd to 0.10 mgd or greater would most likely require purchase of new equipment, such as pumps, chlorinators, and screens, because operating multiple smaller units becomes more costly to maintain than purchasing larger units.

Regardless of the size of the upgraded facility, the existing site would require significant modification once the facultative lagoons are taken off-line. The ponds must be abandoned after the new facility is constructed. This requires removing and disposing of all deposited sludge from the lagoon bottoms and regrading and replanting the lagoon areas to provide surface water control. Another alternative is to use the pond cells for storage. As mentioned previously, one of the ponds can be used for sludge stabilization with only slight modifications to piping and the addition of aerators. Another one of the cells can be used as a storage basin for flow equalization. Providing flow equalization allows the facility to perform well under shock hydraulic loadings and also allows downstream equipment to be a smaller size.

Costs

Budgetary costs for the 0.04 mgd and 0.3 mgd treatment facilities are shown in Tables 5 and 6. Capital costs are based on quotes from equipment manufacturers and standard construction costs. Final design for the chosen alternative will require more detailed cost estimates based on final designs and plant layouts. The costs presented here do not include land acquisition, permitting, or administrative requirements. In addition, the costs of abandoning the lagoons or converting them to effluent storage or sludge holding basins are not included in the 0.3 mgd capital cost estimate. However, the cost of abandoning one of the lagoon cells is estimated to be $36,000.

Annual operation and maintenance costs for the treatment plant are based on an annual percentage of the capital costs for each system component that includes both operator time and maintenance and replacement costs for equipment. The percentages used are 10 percent for high maintenance items such as the extended aeration basins and chlorination equipment, and 1 percent for low-maintenance items such as the lagoons. Sludge handling is also included in the yearly operating costs for the 0.3 mgd facility, assuming that solids are removed from the stabilization pond once a year.

ALTERNATIVE 2 - SEQUENCING BATCH REACTORS

The second alternative considered for the City of Carnation wastewater treatment facility is an SBR plant for the initial capacity of 0.04 mgd and the ultimate capacity of 0.3 mgd. The 0.04 mgd facility would consist of influent pumping, screening, one SBR tank, chlorination and dechlorination, storage, and effluent pumping. The land requirement for this facility is approximately 4 acres. This facility would fit on three of the five potential treatment facility sites identified by the city. A conceptual plan of the proposed facility on the 16-acre site is shown in Figure 3.

Table 5. Conceptual capital and O&M costs for a 0.04 mgd facultative lagoon treatment plant.

Description	Cost
Facilities	
Site preparation	$ 20,000
Headworks	
Flow monitoring	6,000
Screening	10,000
Influent pumping	25,000
Lagoons	519,000
Chlorination	10,000
Dechlorination	10,000
Storage	100,000
Effluent pump station	25,000
Effluent piping	270,000
Electrical	20,000
Miscellaneous (roads, monitoring wells)	30,000
Subtotal	**$ 1,045,000**
Contingency (30%)	314,000
Engineering/administrative (20%)	272,000
Sales tax (8.2%)	134,000
Total Treatment Cost	**$ 1,765,000**
Annual Operating Costs	
Treatment plant O & M	30,000
Sludge handling and disposal	—
Subtotal	**$ 30,000**

Table 6. Conceptual capital and O&M costs for a 0.3 mgd extended aeration treatment plant.

Description	Cost
Facilities	
Site preparation	$ 50,000
Headworks	
Flow monitoring	15,000
Screening	40,000
Influent pumping	30,000
Grit chamber	22,000
Extended aeration package plant	500,000
Chlorination	35,000
Dechlorination	35,000
Effluent pump station	30,000
Effluent piping	270,000
Electrical	100,000
Administrative building	200,000
Miscellaneous	50,000
Subtotal	**$ 1,377,000**
Contingency (30%)	413,000
Engineering/administrative (20%)	358,000
Sales tax (8.2%)	176,000
Total Capital Costs	**$ 2,324,000**
Annual Operating Costs	
Treatment plant O & M	80,000
Sludge handling and disposal	122,500
Subtotal	**$ 202,500**

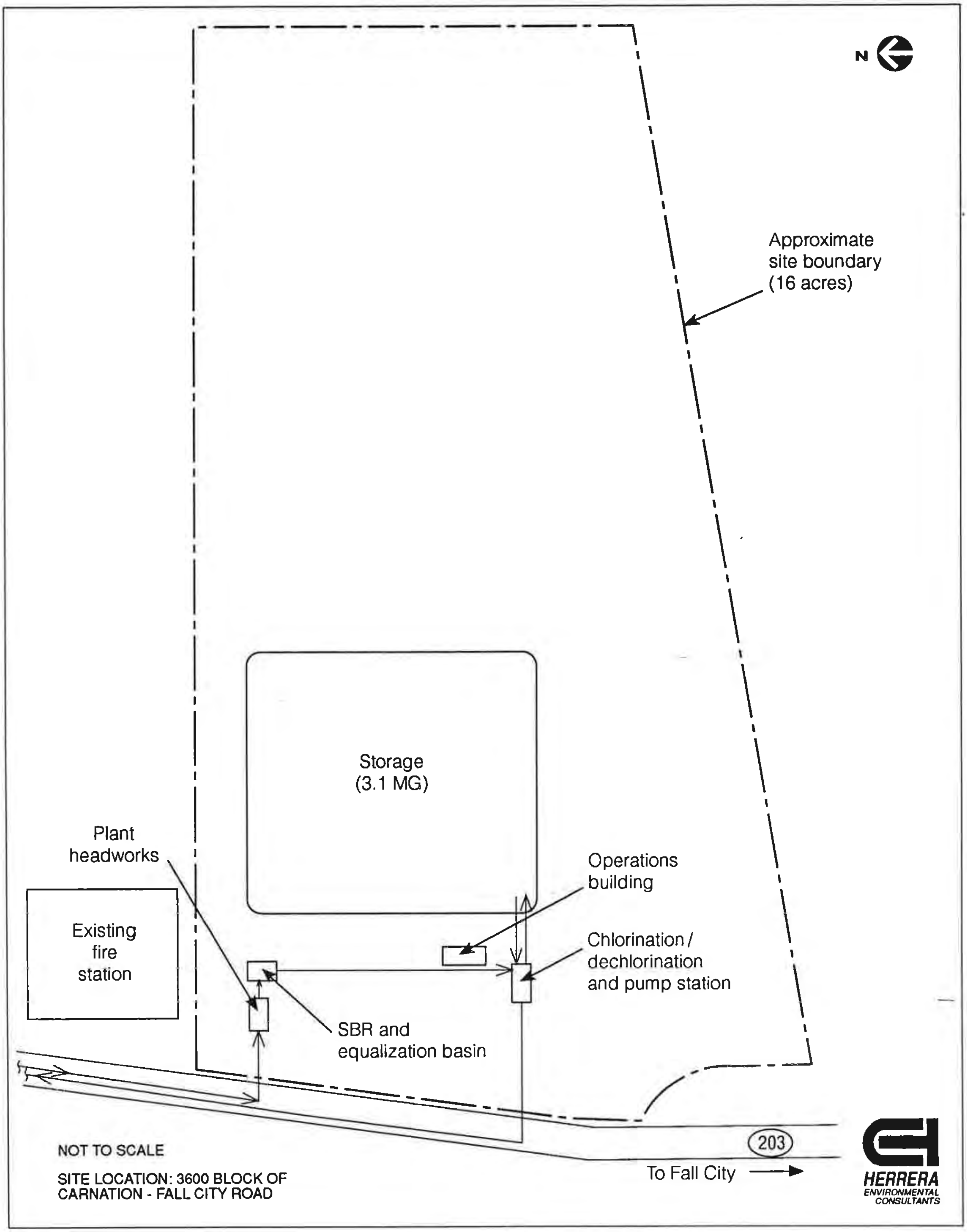

Figure 3. **Conceptual layout of 0.04 MGD treatment facility for alternative 2.**

The conceptual design criteria for each unit process are shown in Table 7. Screening would be accomplished using a manually cleaned bar screen placed in a concrete channel, with a bypass channel around the screen. The SBR is a rectangular tank approximately 24 feet long, 20 feet wide, and 18 feet deep. The SBR would require an equalization tank with a capacity of approximately 0.02 mgd. The SBRs are expected to produce an effluent with a BOD concentration of 10 mg/L, a TSS concentration of 10 mg/L, and an ammonia concentration of 1 mg/L as nitrogen.

Disinfection would be accomplished using chlorine, with a total chlorine requirement of approximately 2.8 pounds per day. The chlorine equipment would be sized for the SBR decant rate of 333 gpm. Dechlorination would be required during periods of discharge to the Snoqualmie River to meet the allowed chlorine concentrations. In addition, dechlorination may also be required if land application of the effluent is employed. Dechlorination would be accomplished with sulfur dioxide.

Similar to the first alternative, effluent from the 0.04 mgd plant would be discharged to the Snoqualmie River during non-low flow periods. During low flow periods in the Snoqualmie (August through October), the effluent would be stored in an onsite reservoir until conditions in the Snoqualmie River permit discharge. The volume of the reservoir required for the 0.04 mgd facility is 3.1 million gallons. The reservoir would be 8 feet deep and have a surface area of approximately 1.4 acres.

For the 0.04 mgd facility it is assumed that wastewater solids from the SBR would be hauled to Metro's East Division Reclamation Facility without further treatment at Carnation. Therefore the conceptual design includes a truck loading area. Solids handling is one of the most costly components to wastewater treatment. By hauling solids to Metro, the City of Carnation can delay purchasing digestion and dewatering equipment.

The 0.3 mgd facility would consist of influent pumping, screening, grit removal, SBRs, chlorination and dechlorination, and effluent pumping, as shown in Figure 4. The conceptual design criteria for the 0.3 mgd treatment facility are shown in Table 8. Screening would be accomplished using a mechanically cleaned bar screen placed in an 18-inch wide bar screen. A bypass would be provided so that the screen can be taken out of service. Grit would be removed using a screw-type grit collector. The grit collector would be installed in a 1.5-foot wide concrete channel approximately 20 feet long.

The SBR treatment process consists of two square tanks and an equalization basin. Each SBR tank is 43 feet long on each side and 18 feet deep, and the equalization basin has a capacity of 0.06 mgd. Each reactor tank is equipped with jet aerators and submersible centrifugal pumps for mixing, positive displacement blowers, floating effluent decant equipment, submersible sludge wasting pumps, and process controls. Effluent from the 0.3 mgd SBR is expected to be similar in quality to the 0.04 mgd SBR.

Table 7. Design criteria for alternative 2: treatment plant capacity of 0.04 mgd.

Process	Ecology Requirements	Design Criteria
Influent Pumping		
Number of pumps	2	2
Capacity, each	peak design flow with one pump	
Screening		
Type		mechanically cleaned bar screen
Size	1/2-inch or larger	1/2-inch spacing between bars
Flow rate		0.13 mgd
Grit Chamber		
Type		channel
Flow rate		0.13 mgd
Removal efficiency		90 percent
Grit size		65-mesh
Sequencing Batch Reactor		
Process Parameters		1
F/M ratio		0.12 lb BOD/lb MLSS
Organic loading	10-25 lb BOD/1,000 cf/day	15 lb BOD/1,000 cf/day
Detention time		38 hours
Sludge age		10 days
Mixed liquor suspended		
Oxygen requirements		124 lbs/day
Decant Rate		333 gpm
Physical Characteristics		
Number of tanks		1
Dimensions, per tank		24 x 20 feet
Minimum depth		15.1 feet
Maximum depth		18.0 feet
Number of cycles		4 per day
Chlorination		
Disinfection level	200/100 mL	200/100 mL
Dosage capacity		5-15 mg/L
Contact time	minimum 20 minutes	30 minutes
Dechlorination		
Method		sulfur dioxide
Dosage		1.5-4 mg/L per mg/L of chlorine
Contact Time		45 seconds
Storage		
Volume		3.1 million gallons
Effluent Pump Station		
Number of pumps	2	2
Capacity, each	peak design flow with one pump	

Storage of effluent is not practical for a 0.3 mgd treatment plant over the entire low flow period. The surface impoundment would be very large and would come under dam safety regulations. For a treatment plant of this size, the City of Carnation will have to pursue alternative disposal means, or provide additional treatment for nutrient removal. These technologies are not addressed under this study.

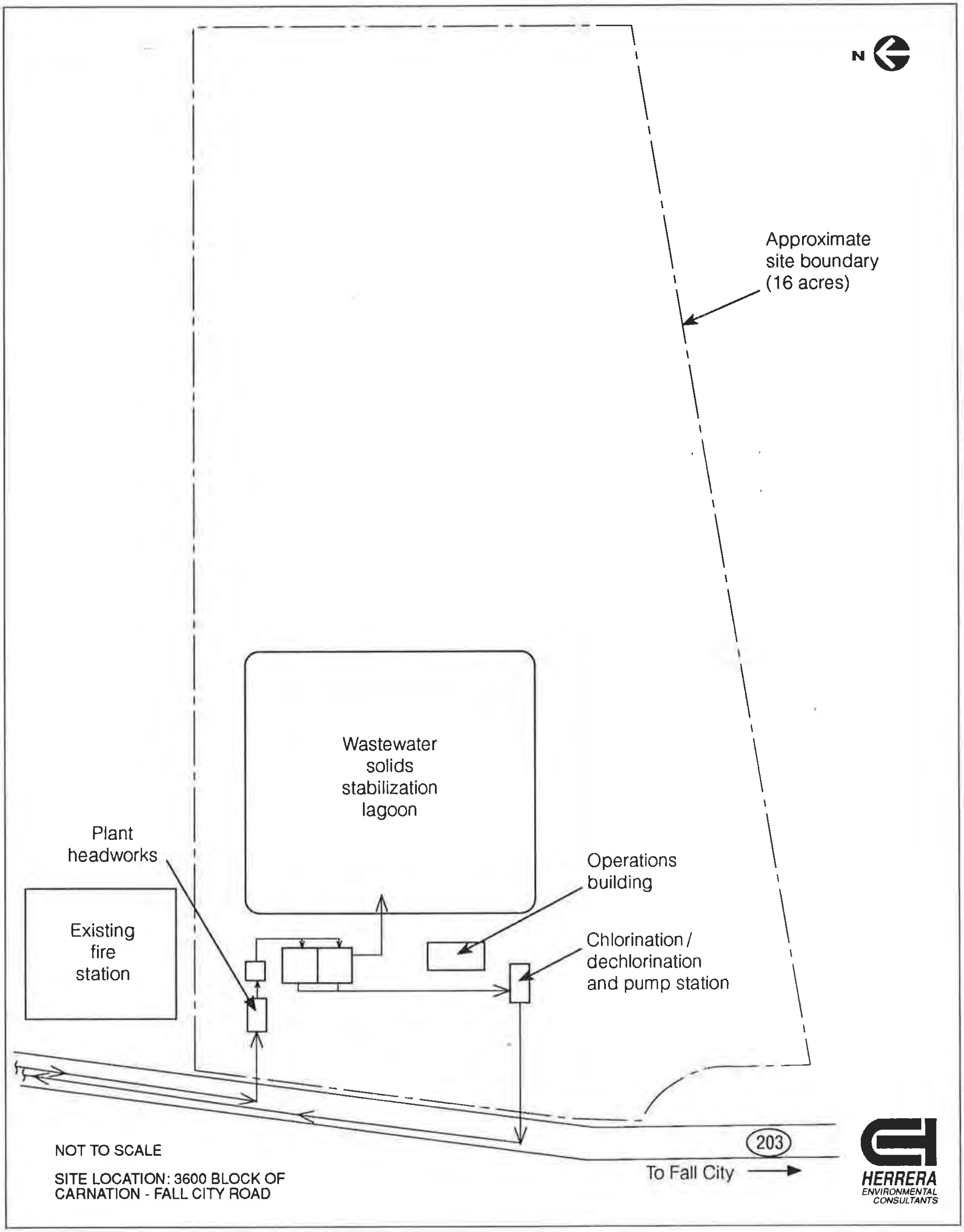

Figure 4. Conceptual layout of 0.3 MGD treatment facility for alternative 2.

Table 8. Design criteria for alternative 2: treatment plant capacity of 0.30 mgd.

Process	Ecology Requirements	Design Criteria
Influent Pumping		
Number of pumps	2	2
Capacity, each	peak design flow with one pump off-line	700 gpm
Screening		
Type		mechanically cleaned bar screen
Size	1/2-inch or larger	1/2-inch spacing between bars
Flow rate		1.0 mgd
Grit Chamber		
Type		channel
Flow rate		1.0 mgd
Removal efficiency		90 percent
Grit size		65-mesh
Sequencing Batch Reactor		
Process Parameters		1
F/M ratio		0.12 lb BOD/lb MLSS
Organic loading	10-25 lb BOD/1,000 cf/day	15 lb BOD/1,000 cf/day
Detention time		38 hours
Sludge age		10 days
Mixed liquor suspended solids	2,000-6,000 mg/L	2,500 mg/L
Oxygen requirements		993 lbs/day
Decant rate		1,333 gpm
Physical Characteristics		
Number of tanks		2
Dimensions, per tank		43 x 43 feet
Minimum depth		15.1 feet
Maximum depth		18.0 feet
Number of cycles		4 per day
Chlorination		
Disinfection level	200/100 mL	200/100 mL
Dosage capacity		5-15 mg/L
Contact time	minimum 20 minutes	30 minutes
Dechlorination		
Method		sulfur dioxide
Dosage		1.5-4 mg/L per mg/L of chlorine residual
Contact time		45 seconds
Effluent Pump Station		
Number of pumps	2	2
Capacity, each	peak design flow with one pump off-line	333 gpm

Effluent from the SBR system would be chlorinated, dechlorinated, and discharged. The total chlorine requirement for this system is approximately 21 pounds per day averaged over the year, for a decant rate of 1,333 gpm. Dechlorination would be required during periods of discharge to the Snoqualmie River to meet the allowed chlorine concentrations. In addition, dechlorination may also be required if land application of the effluent is employed. Dechlorination would be accomplished with sulfur dioxide.

Solids from the SBR can be handled by either hauling and disposal at Metro's East Division Reclamation Plant or installing an aerobic digester and sludge dewatering equipment. Under this alternative, it is assumed that the solids are hauled to Renton for disposal. Costs associated with digestion and dewatering are presented in the 1991 facilities plan (R.W. Beck 1991) and are not included in this analysis.

Operational Considerations

Sequencing batch reactor plants have a history of being reliable and requiring low maintenance. Operational requirements of a SBR plant are expected to be somewhat lower than those of other activated sludge processes. SBR systems have less mechanical equipment associated with them because there is no return sludge line and no separate clarifier. Energy consumption is expected to be similar to that of an extended aeration system.

As is typical with activated sludge plants, SBRs require a skilled operator to provide regular supervision of treatment processes. Operational analyses of process parameters and adjustment of cycle times are required to optimize the performance of the reactor. The operator must monitor the accumulation of solids and regularly waste the solids from the reactor. In addition, maintenance of mechanical equipment associated with the SBRs and with the other treatment units must occur on a regular basis to maintain the equipment in good condition. Regular effluent quantity monitoring must also be performed by plant personnel.

Phasing

Phasing the development of the SBR facility from a 0.04 mgd plant to a 0.3 mgd plant would require most of the equipment to be replaced at some point in time. The initial expansion of the plant to a capacity of 0.12 mgd may be accomplished by adding units to the existing facility and modifying the process piping. However, at some point it becomes more economically feasible to increase the capacity of the physical units than to increase the number of units.

One way of increasing capacity is by building the second reactor adjacent to the first reactor, then removing the wall between the two to make a single, larger tank. However it is likely that the equipment within the tank would have to be replaced to fit the new dimensions of the reactor. Also, most of the support equipment, such as pumps, piping, and screening and grit removal, would have to be replaced with larger units.

Costs

Budgetary costs for the 0.04 mgd and 0.3 mgd treatment facilities are shown in Tables 9 and 10. Capital costs are based on quotes from equipment manufacturers and standard construction costs. Final design for the chosen alternative will require more detailed cost estimates based on final designs and plant layouts. The costs presented here do not include land acquisition, permitting, or administrative requirements.

Annual operation and maintenance costs for the treatment plant are based on an annual percentage of the capital costs for each system component that includes both operator time and maintenance and replacement costs for equipment. The percentages used are 10 percent for high maintenance items such as the extended aeration basins and chlorination equipment, and 1 percent for low-maintenance items such as the lagoons. In addition, the annual operating expenses for the 0.04 and 0.3 mgd facilities include costs for hauling and disposing of wastewater solids at Renton.

Table 9. Conceptual capital and O&M costs for a 0.04 mgd sequencing batch reactor plant plant.

Description	Cost
Facilities	
Site preparation	$ 40,000
Headworks	
Flow monitoring	6,000
Screening	10,000
Influent pumping	25,000
Sequencing batch reactor	170,000
Chlorination	15,000
Dechlorination	15,000
Storage	100,000
Effluent pump station	30,000
Effluent piping	270,000
Electrical	120,000
Administrative building	200,000
Miscellaneous	50,000
Subtotal	**$ 1,051,000**
Contingency (30%)	315,000
Engineering/administrative (20%)	273,000
Sales tax (8.2%)	134,000
Total Capital Costs	**$ 1,773,000**
Annual Operating Costs	
Treatment plant O & M	40,000
Sludge handling and disposal	24,600
Subtotal	**$ 64,600**

Table 10. Conceptual capital and O&M costs for a 0.3 mgd sequencing batch reactor plant.

Description	Cost
Facilities	
Site preparation	$ 50,000
Headworks	
Flow monitoring	15,000
Screening	40,000
Influent pumping	30,000
Grit chamber	22,000
Sequencing batch reactor	420,000
Chlorination	45,000
Dechlorination	45,000
Effluent pump station	35,000
Effluent piping	270,000
Electrical	350,000
Administrative building	200,000
Miscellaneous	50,000
Subtotal	**$ 1,572,000**
Contingency (30%)	472,000
Engineering/administrative (20%)	409,000
Sales tax (8.2%)	201,000
Total Capital Costs	**$ 2,654,000**
Annual Operating Costs	
Treatment plant O & M	94,000
Sludge handling and disposal	192,000
Subtotal	**$ 286,000**

WASTEWATER COLLECTION SYSTEM

For both treatment alternatives, a conceptual wastewater collection system has been developed. The components of the collection system are sized based on the ultimate capacity of the wastewater treatment facility, which is 0.3 mgd. However, the cost analysis is completed only for the initial phase of sewer service. The sewer system for the ultimate service area would be similar in size to the one proposed in the 1991 facilities plan and is therefore not presented here.

The collection system proposed for the City of Carnation is a conventional gravity system. The components of the sewer system are sized for the peak hourly flow rate. The peak hourly flow rate is determined using a peaking factor of 3.3 on the average day peak month flow rate used to size the treatment processes. Therefore, the capacity of the main trunk and pump station is 1.0 mgd. The pipes are sized for a minimum velocity of 2.0 feet per second.

The proposed layout of the initial collection system is shown on Figure 5. The collection system consists of a 12-inch main trunk running along the Carnation-Fall City Road. Eight-inch laterals extend in one block from the main road. Manholes are situated at maximum 400-foot intervals. The main trunk continues to the treatment plant site; however, the direction and length depends on which site is selected. For the purposes of this cost analysis, it is assumed that the treatment plant will be sited south of the central business district along the Carnation-Fall City Road at approximately the 3600 block.

The estimated costs of the collection system for the initial sewer service area are shown in Table 11.

Table 11. Conceptual capital and O&M costs for the collection system.

Description	Cost
Facilities	
Piping	$ 400,000
Manholes	120,000
Subtotal	**$ 520,000**
Contingency (30%)	156,000
Engineering/administrative (20%)	135,000
Sales tax (8.2%)	24,000
Total Collection System Cost	**$ 811,000**
Annual O&M Costs	**$ 50,000**

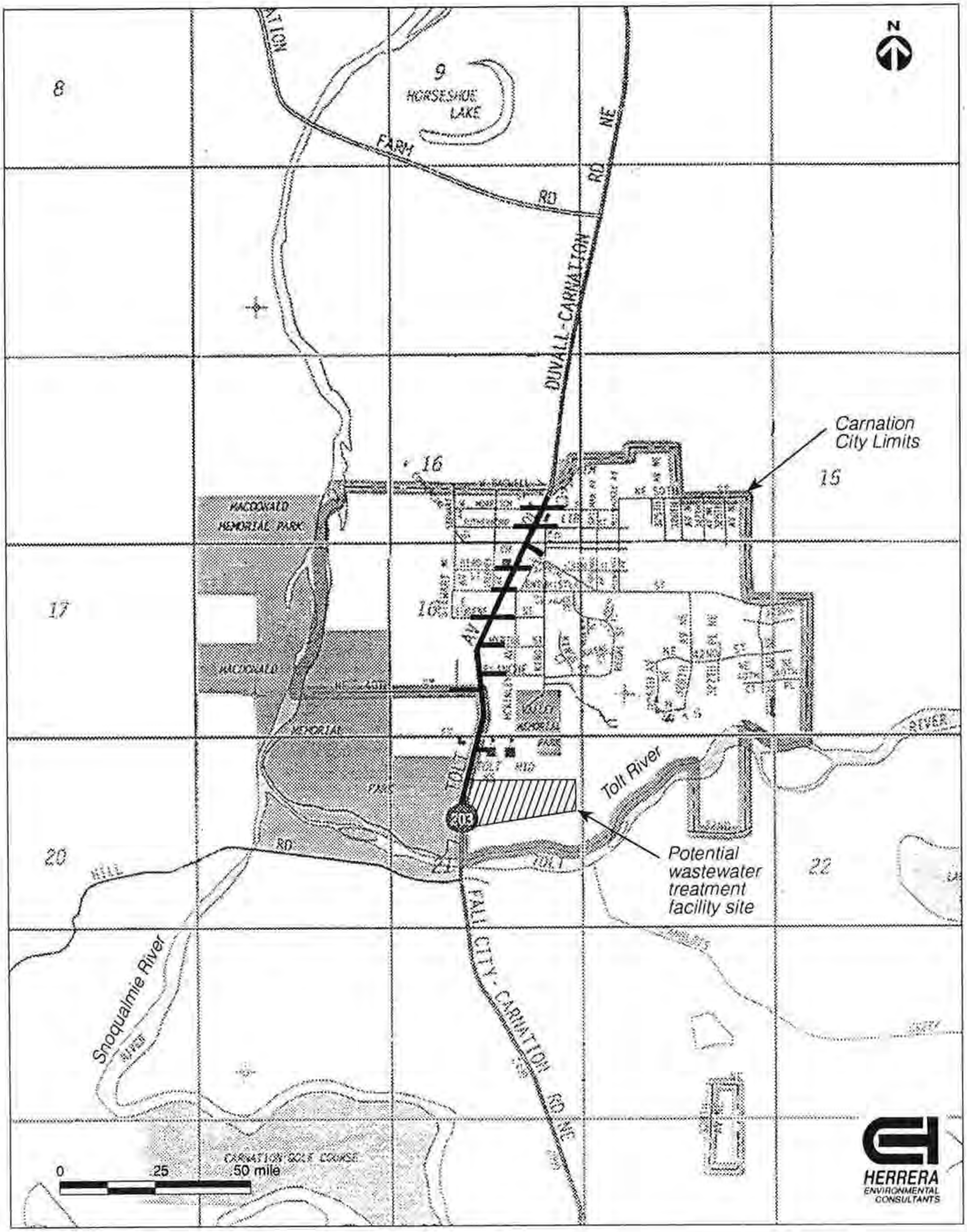

Figure 5. **Layout for wastewater collection system serving initial sewer service area for the City of Carnation.**

SUMMARY

Two alternatives have been evaluated for providing wastewater collection and treatment to an initial service area incorporating the central business district of Carnation and ultimately providing wastewater treatment to most areas of the incorporated city. The intent of both alternatives is to initiate a public sewer system for the City of Carnation by starting with a small facility that is less costly than a full-sized plant. The small facility will allow growth in the central business district where new septic systems would not be permitted. Once the public utility is in operation, the facility can be expanded to slowly replace older septic systems and allow for new construction within the city limits.

Table 12 presents a summary comparison of the two alternatives. For each criterion a rating of high, medium, or low is given with high being the most difficult or most costly. The alternatives are compared on the basis of the following criteria:

- *Siting Complexity*—Includes issues associated with the proposed location and size of the main facility and aesthetic problems
- *Reliability*—Reflects the historical performance of similarly designed facilities
- *System complexity*—Includes issues associated with facility operation and maintenance
- *Regulatory complexity*—Includes issues related to permitting
- *Costs*—Includes capital and O&M costs.

All alternatives are designed to provide sufficient treatment so that environmental impacts are minimized. It is assumed that either the 0.3 mgd treatment facilities would include treatment processes for nutrient removal or the effluent would be disposed of by land application.

The primary concern with the first alternative is whether the Department of Ecology is willing to permit facultative lagoons in western Washington. There are two conditions that may cause Ecology to consider allowing facultative lagoons: 1) no alternative treatment technology may be available at comparable costs, and 2) failing septic systems are causing water quality problems in the Snoqualmie River. Under this scenario the permitting process may require a considerable amount of time to satisfy Ecology's concerns. This process may offset the cost saving associated with the lagoon system.

It is clear from the cost estimates that there is a considerable economy of scale between the 0.04 mgd and 0.30 mgd facilities. The facultative lagoon facility does not provide a substantial capital cost savings over the sequencing batch reactor facility; however the yearly operating cost is significantly lower than the activated sludge process. Operating the facultative lagoons does not require a full-time operator, and there are no solids handling requirements.

Table 12. Summary of wastewater treatment facility alternative issues.

	Alternative 1		Alternative 2	
	Lagoons 0.04 mgd	Extended Aeration 0.30 mgd	SBR 0.04 mgd	SBR 0.30 mgd
Siting Complexity	HIGH -large land requirements -odor problems	MEDIUM -requires little land area -aesthetic problems	MEDIUM -requires little land area -aesthetic problems	MEDIUM -requires little land area -aesthetic problems
Reliability	MEDIUM -summer algae blooms -potential winter freezing	HIGH -good performance record	HIGH -varied performance record -handles shock loadings	HIGH -varied performance record -handles shock loadings
System Complexity	LOW -no controls -no solids handling	LOW -simple process controls -minimal mechanical parts	MEDIUM -no process piping -cycling timing	MEDIUM -no process piping -cycling timing
Regulatory Complexity	HIGH -effluent criteria may be diffucult to meet	MEDIUM -summer discharge or land application	LOW -no summer discharge	MEDIUM -summer discharge or land application
Costs	MEDIUM -Capital: $1.77 M -O&M: $30 K	HIGH -Capital: $2.32 M -O&M: $203 K	MEDIUM -Capital: $1.77 M -O&M: $65 K	HIGH -Capital: $2.65 M -O&M: $286 K

Both the extended aeration process and sequencing batch reactors are expected to provide reliable treatment of the wastewater at comparable costs. Both systems have minimal appurtenances associated with them compared to conventional activated sludge processes. The extended aeration system is a package plant in which the biological treatment tanks and final clarifier are housed side by side within the same unit. This configuration minimizes the amount of mechanical equipment required to operate the facility. The result is that the process controls for the system are very simple. The sequencing batch reactor also does not require a lot of additional appurtenances because all steps of the process occur in the same tank. Managing the cycle time of the sequencing batch reactor may create additional operational requirements; however, the cycling can be used to adjust the treatment to accommodate influent conditions. Deciding between the two systems should entail a careful study of the performance of other units installed by the same manufacturer considered for Carnation.

REFERENCES

Bleeker, Gary. April 14, 1995. Personal communication (letter to Ellis McCoy, King County Department of Metropolitan Services concerning City of Carnation existing information gathering). HDR Engineering, Inc., Bellevue, WA.

HDR Engineering. May 11, 1995. City of Carnation technology review workshop meeting minutes. HDR Engineering, Inc., Bellevue, WA.

Henigar and Ray, Inc. 1992. City of Carnation Comprehensive Plan. Prepared for the City of Carnation, WA, by Henigar and Ray, Inc.

Jensen, E. and H. Morgan. March 20, 1995a. Personal communication (memorandum to Don Morrison, City of Carnation concerning proposed zones for phasing in development of a sewer system facility). City of Carnation Public Works.

Jensen, E. and H. Morgan. March 20, 1995b. Personal communication (memorandum to Don Morrison, City of Carnation concerning evaluation of potential sites for sewer system facility). City of Carnation Public Works.

Metcalf & Eddy. 1991. Wastewater engineering treatment, disposal, and reuse. Third edition. McGraw Hill, Inc., New York City, NY.

Middlebrooks, D.J., C.H. Middlebrooks, J.H. Reynolds, G.Z. Watters, S.C. Reed and D.B. George. 1982. Wastewater stabilization lagoon design, performance and upgrading. Macmillan Publishing Co., Inc.

R.W. Beck. 1991 City of Carnation second draft wastewater facilities plan. Prepared for the City of Carnation, WA by R.W. Beck and Associates, Seattle, WA.

U.S. EPA. 1992. Wastewater treatment/disposal for small communities. EPA/625/R-92/005. U.S. Environmental Protection Agency.

U.S. EPA. 1986. Municipal wastewater disinfection. EPA/625/1-86/021. U.S. Environmental Protection Agency.

Wun-Jerg, Ng, and R.L. Droste. 1982. Sequencing batch reactor (SBR) treatment of wastewaters. Environmental Sanitation Reviews, No. 28, September 1989, 59p.

Role of Metropolitan Services Department Under Current Snoqualmie Valley Cities Planning

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October 1995

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TABLES

INTRODUCTION

This memorandum presents an estimate of biosolids and septage volumes produced each year between 2000 and 2030 from Snoqualmie Valley cities. Delivery costs for hauling the biosolids and septage to the Renton wastewater treatment plant are also presented. The cities included for this analysis are North Bend, Snoqualmie, Carnation, and Duvall. The analysis is based on existing information gathered from comprehensive plans prepared by each city and from communications with personnel from each city. The estimates presented here are approximate because population projections and proposed wastewater treatment facilities are continually being updated and refined. Also, each city that currently operates a wastewater treatment plant has indicated that it wants to develop alternative markets for biosolids disposal in the near future. However, none of the cities are able to provide definitive plans or expected target dates for biosolids disposal options. Therefore, a range of Snoqualmie Valley biosolids quantities that may be disposed of at the Renton wastewater treatment plant is presented.

Analysis of Biosolids and Septage Volumes

Method of Analysis

Biosolids quantities produced from secondary wastewater treatment facilities in the Snoqualmie Valley cities are determined based on typical solids volumes produced at North Bend's wastewater treatment plant. It is assumed that wastewater characteristics of the Snoqualmie Valley cities are similar, so that the quantities produced in North Bend are typical for the entire valley. In 1991, North Bend produced 93,500 pounds of biosolids and had a sewered population of 1426. Therefore the biosolids production rate is approximately 0.18 pounds per capita per day (ppcd). This number can be applied to population estimates for each city to determine biosolids quantities. Population estimates for the year 2000 are interpolated from data presented for existing conditions (typically reported for 1991) and projections for the planning period (typically 20 year projections). Population estimates for the year 2030 are generally based on buildout in each urban growth area. Buildout population is an estimate of the number of persons in the urban growth area when the maximum density is achieved for each zoning area.

Septage volumes are also determined based on population projections. Typically, the Snoqualmie Valley cities do not have records on the number of on-site systems in their communities. Therefore, volumes of septage are based on the number of people within the respective urban growth areas that are not served by a sewer system. This can be estimated as the difference between the total population in the urban growth area and the sewered population. The unsewered population is divided by the number of people per household, which is assumed to be 2.5 (Metcalf & Eddy 1991). Furthermore, it is estimated that a typical household has its septic tank pumped approximately every four years. Typically, approximately 1000 gallons of septage is pumped from each tank at a solids concentration of two percent (Finger 1995 personal communication). All of the private septic haulers serving the Snoqualmie Valley cities are assumed to dispose of septage at the Renton wastewater treatment plant.

Costs incurred by each Snoqualmie Valley city for delivery of biosolids and septage to the Renton wastewater treatment plant are determined based on two different scenarios. The first scenario assumes that each city sends all of its solids and septage to Metro. This assumption is used because there is inadequate information available at this time to predict the extent to which each city will be able to develop an alternative market for biosolids disposal. In addition, it provides a conservative quantity for predicting solids and septage loading to the Renton plant and disposal costs that can be used in a comparison to each city's processing and disposal alternatives. It should be recognized that each city currently disposes of or plans to dispose of its biosolids through reuse markets to the maximum extent possible. The second scenario assumes that each city which has indicated that it plans to pursue an alternative market has been able to develop that market for its entire volume of biosolids by the year 2000.

The costs used for disposal of biosolids at the Renton wastewater treatment plant are based on the cost currently used by Metro. All biosolids are disposed of at the headworks

of the wastewater treatment plant, regardless of whether the solids have been stabilized (Finger 1995 personal communication). For 1995, Metro charges $0.07 per gallon of biosolids for disposal at Renton, based on a solids concentration of 2 percent (Finger 1995 personal communication). The rate increases proportionally with increasing solids concentration. This rate is equivalent to approximately $0.41 per pound of dry solids. Pumping and hauling costs are estimated to be $0.05 per gallon. Using a 5 percent inflation rate, the costs for disposal of biosolids at Renton in 2000 and 2030 are $0.52 and $2.25 per gallon, respectively. The costs for pumping and hauling the biosolids from each city are approximately $0.06 in 2000 and $0.28 in 2030 based on a 5 percent inflation rate.

The costs for hauling septage to the Renton wastewater treatment plant are based on the rates used by private haulers in the area. The typical cost to a residential household for having its septic tank pumped is $265 in 1995 dollars. Assuming each septic tank yields approximately 1000 gallons every time it is pumped, the cost for pumping, hauling, and disposing of septage to Renton is approximately $0.27 per gallon. Using a 5 percent inflation rate, the costs for hauling septage to Renton in 2000 and 2030 are $0.34 and $1.46 per gallon, respectively.

North Bend

The City of North Bend operates a 0.4 million gallons per day (mgd) secondary wastewater treatment plant which served a sewered population of 1426 in 1993. The plant experiences wet season flows as high as six times the average daily flow due to excessive inflow and infiltration in its collection system (Herrera Environmental Consultants 1994). The city is currently replacing existing piping where excessive inflow and infiltration are occurring.

The existing wastewater treatment plant includes an aerobic digester for solids handling. In 1991, approximately 93,500 pounds of biosolids were generated at the plant. Approximately 84,200 pounds were hauled to the Renton wastewater treatment plant for disposal. The remaining 9,300 pounds were dried on biosolids drying beds and hauled to GroCo, Inc. for use as a soil amendment. The amount of biosolids hauled to GroCo is currently limited by the capacity of North Bend's drying beds. Table 1 presents the volumes of biosolids hauled to Metro from North Bend between 1991 and 1995 (Lewis 1995 personal communication).

The reason for the greater amount of biosolids produced in 1994 as compared to previous years is unknown. Also, the quantities estimated for 1995 are somewhat low because the city was testing a sludge press during this period (Tissell 1995 personal communication). The actual quantity may be as much as ten percent greater, or 108,000 pounds.

Currently, the city is expanding its treatment plant to a design capacity of 2.3 mgd (Semrau 1995 personal communication). Construction is expected to start within the next couple of years. This expansion is expected to accommodate 5 to 10 years of growth. The plans call for the existing oxidation ditch to be converted to a sequencing batch reactor. In addition, the expanded plant will include biosolids handling facilities, with aerobic digestion and sludge presses for biosolids dewatering. The city tested a sludge

press on its biosolids in 1995 and achieved good results. It expects to purchase a sludge press in the next few years that will provide more options for biosolids disposal. North Bend plans to explore the biosolids reuse market to develop disposal alternatives once its treatment plant upgrade is complete.

Table 1. Annual volumes of biosolids hauled to Metro from North Bend.

Year	Volume (gallons)	Percent Solids	Approximate Weight of Dry Solids (pounds)[1]
1991	595,815	1.8	89,000
1992	556,020	2.1	97,000
1993	468,290	2.5	101,000
1994	687,500	2.4	141,000
1995[2]	506,000	2.3	98,000

[1] Weight of dry solids based on a specific gravity of the biosolids of 1.015.
[2] 1995 volumes based on quantities generated between January and May projected through the end of the year.

Population and wastewater treatment flows can be estimated from projections stated in the city's comprehensive plan and from planning figures used by the city's consultants. The comprehensive plan for the City of North Bend states that the goal is to provide sewer service to the entire urban growth area (RH2 Engineering 1991). The population of North Bend at buildout, including developments outside the urban growth area that will be sending their wastewater to the North Bend treatment plant, is approximately 30,000. Furthermore, current projections for the year 2014 include a total population of 7200, a sewered population of 6600, and an average daily wastewater flow of 1.4 mgd (Semrau 1995 personal communication).

In order to estimate the maximum biosolids and septage volumes that could be delivered to the Renton wastewater treatment plant from the City of North Bend, the following assumptions are made:

- In the year 2030, the buildout population is 30,000 persons. This assumes that the City of North Bend will be receiving wastewater flow from the Villages at North Bend.
- Entire population in the year 2030 is sewered.
- Biosolids production is 0.178 ppcd.
- Biosolids concentrations are 15 percent after dewatering (Semrau 1995 personal communication).
- The digesters achieve a 40 percent reduction in total solids.

Populations, wastewater flows, and quantities of biosolids and septage for the City of North Bend are presented in Table 2. The costs for disposing of the biosolids and septage

at the Renton plant are presented in Tables A1 and A2, respectively. Costs are based on a 5 percent inflation rate and a 7 percent discount rate. The net present worth costs of disposing of biosolids and septage at Renton for the City of North Bend are $4,070,000 and $330,000, respectively.

SNOQUALMIE

The City of Snoqualmie currently operates a facultative lagoon treatment plant, which serves an estimated 1550 people. A new wastewater treatment plant consisting of an Eimco oxidation ditch, with a 1.2 mgd monthly average design flow, is presently being designed by KCM, Inc. The plant is expected to be on-line in twelve months.

With a facultative lagoon, Snoqualmie does not have a biosolids handling program. Solids are stored in the lagoon. When the new plant comes on-line, the existing lagoon will be converted to a facultative biosolids lagoon. Collected biosolids will continue to be treated and stored in this lagoon, which has an estimated ten year storage capacity. When the storage capacity of the lagoon is reached, the City of Snoqualmie plans to remove, dewater, and dispose of the biosolids through land application.

The City of Snoqualmie has prepared a draft comprehensive plan, which estimates population and services to be provided for a proposed urban growth area (UGA). Portions of the UGA will be annexed by the city and provided with sewage collection. The City of Snoqualmie anticipates that 100 percent buildout will be achieved in the year 2014, and the population of the current UGA will be 10,040 (Snoqualmie 1994). Snoqualmie does not plan to stop growth after buildout, and it may expand the UGA boundary or allow additional population within the existing UGA (Tucker 1995 personal communication). In order to establish maximum biosolids and septage volumes that could be delivered to Renton wastewater treatment plant from the City of Snoqualmie, the following assumptions were made:

- The total current population within the UGA is 2,250. The population within the city limits is sewered and is approximately 1,550 (Centruck 1995 personal communication).
- After the year 2014, the City of Carnation will expand its UGA boundaries, and/or allow more concentrated population within the current UGA. Growth between 2014 and 2030 is assumed to be slow, at 2 percent.
- Approximately 700 people living within the UGA are not sewered. This number remains constant until 2000, and then decreases to zero by 2030.
- Biosolids production is 0.18 ppcd.
- Biosolids are stored in the facultative lagoon for the first ten years. Once the lagoon is full, the biosolids are hauled to Renton wastewater treatment plant.

Table 2. Population, wastewater flows, biosolids, and septage volumes for the Snoqualmie Valley cities.								
	North Bend		**Snoqualmie**		**Carnation**		**Duvall**	
Year	**2000**	**2030**	**2000**	**2030**	**2000**	**2030**	**2000**	**2030**
Population								
Total	4,200	30,000	4,300	13,780	2,000	4,229	4,351	9,000
Sewered	3,150	30,000	3,000	13,040	400	4,125	4,137	9,000
Unsewered	1,050	—	700	—	1,600	104	214	—
Average wastewater flow (mgd)	0.66	4.80	0.59	2.54	0.04	0.41	0.41	0.90
Biosolids production (ppcd)	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18
Biosolids mass (lbs/yr)	123,000	1,170,000	195,000	847,000	26,000	268,000	161,000	351,000
Biosolids concentration (% solids)	15	15	1.5	1.5	1.5	1.5	15	15
Biosolids volume (gal/yr)	97,000	921,000	1,540,000	6,670,000	205,000	2,110,000	127,000	276,000
Septage production (gal/cap)	100	100	100	100	100	100	100	100
Septage volume (gal/yr)	105,000	—	70,000	—	160,000	10,400	21,400	—

Abbreviations:

ppcd: pounds per capita per day

gpcd: gallons per capita per day

lbs: pounds

mgd: million gallons per day

- Biosolids from the lagoon are pumped out and hauled to Renton in the year 2010 and 2011. Treatment in the lagoon over the ten year period is assumed to result in a 40 percent reduction in dry solids. After the year 2011, the lagoon is assumed to be taken off-line.

- Biosolids (from the oxidation ditch) concentration hauled to Renton is approximately 1.5 percent.

Populations, wastewater flows, and quantities of biosolids and septage for the City of Snoqualmie are presented in Table 2. The costs for disposing of the biosolids and septage at the Renton plant are presented in Tables A3 and A4, respectively. Costs are based on a 5 percent inflation rate and a 7 percent discount rate. The net present worth costs of disposing of biosolids and septage at Renton for the City of Snoqualmie are $7,560,000 and $220,000, respectively.

CARNATION

The City of Carnation currently does not have a wastewater treatment facility. Wastewater is disposed of exclusively through the use of on-site systems. The city prepared a wastewater facilities plan in 1991 that presented a 20-year plan to manage wastewater. The recommended action in this plan was to provide sewer connections to the entire city and the expansion areas, and to provide secondary treatment with disposal of biosolids by hauling to Renton wastewater treatment plant. However, a subsequent 1992 comprehensive plan recommended that the city should initially pursue a 0.08 mgd treatment plant to serve the downtown area.

In a 1995 memorandum the city presented a refined phasing for providing sewer service. The initial area to be sewered includes the town center along Tolt Avenue and the adjacent residential area. The wastewater flow for this service area is estimated to be 0.04 mgd. This figure does not include businesses in the town center that have recently installed on-site disposal systems.

In order to estimate the maximum biosolids and septage volume that could be delivered to Renton wastewater treatment plant from the City of Carnation, the following assumptions are made:

- The population figure for the year 2000 can be based on an extrapolation of population projections presented in the 1991 facilities plan (R.W. Beck 1991).

- The buildout population and sewered population are based on an estimate prepared by the City of Carnation (Carnation 1995).

- Biosolids production is 0.18 ppcd.

- Biosolids concentrations are 1.5 percent after secondary treatment.

- No solids handling facilities are added to the wastewater treatment plant.

Populations, wastewater flows, and quantities of biosolids and septage for the City of Carnation are presented in Table 2. The costs for disposing of the biosolids and septage at the Renton plant are presented in Tables A5 and A6, respectively. Costs are based on a 5 percent inflation rate and a 7 percent discount rate. The net present worth costs of disposing of biosolids and septage at Renton for the City of Carnation are $2,230,000 and $529,000, respectively.

DUVALL

The City of Duvall's wastewater treatment plant currently serves an estimated 3466 people (Chapman 1995 personal communication). The plant currently treats approximately 0.35 mgd and consists of three oxidation ditches; however only one oxidation ditch is presently being used (Tittle 1995 personal communication). As flows increase, it is anticipated that one of the other oxidation ditches will be brought on-line. The remaining ditch is planned to be converted into an aerobic digester (McDowell 1995 personal communication). Gray & Osborne Inc. are currently preparing a sewer comprehensive plan.

Duvall uses two methods for disposing of biosolids. During the summer months biosolids from the treatment plant are spread on agricultural lands in the Snoqualmie Valley. In the winter months, Duvall hauls its biosolids for disposal at the Renton wastewater treatment plant. Table 3 presents the total volume of biosolids produced at Duvall's wastewater treatment plant.

Over the five year period between 1990 and 1994, Duvall disposed of approximately 40 percent of its biosolids at Metro facilities. The remaining 60 percent were disposed of by land application.

Starting in 1995, Duvall began dewatering its biosolids. A portion of the dewatered biosolids are being hauled to GroCo, Inc. for use as a soil amendment. In addition, Duvall plans to continue to spread biosolids on agricultural lands. Although its goal is to find a reuse market for its entire annual quality of biosolids, Duvall will continue to rely on Metro for biosolids disposal as needed.

Table 3. Annual volume of biosolids produced at Duvall.

Year	Volume (gallons)	Approximate Percent Solids	Approximate Weight of Dry Solids (pounds)[1]
1990	376,000	2.0	64,000
1991	565,800	2.0	96,000
1992	569,600	2.0	96,500
1993	752,500	2.0	127,000
1994	762,200	2.0	129,000

[1] Weight of dry solids based on a specific gravity of the biosolids of 1.015

The City of Duvall adopted a comprehensive plan in April 1994 which estimates population and services to be provided for a proposed urban growth area (UGA). The

City of Duvall presently has a population of approximately 3685 within the UGA (Tittle 1995 personal communication). Duvall plans to provide sewage collection and treatment facilities for everyone within the city limits as portions of the UGA are annexed. Duvall does not plan to expand the UGA after 100 percent buildout, which corresponds to a population of 9000 (Duvall 1994).

In order to estimate the maximum biosolids and septage volumes that could be hauled to the Renton wastewater treatment plant from the City of Duvall, the following assumptions are made:

- Approximately 179 people presently living within the UGA are not sewered, approximately 5 percent of the total population in the UGA. This percentage is assumed to remain constant until 2000. Between 2000 and 2030, this percentage is assumed to decrease to zero when buildout is achieved.
- Biosolids production is 0.18 ppcd.
- Biosolids concentrations are 10 percent after dewatering.
- The City of Duvall will have an oxidation ditch converted to an aerobic digester by the year 2000. The digester can achieve a 40 percent reduction in total solids.
- 40 percent of the annual volume of biosolids is hauled to Metro facilities.

Populations, wastewater flows, and quantities of biosolids and septage for the City of Duvall are presented in Table 2. The costs for disposing of the biosolids and septage at the Renton wastewater treatment plant are presented in Tables A7 and A8, respectively. Costs are based on a 5 percent inflation rate and a 7 percent discount rate. The net present worth costs of disposing of biosolids and septage at Renton for the City of Duvall are $990,000 and $67,000, respectively.

SUMMARY

Quantities of biosolids hauled to Metro facilities from the Snoqualmie Valley cities for the planning period of 2000 to 2030 are contingent upon the success of each city's effort to develop markets for its biosolids. North Bend and Duvall currently dispose of a portion of their biosolids by hauling to GroCo. Duvall also relies on land application during the summer months. However, GroCo has indicated it does not want to produce any more biosolids compost (Metro 1995). Therefore, because of the uncertainty of the future market for biosolids from the Snoqualmie Valley cities, a range of biosolids volume hauled to Metro facilities is presented.

Table A9 presents the total projected maximum biosolids quantity and associated costs that could be hauled to the Renton wastewater treatment plant between the years 2000 and 2030. These figures are based on the assumption that none of the cities build additional solids handling facilities beyond those currently planned. In addition, it is assumed that a biosolids market has not developed beyond the current conditions, and GroCo no longer accepts biosolids for composting. The net present worth cost of this scenario is approximately $15 million, based on a 5 percent inflation rate and 7 percent discount rate.

Table A10 presents the quantity and associated costs of biosolids hauled to the Renton wastewater treatment plant between the years 2000 and 2030, assuming that North Bend, Snoqualmie, and Duvall have developed alternative disposal methods for their biosolids by the year 2000. For the purpose of this analysis, it is assumed that North Bend and Snoqualmie are able to dispose of approximately 50 percent of their biosolids through land application and composting locally, and that Duvall disposes of 25 percent of its biosolids by composting. This assumption is contingent upon development of new privatization opportunities for land application and composting in the Snoqualmie Valley. This is considered optimistic given the large degree of uncertainty concerning future biosolids markets. The net present worth cost of this scenario is $6.4 million, based on a 5 percent inflation rate and 7 percent discount rate.

Table A11 presents the total projected volumes and associated costs of septage hauled to Metro by private haulers from the Snoqualmie Valley cities, including their urban growth areas. The cost of this scenario (in 1995 dollars) is approximately $1,160,000, based on an inflation rate of 5 percent and a discount rate of 7 percent.

References

Centruck, Jim. May 1995. Personal communication (telephone conversation with Jeff Remily, Herrera Environmental Consultants). KCM Inc., Seattle, WA.

Chapman, Linda. May 1995. Personal communication (telephone conversation with Jeff Remily, Herrera Environmental Consultants). City of Duvall, Duvall, WA.

Collin, Dean. May 1995. Personal communication (telephone conversation with Jeff Remily, Herrera Environmental Consultants). City of Snoqualmie, Snoqualmie, WA.

Duvall, City of. April 1994. Comprehensive Plan, City of Duvall.

Finger, Dick. May 1995. Personal communication (telephone conversation with Jeff Remily, Herrera Environmental Consultants). King County Department of Metropolitan Services, Seattle, WA.

Jensen, Eric. March 1995. Personal communication (memorandum to Don Morrison, City of Carnation, concerning sewer capacity needs for Carnation and Urban Growth Area). City of Carnation, Carnation, WA.

Lewis, Carrie. June 1995. Personal communication (Facsimile to Wendy Gibble, Herrera Environmental Consultants). City of North Bend, North Bend, WA.

McDowell, Ken. May 1995. Personal communication (telephone conversation with Jeff Remily, Herrera Environmental Consultants). City of Duvall, Duvall, WA.

Metcalf & Eddy. 1991. Wastewater Engineering Treatment, Disposal, and Reuse. Third Edition. McGraw Hill, Inc., New York City, NY.

Metro. April 1995. Biosolids Long-Range Strategy and Facilities Plan, Phase II. Prepared for King County Department of Metropolitan Services by O'Neill & Company, Seattle, WA.

RH2 Engineering, P.S. 1991. City of North Bend Comprehensive Sewer System Plan. Prepared for the City of North Bend, WA by RH2 Engineering, Redmond, WA.

R.W. Beck. 1991. City of Carnation Second Draft Wastewater Facilities Plan. Prepared by R.W. Beck and Associates, Seattle, WA.

Semrau, Mark. May 1995. Personal communication (telephone conversation with Wendy Gibble, Herrera Environmental Consultants). RH2 Engineering, Redmond, WA.

Snoqualmie, City of. April 1994. Snoqualmie Vicinity Comprehensive Plan, Update 1994.

Tissell, Paul. June 1995. Personal communication (telephone conversation with Wendy Gibble, Herrera Environmental Consultants). City of North Bend, North Bend, WA.

Tittle, Piper. May 1995. Personal communication (telephone conversation with Jeff Remily, Herrera Environmental Consultants). Gray & Osborne Inc., Seattle, WA.

APPENDIX A

COST TABLES

Table A1. Projected biosolids disposal costs for the City of North Bend[1].

Year	Biosolids						
	Population Served	ADF (MGD)	Dry Solids (pounds)	Disposal Cost ($/lb)	Volume (MG)	Hauling Cost ($/gal)	Extended Cost
2000	3,150	0.66	123,000	$ 0.52	0.097	$ 0.06	$ 70,000
2001	3,396	0.71	132,000	$ 0.55	0.104	$ 0.07	$ 79,000
2002	3,643	0.77	142,000	$ 0.57	0.112	$ 0.07	$ 89,000
2003	3,889	0.82	152,000	$ 0.60	0.120	$ 0.07	$ 100,000
2004	4,136	0.87	161,000	$ 0.63	0.127	$ 0.08	$ 112,000
2005	4,382	0.92	171,000	$ 0.66	0.135	$ 0.08	$ 124,000
2006	4,629	0.97	180,000	$ 0.70	0.142	$ 0.09	$ 138,000
2007	4,875	1.02	190,000	$ 0.73	0.150	$ 0.09	$ 152,000
2008	5,122	1.08	200,000	$ 0.77	0.157	$ 0.09	$ 169,000
2009	5,368	1.13	209,000	$ 0.81	0.165	$ 0.10	$ 185,000
2010	5,615	1.18	219,000	$ 0.85	0.172	$ 0.10	$ 203,000
2011	5,861	1.23	228,000	$ 0.89	0.180	$ 0.11	$ 222,000
2012	6,108	1.28	238,000	$ 0.93	0.187	$ 0.11	$ 244,000
2013	6,354	1.33	248,000	$ 0.98	0.195	$ 0.12	$ 267,000
2014	6,600	1.39	257,000	$ 1.03	0.202	$ 0.13	$ 290,000
2015	8,063	1.60	314,000	$ 1.08	0.247	$ 0.13	$ 372,000
2016	9,525	1.82	371,000	$ 1.14	0.292	$ 0.14	$ 462,000
2017	10,988	2.03	428,000	$ 1.19	0.337	$ 0.15	$ 560,000
2018	12,450	2.24	485,000	$ 1.25	0.382	$ 0.15	$ 666,000
2019	13,913	2.46	542,000	$ 1.31	0.427	$ 0.16	$ 781,000
2020	15,375	2.67	599,000	$ 1.38	0.472	$ 0.17	$ 907,000
2021	16,838	2.88	656,000	$ 1.45	0.516	$ 0.18	$ 1,042,000
2022	18,300	3.10	713,000	$ 1.52	0.561	$ 0.19	$ 1,190,000
2023	19,763	3.31	770,000	$ 1.60	0.606	$ 0.20	$ 1,349,000
2024	21,225	3.52	827,000	$ 1.68	0.651	$ 0.21	$ 1,521,000
2025	22,688	3.73	884,000	$ 1.76	0.696	$ 0.22	$ 1,707,000
2026	24,150	3.95	941,000	$ 1.85	0.741	$ 0.23	$ 1,908,000
2027	25,613	4.16	998,000	$ 1.94	0.786	$ 0.24	$ 2,125,000
2028	27,075	4.37	1,060,000	$ 2.04	0.835	$ 0.25	$ 2,370,000
2029	28,538	4.59	1,110,000	$ 2.14	0.874	$ 0.26	$ 2,606,000
2030	30,000	4.80	1,170,000	$ 2.25	0.921	$ 0.28	$ 2,884,000
Net Present Worth (1995)							$ 4,070,000

[1]Disposal of all biosolids at the Renton wastewater treatment plant.

Table A2. Projected septage disposal costs for the City of North Bend.

Year	Septage			
	Unit Cost ($/gal)	Population Served	Septage (gallons)	Extended Cost
2000	$ 0.34	1,050	105,000	$ 35,500
2001	$ 0.35	1,018	101,500	$ 36,000
2002	$ 0.37	986	98,000	$ 36,500
2003	$ 0.39	954	94,500	$ 37,000
2004	$ 0.41	921	91,000	$ 37,400
2005	$ 0.43	889	87,500	$ 37,700
2006	$ 0.45	857	84,000	$ 38,000
2007	$ 0.48	825	80,500	$ 38,300
2008	$ 0.50	793	77,000	$ 38,500
2009	$ 0.52	761	73,500	$ 38,500
2010	$ 0.55	729	70,000	$ 38,500
2011	$ 0.58	696	66,500	$ 38,400
2012	$ 0.61	664	63,000	$ 38,200
2013	$ 0.64	632	59,500	$ 37,900
2014	$ 0.67	600	56,000	$ 37,500
2015	$ 0.70	562	52,500	$ 36,900
2016	$ 0.74	525	49,000	$ 36,200
2017	$ 0.77	487	45,500	$ 35,200
2018	$ 0.81	450	42,000	$ 34,200
2019	$ 0.85	412	38,500	$ 32,900
2020	$ 0.90	375	35,000	$ 31,400
2021	$ 0.94	337	31,500	$ 29,700
2022	$ 0.99	300	28,000	$ 27,700
2023	$ 1.04	262	24,500	$ 25,400
2024	$ 1.09	225	21,000	$ 22,900
2025	$ 1.14	187	17,500	$ 20,000
2026	$ 1.20	150	14,000	$ 16,800
2027	$ 1.26	112	10,500	$ 13,300
2028	$ 1.33	75	7,000	$ 9,300
2029	$ 1.39	37	3,500	$ 4,900
2030	$ 1.46	0	0	$ -
Net Present Worth (1995)				$ 330,000

Table A3. Projected biosolids disposal costs for the City of Snoqualmie[1].

Year	Population Served	ADF (MGD)	Biosolids Dry Solids (pounds)	Disposal Cost ($/lb)	Volume (MG)	Hauling Cost ($/gal)	Extended Cost
2000	3,000	0.59	195,000	$ 0.52	1.54	$ 0.06	$ -
2001	3,335	0.65	217,000	$ 0.55	1.71	$ 0.07	$ -
2002	3,669	0.72	238,000	$ 0.57	1.87	$ 0.07	$ -
2003	4,004	0.78	260,000	$ 0.60	2.05	$ 0.07	$ -
2004	4,339	0.85	282,000	$ 0.63	2.22	$ 0.08	$ -
2005	4,673	0.91	304,000	$ 0.66	2.39	$ 0.08	$ -
2006	5,008	0.98	325,000	$ 0.70	2.56	$ 0.09	$ -
2007	5,343	1.04	347,000	$ 0.73	2.73	$ 0.09	$ -
2008	5,677	1.11	369,000	$ 0.77	2.91	$ 0.09	$ -
2009	6,012	1.17	391,000	$ 0.81	3.08	$ 0.10	$ -
2010	6,347	1.24	1,290,000	$ 0.85	10.16	$ 0.10	$ 2,151,000
2011	6,681	1.30	1,312,000	$ 0.89	10.33	$ 0.11	$ 2,298,000
2012	7,016	1.37	456,000	$ 0.93	3.59	$ 0.11	$ 838,000
2013	7,351	1.43	478,000	$ 0.98	3.76	$ 0.12	$ 923,000
2014	7,685	1.50	499,000	$ 1.03	3.93	$ 0.13	$ 1,012,000
2015	8,020	1.56	521,000	$ 1.08	4.10	$ 0.13	$ 1,109,000
2016	8,355	1.63	543,000	$ 1.14	4.28	$ 0.14	$ 1,214,000
2017	8,689	1.69	565,000	$ 1.19	4.45	$ 0.15	$ 1,326,000
2018	9,024	1.76	586,000	$ 1.25	4.61	$ 0.15	$ 1,444,000
2019	9,359	1.82	608,000	$ 1.31	4.79	$ 0.16	$ 1,573,000
2020	9,693	1.89	630,000	$ 1.38	4.96	$ 0.17	$ 1,712,000
2021	10,028	1.96	652,000	$ 1.45	5.13	$ 0.18	$ 1,860,000
2022	10,363	2.02	673,000	$ 1.52	5.30	$ 0.19	$ 2,016,000
2023	10,697	2.09	695,000	$ 1.60	5.47	$ 0.20	$ 2,186,000
2024	11,032	2.15	717,000	$ 1.68	5.65	$ 0.21	$ 2,368,000
2025	11,367	2.22	738,000	$ 1.76	5.81	$ 0.22	$ 2,559,000
2026	11,701	2.28	760,000	$ 1.85	5.98	$ 0.23	$ 2,767,000
2027	12,036	2.35	782,000	$ 1.94	6.16	$ 0.24	$ 2,989,000
2028	12,371	2.41	804,000	$ 2.04	6.33	$ 0.25	$ 3,227,000
2029	12,705	2.48	825,000	$ 2.14	6.50	$ 0.26	$ 3,477,000
2030	13,040	2.54	847,000	$ 2.25	6.67	$ 0.28	$ 3,748,000
Net Present Worth (1995)							$ 7,560,000

[1]Disposal of all biosolids at the Renton wastewater treatment plant.

Table A4. Projected septage disposal costs for the City of Snoqualmie.

Year	Septage			
	Unit Cost ($/gal)	Population Served	Septage (gallons)	Extended Cost
2000	$ 0.34	700	70,000	$ 23,700
2001	$ 0.35	677	68,000	$ 24,100
2002	$ 0.37	653	65,000	$ 24,200
2003	$ 0.39	630	63,000	$ 24,700
2004	$ 0.41	607	61,000	$ 25,100
2005	$ 0.43	583	58,000	$ 25,000
2006	$ 0.45	560	56,000	$ 25,400
2007	$ 0.48	537	54,000	$ 25,700
2008	$ 0.50	513	51,000	$ 25,500
2009	$ 0.52	490	49,000	$ 25,700
2010	$ 0.55	467	47,000	$ 25,900
2011	$ 0.58	443	44,000	$ 25,400
2012	$ 0.61	420	42,000	$ 25,500
2013	$ 0.64	397	40,000	$ 25,500
2014	$ 0.67	373	37,000	$ 24,800
2015	$ 0.70	350	35,000	$ 24,600
2016	$ 0.74	327	33,000	$ 24,300
2017	$ 0.77	303	30,300	$ 23,500
2018	$ 0.81	280	28,000	$ 22,800
2019	$ 0.85	257	25,700	$ 22,000
2020	$ 0.90	233	23,300	$ 20,900
2021	$ 0.94	210	21,000	$ 19,800
2022	$ 0.99	187	18,700	$ 18,500
2023	$ 1.04	163	16,300	$ 16,900
2024	$ 1.09	140	14,000	$ 15,300
2025	$ 1.14	117	11,700	$ 13,400
2026	$ 1.20	93	9,300	$ 11,200
2027	$ 1.26	70	7,000	$ 8,800
2028	$ 1.33	47	4,700	$ 6,200
2029	$ 1.39	23	2,300	$ 3,200
2030	$ 1.46	0	0	$ -
Net Present Worth (1995)				$ 220,000

Table A5. Projected biosolids disposal costs for the City of Carnation[1].

Year	Biosolids						
	Population Served	ADF (MGD)	Dry Solids (pounds)	Disposal Cost ($/lb)	Volume (MG)	Hauling Cost ($/gal)	Extended Cost
2000	400	0.04	26,000	$ 0.52	0.20	$ 0.06	$ 26,600
2001	524	0.05	34,000	$ 0.55	0.27	$ 0.07	$ 36,600
2002	648	0.06	42,000	$ 0.57	0.33	$ 0.07	$ 47,400
2003	773	0.08	50,000	$ 0.60	0.39	$ 0.07	$ 59,300
2004	897	0.09	58,000	$ 0.63	0.46	$ 0.08	$ 72,200
2005	1,021	0.10	66,000	$ 0.66	0.52	$ 0.08	$ 86,200
2006	1,145	0.11	74,000	$ 0.70	0.58	$ 0.09	$ 101,500
2007	1,269	0.13	82,000	$ 0.73	0.65	$ 0.09	$ 118,100
2008	1,393	0.14	91,000	$ 0.77	0.72	$ 0.09	$ 137,700
2009	1,518	0.15	99,000	$ 0.81	0.78	$ 0.10	$ 157,300
2010	1,642	0.16	107,000	$ 0.85	0.84	$ 0.10	$ 178,500
2011	1,766	0.18	115,000	$ 0.89	0.91	$ 0.11	$ 201,400
2012	1,890	0.19	123,000	$ 0.93	0.97	$ 0.11	$ 226,200
2013	2,014	0.20	131,000	$ 0.98	1.03	$ 0.12	$ 252,900
2014	2,138	0.21	139,000	$ 1.03	1.09	$ 0.13	$ 281,800
2015	2,263	0.23	147,000	$ 1.08	1.16	$ 0.13	$ 312,900
2016	2,387	0.24	155,000	$ 1.14	1.22	$ 0.14	$ 346,400
2017	2,511	0.25	163,000	$ 1.19	1.28	$ 0.15	$ 382,500
2018	2,635	0.26	171,000	$ 1.25	1.35	$ 0.15	$ 421,400
2019	2,759	0.28	179,000	$ 1.31	1.41	$ 0.16	$ 463,100
2020	2,883	0.29	187,000	$ 1.38	1.47	$ 0.17	$ 508,000
2021	3,008	0.30	195,000	$ 1.45	1.54	$ 0.18	$ 556,200
2022	3,132	0.31	203,000	$ 1.52	1.60	$ 0.19	$ 608,000
2023	3,256	0.33	212,000	$ 1.60	1.67	$ 0.20	$ 666,700
2024	3,380	0.34	220,000	$ 1.68	1.73	$ 0.21	$ 726,500
2025	3,504	0.35	228,000	$ 1.76	1.80	$ 0.22	$ 790,500
2026	3,628	0.36	236,000	$ 1.85	1.86	$ 0.23	$ 859,200
2027	3,753	0.38	244,000	$ 1.94	1.92	$ 0.24	$ 932,700
2028	3,877	0.39	252,000	$ 2.04	1.98	$ 0.25	$ 1,011,500
2029	4,001	0.40	260,000	$ 2.14	2.05	$ 0.26	$ 1,095,800
2030	4,125	0.41	268,000	$ 2.25	2.11	$ 0.28	$ 1,186,000
Net Present Worth (1995)							$ 2,330,000

[1]Disposal of all biosolids at the Renton wastewater treatment plant.

Table A6. Projected septage disposal costs for the City of Carnation.

Year	Septage			
	Unit Cost ($/gal)	Population Served	Quantity (gallons)	Extended Cost
2000	$ 0.34	1,600	160,000	$ 54,080
2001	$ 0.35	1,550	155,000	$ 55,010
2002	$ 0.37	1,500	150,000	$ 55,897
2003	$ 0.39	1,450	145,000	$ 56,735
2004	$ 0.41	1,401	140,000	$ 57,518
2005	$ 0.43	1,351	135,000	$ 58,237
2006	$ 0.45	1,301	130,000	$ 58,884
2007	$ 0.48	1,251	125,000	$ 59,450
2008	$ 0.50	1,201	120,000	$ 59,926
2009	$ 0.52	1,151	115,000	$ 60,300
2010	$ 0.55	1,101	110,000	$ 60,562
2011	$ 0.58	1,051	105,000	$ 60,700
2012	$ 0.61	1,002	100,000	$ 60,700
2013	$ 0.64	952	95,200	$ 60,676
2014	$ 0.67	902	90,200	$ 60,363
2015	$ 0.70	852	85,200	$ 59,868
2016	$ 0.74	802	80,200	$ 59,172
2017	$ 0.77	752	75,200	$ 58,258
2018	$ 0.81	702	70,200	$ 57,103
2019	$ 0.85	653	65,300	$ 55,773
2020	$ 0.90	603	60,300	$ 54,078
2021	$ 0.94	553	55,300	$ 52,074
2022	$ 0.99	503	50,300	$ 49,734
2023	$ 1.04	453	45,300	$ 47,029
2024	$ 1.09	403	40,300	$ 43,930
2025	$ 1.14	353	35,300	$ 40,404
2026	$ 1.20	303	30,300	$ 36,415
2027	$ 1.26	254	25,400	$ 32,052
2028	$ 1.33	204	20,400	$ 27,030
2029	$ 1.39	154	15,400	$ 21,425
2030	$ 1.46	104	10,400	$ 15,192
Net Present Worth (1995)				$ 529,000

Table A7. Projected disposal costs for hauling biosolids to Metro from the City of Duvall[1].

Year	Biosolids						
	Population Served	ADF (MGD)	Dry Solids (pounds)	Disposal Cost ($/lb)	Volume (MG)	Hauling Cost ($/gal)	Extended Cost
2000	4,137	0.41	65,000	$ 0.52	0.077	$ 0.06	$ 39,000
2001	4,299	0.43	67,000	$ 0.55	0.079	$ 0.07	$ 41,900
2002	4,461	0.45	70,000	$ 0.57	0.083	$ 0.07	$ 46,000
2003	4,623	0.46	72,000	$ 0.60	0.085	$ 0.07	$ 49,600
2004	4,785	0.48	75,000	$ 0.63	0.089	$ 0.08	$ 54,300
2005	4,948	0.49	77,000	$ 0.66	0.091	$ 0.08	$ 58,500
2006	5,110	0.51	80,000	$ 0.70	0.094	$ 0.09	$ 63,900
2007	5,272	0.53	82,000	$ 0.73	0.097	$ 0.09	$ 68,700
2008	5,434	0.54	85,000	$ 0.77	0.100	$ 0.09	$ 74,800
2009	5,596	0.56	87,000	$ 0.81	0.103	$ 0.10	$ 80,400
2010	5,758	0.58	90,000	$ 0.85	0.106	$ 0.10	$ 87,300
2011	5,920	0.59	92,000	$ 0.89	0.109	$ 0.11	$ 93,700
2012	6,082	0.61	95,000	$ 0.93	0.112	$ 0.11	$ 101,600
2013	6,244	0.62	97,000	$ 0.98	0.115	$ 0.12	$ 108,900
2014	6,406	0.64	100,000	$ 1.03	0.118	$ 0.13	$ 117,900
2015	6,569	0.66	102,000	$ 1.08	0.120	$ 0.13	$ 126,300
2016	6,731	0.67	105,000	$ 1.14	0.124	$ 0.14	$ 136,500
2017	6,893	0.69	107,000	$ 1.19	0.126	$ 0.15	$ 146,100
2018	7,055	0.71	110,000	$ 1.25	0.130	$ 0.15	$ 157,700
2019	7,217	0.72	113,000	$ 1.31	0.133	$ 0.16	$ 170,100
2020	7,379	0.74	115,000	$ 1.38	0.136	$ 0.17	$ 181,700
2021	7,541	0.75	118,000	$ 1.45	0.139	$ 0.18	$ 195,800
2022	7,703	0.77	120,000	$ 1.52	0.142	$ 0.19	$ 209,100
2023	7,865	0.79	123,000	$ 1.60	0.145	$ 0.20	$ 225,000
2024	8,027	0.80	125,000	$ 1.68	0.148	$ 0.21	$ 240,100
2025	8,190	0.82	128,000	$ 1.76	0.151	$ 0.22	$ 258,200
2026	8,352	0.84	130,000	$ 1.85	0.154	$ 0.23	$ 275,300
2027	8,514	0.85	133,000	$ 1.94	0.157	$ 0.24	$ 295,700
2028	8,676	0.87	135,000	$ 2.04	0.159	$ 0.25	$ 315,200
2029	8,838	0.88	138,000	$ 2.14	0.163	$ 0.26	$ 338,300
2030	9,000	0.90	140,000	$ 2.25	0.165	$ 0.28	$ 360,400
Net Present Worth (1995)							$ 990,000

[1]Disposal of 40 percent of Duvall's biosolids at the Renton wastewater treatment plant.

Table A8. Projected septage disposal costs for the City of Duvall.

Year	Septage			
	Unit Cost ($/gal)	Population Served	Quantity (gallons)	Extended Cost
2000	$ 0.34	214	21,400	$ 7,233
2001	$ 0.35	207	20,700	$ 7,346
2002	$ 0.37	200	20,000	$ 7,453
2003	$ 0.39	193	19,300	$ 7,552
2004	$ 0.41	185	18,500	$ 7,601
2005	$ 0.43	178	17,800	$ 7,679
2006	$ 0.45	171	17,100	$ 7,745
2007	$ 0.48	164	16,400	$ 7,800
2008	$ 0.50	157	15,700	$ 7,840
2009	$ 0.52	150	15,000	$ 7,865
2010	$ 0.55	143	14,300	$ 7,873
2011	$ 0.58	136	13,600	$ 7,862
2012	$ 0.61	128	12,800	$ 7,770
2013	$ 0.64	121	12,100	$ 7,712
2014	$ 0.67	114	11,400	$ 7,629
2015	$ 0.70	107	10,700	$ 7,519
2016	$ 0.74	100	10,000	$ 7,378
2017	$ 0.77	93	9,300	$ 7,205
2018	$ 0.81	86	8,600	$ 6,996
2019	$ 0.85	78	7,800	$ 6,662
2020	$ 0.90	71	7,100	$ 6,367
2021	$ 0.94	64	6,400	$ 6,027
2022	$ 0.99	57	5,700	$ 5,636
2023	$ 1.04	50	5,000	$ 5,191
2024	$ 1.09	43	4,300	$ 4,687
2025	$ 1.14	36	3,600	$ 4,121
2026	$ 1.20	29	2,900	$ 3,485
2027	$ 1.26	21	2,100	$ 2,650
2028	$ 1.33	14	1,400	$ 1,855
2029	$ 1.39	7	700	$ 974
2030	$ 1.46	0	0	$ -
Net Present Worth (1995)				$ 67,000

Table A9. Total projected quantities and disposal costs for biosolids hauled to Metro from all Snoqualmie Valley cities assuming no local biosolids markets are developed.

Year	Biosolids				
	Dry Solids (pounds)	Disposal Cost ($/lb)	Volume (gallons)	Hauling Cost ($/gal)	Extended Cost
2000	214,000	$ 0.52	0.38	$ 0.06	$ 135,000
2001	233,000	$ 0.55	0.45	$ 0.07	$ 158,000
2002	254,000	$ 0.57	0.53	$ 0.07	$ 183,000
2003	274,000	$ 0.60	0.60	$ 0.07	$ 209,000
2004	294,000	$ 0.63	0.67	$ 0.08	$ 238,000
2005	314,000	$ 0.66	0.75	$ 0.08	$ 269,000
2006	334,000	$ 0.70	0.82	$ 0.09	$ 303,000
2007	354,000	$ 0.73	0.89	$ 0.09	$ 339,000
2008	376,000	$ 0.77	0.97	$ 0.09	$ 381,000
2009	395,000	$ 0.81	1.05	$ 0.10	$ 423,000
2010	1,710,000	$ 0.85	11.28	$ 0.10	$ 2,624,000
2011	1,750,000	$ 0.89	11.52	$ 0.11	$ 2,818,000
2012	910,000	$ 0.93	4.86	$ 0.11	$ 1,408,000
2013	950,000	$ 0.98	5.10	$ 0.12	$ 1,548,000
2014	1,000,000	$ 1.03	5.34	$ 0.13	$ 1,707,000
2015	1,080,000	$ 1.08	5.63	$ 0.13	$ 1,916,000
2016	1,170,000	$ 1.14	5.91	$ 0.14	$ 2,154,000
2017	1,260,000	$ 1.19	6.20	$ 0.15	$ 2,410,000
2018	1,350,000	$ 1.25	6.47	$ 0.15	$ 2,686,000
2019	1,440,000	$ 1.31	6.76	$ 0.16	$ 2,985,000
2020	1,530,000	$ 1.38	7.04	$ 0.17	$ 3,306,000
2021	1,620,000	$ 1.45	7.32	$ 0.18	$ 3,653,000
2022	1,710,000	$ 1.52	7.60	$ 0.19	$ 4,024,000
2023	1,800,000	$ 1.60	7.89	$ 0.20	$ 4,426,000
2024	1,890,000	$ 1.68	8.18	$ 0.21	$ 4,857,000
2025	1,980,000	$ 1.76	8.45	$ 0.22	$ 5,319,000
2026	2,070,000	$ 1.85	8.74	$ 0.23	$ 5,815,000
2027	2,160,000	$ 1.94	9.02	$ 0.24	$ 6,349,000
2028	2,250,000	$ 2.04	9.31	$ 0.25	$ 6,922,000
2029	2,330,000	$ 2.14	9.58	$ 0.26	$ 7,511,000
2030	2,430,000	$ 2.25	9.87	$ 0.28	$ 8,190,000
Net Present Worth (1995)					$15,000,000

Table A10. Total projected quantities and costs for biosolids hauled to Metro from Snoqualmie Valley cities assuming a local biosolids market is developed.

Year	Biosolids				
	Dry Solids (pounds)	Disposal Cost ($/lb)	Volume (gallons)	Hauling Cost ($/gal)	Extended Cost
2000	110,000	$ 0.52	0.20	$ 0.06	$ 70,000
2001	130,000	$ 0.55	0.27	$ 0.07	$ 89,000
2002	140,000	$ 0.57	0.33	$ 0.07	$ 104,000
2003	150,000	$ 0.60	0.39	$ 0.07	$ 119,000
2004	170,000	$ 0.63	0.46	$ 0.08	$ 143,000
2005	180,000	$ 0.66	0.52	$ 0.08	$ 162,000
2006	190,000	$ 0.70	0.58	$ 0.09	$ 182,000
2007	210,000	$ 0.73	0.65	$ 0.09	$ 212,000
2008	220,000	$ 0.77	0.72	$ 0.09	$ 237,000
2009	240,000	$ 0.81	0.78	$ 0.10	$ 271,000
2010	900,000	$ 0.85	0.84	$ 0.10	$ 850,000
2011	920,000	$ 0.89	0.91	$ 0.11	$ 917,000
2012	510,000	$ 0.93	0.97	$ 0.11	$ 588,000
2013	530,000	$ 0.98	1.03	$ 0.12	$ 644,000
2014	550,000	$ 1.03	1.09	$ 0.13	$ 705,000
2015	600,000	$ 1.08	1.16	$ 0.13	$ 803,000
2016	650,000	$ 1.14	1.22	$ 0.14	$ 908,000
2017	700,000	$ 1.19	1.28	$ 0.15	$ 1,023,000
2018	750,000	$ 1.25	1.35	$ 0.15	$ 1,146,000
2019	800,000	$ 1.31	1.41	$ 0.16	$ 1,279,000
2020	840,000	$ 1.38	1.47	$ 0.17	$ 1,409,000
2021	890,000	$ 1.45	1.54	$ 0.18	$ 1,563,000
2022	940,000	$ 1.52	1.60	$ 0.19	$ 1,729,000
2023	990,000	$ 1.60	1.67	$ 0.20	$ 1,909,000
2024	1,040,000	$ 1.68	1.73	$ 0.21	$ 2,102,000
2025	1,090,000	$ 1.76	1.80	$ 0.22	$ 2,308,000
2026	1,140,000	$ 1.85	1.86	$ 0.23	$ 2,531,000
2027	1,180,000	$ 1.94	1.92	$ 0.24	$ 2,750,000
2028	1,230,000	$ 2.04	1.98	$ 0.25	$ 3,005,000
2029	1,280,000	$ 2.14	2.05	$ 0.26	$ 3,279,000
2030	1,330,000	$ 2.25	2.11	$ 0.28	$ 3,573,000
Net Present Worth (1995)					$ 6,400,000

Table A11. Total projected septage quantities and disposal costs for all Snoqualmie Valley cities.

Year	Septage				
	Unit Cost ($/gal)		Volume (gallons)	Extended Cost	
2000	$	0.34	356,000	$	120,300
2001	$	0.35	347,000	$	123,200
2002	$	0.37	336,000	$	125,200
2003	$	0.39	324,000	$	126,800
2004	$	0.41	313,000	$	128,600
2005	$	0.43	301,000	$	129,800
2006	$	0.45	289,000	$	130,900
2007	$	0.48	278,000	$	132,200
2008	$	0.50	267,000	$	133,300
2009	$	0.52	255,000	$	133,700
2010	$	0.55	243,000	$	133,800
2011	$	0.58	232,000	$	134,100
2012	$	0.61	220,000	$	133,500
2013	$	0.64	209,000	$	133,200
2014	$	0.67	198,000	$	132,500
2015	$	0.70	185,000	$	130,000
2016	$	0.74	174,000	$	128,400
2017	$	0.77	163,000	$	126,300
2018	$	0.81	151,000	$	122,800
2019	$	0.85	140,000	$	119,600
2020	$	0.90	128,000	$	114,800
2021	$	0.94	117,000	$	110,200
2022	$	0.99	105,000	$	103,800
2023	$	1.04	93,500	$	97,100
2024	$	1.09	81,900	$	89,300
2025	$	1.14	70,400	$	80,600
2026	$	1.20	58,900	$	70,800
2027	$	1.26	47,300	$	59,700
2028	$	1.33	35,800	$	47,400
2029	$	1.39	24,300	$	33,800
2030	$	1.46	12,700	$	18,600
Net Present Worth (1995)				$	1,160,000

SNOQUALMIE VALLEY WASTEWATER TREATMENT FACILITIES AND OPERATIONS

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TABLES

FIGURES

INTRODUCTION

The Snoqualmie Valley cities of North Bend, Snoqualmie, Carnation, Duvall, and the Echo Glen Children's Center currently operate and maintain separate wastewater collection and treatment facilities. This study was conducted to investigate the possibility of combining wastewater from two or more communities and providing a more centralized approach to wastewater collection and treatment. In support of the wastewater comprehensive plan being developed by King County Department of Metropolitan Services (Metro), and at the request of the Snoqualmie Valley cities of North Bend, Snoqualmie, Carnation, and Duvall, and the Echo Glen Children's Center, this report identifies and presents alternatives to provide a more centralized solution to wastewater treatment in the Snoqualmie Valley.

In the following sections, each of the existing collection and treatment systems is described, with current and projected wastewater flows. Four alternatives are then described that provide a more centralized approach for wastewater collection, conveyance, and treatment. The collection and treatment alternatives are presented at a conceptual, feasibility study level. The wastewater management alternatives examined in this report include the following:

- Alternative 1: Echo Glen wastewater flows to Snoqualmie — Combining the wastewater flows of Echo Glen and Snoqualmie, with treatment at the Snoqualmie wastewater treatment plant.
- Alternative 2: Echo Glen and North Bend wastewater flows to Snoqualmie — Combining the wastewater flows of Echo Glen, North Bend, and Snoqualmie, with treatment at the Snoqualmie wastewater treatment plant.
- Alternative 3: Carnation wastewater flows to Duvall — Combining the wastewater flows of Carnation and Duvall, with treatment at the Duvall wastewater treatment plant.
- Alternative 4: All wastewater flows to Duvall — Combining the wastewater flows of North Bend, Snoqualmie, Echo Glen, Carnation, and Duvall, with treatment at the Duvall wastewater treatment plant.

For each alternative, the conceptual conveyance and treatment system is described, including discussion of general constructability and implementation issues, environmental impacts, and planning level project cost estimates.

The alternative treatment systems outlined in this report, and therefore a portion of the capital improvement costs, represent upgrades of the existing treatment plants necessary to treat the anticipated wastewater flows to current water quality standards. The conceptual treatment systems and associated cost estimates do not include tertiary treatment (i.e., nutrient removal) or wastewater solids disposal. No consideration is given to the value of the existing conveyance systems, treatment plants, or pending upgrades already planned by the communities; it is assumed that these are in place and operational before the upgrades described here are implemented.

This study does not include evaluation of a no-action alternative or an alternative involving connection of the Snoqualmie Valley communities to the King County Metro system. Other issues, such as dividing the responsibility for administration (including rate setting and billing are beyond the scope of this feasibility study.

Project cost estimates given in this report are intended for the purpose of relative comparison only. These estimates are based on conceptual level planning layouts and assumptions. The costs presented are not to be construed as budget values, estimates of construction, or total project costs.

EXISTING WASTEWATER SYSTEMS: COLLECTION AND TREATMENT

Figure 1 shows the relative locations of the cities in the Snoqualmie Valley study area. In the following sections, wastewater flows and populations for each entity are estimated for the target years 2000 and 2030, based on the findings presented by Herrera (1995) in Role of Metropolitan Services Department Under Current Valley Cities Planning. These estimates are used for the conceptual sizing and layout of the proposed facilities discussed in each alternative.

NORTH BEND

The city of North Bend currently operates a 0.4-million-gallon per day (mgd) secondary treatment plant consisting of an oxidation ditch, two clarifiers, a chlorine contact chamber, and an aerobic digester for wastewater solids stabilization. The existing plant serves a sewered population of approximately 2,700 (Herrera 1994).

North Bend is expanding its wastewater treatment plant to handle a design capacity of 2.3 mgd. The upgraded plant will convert the existing oxidation ditch to a sequencing batch reactor and an improved biosolids handling system including a belt filter press to dewater the biosolids after aerobic digestion. North Bend is also upgrading portions of its wastewater collection system to reduce inflow and infiltration.

It is anticipated that the upgraded plant will be sufficient to serve the growing North Bend population for 5 to 10 years. The city is expected to grow from its current population to approximately 3,150 in the year 2000. The ultimate population of the urban growth area at full development is expected to reach 30,000 by the year 2030 (Herrera 1995). Corresponding wastewater flows are expected to increase to 0.66 mgd and 4.8 mgd in the years 2000 and 2030, respectively. Table 1 summarizes the projected populations, wastewater flows, and biosolids production for the city of North Bend and the other Snoqualmie Valley communities.

SNOQUALMIE

The city of Snoqualmie is located immediately north of and just downstream from North Bend on the Snoqualmie River. Snoqualmie currently operates a two-cell facultative lagoon wastewater treatment system. The existing plant handles approximately 0.3 mgd of wastewater from a sewered population of approximately 1,550 people. The present collection system uses five pump stations to convey wastewater to the treatment plant because the service area is generally flat. Pump stations 4 and 5 pump into the service areas of pump stations 3 and 2, respectively. Pump stations 2 and 3 pump to the pump station 1 area (Gray and Osborne 1991).

Snoqualmie is also planning to upgrade its treatment plant to a 1.2-mgd Eimco oxidation ditch system situated adjacent to the existing lagoons. The upgraded plant is currently being designed and is expected to be on-line by mid-1996. The conveyance piping is being sized to handle monthly average flows as high as 2.2 mgd and peaks as high as 7.3 mgd, in an effort to simplify

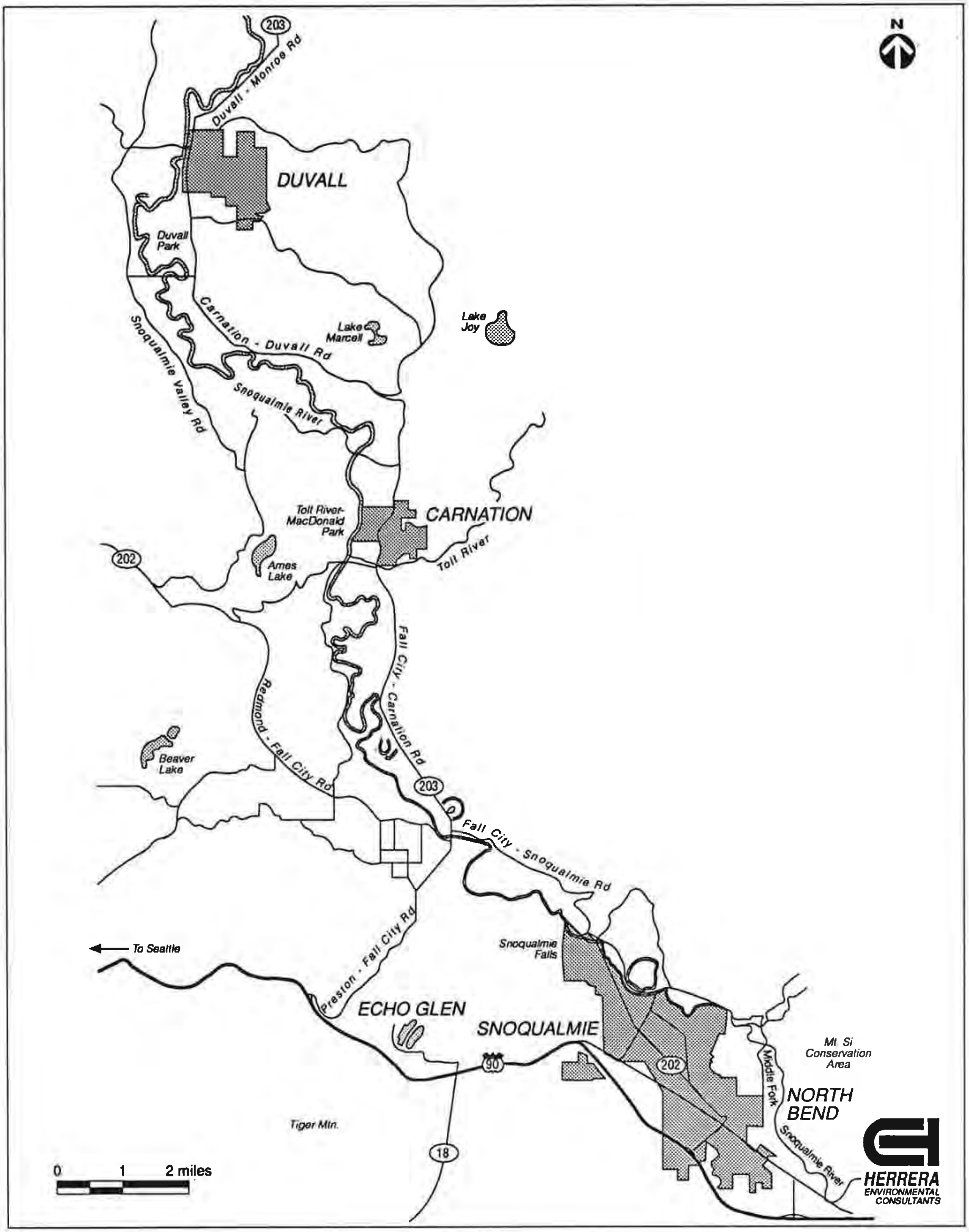

Figure 1. **Snoqualmie Valley study area.**

the next phase of expansion (Centruck 1995a personal communication). The existing facultative lagoon will be converted to a facultative wastewater solids stabilization lagoon.

Table 1. Estimated populations, wastewater flows, and biosolids volumes for the Snoqualmie Valley cities.

Year	Population	Average Wastewater Flow (mgd)	Biosolids Mass (lb/yr)
North Bend			
2000	3,150	0.66	123,000
2030	30,000	4.80	1,170,000
Snoqualmie			
2000	3,000	0.59	195,000
2030	13,040	2.54	847,000
Carnation			
2000	400	0.04	26,000
2030	4,125	0.41	268,000
Duvall			
2000	4,140	0.41	161,000
2030	9,000	0.90	351,000
Echo Glen			
2000	390	0.04	25,625
2030	390	0.04	25,625

Abbreviations:
lbs/yr pounds per year
mgd million gallons per day

Snoqualmie's sewered population is expected to increase to 3,000 by the year 2000. In the year 2030, the population is expected to be approximately 13,040 at full development of the urban growth area. Wastewater flows are estimated to increase to 0.59 mgd in the year 2000 and reach 2.54 mgd by the year 2030 (Herrera 1995). Table 1 summarizes the projected population, wastewater flows, and biosolids production for the city of Snoqualmie.

CARNATION

The city of Carnation is located approximately 9 miles north of Snoqualmie, downstream on the Snoqualmie River. Carnation currently does not have a city-owned wastewater collection and treatment facility. Wastewater collection and treatment are handled exclusively through onsite

systems. A comprehensive plan prepared in 1992 recognizes Carnation's need for a wastewater treatment facility and recommends that a 0.08-mgd plant be constructed to serve the downtown area (Herrera 1995). Carnation continues to investigate alternatives for municipal collection and treatment of wastewater.

Approximately 1,900 people live within the Carnation urban growth area at this time. It is assumed, for the purposes of this study, that Carnation takes a phased approach to the implementation of a wastewater collection system. By the year 2000, this population is expected to increase to 2000 people, 400 of whom are expected to be on a sewer system. The sewered population is assumed to include the town center and adjacent residential area. In the year 2030, it is estimated that 4,125 people will be connected to a community wastewater system. Wastewater flows are expected to increase from 0.04 mgd to 0.41 mgd between the years 2000 and 2030 (Herrera 1995). Table 1 summarizes the projected population, wastewater flows, and biosolids production for the city of Carnation.

DUVALL

Duvall is the northernmost city in the Snoqualmie Valley study area and the farthest downstream on the Snoqualmie River. The Duvall wastewater treatment plant currently treats approximately 0.35 mgd and uses an oxidation ditch, two clarifiers, and a chlorine contact chamber to achieve secondary treatment (Herrera 1994). The oxidation ditch was constructed in 1992 and is capable of treating up to 0.63 mgd. The treatment plant actually has a total of three oxidation ditches; the original oxidation ditches were constructed in 1976 but are not being used at this time. As wastewater flows increase, Duvall plans to bring one of the other oxidation ditches on-line, allowing the plant to treat up to 0.9 mgd (Gray and Osborne 1995). The treatment plant is permitted for an average flow of 0.9 mgd. Wastewater solids are presently lime-stabilized; however, Duvall plans to convert the remaining oxidation ditch into an aerobic digester (Herrera 1995). The present collection system uses five pump stations to convey wastewater to the treatment plant.

The existing wastewater treatment plant serves an estimated 3,466 people. The population in Duvall is expected to grow to approximately 4,140 people by the year 2000, and to 9,000 people by the year 2030. Corresponding wastewater flows should increase from 0.41 mgd to 0.9 mgd between the years 2000 and 2030 (Herrera 1995). Table 1 summarizes the projected populations, wastewater flows, and biosolids production for the city of Duvall.

ECHO GLEN

The Echo Glen Children's Center is a juvenile detention facility funded by the state of Washington and located on Our Lake, west of the city of Snoqualmie. Echo Glen operates its own secondary wastewater treatment plant and wastewater solids handling facility, processing domestic wastewater from the school kitchen, restrooms, showers, and laundry facilities. The Echo Glen treatment plant consists of a bar screen, comminutor, aeration basin, clarifiers, two polishing ponds operated in series, and effluent chlorination (Shawn 1995 personal communication). The polishing ponds are used mainly for flow equalization. Effluent is discharged to nearby Icy Creek, which flows into the Raging River and ultimately into the

Snoqualmie River downstream of the city of Snoqualmie. Wastewater solids are dewatered using polymer addition and a dewatering press. Echo Glen operates a biosolids composting facility onsite and recently received a grant to perform a pilot study to compost refuse.

The Echo Glen wastewater facility currently treats an average of 30,000 gallons per day (gpd) and is permitted to treat 37,500 gpd. Currently the maximum occupancy at the facility at any one time is approximately 310 people, including both students and staff, depending on the time of day and whether school is in session. Recent legislation has provided funding for 48 additional beds and approximately 60 additional employees (Brown 1995 personal communication). The expansion should be complete by the year 2000. For the purposes of this report, it is assumed that occupancy and wastewater flows will remain constant at the Echo Glen Children's Center. Table 1 summarizes the occupancy, wastewater flows, and biosolids production for Echo Glen.

ALTERNATIVE 1 — ECHO GLEN WASTEWATER FLOWS TO SNOQUALMIE

Alternative 1 examines the option of collecting flows from the Echo Glen facility and conveying them to the Snoqualmie wastewater treatment plant for treatment and disposal.

COLLECTION AND CONVEYANCE SYSTEM

In this alternative, wastewater generated at the Echo Glen facility is conveyed to the Snoqualmie treatment plant. A possible pipeline alignment would convey Echo Glen's estimated 28 gpm of wastewater northeast to an existing power line right-of-way, and then eastward toward Snoqualmie along SE 80th street. This alignment follows the southern edge of the city limits in the newly annexed Snoqualmie Ridge area, through an area not yet incorporated by the city, and ties into the existing sewage collection system in the service area of pump station 2. The Snoqualmie wastewater conveyance system can easily handle Echo Glen's contribution. Overall length of the pipeline is approximately 3.3 miles. Figure 2 shows the potential pipeline alignment.

Wastewater from Echo Glen could tie into the collection system that will be installed when the Snoqualmie Ridge area is developed, as a means to share the capital costs for the pipeline. In this report, however, it is assumed that the Echo Glen flows are conveyed directly to the existing Snoqualmie collection system.

Echo Glen is situated on a plateau at approximately elevation 900, and the pipeline must traverse approximately 1.4 miles of relatively flat terrain before the plateau ends and the ground surface begins to drop toward the Snoqualmie River. The terrain is also flat in the Snoqualmie Valley. Two new pump stations may be necessary to convey the wastewater flows through these flat areas and into the existing collection system. Possible locations for these pump stations are shown on Figure 2. Force main piping would be approximately 4 inches in diameter, and gravity flow can be conveyed in a 12-inch sewer.

PROPOSED TREATMENT SYSTEM

As mentioned above, Snoqualmie is in the process of upgrading its treatment plant to a 1.2-mgd oxidation ditch system, which will be on-line sometime in 1996. The new plant has more than adequate capacity to handle the combined wastewater flows of 0.63 mgd from both Echo Glen and Snoqualmie in the year 2000. By the year 2030, the average combined flows of 2.58 mgd (2.54 mgd contributed by Snoqualmie) are slightly larger than the new plant's average design capacity of 2.2 mgd. Table 2 shows projected wastewater volumes requiring treatment under Alternative 1. The Snoqualmie treatment plant can be easily upgraded in phases to handle the additional flow. Design of the new plant will allow as many as two additional oxidation ditches (for a total of three) and two additional clarifiers (for a total of four) to be constructed on the property without encroaching on the existing facultative lagoons. For this alternative it is assumed that wastewater solids are treated in the existing facultative lagoons.

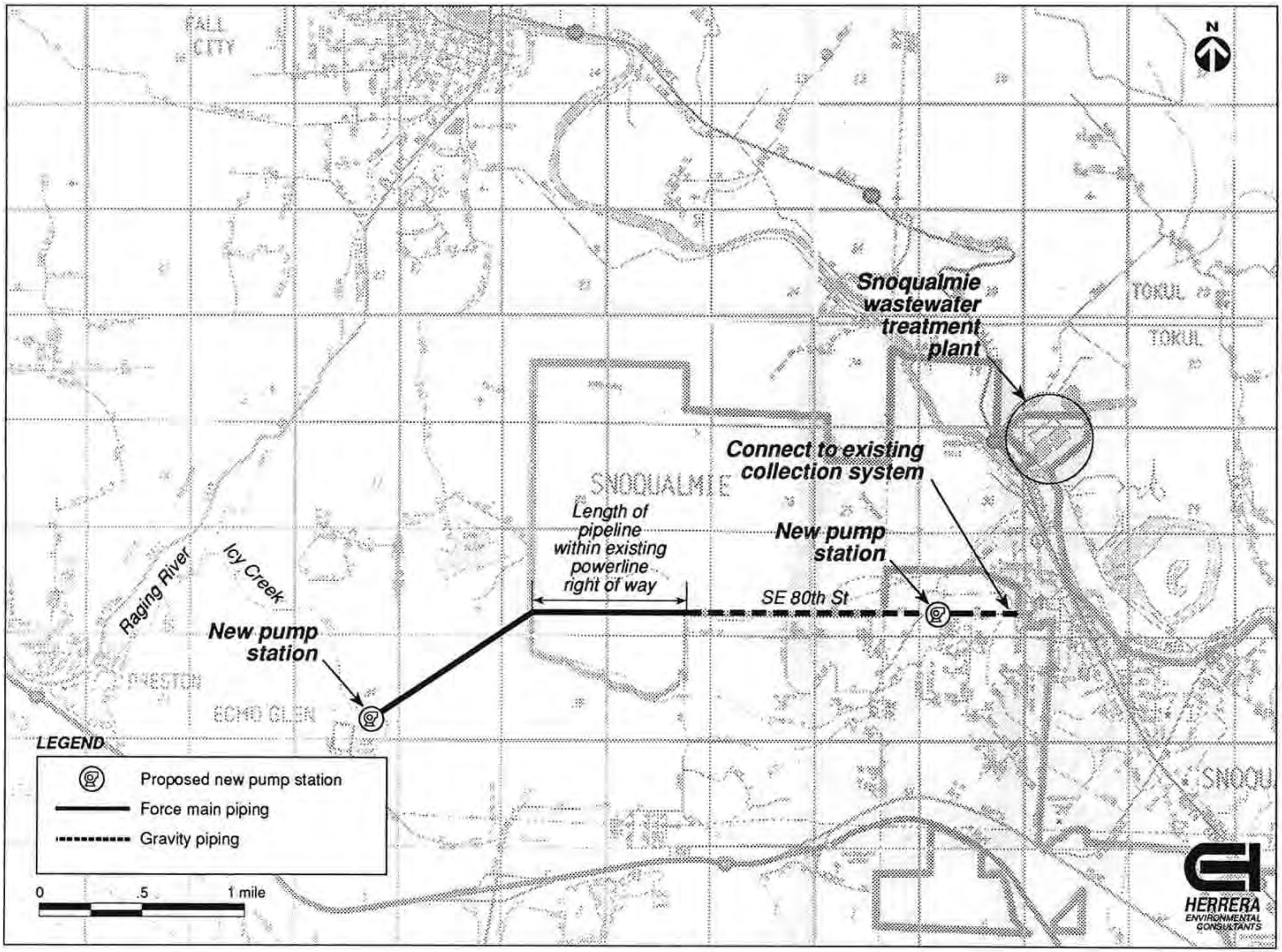

Figure 2. Alternative 1 conveyance system alignment.

Table 2. Projected wastewater flows for Alternatives 1 and 2 (mgd).		
Contributing Entity	**Flows in Year 2000**	**Flows in Year 2030**
Snoqualmie	0.59	2.54
Echo Glen	0.04	0.04
Subtotal (Alternative 1)	0.63	2.58
North Bend	0.66	4.8
Total (Alternative 2)	1.29	7.38

CONSTRUCTABILITY AND IMPLEMENTATION

Collection and Conveyance System

From the Echo Glen facility, the proposed conveyance piping alignment generally follows an existing gravel road toward the northeast, making construction and maintenance vehicle access relatively easy. Approximately 0.5 miles of the alignment's northeasterly portion crosses an undisturbed area, however, making construction access more difficult.

The potential alignment partially follows an existing power line right-of-way running east and west. This alignment choice is beneficial because the power line right-of-way has already been cleared, allowing easier construction and maintenance access. However, Snoqualmie and Echo Glen would be required to obtain an easement from the affected power utility to use the right-of-way.

Treatment System

Combining Echo Glen's wastewater with that of Snoqualmie would shorten the useful life of the new treatment plant slightly. Snoqualmie may need to expand its plant prior to the year 2030 in any case. Snoqualmie's anticipated average flow for the year 2030 is expected to be 2.54 mgd, while the new plant will be sized to handle an average flow of 2.2 mgd. If Echo Glen wastewater is added, Snoqualmie's expansion costs could be offset somewhat by a funding contribution from Echo Glen.

ENVIRONMENTAL IMPACTS

Collection and Conveyance System

The conveyance piping traverses the plateau and could affect existing wetlands. If this alternative is developed further, a more detailed study is needed to determine the extent of any impact on existing wetlands.

Treatment System

Although Echo Glen's wastewater flows are relatively small, the effluent discharge has an impact on the water quality of Icy Creek and Raging River. By treating Echo Glen's wastewater in Snoqualmie, the water quality in Icy Creek and Raging River is improved.

Treatment plant expansion activities should be carried out in such a way that environmental impacts on the Snoqualmie River are minimized. This is especially important with respect to erosion control and the installation of an upgraded effluent outfall into the Snoqualmie River. These precautions are necessary when Snoqualmie upgrades its treatment plant prior to 2030, regardless of whether Echo Glen is contributing wastewater flows to the facility.

PROJECT COSTS

Capital Improvement Costs

The Alternative 1 capital improvement cost estimate is shown in Table 3. Values shown are in 1995 dollars. This estimate is based on the following assumptions:

- The conveyance system from Echo Glen consists of the following components: two pump stations, blowoff valve assemblies at each low point in the force main, pressure relief valve assemblies at every high point in the force main, a cleanout located every 500 feet of force main, and a manhole located every 500 feet of gravity piping.

- Snoqualmie's treatment plant is upgraded to handle flows expected by the year 2030. Capital cost improvements listed in Table 3, which are in addition to those currently being designed, consist of the following components: two additional oxidation ditches, one additional clarifier, and upgraded plant piping.

- There is adequate space at the current treatment plant location; purchase of additional land is not necessary.

Conveyance facility capital costs amount to approximately 68 percent of the total capital costs for this alternative.

Operation and Maintenance Costs

The yearly estimated operation and maintenance (O&M) costs associated with the conveyance facilities for each alternative are estimated as 10 percent of the estimated capital cost and are presented in 1995 dollars.

Operation and maintenance costs for each alternative's wastewater treatment facility were estimated using the guidelines set forth in Operation and Maintenance Costs for Municipal Wastewater Facilities (U.S. EPA 1981). The yearly costs shown are based on anticipated wastewater flows for the years 2000 and 2030. Treatment O&M costs include administration costs as well as the O&M costs associated with secondary treatment, suspended growth treatment plants, wastewater solids digestion, and dewatering. Values are adjusted by a regional factor. Costs are presented in 1995 dollars.

Operation and maintenance costs associated with the Alternative 1 conveyance system total approximately $222,000 per year. Treatment system O&M costs are estimated to increase from $349,000 per year to approximately $917,000 per year, based on the wastewater flows expected for the years 2000 and 2030, respectively.

Table 3. Capital improvement cost estimate for Alternative 1—Echo Glen wastewater flows to Snoqualmie.				
Description	**Units**	**Estimated Quantity**	**Estimated Unit Price**	**Extended Amount**
Conveyance System				
Pump Stations	EA	2	$ 75,000	$ 150,000
Forcemain Piping (4" Dia.)	LF	9000	50	450,000
Gravity Piping (12" Dia.)	LF	8500	60	510,000
Pressure Relief Valve Assemblies	EA	4	5,000	20,000
Blowoff Valve Assemblies	EA	4	5,000	20,000
Cleanouts	EA	18	2,500	45,000
Manholes	EA	17	5,000	85,000
Subtotal Conveyance				$ 1,280,000
Contingency @ 30%				384,000
Sales Tax @ 8.2%				136,448
Engineering & Administration @ 25%				416,000
Total Conveyance				$ 2,216,448
Wastewater Treatment Plant Upgrade				
Oxidation Ditches	EA	2	150,000	300,000
Clarifiers	EA	1	150,000	150,000
Plant Piping	LS	1	150,000	150,000
Subtotal WWTP Upgrade				$ 600,000
Contingency @ 30%				180,000
Sales Tax @ 8.2%				63,960
Engineering & Administration @ 25%				195,000
Total Wastewater Treatment Plant Upgrade				$ 1,038,960
TOTAL ESTIMATED CAPITAL COST ALTERNATIVE 1				$ 3,255,408

Alternative 2 — Echo Glen and North Bend Wastewater Flows to Snoqualmie

Alternative 2 is an extension of Alternative 1, adding wastewater flows from North Bend to those of Echo Glen and Snoqualmie, with treatment at the Snoqualmie wastewater treatment plant.

Collection and Conveyance System

In this alternative, Echo Glen wastewater is collected and conveyed to the Snoqualmie treatment plant as described in Alternative 1 (See Figure 2).

Wastewater flows in North Bend are collected and consolidated at the North Bend treatment plant. North Bend and Snoqualmie are located in a relatively flat area of the Snoqualmie Valley. A conveyance system between the two cities would most likely use a combination of force main and gravity drains to transfer wastewater the 2.5 miles necessary to combine the systems. A pump station transfers the collected wastewater from the North Bend treatment plant to the Snoqualmie wastewater collection system. The pipeline alignment follows state route 202 to the northwest and connects into the Snoqualmie collection system at Newton Avenue. North Bend wastewater flows would be added to the Snoqualmie pump station 3 service area. Figure 3 shows this potential pipeline alignment.

North Bend's average wastewater flows are expected to increase from 0.66 mgd to 4.8 mgd between the years 2000 and 2030; therefore the conveyance system must be sized accordingly. The gravity portions of the conveyance pipeline must be approximately 30 to 36 inches in diameter to handle the average flow expected in the year 2030.

North Bend's wastewater contribution increases flows handled by the Snoqualmie conveyance system by approximately 188 percent in the year 2030. As a result, Snoqualmie's existing conveyance system, specifically pump station 3 and pump station 1, requires an upgrade to handle the anticipated flows. The increase may not be large in the year 2000, when North Bend's contribution is nearly 460 gpm; but in the year 2030 the North Bend wastewater flows are expected to be over 3,300 gpm.

Proposed Treatment System

In the year 2000, the projected combined flows of Echo Glen, North Bend, and Snoqualmie are slightly larger than the current Snoqualmie plant upgrade (1.29 mgd compared to 1.2 mgd). Table 2 shows the projected wastewater volumes requiring treatment under Alternative 2. There are plans, however, to add as many as two more oxidation ditches, which could potentially increase the plant capacity to 3.6 mgd, assuming each ditch can treat 1.2 mgd as planned. The addition of just one more oxidation ditch could handle anticipated flows for Echo Glen, North Bend, and Snoqualmie past the year 2000. As mentioned in Alternative 1, the plant piping will be sized to handle 2.2 mgd, which is more than adequate to handle the flows projected for the year 2000.

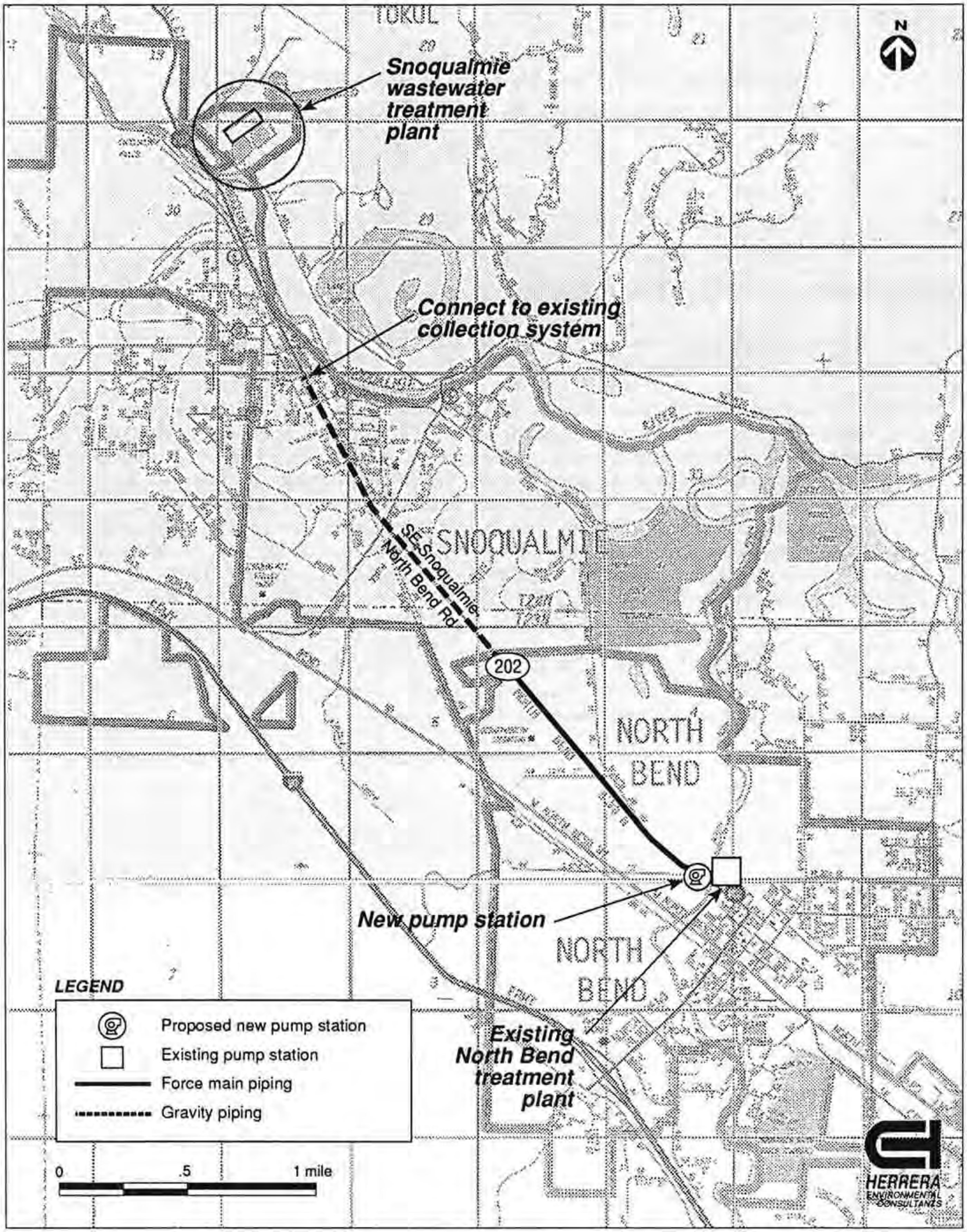

Figure 3. Alternative 2 conveyance system alignment (North Bend to Snoqualmie).

By the year 2030, however, the combined average wastewater flows are projected to increase to approximately 7.38 mgd (see Table 2). Flows this large would require another significant plant upgrade, involving an alternative treatment method as well as wastewater solids digestion and dewatering facilities.

CONSTRUCTABILITY AND IMPLEMENTATION

Collection and Conveyance System

The constructability and implementation issues discussed in Alternative 1, associated with the wastewater flows from Echo Glen, are applicable to Alternative 2 as well.

Construction of the pipeline between North Bend and Snoqualmie appears to be relatively straightforward. The proposed alignment follows state route 202, allowing easy access for construction equipment and materials. Portions of the highway would be subject to temporary closure during construction.

Construction and implementation issues become more complex once the North Bend wastewater flows are added to the existing Snoqualmie collection and conveyance system. As mentioned above, two of the existing pump stations would require upgrades. The existing conveyance system would need to remain operational while the upgrade is performed. It may be possible to phase the upgrade work gradually, upgrading portions of the conveyance system as necessary to handle the increasing wastewater flows.

Treatment System

As mentioned in Alternative 1, the addition of wastewater flows from Echo Glen has little impact on constructability and implementation issues associated with the treatment system.

The introduction of wastewater flows from North Bend, however, greatly affects Snoqualmie's current plans. Snoqualmie would need to construct at least one additional oxidation ditch to handle the flows expected by the year 2000. Wastewater flows projected by the year 2030 are significantly larger (approaching 6 times the flows projected in the year 2000) and may require the employment of an alternative treatment method. On the positive side, Snoqualmie's wastewater treatment plant property is well suited for expansion (Centruck 1995b personal communication). The new treatment plant is being constructed on the north side of the existing facultative lagoons. These lagoons occupy approximately 8.5 acres and are presently planned to be used as facultative sludge lagoons. One or both of the lagoons could be dredged and filled to provide more area for treatment processes, including a larger secondary treatment system and an alternative solids handling facility. For example, the oxidation ditches, constructed as part of earlier wastewater treatment plant phases, could be converted for use as aerobic sludge digesters.

Environmental Impacts

Collection and Conveyance System

The environmental impacts of the collection and conveyance piping described in Alternative 2 are similar to those described in Alternative 1. Piping from the Echo Glen facility is exactly the same for both alternatives. The piping between North Bend and Snoqualmie along the river valley may also affect existing wetlands. If the alignment is kept mainly within the roadway prism and if strict erosion control measures are observed, wetland damage can be minimized. If this alternative is developed further, a more detailed study is needed to determine the extent of any impact on existing wetlands.

Treatment System

North Bend currently discharges its wastewater treatment plant effluent to the South Fork of the Snoqualmie River. The South Fork flows into the main reach of the Snoqualmie River upstream of the Snoqualmie treatment plant outfall. Water quality in the South Fork and the Snoqualmie River upstream of the Snoqualmie treatment plant outfall is improved if North Bend wastewater is treated at the Snoqualmie wastewater treatment plant. The effects of discharging the combined effluent volumes of Echo Glen, North Bend, and Snoqualmie to the Snoqualmie River at a single location require further investigation.

Treatment plant expansion activities should be carried out in such a way that environmental impacts on the Snoqualmie River are minimized. This is especially important with respect to erosion control and the installation of an upgraded effluent outfall into the Snoqualmie River. These precautions are necessary when Snoqualmie upgrades its treatment plant prior to 2030, regardless of whether Echo Glen or North Bend is contributing wastewater flows to the facility.

In the event that it is decided to dredge and fill the existing lagoons to reclaim the land for future expansion, the removal and proper disposal or reuse of accumulated solids becomes an issue. The existing lagoons have been in operation for 28 years as part of a wastewater treatment process; if converted for use in a solids stabilization process, the lagoons may not be dredged for another 10 to 15 years, during which time a significant volume of sludge may accumulate.

Project Costs

Capital Improvement Costs

The Alternative 2 capital improvement cost estimate is shown in Table 4. Values shown are in 1995 dollars. This estimate is based on the following assumptions:

- The conveyance systems from Echo Glen and North Bend are sized to handle wastewater flows expected for the year 2030. The conveyance system from North Bend to Snoqualmie consists of the following components: one pump station, blowoff valve assemblies at each low point in the force main, pressure relief valve assemblies

at every high point in the force main, a cleanout located every 500 feet of force main, and a manhole located every 500 feet of gravity piping.

- Snoqualmie's existing pump stations 1 and 3 are upgraded, but the existing conveyance piping (force main and gravity) is adequate to handle the expected flows and does not require replacement.

- The Snoqualmie treatment plant is upgraded twice, and the capital cost improvements listed in Table 4 are in addition to those currently being designed.

  – Phase I upgrades consist of the following components: one additional oxidation ditch, one additional clarifier, and upgraded plant piping sized for the wastewater flows expected in the year 2030

  – Phase II upgrades consist of the following components: activated sludge treatment plant, three additional clarifiers, and solids digestion and dewatering facilities.

- There is adequate space at the current treatment plant location; purchase of additional land is not necessary.

Conveyance facility capital costs account for approximately 57 percent of the total capital costs for this alternative.

Operation and Maintenance Costs

Conveyance system O&M costs associated with Alternative 2 are estimated at approximately $437,000 per year. O&M costs for the treatment facility are estimated to increase from $535,000 per year to approximately $1,746,000 per year, based on the wastewater flows expected for the years 2000 and 2030, respectively.

Table 4. Capital improvement cost estimate for Alternative 2—Echo Glen and North Bend wastewater flows to Snoqualmie.

Description	Units	Estimated Quantity	Estimated Unit Price	Extended Amount
Conveyance Systems				
North Bend to Snoqualmie				
Pump Stations	EA	1	75,000	75,000
Forcemain Piping (12" Dia.)	LF	6600	60	396,000
Gravity Piping (36" Dia.)	LF	6600	70	462,000
Pressure Relief Valve Assemblies	EA	2	5,000	10,000
Blowoff Valve Assemblies	EA	2	5,000	10,000
Cleanouts	EA	12	2,500	30,000
Manholes	EA	12	5,000	60,000
Subtotal North Bend to Snoqualmie				1,043,000
Snoqualmie Conveyance System Upgrade				
Upgrade Snoqualmie Pump Stations	EA	2	100,000	200,000
Subtotal Snoqualmie Conveyance System Upgrade				200,000
Subtotal Echo Glen to Snoqualmie (Alternative 1)				1,280,000
Subtotal Conveyance				2,523,000
Contingency @ 30%				756,900
Sales Tax @ 8.2%				268,952
Engineering and Administration @ 25%				819,975
Total Conveyance				4,368,827
Wastewater Treatment Plant Upgrade - Phase I				
Oxidation Ditches	EA	1	150,000	150,000
Clarifiers	EA	1	150,000	150,000
Plant Piping	LS	1	200,000	200,000
Subtotal WWTP Upgrade - Phase I				500,000
Contingency @ 30%				150,000
Sales Tax @ 8.2%				53,300
Engineering and Administration @ 25%				162,500
Total WWTP Upgrade - Phase I				865,800
Wastewater Treatment Plant Upgrade - Phase II				
Activated Sludge Wastewater Plant	LS	1	500,000	500,000
Clarifiers	EA	3	150,000	450,000
Solids Digestion	LS	1	450,000	450,000
Subtotal WWTP Upgrade - Phase II				1,400,000
Contingency @ 30%				420,000
Sales Tax @ 8.2%				149,240
Engineering and Administration @ 25%				455,000
Total WWTP Upgrade - Phase II				2,424,240
TOTAL ESTIMATED CAPITAL COST ALTERNATIVE 2				**$7,658,867**

Alternative 3 — Carnation Wastewater Flows to Duvall

In Alternative 3, wastewater flows from Carnation are collected and conveyed to Duvall. Carnation flows are combined with Duvall wastewater and treated at the city of Duvall wastewater treatment plant.

Collection and Conveyance System

The city of Carnation does not have a community wastewater collection and treatment system. All wastewater treatment is handled through individual onsite systems. Installation of a sanitary sewer collection and conveyance system for the city of Carnation is discussed in a separate report, currently in preparation. The alternative discussed here only considers conveyance of wastewater from Carnation to Duvall.

For this alternative, it is assumed that the Carnation collection system consolidates wastewater to the northern side of town at a pump station. Wastewater is conveyed from Carnation to Duvall through an 8.7-mile pipeline that follows the alignment of the Carnation-Duvall Road. Figure 4 shows the potential piping alignment. An alternative route, following the 8.4-mile alignment of an abandoned railroad right-of-way, is also a possibility but is less desirable for two reasons. First, the railroad route is located closer to the Snoqualmie River and may be more susceptible to flooding. Second, the railroad alignment is currently used for recreational purposes, having been converted to a bicycle and horseback riding path.

The city of Carnation is situated in a relatively flat area along the Snoqualmie River. The entire city is at approximately elevation 75 feet (mean sea level). Although Duvall is located downstream of Carnation, the ground elevation in Duvall is actually higher, varying from approximately 220 feet in the eastern portion of the city to 80 feet in the west. Traveling from Carnation to Duvall, the roadway profile between the cities is generally flat for the first 6.8 miles. Road grades do not exceed 0.6 percent. The next 2 miles, however, traverse two hills, with road grades varying from 1.4 percent to 7.6 percent.

For this analysis it is assumed that at least two pump stations are necessary to convey the wastewater flows from Carnation to Duvall. The first pump station pumps wastewater from the main collector in Carnation, along the relatively flat portion of piping alignment to the top of the first hill, approximately 7.3 miles north of the Carnation service area. Wastewater then flows approximately 0.3 miles by gravity to the next pump station. The second pump station then lifts the wastewater a distance of 0.3 miles to the top of the next hill. Wastewater then flows by gravity into the Duvall wastewater treatment plant, which is located conveniently on the south side of town, just west of state route 203.

The pipeline should be sized to handle the maximum anticipated flow of 0.41 mgd expected to be collected from Carnation by the year 2030. Table 5 shows the projected wastewater flows for Alternative 3. The force main would be constructed of approximately 6-inch-diameter piping. Gravity flow can be conveyed in 12-inch-diameter piping.

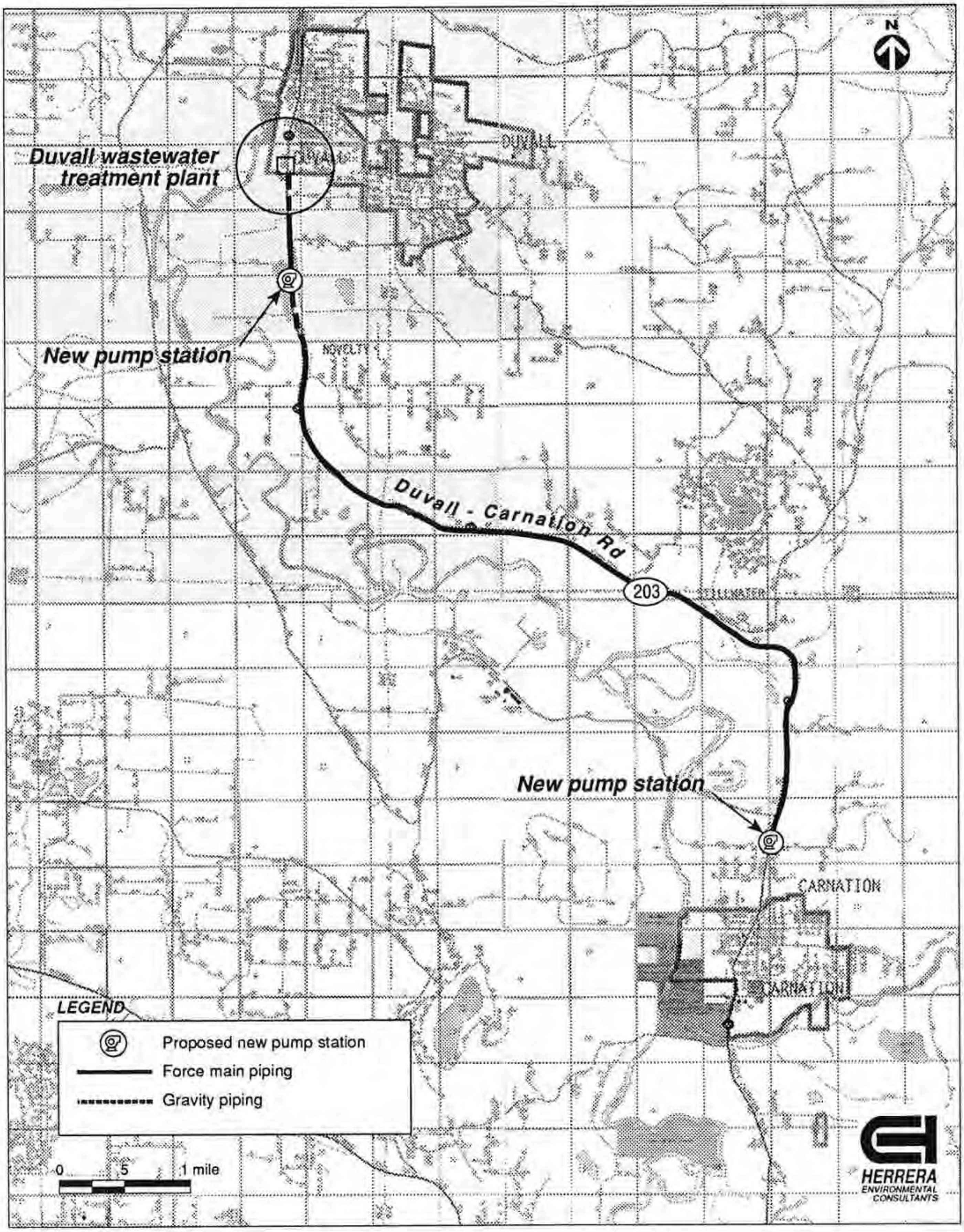

Figure 4. Alternative 3 conveyance system alignment (Carnation to Duvall).

Table 5. Projected wastewater flows for Alternatives 3 and 4 (mgd).		
Contributing Entity	**Flows in Year 2000**	**Flows in Year 2030**
Duvall	0.41	0.90
Carnation	0.04	0.41
Subtotal (Alternative 3)	0.45	1.31
Snoqualmie	0.59	2.54
Echo Glen	0.04	0.04
North Bend	0.66	4.80
Total (Alternative 4)	1.74	8.69

PROPOSED TREATMENT SYSTEM

The Duvall treatment plant as currently configured has more than adequate capacity to handle the combined wastewater flows of 0.45 mgd from Carnation and Duvall in the year 2000. By the year 2030, however, the anticipated combined flows of 1.31 mgd will exceed the plant's 0.9-mgd capacity, even after the planned expansion. If Duvall is to treat Carnation wastewater, the treatment plant must be upgraded prior to the year 2030 to handle the additional flow. An additional oxidation ditch similar to the one installed in 1992 (for a total of three) and two additional clarifiers (for a total of four) would be adequate to treat the anticipated wastewater flows. This alternative assumes that Duvall continues to aerobically digest and dewater wastewater solids. The Duvall treatment plant can be easily upgraded, and space is available for the additional unit processes.

CONSTRUCTABILITY AND IMPLEMENTATION

Collection and Conveyance System

From Carnation to Duvall, the proposed conveyance piping and pump stations are located within the alignment of state route 203, making construction and maintenance vehicle access relatively easy. Portions of the highway would be subject to temporary closure during construction periods.

Treatment System

Present plans of the city of Duvall call for relatively minor modifications to existing structures in order to serve the city's own needs through the year 2030. Combining Carnation wastewater with that of Duvall would require Duvall to make an additional plant upgrade involving the construction of new structures and facilities. However, Carnation would be responsible for the plant expansion costs.

ENVIRONMENTAL IMPACTS

Collection and Conveyance System

The pipeline between Carnation and Duvall passes through a long portion of the Snoqualmie River Valley, including lowlands and possible wetland areas. If the alignment is kept mainly within the roadway prism, and if strict erosion control measures are observed, wetland damage can be minimized. However, this alignment runs directly along the Snoqualmie River at one point, and adjacent to Horseshoe Lake prior to reaching Duvall. Care must be taken to minimize disturbance during construction and to insure that the pipeline does not leak, so that the quality of these water bodies is preserved. If this alternative is developed further, a more detailed study is needed to determine the extent of any impact the construction of these conveyance facilities might have on the surrounding wetlands and bodies of water.

Treatment System

Treatment plant expansion activities should be carried out in such a way that environmental impacts on the Snoqualmie River are minimized. This is especially important with respect to erosion control and the installation of an upgraded effluent outfall into the Snoqualmie River, if necessary.

PROJECT COSTS

Capital Improvement Costs

The Alternative 3 capital improvement cost estimate is shown in Table 6. Values shown are in 1995 dollars. This estimate is based on the following assumptions:

- The conveyance system from Carnation to Duvall is sized to handle wastewater flows expected for the year 2030. The conveyance system for Alternative 3 consists of the following components: two pump stations, blowoff valve assemblies at each low point in the force main, pressure relief valve assemblies at every high point in the force main, a cleanout located every 500 feet of force main, and a manhole located every 500 feet of gravity piping.
- The Duvall treatment plant is upgraded to handle wastewater flows expected by the year 2030. Improvements are incorporated after the plant has already undergone the planned expansion (i.e., one of the existing oxidation ditches is on-line, the remaining oxidation ditch is transformed into an aerobic digester, etc.). Assumed improvements consist of the following components: one additional oxidation ditch, two additional clarifiers, and upgraded plant piping.
- There is adequate space at the current treatment plant location; purchase of additional land is not necessary.

Conveyance facility capital costs amount to approximately 83 percent of the total capital costs for this alternative.

Operation and Maintenance Costs

Operation and maintenance costs associated with the Alternative 3 conveyance system are estimated to be approximately $523,000 per year. The treatment system O&M costs are estimated to increase from $262,000 per year to approximately $535,000 per year, based on the flows anticipated in the year 2000 and the year 2030, respectively.

Table 6. Capital improvement cost estimate for Alternative 3—Carnation wastewater flows to Duvall.

Description	Units	Estimated Quantity	Estimated Unit Price	Extended Amount
Conveyance System				
Pump Stations	EA	2	$100,000	$ 200,000
Forcemain Piping (6" Dia.)	LF	40200	50	2,010,000
Gravity Piping (12" Dia.)	LF	8100	60	486,000
Pressure Relief Valve Assemblies	EA	5	5,000	25,000
Blowoff Valve Assemblies	EA	4	5,000	20,000
Cleanouts	EA	80	2,500	200,000
Manholes	EA	16	5,000	80,000
Subtotal Conveyance				$3,021,000
Contingency @ 30%				906,300
Sales Tax @ 8.2%				322,039
Engineering & Administration @ 25%				981,825
Total Conveyance				$5,231,164
Wastewater Treatment Plant Upgrade				
Oxidation Ditches	EA	1	150,000	150,000
Clarifiers	EA	2	150,000	300,000
Plant Piping	LS	1	150,000	150,000
Subtotal WWTP Upgrade				600,000
Contingency @ 30%				180,000
Sales Tax @ 8.2%				63,960
Engineering & Administration @ 25%				195,000
Total WWTP Upgrade				$1,038,960
TOTAL ESTIMATED CAPITAL COST ALTERNATIVE 3				$6,270,124

ALTERNATIVE 4 — ALL WASTEWATER FLOWS TO DUVALL

In Alternative 4, all flows from the Snoqualmie Valley cities of North Bend, Snoqualmie, Carnation, and the Echo Glen Children's Center are collected and directed to Duvall. The Duvall treatment plant would be upgraded to handle the projected regional wastewater flows. Many of the facilities described in previous alternatives are directly applicable to this alternative.

COLLECTION AND CONVEYANCE SYSTEM

The collection and conveyance systems described in Alternatives 1, 2, and 3 are applicable in this alternative as well. Wastewater from Echo Glen and North Bend is combined with wastewater from Snoqualmie, as described in Alternative 2. Wastewater flows collected at Snoqualmie are conveyed to Carnation and combined with Carnation wastewater. The combined flows are then conveyed to Duvall, as generally described in Alternative 3.

There are two potential alignments between the cities of Snoqualmie and Carnation, and both must bypass Snoqualmie Falls. The preferred alignment, which is approximately 9.6 miles long, generally follows state route 202 to its junction with state route 203 at Fall City, then follows state route 203 into Carnation. This alignment would permit gravity flow for the first 2 miles, going around Snoqualmie Falls to the valley floor in a 24- to 30-inch pipeline. The remaining 7.6 miles would involve a combination of force main and gravity flow, using approximately two pump stations, to convey wastewater along the Snoqualmie Valley to the Carnation collection system. The gravity portions along the valley floor would require a 30- to 36-inch pipeline. The force main piping would be approximately 12 inches in diameter. Figure 5 shows the preferred piping alignment between Snoqualmie and Carnation.

The second potential alignment generally follows an existing railroad right-of-way along the hillside above the valley floor. This alignment option is longer, nearly 10.3 miles, but would permit approximately 9 miles of gravity flow in 24- or 30-inch-diameter piping. This option is less desirable because access to the pipeline is limited.

As described in Alternative 2, wastewater flows from Echo Glen, North Bend, and Snoqualmie are expected to be as high as 7.38 mgd (5,125 gpm) in the year 2030. The conveyance piping between Carnation and Duvall must be of adequate size to handle this large contribution as well as the flows expected from Carnation. Table 5 shows the projected wastewater volumes for Alternative 4. The alignment between Carnation and Duvall is the same as described in Alternative 3; however, the pipelines are somewhat larger. Force main piping between the cities of Carnation and Duvall would be approximately 12 inches in diameter. The gravity portions of the conveyance pipeline for this segment would be approximately 24 inches in diameter.

PROPOSED TREATMENT SYSTEM

In the year 2000, the estimated combined flows of Echo Glen, North Bend, Snoqualmie, Carnation, and Duvall are almost twice those of the Duvall plant's permitted capacity after the

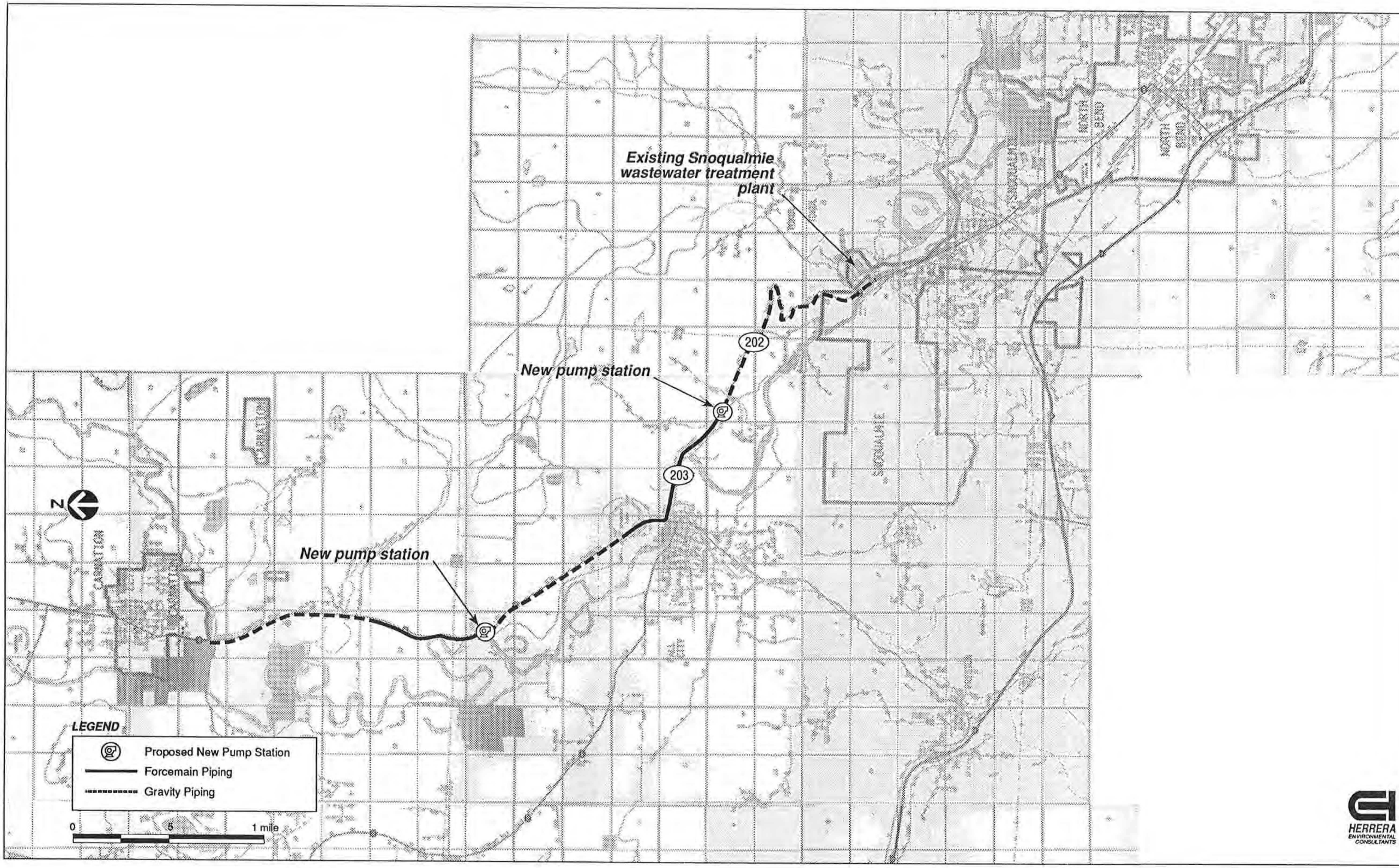

Figure 5. Alternative 4 conveyance system alignment (Snoqualmie to Carnation).

planned expansion. By the year 2030, the estimated flows are expected to be nearly 10 times Duvall's permitted capacity (see Table 5). Flows this large require a significant plant upgrade immediately, possibly involving a different secondary treatment process. The existing unit processes could be converted to solids digestion facilities.

CONSTRUCTABILITY AND IMPLEMENTATION

Collection and Conveyance System

Constructability and implementation issues described in Alternative 2 are also applicable to this alternative.

Of the two potential alignments between Snoqualmie and Carnation discussed above, the alignment that follows state route 202 and state route 203 is the better choice for constructability, implementation, and maintenance requirements. This alignment provides easier access for construction equipment and delivery of materials. Pump station installation adds a certain degree of complexity to the construction process; however, the ease of access and shorter pipeline length should more than compensate for the capital costs of two pump stations. Once the conveyance system is constructed and operational, maintenance vehicles will also benefit from the ease of access. The second potential alignment along the railroad right-of-way would involve construction on a steep hillside without many access roads for the insertion of equipment and materials.

Construction of the conveyance system between Carnation and Duvall raises the same concerns and issues as those discussed in Alternative 3, except that the piping and pump stations to be installed are larger.

Treatment System

The construction and implementation issues discussed in the previous alternatives are applicable in this alternative as well.

The introduction of the large flows from the cities upstream would greatly affect the Duvall treatment system. If this alternative is chosen, the needs of the cities may be best served if the new treatment plant is initially constructed to handle the 2030 design flows, or at least half of the anticipated design flows, so that the number of necessary upgrades is minimized. This is especially important because the existing wastewater treatment service must be maintained during the construction periods.

ENVIRONMENTAL IMPACTS

Collection and Conveyance System

The environmental impacts discussed in the previous alternatives are all applicable to this alternative as well. The pipeline between Snoqualmie and Carnation is a new feature, however, and this pipeline passes through a long portion of the Snoqualmie River Valley, including lowlands and possible wetland areas. If the alignment is kept mainly within the roadway prism, and if strict erosion control measures are observed, wetland damage can be minimized. However, this alignment runs directly along the Snoqualmie River at three points, crosses several sloughs, and also crosses the Tolt River prior to reaching Carnation. Care must be taken to minimize disturbance during construction and to insure that the pipeline does not leak, so that the quality of these water bodies is preserved. If this alternative is developed further, a more detailed study is needed to determine the extent of any impact the construction of these conveyance facilities might have on the surrounding wetlands and bodies of water.

Treatment System

This alternative eliminates effluent discharge in the Snoqualmie River upstream of Duvall and improves the water quality in this portion of the river. However, effluent discharge is concentrated at one location, and it is important that the treatment plant and the outfall are designed to minimize the impact on the Snoqualmie River. The effects of discharging the combined effluent volumes of Snoqualmie, Echo Glen, North Bend, Carnation, and Duvall to the Snoqualmie River at a single location should be investigated further.

PROJECT COSTS

Capital Improvement Costs

The Alternative 4 capital improvement cost estimate is shown in Table 7. Values shown are in 1995 dollars. This estimate is based on the following assumptions:

- The conveyance systems are sized to handle wastewater flows expected for the year 2030. Conveyance systems described in previous alternatives consist of the same components. Between Snoqualmie and Carnation, the conveyance system consists of the following components: two pump stations, blowoff valve assemblies at each low point in the force main, pressure relief valve assemblies at every high point in the force main, a cleanout located every 500 feet of force main, and a manhole located every 500 feet of gravity piping.
- The Duvall treatment plant is upgraded twice, according to the following schedule:
  - Phase I upgrades consist of the following components: an activated sludge process, clarifiers and sludge handling facilities sized for one

half of the flows anticipated for the year 2030, and upgraded plant piping sized for the wastewater flows expected in the year 2030

  - Phase II upgrades consist of the following components: another activated sludge process, and clarifiers and solids digestion and dewatering facilities to accommodate the remainder of the wastewater flows anticipated in the year 2030.

- There is adequate space at the current treatment plant location; purchase of additional land is not necessary.

Conveyance facility capital costs amount to approximately 79 percent of the total capital costs for this alternative.

Operation and Maintenance Costs

Operation and maintenance costs associated with the Alternative 4 conveyance system are estimated to be approximately $1,709,000 per year. Treatment O&M costs are expected to increase from $699,000 per year to $1,965,000 per year, based on the flows anticipated in the years 2000 and 2030, respectively.

Table 7. Capital improvement cost estimate for Alternative 4—all wastewater flows to Duvall.

Description	Units	Estimated Quantity	Estimated Unit Price	Extended Amount
Conveyance Systems				
Snoqualmie to Carnation				
Pump Stations	EA	2	$ 75,000	$ 150,000
Forcemain Piping (12" Dia.)	LF	20000	60	1,200,000
Gravity Piping (36" Dia.)	LF	30600	70	2,142,000
Pressure Relief Valve Assemblies	EA	4	5,000	20,000
Blowoff Valve Assemblies	EA	4	5,000	20,000
Cleanouts	EA	61	2,500	152,500
Manholes	EA	40	5,000	200,000
Subtotal Snoqualmie to Carnation				3,884,500
Carnation to Duvall				
Pump Stations	EA	2	100,000	200,000
Forcemain Piping (12" Dia.)	LF	40200	60	2,412,000
Gravity Piping (24" Dia.)	LF	8100	65	526,500
Pressure Relief Valve Assemblies	EA	5	5,000	25,000
Blowoff Valve Assemblies	EA	4	5,000	20,000
Cleanouts	EA	80	2,500	200,000
Manholes	EA	16	5,000	80,000
Subtotal Carnation to Duvall				3,463,500
Subtotal Echo Glen to Snoqualmie (Alternative 1)				1,280,000
Subtotal North Bend to Snoqualmie (Alternative 2)				1,243,000
Subtotal Conveyance				9,871,000
Contingency @ 30%				2,961,300
Sales Tax @ 8.2%				1,052,249
Engineering & Administration @ 25%				3,208,075
Total Conveyance				17,092,624
Wastewater Treatment Plant Upgrade - Phase I				
Activated Sludge Wastewater Plant	LS	1	500,000	500,000
Clarifiers	EA	3	150,000	450,000
Plant Piping	LS	1	200,000	200,000
Subtotal WWTP Upgrade - Phase I				1,150,000
Contingency @ 30%				345,000
Sales Tax @ 8.2%				122,590
Engineering & Administration @ 25%				373,750
Total WWTP Upgrade - Phase I				1,991,340
Wastewater Treatment Plant Upgrade - Phase II				
Activated Sludge Wastewater Plant	LS	1	500,000	500,000
Clarifiers	EA	3	150,000	450,000
Solids Digestion	LS	1	450,000	450,000
Subtotal WWTP Upgrade - Phase II				1,400,000
Contingency @ 30%				420,000
Sales Tax @ 8.2%				149,240
Engineering & Administration @ 25%				455,000
Total WWTP Upgrade - Phase II				2,424,240
TOTAL ESTIMATED CAPITAL COST ALTERNATIVE 4				**$21,508,204**

SUMMARY AND CONCLUSIONS

The estimated costs presented for each alternative are intended for comparison only. The methods used to derive those costs involve many assumptions and are based on conceptual level planning layouts. If any of the alternative concepts discussed in this report are developed further, it is recommended that a more detailed, budget level cost estimate be developed as well.

Table 8 outlines the relative capital and O&M costs realized by each community for each of the alternatives discussed in this report. The estimated costs shown are allocated among the communities as follows:

- **Alternative 1** — Echo Glen is responsible for the installation and O&M of the conveyance system as well as a portion of the treatment plant upgrade. Snoqualmie is responsible for a portion of the capital and O&M costs associated with the treatment plant upgrade. Portions are based on the percentage of total wastewater flow contributed by each entity.

- **Alternative 2** — Echo Glen is responsible for the installation and O&M of the conveyance system between Echo Glen and Snoqualmie as well as a portion of the treatment plant upgrades. North Bend is responsible for the installation and O&M of the conveyance system between North Bend and Snoqualmie, the Snoqualmie pump station upgrades, and a portion of the treatment plant upgrades. Snoqualmie is responsible for a portion of the capital and O&M costs associated with the treatment plant upgrades. Portions are based on the percentage of total wastewater flow contributed by each city.

- **Alternative 3** — Carnation is responsible for the installation and O&M of the conveyance system between Carnation and Duvall, as well as a portion of the treatment plant upgrade. Duvall is responsible only for a portion of the treatment plant O&M costs. The portions are based on the percentage of total wastewater flow contributed by each city.

- **Alternative 4** — Echo Glen is responsible for the installation and O&M of the conveyance system between Echo Glen and Snoqualmie, a portion of the Snoqualmie-to-Carnation conveyance system, a portion of the Carnation-to-Duvall conveyance system, and a portion of the treatment plant upgrades. North Bend is responsible for the installation and O&M of the conveyance system between North Bend and Snoqualmie, the Snoqualmie pump station upgrades, a portion of the Snoqualmie-to-Carnation conveyance system, a portion of the Carnation-to-Duvall conveyance system, and a portion of the treatment plant upgrades. Snoqualmie is responsible for the capital and O&M costs associated with a portion of the Snoqualmie-to-Carnation conveyance system, a portion of the Carnation-to-Duvall conveyance system, and a portion of the treatment plant upgrades. Carnation is responsible for the capital and O&M costs associated with a portion of the conveyance system between Carnation and Duvall, as well as a portion of the treatment plant upgrades. Duvall is responsible only for a portion of the treatment plant O&M costs. The portions are based on the percentage of total wastewater flow contributed by each city.

The estimated capital costs realized by each community are presented in 1995 dollars.

The annual O&M costs are shown in 1995 dollars but are based on wastewater flows expected in the year 2030. These are the estimated maximum flows investigated; flows each preceding year will be lower, with correspondingly lower O&M costs.

Of the communities studied in these alternatives, North Bend can expect to incur the greatest cost, because North Bend will generate the most wastewater flow, and the city lies farthest upstream. Echo Glen would pay the lowest O&M costs on an annual basis, as expected because of its low wastewater flow, although Echo Glen's estimated capital costs are higher than Duvall's in Alternative 4. If Snoqualmie or Duvall is to treat wastewater from other cities, Snoqualmie and Duvall realize cost benefits by including these cities. Total annual O&M costs are reduced significantly if each city assumes its share based on contributed flow volumes.

If each community's preference among alternatives were based solely on the estimated costs shown in Table 8, it appears that North Bend and Echo Glen would prefer Alternative 2. Snoqualmie's capital costs are lowest in Alternative 1; however, its annual O&M costs are lower in Alternative 2. Carnation would prefer Alternative 4, because the capital costs of the conveyance line between Carnation and Duvall, as well as the O&M costs of the treatment plant, are divided among more cities. Alternative 4 would be more attractive to Duvall also, because, as mentioned above, the annual O&M costs are split among a greater number of cities, two of which are expected to generate significantly more wastewater.

In weighing the cost projections presented here, the most important criterion is whether an alternative is more economical for a community, or a group of communities, when these costs are compared to the anticipated costs of operating, maintaining, and upgrading separate wastewater treatment facilities. Other criteria such as contructability, implementation issues, and environmental impacts, which are not specifically addressed in the relative project costs, are also important in evaluating these alternatives.

This preliminary study shows that combining flows and treating wastewater in a more centralized manner may provide benefits to the Snoqualmie Valley communities. Additional study and investigation is recommended to further refine these alternatives, if the concepts discussed here are to be developed.

.Table 8. Cost estimate summary for Alternatives 1 through 4 (1995 dollars).					
	North Bend	**Snoqualmie**	**Echo Glen**	**Carnation**	**Duvall**
Alternative 1					
Capital Cost					
Conveyance	--	0	2,216,000	--	--
Treatment	--	947,000	92,000	--	--
Total	--	947,000	2,308,000	--	--
O&M Costs					
Conveyance	--	0	221,600	--	--
Treatment	--	903,000	14,000	--	--
Total	--	903,000	235,600	--	--
Alternative 2					
Capital Cost					
Conveyance	2,153,000	0	2,216,000	--	--
Treatment	2,020,000	1,230,000	40,000	--	--
Total	4,173,000	1,230,000	2,256,000	--	--
O&M Costs					
Conveyance	215,300	0	221,600	--	--
Treatment	1,136,000	601,000	9,000	--	--
Total	1,351,300	601,000	230,600	--	--
Alternative 3					
Capital Cost					
Conveyance	--	--	--	5,231,000	0
Treatment	--	--	--	1,039,000	0
Total	--	--	--	6,270,000	0
O&M Costs					
Conveyance	--	--	--	523,100	0
Treatment	--	--	--	167,000	368,000
Total	--	--	--	690,100	368,000
Alternative 4					
Capital Cost					
Conveyance	10,223,000	4,271,000	2,283,000	316,000	0
Treatment	2,482,000	1,674,000	72,000	187,000	0
Total	12,705,000	5,945,000	2,355,000	503,000	0
O&M Costs					
Conveyance	1,022,300	427,100	228,300	31,600	0
Treatment	1,085,000	574,000	9,000	93,000	204,000
Total	2,107,300	1,001,100	237,300	124,600	204,000

References

Brown, Ken. June 23, 1995. Personal communication (telephone conversation with Jeff Remily, Herrera Environmental Consultants). Echo Glen Children's Center, Snoqualmie, WA.

Centruck, Jim. May 11, 1995a. Personal communication (telephone conversation with Jeff Remily, Herrera Environmental Consultants). KCM Inc., Seattle, WA.

Centruck, Jim. June 20, 1995b. Personal communication (telephone conversation with Jeff Remily, Herrera Environmental Consultants). KCM Inc., Seattle, WA.

Gray and Osborne. 1991. City of Snoqualmie Sewer System Comprehensive Plan. Prepared for the City of Snoqualmie by Gray and Osborne, Inc., Seattle, WA.

Gray and Osborne. 1995. City of Duvall Draft General Sewer Plan. Prepared for the City of Duvall by Gray and Osborne, Inc., Seattle, WA.

Herrera. 1994. Snoqualmie Valley Wastewater Services. Prepared for HDR Engineering Inc., Seattle, WA, and King County Department of Metropolitan Services, by Herrera Environmental Consultants Inc., Seattle, WA.

Herrera. 1995. Role of Metropolitan Services Department Under Current Valley Cities Planning. Prepared for HDR Engineering Inc., Seattle, WA, and King County Department of Metropolitan Services, by Herrera Environmental Consultants Inc., Seattle, WA.

Shawn, Mike. June 22, 1995. Personal communication (telephone conversation with Jeff Remily, Herrera Environmental Consultants). Echo Glen Children's Center, Snoqualmie, WA.

U.S. EPA. 1981. Operation and Maintenance Costs for Municipal Wastewater Facilities. EPA/430/9-81/004. U.S. Environmental Protection Agency, Office of Water Program Operations, Washington, DC.

SNOQUALMIE VALLEY
BIOSOLIDS MANAGEMENT ALTERNATIVES

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CONTENTS

TABLES

INTRODUCTION

In support of the wastewater comprehensive plan being developed by King County Department of Metropolitan Services (Metro), and at the request of the Snoqualmie Valley cities of North Bend, Snoqualmie, Carnation, and Duvall, and the Echo Glen Children's Center, this study was conducted to investigate centralized and decentralized approaches to wastewater solids and biosolids treatment. The cities of North Bend, Snoqualmie, Carnation, and Duvall, and the Echo Glen Children's Center, currently operate and maintain separate wastewater collection and treatment facilities. This report identifies and presents alternatives to provide a more centralized solution to wastewater solids and biosolids treatment in the Snoqualmie Valley.

Three biosolids management alternatives are presented for the cities of North Bend, Snoqualmie, Carnation, and Duvall, and for the Echo Glen Children's Center. These alternatives consist of the following:

- Alternative 1—Decentralized Biosolids Processing: decentralized wastewater and biosolids treatment. Each community processes its own wastewater solids and biosolids.

- Alternative 2—Centralized Biosolids Processing: decentralized wastewater treatment and centralized biosolids treatment. Each city processes its own wastewater; biosolids treatment takes place either at one facility in Duvall, or at two facilities located either in Duvall and Snoqualmie or in Duvall and Echo Glen.

- Alternative 3—Centralized Wastewater Solids and Biosolids Processing: centralized wastewater solids and biosolids treatment. Wastewater solids treatment and biosolids processing takes place either at one facility located in Duvall, or at two facilities located either in Duvall and Snoqualmie or in Duvall and Echo Glen.

The terms *wastewater solids* and *biosolids* are used throughout this report. For the purposes of this report, *wastewater solids* and *solids* refer to the solids produced from primary or secondary wastewater treatment. Solids require further processing prior to beneficial reuse. *Biosolids* are solids that have been treated and processed in accordance with federal regulations (40 Code of Federal Regulations [CFR] 503) and state regulations (70.95J Revised Code of Washington [RCW]) to allow for beneficial reuse. Biosolids are beneficially reused for nutrient and soil conditioning in a variety of ways, e.g., in agriculture to grow food and nonfood crops; in silviculture to improve forest productivity; in the production of sod and the maintenance of turf; and in the revegetation of areas disturbed by construction, mining, and waste disposal activities.

Each of the three biosolids management alternatives described in this report involves biosolids processing and beneficial reuse of biosolids. The biosolids processing technologies discussed here are treatment processes used to render wastewater solids suitable for beneficial reuse. These technologies include dewatering, aerobic digestion, heat drying, and composting. Reuse options

include land application of aerobically digested biosolids for agriculture, silviculture, and reclamation, and distribution of heat-dried and composted products. Another option discussed in this report is to haul a portion or all of each facility's wastewater solids or biosolids to the Metro East Division reclamation plant in Renton.

The management alternatives considered here are based on estimated wastewater flows for the year 2030. None of the existing wastewater treatment facilities, except the facility at Echo Glen Children's Center, has the design capacity to handle wastewater flows or biosolids for the year 2030.

In this report, the management alternatives are discussed and compared through consideration of the following factors: reliability, cost, compliance with federal disposal regulations, overall benefit to the community, environmental impacts, and benefits and drawbacks (i.e., advantages, disadvantages, and opportunities). The report also presents wastewater flow projections and describes the biosolids processing technologies proposed under each alternative. A summary of pertinent regulations and a detailed description of biosolids treatment technologies and reuse options are provided in appendices.

WASTEWATER FLOW AND BIOSOLIDS QUANTITY PROJECTIONS

The biosolids quantities produced by the four cities and Echo Glen Children's Center for the years 2000 and 2030 are based on projections of wastewater flow to each treatment facility (Table 1). These quantities do not include septage from onsite systems. A quantity of 0.18 pounds per capita per day is used to estimate volumes of wastewater solids produced at each treatment facility. Based on this assumption, biosolids quantities for the four cities and Echo Glen Children's Center are projected at 535,535 pounds of dry solids for the year 2000 and 2,666,535 pounds of dry solids for the year 2030 (Table 1).

The following paragraphs describe the wastewater and biosolids treatment processes, biosolids quantities, and volumes of septage from onsite systems projected for the cities of North Bend, Snoqualmie, Carnation, and Duvall, and from the Echo Glen Children's Center, for the years 2000 and 2030 as they pertain to this study.

North Bend

The average North Bend wastewater flows for the years 2000 and 2030 are estimated at 0.66 million gallons per day (mgd) and 4.80 mgd, respectively. The city operates a secondary treatment facility that includes an aerobic digester. It is assumed that a 40 percent reduction in total solids is achieved by the digester. Annual biosolids production for the years 2000 and 2030 is estimated at 123,000 pounds (97,000 gallons) and 1,170,000 pounds (921,000 gallons), respectively. In addition, by the year 2000 North Bend is assumed to have dewatering equipment that dewaters the biosolids to 15 percent solids. In the year 2000, septage from onsite systems is estimated to be 105,000 gallons per year. The entire city population is expected to be sewered by the year 2030.

Table 1. Estimated populations, wastewater flows, and biosolids volumes for the Snoqualmie Valley communities in the years 2000 and 2030.

	Population	Average Wastewater Flow (mgd)	Biosolids Mass (lb/yr)
North Bend			
2000	3,150	0.66	123,000
2030	30,000	4.80	1,170,000
Snoqualmie			
2000	3,000	0.59	195,000
2030	13,040	2.54	847,000
Carnation			
2000	400	0.04	26,000
2030	4,125	0.41	268,000
Duvall			
2000	4,140	0.41	161,000
2030	9,000	0.90	351,000
Echo Glen			
2000	390	0.04	26,000
2030	390	0.04	26,000

Abbreviations:
- lb/yr pounds per year, dry weight
- mgd million gallons per day

Snoqualmie

The average Snoqualmie wastewater flows for the years 2000 and 2030 are estimated at 0.59 mgd and 2.54 mgd, respectively. The city is currently installing an oxidation ditch to replace the existing facultative lagoons. The lagoons are being converted to wastewater solids stabilization ponds. It is assumed for this study that wastewater stabilization in the ponds will achieve a 40 percent reduction in dry solids, and may achieve significant pathogen reduction resulting in Class B biosolids. Annual biosolids production for the years 2000 and 2030 is estimated to be 195,000 pounds (1,540,000 gallons) and 847,000 pounds (6,670,000 gallons), respectively. Biosolids removed from the stabilization ponds are assumed to have a solids content of 1.5 percent. In the year 2000, septage from onsite systems is estimated to be 70,000 gallons per year. The entire city is expected to be sewered by the year 2030.

Carnation

The average Carnation wastewater flows for the years 2000 and 2030 are estimated to be 0.04 mgd and 0.41 mgd, respectively. For the purposes of this study, it is assumed that Carnation will operate a secondary treatment facility that will provide sewer service to the business district by the year 2000. Wastewater solids production for the years 2000 and 2030 is estimated to be 26,000 pounds and 268,000 pounds per year, respectively. It is assumed that solids hauled from the treatment facility have a concentration of 1.5 percent and have not been digested. Septage from onsite systems is estimated to be 160,000 gallons per year. Septage from onsite systems for the year 2030 is estimated to be 10,400 gallons per year.

Duvall

The average Duvall wastewater flows for the years 2000 and 2030 are estimated to be 0.41 mgd and 0.90 mgd, respectively. The city is currently upgrading its secondary treatment facility and constructing an aerobic digester. It is assumed that a 40 percent reduction in total solids is achieved by digestion. In addition, Duvall operates a screw press that is assumed to produce a cake with a 15 percent solids concentration. Annual biosolids production for the years 2000 and 2030 is estimated to be 161,000 pounds (127,000 gallons) and 351,000 pounds (276,000 gallons), respectively. Septage from onsite systems for the year 2000 is estimated to be 21,400 gallons. The city expects to be entirely sewered by the year 2030.

Echo Glen Children's Center

The design flow for the wastewater treatment facility at Echo Glen Children's Center is 0.037 mgd. The facility uses an extended aeration package plant and achieves a 15 to 19 percent reduction in total solids through digestion. Biosolids production for the years 2000 and 2030 is estimated to be 30,535 pounds (24,040 gallons) per year.

REGULATORY REQUIREMENTS

All facilities described under the three management alternatives must comply with 40 CFR 503, Standards for the Use or Disposal of Sewage, published in February 1993 by the U.S. Environmental Protection Agency (U.S. EPA). The 503 regulations apply "to any person who prepares wastewater solids, applies wastewater solids to the land, or fires wastewater solids in a wastewater solids incinerator, and the owner/operator of a surface disposal site." The standards established by the 503 regulations include the frequency of monitoring and record-keeping requirements for wastewater solids land application, surface disposal, and incineration. The 503 regulations specify acceptable wastewater solids treatments and applications to protect human health and the environment.

The 503 regulations specify a two-tiered standard for biosolids quality based on three criteria: metals, pathogens, and vector attraction reduction. The two standards, Class A and Class B, are each suitable for land application. Both standards have the same allowable limits for metals or trace elements. Class A biosolids meet stringent pathogen requirements and therefore have minimum restrictions on application or reuse. Class B standards have less stringent pathogen requirements since pathogen destruction of Class B biosolids is assumed to continue at the application site. Consequently, Class B land application sites are subject to access restrictions. Class A biosolids that meet the most restrictive trace element criteria are classified as exceptional quality biosolids. These biosolids can be distributed in bulk or containers and are not subject to loading restrictions.

The Washington State Department of Ecology (Ecology) is the primary agency for the management of biosolids in Washington state. Other agencies, however, such as the U.S. Soil Conservation Service and the local health department, also play a role in the management of biosolids (Ecology 1993a). The Seattle/King County Department of Public Health is the agency responsible for permitting biosolids facilities. As a jurisdictional health department, it has the regulatory authority to impose more stringent guidelines.

Pertinent federal, state, and local regulations are discussed in the following sections for each of the biosolids processing technologies and reuse methods. A summary of the 40 CFR 503 regulations is presented in Appendix D.

BIOSOLIDS MANAGEMENT

BIOSOLIDS MANAGEMENT ALTERNATIVES

To accommodate wastewater flows anticipated for the years 2000 and 2030, three alternatives are presented for biosolids processing facilities (Table 2).

- *Alternative 1—Decentralized Biosolids Processing* involves a decentralized system in which each of the four cities and Echo Glen Children's Center processes its biosolids separately. Septage is either hauled to Metro's East Division reclamation plant at Renton or processed onsite.

- *Alternative 2—Centralized Biosolids Processing* involves a centralized facility for biosolids processing. Under this alternative, wastewater treatment continues to be decentralized, in other words, accomplished by each community. Biosolids from North Bend and Duvall and wastewater solids from Snoqualmie and Carnation are processed either at one facility located in Duvall, or at two facilities, located either in Duvall and Snoqualmie or in Duvall and Echo Glen.

- *Alternative 3—Centralized Wastewater Solids and Biosolids Processing* involves a centralized location for the processing of both wastewater solids and biosolids. Under this alternative, wastewater solids and biosolids processing take place either at one facility located in Duvall, or at two facilities, located either in Duvall and Snoqualmie or in Duvall and Echo Glen. This alternative is consistent with the centralized wastewater treatment plant alternatives presented by Herrera (1995b).

Alternatives 1 and 2 assume that the wastewater treatment facility in each community provides at least secondary treatment. Secondary treatment involves screening and sedimentation to remove the floating and settlable solids from wastewater, followed by biological and chemical processes. The wastewater solids that are a product of secondary treatment are highly malodorous and contain pathogenic organisms. The solids content following secondary treatment ranges between 0.5 and 3 percent (Metcalf & Eddy 1991).

Each alternative also assumes that each community dewaters wastewater solids or biosolids prior to hauling. Dewatering is required prior to implementation of any of the biosolids treatment technologies. Although dewatering usually follows digestion or another method of stabilization, wastewater solids that are dewatered can be directly heat-dried or composted without stabilization to meet Class A or Class B biosolids standards. In addition, hauling dewatered solids (at 15 percent solids) is significantly less costly than hauling wastewater solids at 2 percent solids.

Table 2. Biosolids management alternatives for Snoqualmie Valley communities.

Alternative 1 — Decentralized Biosolids Processing	**Alternative 2** — Centralized Biosolids Processing	**Alternative 3** — Centralized Wastewater Solids and Biosolids Processing
North Bend Provides aerobic digestion.	**2.A.** One facility at Duvall Accepts wastewater solids from Snoqualmie and Carnation. Accepts digested solids (biosolids) from North Bend and Duvall. (Echo Glen processes solids onsite.)	**3.A.** One facility at Duvall Accepts wastewater solids (or wastewater[1])from North Bend, Snoqualmie, Carnation, and Duvall. (Echo Glen processes solids onsite.)
Snoqualmie Provides secondary treatment.	**2.B.** Two facilities, at Duvall and either Snoqualmie or Echo Glen:	**3.B.** Two facilities, at Duvall and either Snoqualmie or Echo Glen:
Carnation Provides secondary treatment.	**2.B.1.** Facility at Duvall Accepts digested solids (biosolids) from Duvall. Accepts wastewater solids from Carnation.	**3.B.1.** Facility at Duvall Accepts wastewater solids (or wastewater[1]) from Carnation and Duvall.
Duvall Provides aerobic digestion.	Facility at Snoqualmie Accepts wastewater solids from Snoqualmie. Accepts digested solids (biosolids) from North Bend (Echo Glen processes solids onsite.)	Facility at Snoqualmie Accepts wastewater solids (or wastewater[1]) from North Bend and Snoqualmie. (Echo Glen processes solids onsite.)
Echo Glen Provides an extended aeration package and produces Class A biosolids compost.	**2.B.2.** Facility at Duvall Accepts digested solids (biosolids) from Duvall. Accepts wastewater solids from Carnation.	**3.B.2.** Facility at Duvall Accepts wastewater solids (or wastewater[1]) from Carnation and Duvall.
	Facility at Echo Glen Accepts wastewater solids from Snoqualmie, and Echo Glen. Accepts digested solids (biosolids) from North Bend.	Facility at Echo Glen Accepts wastewater solids (or wastewater[1]) from North Bend, Snoqualmie, and Echo Glen.

[1] See Herrera (1995b) report for centralized wastewater treatment facility and conveyance systems.

Alternative 3, when viewed together with centralized wastewater treatment, represents a regional wastewater and solids management approach. Alternative 3 as presented here assumes that each community hauls dewatered wastewater solids to a central facility for processing. This alternative can be combined with the centralized wastewater treatment alternatives presented by Herrera (1995b) by replacing hauling with a wastewater conveyance system.

SOLIDS TREATMENT AND BIOSOLIDS PROCESSING TECHNOLOGIES

Wastewater solids can be processed to meet Class A or Class B biosolids standards through any of several treatment alternatives prescribed in the federal regulations (40 CFR 503). Usually, treatment involves either a *process to significantly reduce pathogens* (abbreviated as PSRP) to meet Class B standards, or a *process to further reduce pathogens* (abbreviated as PFRP) to meet Class A standards. PSRPs include aerobic digestion, air drying, anaerobic digestion, composting, and lime stabilization. PFRPs include composting, heat drying, heat treatment, thermophilic aerobic digestion, beta ray irradiation, gamma ray irradiation, and pasteurization. Appendix C presents an evaluation of biosolids processing technologies and reuse methods.

Biosolids management alternatives 1, 2, and 3 present options to provide biosolids processing. Several biosolids treatment processes used to render wastewater solids suitable for beneficial reuse can be considered for implementation under each alternative. These technologies, which are described in the following paragraphs, include aerobic digestion, heat drying, and composting. For the purposes of this report, land application of Class B biosolids is evaluated as an ultimate processing and disposal option. Dewatering is also described, since dewatering is required in conjunction with each processing technology.

Aerobic Digestion

Aerobic digestion, which is commonly used in municipal wastewater treatment plants following secondary treatment, is currently used at North Bend and Duvall. Aerobic digestion produces Class B biosolids and is used to stabilize volatile solids and reduce solids volume. This treatment typically achieves a 40 percent reduction in total solids. The post-digestion solids content can range between 1.5 and 4.0 percent.

The Class B biosolids generated from aerobic digestion can be used in land application or can undergo a PFRP to meet Class A standards.

Thermal Drying

Thermal drying technology (heat drying), which is a PFRP that produces Class A biosolids, is not a commonly used technology. There is only one heat drying facility on the west coast, located in western Washington and operated by a private contractor for Metro. This technology produces either a thermal cake or a fully dried product. A thermal cake is a result of dewatering and typically contains 35 to 50 percent total solids. Full drying evaporates the moisture to a content less than 10 percent. Thermal drying produces biosolids that are suitable for beneficial

reuse in silviculture, in agriculture, and as a soil amendment. The three most commonly used thermal drying processes are direct drying, indirect drying, and special processes (Metro and JMM 1993).

In direct drying, moisture is evaporated when wastewater solids contact hot gases. Examples of technologies using this process are the rotary kiln drying process, the flash dryer, the Sassi process, the spray dryer, and the toroidal dryer (Metro and JMM 1993).

In indirect drying processes, moisture is evaporated by the contact of wastewater solids with the hot surface of a dryer. Examples of technologies using this process are the jacketed hollow-flight dryer, the vertical thin film dryer, the Carver-Greenfield process, the steam dryer, the tray dryer, and the horizontal thin film dryer (Metro and JMM 1993).

Special processes include those using special carrier fluids to facilitate evaporation of water (Metro and JMM 1993). The Carver-Greenfield process, the best known of the special processes, combines biosolids with an oil carrier fluid, and the water is evaporated in a multiple-effect evaporator (Metro and JMM 1993).

Composting

Composting, or biological conversion, is a biological process used to degrade wastewater solids into a product suitable for beneficial reuse. It is one of the most common processing technologies and is used by many small western Washington treatment facilities. Dewatered septage, wastewater solids, and Class B biosolids may be composted separately or together to meet the Class A requirements of 40 CFR 503 and state composting guidelines (Ecology 1993b). There are three categories of composting systems: windrow, static pile, and in-vessel systems.

The windrow system composts wastewater solids with a bulking agent mixture in long rows or windrows. The windrows are aerated by convective air movement and diffusion and are turned periodically by mechanical means to expose the organic matter (U.S. EPA 1985a). Windrow composting is a common method of composting. According to a composting facilities survey (Goldstein et al. 1994), more than 20 percent of facilities in operation throughout the United States are currently using the windrow method.

The static pile method composts wastewater solids and a bulking agent mixture using a forced-aeration system installed beneath the piles. This system maintains a minimum oxygen level throughout the compost mass (U.S. EPA 1985a). The aerated static pile is a more commonly used method of composting. Of 198 biosolids composting facilities in operation throughout the United States, approximately 45 percent are using the aerated static pile method (Goldstein et al. 1994).

The in-vessel method composts wastewater solids inside an enclosed container or vessel. Mechanical systems control environmental conditions such as air flow, temperature, and oxygen concentrations (Metcalf & Eddy 1991). In-vessel composting systems are in various stages of development, and many systems are being marketed and used. Large institutions as well as

commercial, industrial, and agricultural generators have used these systems. Many small in-vessel systems are portable and do not require a building to house them (Segal 1994). Other advantages of the in-vessel composting method include improved odor control, improved public acceptance, and reduced hauling costs and labor costs. Disadvantages may include higher capital costs.

Bulking materials are used in all three types of composting methods. These materials are used to provide structure to the dewatered solids to allow for proper aeration, reduce the moisture content, provide a carbon or energy source, and dilute the mixture (Metro and JMM 1993). The bulking agent also works to effectively compost the biosolids by increasing the solids content to a minimum of 40 percent. Examples of bulking materials are sawdust, recycled compost, wood chips, paper fibers, and shredded wood waste. The type and amount of bulking agent used depends on the type of compost process (Metro and JMM 1993). Of the 21 in-vessel facilities reported in the Goldstein et al. (1994) composting facilities survey, more than half use sawdust and recycled compost as the primary bulking agents. One in-vessel facility in New Jersey uses pulverized pallets processed into chips; another facility reportedly uses recycled paper. Wood chips are the amendment most commonly used in aerated static pile operations. Windrow composting facilities commonly use wood waste, leaves, sawdust, brush, and manure. With the proper equipment, the larger types of bulking agents (such as wood chips) can be recovered, to reduce operating costs.

Land Application

Land application of digested solids is often a cost-effective biosolids management approach. This report considers land application a biosolids treatment and reuse technology. Biosolids that meet Class B standards, typically achieved by a PSRP (e.g., aerobic digestion), can be land-applied for reuse or disposal. For Class B biosolids, pathogen destruction is continued at the application site; consequently, Class B land application sites are subject to site access restrictions from the time of biosolids application. Land application of biosolids results in improved soil fertility, increased moisture retention, and reduced need for inorganic fertilizers.

Dewatering

Dewatering typically follows digestion or is used prior to composting or heat treatment to produce a cake with a solids content between 10 and 25 percent. Dewatering is frequently used by biosolids treatment facilities to achieve the following benefits (Metcalf & Eddy 1991):

- Reduce transportation costs associated with hauling biosolids to the ultimate treatment or disposal site
- Make the biosolids material easier to handle so that it can be shoveled or moved about with tractors
- Reduce the amount of bulking agents needed for composting

- Decrease odor and putrefaction.

CRITERIA TO ASSESS MANAGEMENT ALTERNATIVES

The solids management alternatives are discussed and compared through consideration of the following factors: reliability, cost, federal disposal regulations, overall benefit to the community, environmental impacts, and advantages and disadvantages. A brief discussion of the relevance of these factors and how they are used to assess the three management alternatives is provided in the following paragraphs.

Reliability

Reliability is assessed by determining whether biosolids can be processed under one of the management alternatives more reliably than under another.

The primary factor affecting the reliability of a given biosolids processing option is the technology used rather than whether processing facilities are centralized or decentralized. The differences in reliability among biosolids processing technologies are related to the consistency of the end product, its potential for reuse, and the availability of reuse options (e.g., land application or distribution for commercial or private use). Appendix C describes the reliability of the biosolids processing technologies and reuse methods, based on the experience of other biosolids handling facilities and wastewater engineering literature.

Reliability is also affected by other less significant factors, for example, by the number of truck trips required to haul wastewater solids and biosolids between facilities. Trucks hauling wastewater solids and biosolids are subject to vehicle disrepair, accidents, and delays due to inclement weather and traffic.

Cost

This report provides estimates of conceptual capital costs and operation and maintenance (O&M) costs for each management alternative. Capital and O&M costs are based on cost curves for treatment technologies and values reported in the literature (U.S. EPA 1985b; CH2M Hill 1994; Metro and JMM 1993). All costs are estimated independently of the location of the facility or land application site. All costs are discounted to 1995 dollars and are based on biosolids and septage quantities generated in the year 2030.

For the alternatives that include a centralized treatment facility, the capital and O&M costs are itemized by community, based on the relative contribution of each community to the total quantity of biosolids. For example, for Alternative 2—Centralized Biosolids Processing, the four cities and Echo Glen would pay the following percentages of costs incurred:

- North Bend – 44 percent
- Snoqualmie – 32 percent

- Carnation – 10 percent
- Duvall – 13 percent
- Echo Glen – 1 percent.

Costs included under each alternative include aerobic digestion (optional), dewatering, hauling, and biosolids processing. Estimated costs for aerobic digestion are based on a cost curve at 2 percent solids (U.S. EPA 1985b). Estimated capital costs for dewatering biosolids are based on a cost curve for belt filter press dewatering at 2 percent solids (U.S. EPA 1985b). These costs include purchase of one or more filter press units and ancillary equipment including a building to house the press. O&M costs include labor, electricity, parts, and materials. Costs are provided for each technology that is applicable to the management alternative.

Hauling costs are included under each alternative for transporting wastewater solids and/or biosolids from each city to centralized treatment facilities. Hauling costs for the purposes of this study are estimated based on the gallons per week hauled (up to 30 miles). Hauling unit costs were provided by a private vendor (Eldredge 1995 personal communication). Costs for transporting septage between the cities and Metro are also provided (Appendix B).

Appendix B provides the hauling and disposal costs estimated for trucking septage and biosolids from the four cities to the East Division reclamation plant in Renton. The costs are based on rates used by Metro in 1995 (Herrera 1995a). Disposal costs are also included because all of the hauled material would be disposed of at the headworks of the wastewater treatment plant, regardless of previous handling or treatment (Finger 1995 personal communication). Echo Glen Children's Center is not included in these estimates because it is not considering hauling wastewater solids to Metro. The costs provided assume that Duvall sends 40 percent of its biosolids (because Duvall already practices land application) and that North Bend, Snoqualmie, and Carnation send all of their biosolids to the wastewater treatment facility in Renton.

Several cost items are not included in this evaluation because of uncertainties associated with management and processing alternatives. These costs include but are not limited to the following:

- Land costs
- Costs (or revenues) for biosolids reuse
- Costs associated with obtaining land application sites
- Hauling costs to application or reuse sites
- Administration, management, monitoring, and engineering costs.

The costs presented in this report are conceptual planning level costs. The costs are presented for comparison of management alternatives only and should not be used for budgeting, engineering, construction, or other purposes.

Compliance with Federal Disposal Regulations

The four Snoqualmie Valley cities and Echo Glen must comply with federal (40 CFR 503) and state (70.95J RCW) regulations pertaining to the processing and reuse of biosolids. These regulations determine biosolids quality based on pathogens, metals, and vector attraction reduction. These regulations are further discussed in Appendix C and Appendix D.

Overall Benefit to Community

Benefits to the community, defined in terms of recycling and sustainability, may be derived from reusing biosolids that are locally generated. Each community, however, will benefit from reusing biosolids anywhere in the Snoqualmie Valley. Therefore, benefits to the community are anticipated to be the same under each of the management alternatives.

Environmental Impacts

This factor is assessed by determining whether impacts on the environment are significantly different among the management alternatives. This factor is assessed independently of the type of biosolids processing technology. The potential environmental impacts resulting from each biosolids processing technology and reuse option are described in Appendix C.

Advantages, Disadvantages, and Opportunities

Advantages and disadvantages of each alternative are summarized in respect to reliability, cost, compliance with the federal disposal regulations, and overall benefits to the community. In addition, local control and potential markets for beneficial reuse are discussed.

EVALUATION OF MANAGEMENT ALTERNATIVES

ALTERNATIVE 1—DECENTRALIZED BIOSOLIDS PROCESSING

Alternative — Decentralized Biosolids Processing (see Table 2) involves a decentralized alternative to biosolids management in which wastewater solids and biosolids are processed or treated separately by each of the four cities and Echo Glen Children's Center (Appendix A, Table A-1). Septage is either hauled to Metro's East Division reclamation plant at Renton or processed onsite. This alternative assumes that each city uses its upgraded treatment facility planned for the year 2000, as described by Herrera (1995b).

The following options for wastewater solids and biosolids treatment are considered under this management alternative: composting, land application, and hauling to the Metro wastewater treatment facility in Renton. A heat drying facility is not considered under this alternative because it is not practical for small quantities of biosolids.

Compost Facility in Each Community

Under this option, each community must design and develop a site for composting, and must purchase equipment needed for the chosen compost method (e.g., front-end loaders, bulking agents or a container for the in-vessel method). Each site must have the permissible site acreage to accommodate the chosen composting process, provide adequate buffers from adjacent land uses, and store bulking amendments and maintain compost piles and compost aisles with room to maneuver equipment (Table 3). Appendix C provides a detailed discussion of composting, considering its reliability (by assessing the experiences of facilities with wastewater flows comparable to those estimated for the Snoqualmie Valley communities), its consistency with federal disposal regulations, its land requirements, its environmental impacts, and its market potential.

North Bend and Duvall would compost digested and dewatered biosolids, since their planned wastewater treatment facilities include aerobic digestion. Carnation and Snoqualmie would dewater but would have the option to not digest their wastewater solids. Undigested or unstabilized wastewater solids are, however, difficult to handle and odoriferous, and they require more bulking agent. Echo Glen would continue its biosolids composting operations. Each community would distribute or sell its final product (i.e., biosolids compost).

Under this option, each community would conduct the following activities:

- North Bend – Provide secondary treatment, aerobic digestion, dewatering, and composting

- Snoqualmie – Provide secondary treatment, treatment in stabilization ponds, dewatering, and composting

Table 3. Estimated land requirements for heat drying, composting, and land application based on projected biosolids quantities.

	Projected Biosolids Quantities (dtpd)		Heat Drying[1,5,6] (acres)	Composting[1,3] (acres)		Land Application (acres)		
	2000	2030		Aerated Static or Windrow[2]	In-Vessel[4]	Agricultural[7] 2000 / 2030	Forest[8] 2000 / 2030	Reclamation[9] 2000 / 2030
Alternative 1 – Decentralized Biosolids Processing								
Duvall	0.22	0.48	0.2	2.4	0.33 [5]	16 / 35.2	20.1 / 44	1.6 / 3.52
Carnation	0.036	0.37	0.15	1.8	0.26 [5]	2.6 / 26.8	3.3 / 33.5	0.3 / 2.68
Snoqualmie	0.27	1.16	0.48	5.8	0.81 [5]	19.5 / 84.8	24.4 / 106	2.0 / 8.48
North Bend	0.17	1.60	0.66	8	1.12	12.3 / 117	15.4 / 146	1.2 / 11.7
Alternative 2 - Centralized Biosolids Processing								
Alternative 3 - Centralized Wastewater Solids and Biosolids Processing								
Carnation-Duvall	0.26	0.85	0.35	4.2	0.60 [5]	18.7 / 62	23.4 / 77.5	1.9 / 6.2
Echo Glen-North Bend-Snoqualmie or North Bend-Snoqualmie	0.47	2.8	1.15	14.0	2.0	34.8 / 205	43.5 / 256	3.5 / 20.5
All-Duvall	0.73	3.6	1.48	18.0	2.6	53.8 / 267	67.3 / 333	5.4 26.7

(dtpd) dry tons per day

1 Based on facility constructed to handle biosolids generated in year 2030.

2 Based on high-end of range presented in Metcalf & Eddy (1991) for aerated static and windrow methods.

3 Assumes 1 dry ton biosolids feedstock to 5 tons finished compost product.

4 Based on 0.14 acres / dry ton compost per day (Metcalf & Eddy 1991).

5 Larger minimum land size likely required to satisfy setback and buffer requirements.

6 Based on estimate for 12.3 dtpd LOTT facility (CH2M Hill 1994).

7 Based on 5 dry ton / acre annual application rate.

8 Annual basis based on 20 tons over 5 years.

9 Based on single application at 50 tons / acre. Requires new site annually.

- Carnation – Provide secondary treatment, dewatering, and composting

- Duvall – Provide secondary treatment, aerobic digestion, dewatering, and composting.

Land Application of Class B Biosolids

Biosolids that meet the Class B standards for pathogen levels, trace element concentrations, and vector attraction reduction can be used for land application as an amendment in reclamation or as fertilizer on crop land and forest land. Under this option, each facility treats biosolids to Class B standards for land application. The cities may choose to purchase or lease a site for joint land application. Appendix C provides a detailed discussion of land application, considering reliability (by assessing the experiences of facilities with wastewater flows comparable to those estimated for the four cities and Echo Glen), consistency with federal disposal regulations, land requirements, environmental impacts, and market potential. Table 3 provides the site requirements for land application by each city.

Biosolids from North Bend and Duvall would most likely meet the Class B standards following aerobic digestion. Wastewater solids from Snoqualmie's facultative lagoon may require further treatment. For Carnation, further treatment of its wastewater solids would be required prior to land application. Carnation may have the option of hauling its wastewater solids to Duvall for aerobic digestion or purchasing an aerobic digester. Echo Glen Children's Center would continue its current composting operation.

To reuse biosolids through land application, the facility in each city would conduct the following activities:

- North Bend – Provide secondary treatment, aerobic digestion, and dewatering; haul to a land application site

- Snoqualmie – Provide secondary treatment, treatment in a solids stabilization pond, and dewatering; haul to a land application site if biosolids meet Class B pathogen standards, or purchase an aerobic digester (or equivalent)

- Carnation – Provide secondary treatment and dewatering, and haul wastewater solids to Duvall for digestion (or purchase an aerobic digester or the equivalent, and haul to a land application site if biosolids meet Class B pathogen standards)

- Duvall – Provide secondary treatment, aerobic digestion, and dewatering; haul to a land application site.

Hauling Solids to Metro Facility

Under this option, all or a portion of the wastewater solids and biosolids are hauled from the wastewater treatment facility at each city to Metro's East Division reclamation plant in Renton for further processing.

Reliability

Under this alternative, each city is responsible for its own biosolids management system and system reliability. Each city would have a reliable system; the degree of reliability is dependent on the technologies selected. Snoqualmie may have difficulties meeting Class B standards with a solids stabilization pond if land application is selected as the preferred approach.

Significant differences in reliability exist among technological approaches. Site availability and adequate permissible acreage may present the biggest challenge for cities that select land application as a reuse method. Land application of biosolids and hauling to Metro also would potentially require more hauling than would be required for composting. For composting, the availability of reuse markets may affect reliability, although according to operators of compost facilities in western Washington, the demand for biosolids compost exceeds the supply (Appendix C). Also, although Carnation and Snoqualmie may choose to compost without digestion, undigested solids are more difficult to handle, have greater aesthetic impacts, are more odoriferous, and potentially require larger buffer zones. These differences are further discussed in Appendix C.

Cost

Appendix A (Table A-1) provides costs incurred by each city under Alternative 1—Decentralized Biosolids Processing. Overall, in-vessel composting has the highest costs for the cities of North Bend and Snoqualmie. Aerated static pile composting has the highest costs for the cities of Carnation and Duvall. Land application appears to be the least expensive option for all four cities, even though Carnation and possibly Snoqualmie would incur additional costs for digestion. However, additional costs incurred under land application involve hauling biosolids to the reuse site (these costs are not included in the cost estimates). Hauling costs are dependent on the location and number of reuse sites. Reuse site locations are unknown at this time. Potential reuse sites are discussed in Appendix C.

The maximum total cost for each city under Alternative 1—Decentralized Biosolids Processing involves aerobic digestion, dewatering, and in-vessel composting (e.g., North Bend and Snoqualmie) or aerated static pile composting (e.g., Carnation and Duvall). Base capital costs are approximately $2,300,000 for North Bend and Snoqualmie with $650,000 annual O&M costs. Base capital costs are approximately $1,500,000 for Carnation and Duvall with $240,000 annual O&M costs.

The minimum total costs for each city under Alternative 1—Decentralized Biosolids Processing involve aerobic digestion, dewatering, and land application of Class B biosolids. Base capital

costs are approximately $1,100,000 for North Bend and Snoqualmie with annual O&M costs of approximately $175,000. Base capital costs are approximately $900,000 for Carnation and Duvall with annual O&M costs of approximately $115,000.

This alternative offers a potential cost savings for Carnation and Duvall. Hauling Carnation's wastewater solids to Duvall would benefit both cities, since the economy of scale would result in lower capital and O&M costs. The cost savings to Carnation would greatly offset its hauling costs. Duvall and North Bend may also have lower costs than indicated, since these cities can use the existing digester until it can no longer handle the wastewater flows projected for the year 2030.

As indicated in Table 3, the wastewater treatment facilities at each city may not be able to accommodate the land requirements for biosolids processing. As a result, additional costs would be incurred for procuring a processing site and providing conveyance or hauling to the site. These costs are not included in the estimates provided in Table A-1.

Federal Disposal Regulations

All biosolids processing facilities and reuse methods must comply with federal, state, and local regulations. The only difference among alternatives in regard to the federal disposal regulations is that Snoqualmie may have difficulty meeting Class B standards with solids stabilization ponds only.

Overall Benefit to Community

Biosolids would not be reused within the city limits of each city. Therefore, benefits to the community are anticipated to be the same under each of the management alternatives.

Environmental Impacts

For this alternative, the impact of each facility would be confined to each city. This alternative would result in lower traffic impacts compared to centralized management alternatives.

Environmental impacts would vary depending on the type of biosolids processing technology and the reuse method. These impacts are discussed in Appendix C.

Advantages, Disadvantages and Opportunities

Cost is the most significant factor associated with each alternative. Advantages and disadvantages are summarized below:

The potential advantages of Alternative 1—Decentralized Biosolids Processing are as follows:

- Each city maintains its autonomy and current wastewater treatment facility.

- Traffic impacts are lower than under other alternatives.

The potential disadvantages of Alternative 1—Decentralized Biosolids Processing are as follows:

- Costs are mostly higher for this alternative since there is not the economy of scale offered by centralized facilities.

- Each city must expand its current wastewater treatment facility and biosolids handling capabilities to handle the projected wastewater flows for the year 2030.

- Only cities that meet the Class B biosolids standards (i.e., North Bend and Duvall) may use land application as a reuse method. Carnation and possibly Snoqualmie would have to provide further wastewater solids treatment to meet the Class B standards.

- If Carnation and Snoqualmie do not stabilize their wastewater solids, composting would be more difficult to handle and more odoriferous, and would require more bulking agents and greater buffer areas.

- Each city may find it difficult to provide adequate land for the processing technology or land application.

Potential opportunities include the following:

- Carnation can offset capital cost requirements by hauling wastewater solids to Duvall. Both cities benefit from the economy of scale of processing their solids jointly.

- The cities may jointly procure or lease land application sites to reduce their land costs.

ALTERNATIVE 2—CENTRALIZED BIOSOLIDS PROCESSING

Alternative 2—Centralized Biosolids Processing involves a centralized heat drying or compost facility for processing to Class A biosolids standards. Wastewater treatment and digestion would continue to be decentralized, in other words, accomplished by each community. Dewatered septage would be processed at the biosolids processing facility or would be hauled to Metro's Renton wastewater treatment facility. Under this alternative, there would be one centralized facility in Duvall, or two centralized facilities in Duvall and Snoqualmie, or Duvall and Echo Glen.

The costs for land application are not provided under Alternative 2—Centralized Biosolids Processing. Duvall and North Bend already produce digested Class B biosolids. These cities

could haul their biosolids to a joint land application site. Snoqualmie and Carnation could also reuse their biosolids at a joint application site with Duvall and North Bend providing they meet the Class B standards (i.e. by providing aerobic digestion or the equivalent).

The following options exist under Alternative 2—Centralized Biosolids Processing (Table 2):

Option 2A. Biosolids Processing Facility in Duvall

Under this option, the four cities would design and develop a facility for composting or heat drying in Duvall, and purchase equipment based on the type of compost or heat drying method. In addition the facility must have the permissible site acreage to 1) accommodate the type of composting or heat drying process, 2) provide adequate buffers from adjacent land uses, and 3) store equipment such as dryers or bulking amendments (Table 3). Appendix C provides a detailed discussion of composting and heat drying considering reliability (by assessing the experiences of facilities with wastewater flows comparable to those estimated for the four cities and Echo Glen), consistency with federal disposal regulations, land requirements, environmental impacts, and market potential.

The facility in Duvall would accept dewatered and digested Class B biosolids from Duvall, and North Bend, and dewatered solids from Snoqualmie and Carnation. The composting or heat drying facility would process Class A biosolids and distribute the end product. Echo Glen would continue to compost its biosolids onsite. Under this option, the facility in each community would conduct the following activities:

- North Bend – Provide secondary treatment, aerobic digestion, and dewatering. Haul biosolids to Duvall for Class A biosolids processing.

- Snoqualmie – Provide secondary treatment, treatment in stabilization ponds, and dewatering. Haul dewatered solids to Duvall for Class A biosolids processing.

- Carnation – Provide secondary treatment and dewatering. Haul dewatered solids to Duvall for Class A biosolids processing.

- Duvall – Provide secondary treatment, aerobic digestion, and dewatering. Compost or thermal drying facility is located in Duvall. Process Class A biosolids from Duvall, Carnation, Snoqualmie, and North Bend.

Option 2B. Biosolids Processing Facilities in Duvall and Snoqualmie

Under this option, heat drying or compost facilities would be constructed in Duvall and Snoqualmie. The cities would design and develop a site, and purchase equipment based on the type of compost or heat drying method. In addition, adequate acreage must be provided to 1) accommodate the type of composting or heat drying process, 2) provide adequate buffers from adjacent land uses, and 3) store equipment such as dryers, or bulking amendments (Table 3).

The facilities located in Duvall and Snoqualmie would accept Class B biosolids and dewatered solids. The facility located in Duvall would accept Duvall's dewatered and digested biosolids, and dewatered solids from Carnation. The facility located in Snoqualmie would accept dewatered solids from Snoqualmie, and dewatered and digested biosolids from North Bend. Echo Glen would continue to compost its biosolids onsite. Each facility would conduct the following activities under this option:

- North Bend – Provide secondary treatment, aerobic digestion, and dewatering. Haul biosolids to Snoqualmie for Class A biosolids processing.

- Snoqualmie – Provide secondary treatment, treatment in stabilization ponds, and dewatering. Thermal drying or composting facility is located in Snoqualmie. Process Class A biosolids from North Bend and wastewater solids from Snoqualmie. The end product is sold or distributed from Snoqualmie.

- Carnation – Provide secondary treatment and dewatering. Haul dewatered solids to Duvall for Class A biosolids processing.

- Duvall – Provide secondary treatment, aerobic digestion, and dewatering. A compost or thermal drying facility is located in Duvall. Process Class A biosolids from Duvall and Carnation. The end product is sold or distributed from Duvall.

Option 2C. Biosolids Processing Facilities in Duvall and at Echo Glen

Under this option, a heat drying or compost facility would be constructed in Duvall and Snoqualmie. The cities would design and develop a site, and purchase equipment based on the type of compost or heat drying method. In addition, adequate acreage must be provided to 1) accommodate the type of composting or heat drying process, 2) provide adequate buffers from adjacent land uses, and 3) store equipment such as dryers, or bulking amendments (Table 3).

The facilities at Duvall and Echo Glen would accept Class B biosolids and dewatered solids. The facility located in Duvall would accept Duvall's dewatered and digested biosolids and dewatered solids from Carnation. The facility located at Echo Glen Children's Center would accept dewatered solids from Echo Glen Children's Center and Snoqualmie, in addition to dewatered and digested biosolids from North Bend. The facility in each community would conduct the following activities under this option:

- North Bend – Provide secondary treatment, aerobic digestion, and dewatering. Haul biosolids to Echo Glen for Class A biosolids processing.

- Snoqualmie – Provide secondary treatment, lagoon treatment, and dewatering. Haul solids to Echo Glen for Class A biosolids processing.

- Carnation – Provide secondary treatment and dewatering. Haul solids to Duvall for Class A processing.
- Duvall – Provide secondary treatment, aerobic digestion, and dewatering. A compost or thermal drying facility is located in Duvall. Process Class A biosolids from Duvall and Carnation.
- Echo Glen – Provide secondary treatment, an extended aeration package, and dewatering. A thermal drying or composting facility is located at Echo Glen. Process Class A biosolids from North Bend and solids from Echo Glen and Snoqualmie.

Reliability

Under this alternative, each community that hauls its solids to another community's processing or treatment facility is dependent on the reliability of the processing community's system and management structure. The cities hauling solids thereby give up some control over their solids. This alternative may be more reliable for Snoqualmie, since a centralized facility can accept solids from Snoqualmie's solids stabilization ponds without additional treatment.

There are some differences in reliability between technologies. The end product of heat drying would potentially be more difficult to reuse than biosolids compost. These differences are further discussed in Appendix C.

Cost

Appendix A (Tables A-2, A-3, and A-4) provide costs incurred by each community under Alternative 2—Centralized Biosolids Processing.

Alternative 2—Centralized Biosolids Processing assumes that each of the four cities dewaters its solids (i.e., Carnation and Snoqualmie) or biosolids (i.e., North Bend and Duvall) to 15 percent solids content prior to hauling. Dewatered solids (e.g., the solids that have received secondary treatment) from Carnation and Snoqualmie could be heat-dried or composted with the digested biosolids from North Bend and/or Duvall to meet Class A biosolids standards.

Overall, heat drying and in-vessel composting are the technologies that incur the highest costs under Alternative 2—Centralized Biosolids Processing. In contrast, windrow composting incurs the lowest costs.

Under Option 2A, a centralized biosolids treatment facility would be located in Duvall. The facility in Duvall would accept dewatered and digested biosolids from Duvall and North Bend, and dewatered solids from Carnation and Snoqualmie.

The highest total cost for biosolids treatment for each city under Option 2A involves aerobic digestion, dewatering, hauling and heat drying. Base capital costs are approximately $2,650,000

for North Bend and Snoqualmie with $450,000 annual O&M costs. Base capital costs are approximately $1,275,000 for Carnation and Duvall with $155,000 annual O&M costs.

The lowest total cost for biosolids treatment involves aerobic digestion, dewatering, hauling, and windrow composting for North Bend and Duvall, and dewatering, hauling, and windrow composting for Carnation and Duvall. Base capital costs and O&M costs for each city, respectively, are approximately: $1,275,000 and $370,000 for North Bend; $605,000 and $210,000, for Snoqualmie; $390,000 and $68,000 for Carnation; and $855,000 and $104,000 for Duvall.

Under Option 2B, biosolids treatment facilities would be located in Snoqualmie and Duvall. North Bend would haul its dewatered and digested biosolids to Snoqualmie, and Carnation would haul its dewatered solids to Duvall.

The highest total cost for biosolids treatment under Option 2B involves aerobic digestion, dewatering, hauling, and heat drying for North Bend and Snoqualmie. For Carnation and Duvall, the highest total cost involves aerobic digestion, dewatering, hauling, and in-vessel composting. Base capital costs are approximately $2,750,000 for North Bend and Snoqualmie with $400,000 annual O&M costs. Base capital costs are approximately $1,200,000 for Carnation and Duvall with $260,000 annual O&M costs.

The lowest total cost for biosolids treatment involves aerobic digestion, dewatering, hauling, and windrow composting for North Bend and Duvall, and dewatering and windrow composting for Carnation and Duvall. Base capital costs and O&M costs, respectively, are as follows: $1,358,000 and $394,000 for North Bend; $670,000 and $110,000, for Snoqualmie; $612,000 and $130,000 for Carnation; and $1,150,000 and $184,000 for Duvall.

Under Option 2C, biosolids treatment facilities would be located in Duvall and Echo Glen. North Bend would haul its dewatered and digested biosolids to Echo Glen. Snoqualmie would haul its dewatered solids to Echo Glen. Carnation would haul its dewatered solids to Duvall.

The highest total cost for biosolids treatment under Option 2C involves aerobic digestion, dewatering, hauling, and heat drying for North Bend, Snoqualmie, and Echo Glen. For Carnation and Duvall the highest total cost involves aerobic digestion, hauling, dewatering and in-vessel composting. Base capital costs are approximately $2,500,000 for North Bend and Snoqualmie with $460,000 annual O&M costs. Base capital costs and O&M costs for Echo Glen are approximately $888,000 and $125,000, respectively. Base capital costs for Carnation and Duvall are approximately $1,200,000 and O&M costs are $260,000.

The lowest total cost for biosolids treatment involves aerobic digestion, dewatering, hauling and windrow composting for North Bend and Duvall, and dewatering, hauling and windrow composting for Carnation, Duvall and Echo Glen. Approximate base capital costs and O&M costs for each community, respectively, are as follows: $1,351,000 and $391,000 for North Bend; $660,000 and $223,000 for Snoqualmie; $25,000 and $5,100 for Echo Glen; $612,000 and $130,000 for Carnation; and $1,150,000 and $184,000 for Duvall.

As shown in Appendix A, compared to biosolids processing costs in Alternative 1, this alternative offers a potential cost savings to each city due to the economy of scale resulting from centralized facilities. For cities hauling solids to a centralized facility, hauling costs may be offset by cost savings due to economy of scale for capital and O&M costs. Communities where centralized facilities are located also benefit from cost savings due to economy of scale. When compared to land application costs under Alternative 1, Alternative 2 may also provide cost savings, since land application site land costs are not included in the cost estimate. .

An additional cost saving may result from Option 2C. Land available at Echo Glen may be less expensive to use than land in Snoqualmie (Option 2B). Land costs savings may also offset hauling costs for Snoqualmie under Option 2C.

Federal Disposal Regulations

There is no significant difference between alternatives in regard to the federal disposal regulations. Regardless of whether the wastewater or biosolids treatment facility is centralized or decentralized, the four cities and Echo Glen Children's Center must comply with all federal, state, and local regulations pertaining to the use and disposal of wastewater solids. Snoqualmie would not need to produce Class B biosolids under this alternative.

Overall Benefit to Community

There are benefits to be gained by each community in terms of recycling and sustainability from locally reusing it's biosolids. However, these benefits would be gained from reusing biosolids anywhere in the Snoqualmie Valley. Benefits to the community are anticipated to be the same under each management alternative.

Environmental Impacts

Under this alternative, the cities where facilities are located would bear the environmental impacts of the facility. Potential environmental impacts vary depending on the type of biosolids processing technology and reuse method. Centralized facilities would also result in more traffic and traffic-related impacts than decentralized facilities.

Advantages, Disadvantages and Opportunities

The potential advantages of Alternative 2—Centralized Biosolids Processing are as follows:

- Each community could continue its current facility operation plans. The biosolids processing facilities would be designed to accept both wastewater solids and digested biosolids to produce Class A biosolids.

- Class A biosolids produced by the facility would be easily reused.

- Each community may realize a cost savings due to the economy of scale of centralized processing.

The potential disadvantages under Alternative 2—Centralized Biosolids Processing are as follows:

- Some of the communities give up some autonomy in handling and being responsible for their own solids.
- If Carnation and Snoqualmie do not stabilize their solids, composting would be more difficult to handle and more odoriferous, and would require greater buffer areas.
- Traffic related environmental impacts are increased.

Potential opportunities under Alternative 2—Centralized Biosolids Processing include:

- Snoqualmie can send stabilized solids from its ponds directly to the solids processing facility without additional treatment.
- Carnation does not need to provide aerobic digestion.
- Land costs may be substantially reduced by locating a processing facility at Echo Glen.

ALTERNATIVE 3—CENTRALIZED WASTEWATER SOLIDS AND BIOSOLIDS PROCESSING

Alternative 3—Centralized Wastewater Solids and Biosolids Processing assumes a centralized location for processing wastewater solids. Under this option, wastewater solids would be treated by aerobic digestion, dewatering, and either land application, heat drying, or composting at a central facility.

This alternative can also be used to evaluate centralized wastewater treatment and biosolids processing for the Snoqualmie Valley communities. Under Alternative 3, it is assumed that the communities haul their dewatered wastewater solids to a centralized facility. By replacing the hauling component of Alternative 3 with a wastewater conveyance component, this alternative can be combined with those presented by Herrera (1995b) to represent a regional wastewater treatment and biosolids management approach for the Snoqualmie Valley communities.

The following options exist under Alternative 3—Centralized Wastewater Solids and Biosolids Processing:

Option 3A. Wastewater Solids and Biosolids Treatment Facility in Duvall

Under this option, a site for wastewater solids and biosolids treatment would be developed in Duvall. Equipment would be purchased for aerobic digestion and dewatering to accommodate the wastewater solids projections for the year 2030. Class B biosolids would be land-applied from the wastewater treatment facility, or a heat drying or compost facility would be constructed. For a biosolids treatment facility, the communities would design and develop a site and would purchase equipment based on the chosen compost or heat drying method. In addition, adequate acreage must be provided to 1) accommodate the chosen composting or heat drying process, 2) provide adequate buffers from adjacent land uses, and 3) store equipment such as dryers, or bulking amendments (Table 3).

The facility in Duvall would accept wastewater solids from Duvall, North Bend, Snoqualmie, and Carnation. The solids would be digested and dewatered. The end product would be reused in land application or processed to produce Class A biosolids (i.e., heat-dried or composted). Echo Glen Children's Center would continue to compost its biosolids onsite.

In relation to the central wastewater treatment Alternative 4 presented by Herrera (1995b), dewatering prior to hauling and hauling components could be replaced by a conveyance system.

Under this option, the facility in each community would conduct the following activities:

- North Bend – Provide secondary treatment. Haul solids at 15 percent solids to Duvall.
- Snoqualmie – Provide secondary treatment. Haul solids at 15 percent solids to Duvall.
- Carnation – Provide secondary treatment. Haul solids at 15 percent solids to Duvall.
- Duvall – Accept solids from North Bend, Carnation, and Snoqualmie. Provide aerobic digestion and dewatering for all communities. Use land application or provide a heat drying or composting facility to produce Class A biosolids.
- Echo Glen – Continue current wastewater solids treatment and composting operation. Use compost onsite.

Option 3B. Wastewater Solids and Biosolids Treatment Facilities in Duvall and Snoqualmie

Wastewater solids and biosolids processing facilities would be designed and developed in Duvall and Snoqualmie. Equipment would be purchased for aerobic digestion and dewatering to accommodate the wastewater projections for the year 2030. Class B biosolids would be land-applied from the wastewater treatment facility, or a heat drying or compost facility would be

constructed. The communities would design and develop a site and would purchase equipment based on the chosen compost or heat drying method. In addition, adequate acreage must be provided to 1) accommodate the chosen composting or heat drying process, 2) provide adequate buffers from adjacent land uses, and 3) store equipment such as dryers, or bulking amendments (Table 3).

In relation to the central wastewater treatment alternatives, dewatering prior to hauling and hauling components can be replaced by a conveyance system. For wastewater treatment facilities Alternative 3 as presented by Herrera (1995b), Carnation's wastewater would be conveyed to Duvall, combining the wastewater flows of Carnation and Duvall at a wastewater and biosolids treatment facility in Duvall. For modified Alternative 2 (Herrera 1995b), North Bend wastewater would be conveyed to Snoqualmie, combining the wastewater flows of North Bend and Snoqualmie with a wastewater and biosolids treatment facility in Snoqualmie.

Under Option 3B, each community would conduct the following activities:

- North Bend – Provide secondary treatment. Haul dewatered solids at 15 percent solids to Snoqualmie.

- Snoqualmie – Accept dewatered solids from Snoqualmie and North Bend. Provide aerobic digestion and dewatering. Use land application or provide a heat drying or composting facility to produce Class A biosolids.

- Carnation – Provide secondary treatment. Haul dewatered solids to Duvall.

- Duvall – Accept dewatered solids from Carnation and Duvall. Provide aerobic digestion and dewatering. Use land application or provide a heat drying or composting facility to produce Class A biosolids.

- Echo Glen – Continue current wastewater solids treatment and composting operation.

Option 3C. Wastewater Solids and Biosolids Treatment Facilities in Duvall and at Echo Glen

A wastewater solids treatment and biosolids processing facility would be designed and developed in Duvall and Echo Glen. Equipment would be purchased for secondary treatment of wastewater, aerobic digestion, and dewatering to accommodate the wastewater flow for the year 2030. Class B biosolids would be land-applied from the wastewater treatment facility, or a heat drying or compost facility would be constructed. For a biosolids treatment facility, the communities would design and develop a site and would purchase equipment based on the chosen compost or heat drying method. In addition, adequate acreage must be provided to 1) accommodate the chosen composting or heat drying process, 2) provide adequate buffers from adjacent land uses, and 3) store equipment such as dryers, or bulking amendments (Table 3).

The facility located in Duvall would accept dewatered solids from Duvall and Carnation. The facility located at Echo Glen Children's Center would accept dewatered solids from Echo Glen, Snoqualmie, and North Bend. Option 3C does not correspond with any of the centralized wastewater treatment alternatives presented by Herrera (1995b).

Each community would conduct the following activities:

- North Bend – Provide secondary treatment. Haul dewatered solids at 15 percent solids to Echo Glen.

- Snoqualmie – Provide secondary treatment. Haul dewatered solids at 15 percent solids to Echo Glen.

- Carnation – Provide secondary treatment. Haul dewatered solids at 15 percent solids to Duvall.

- Duvall – Accept dewatered solids from Carnation and Duvall. Provide aerobic digestion and dewatering. Use land application or provide a heat drying or composting facility to produce Class A biosolids.

- Echo Glen – Accept dewatered solids from Echo Glen, Snoqualmie, and North Bend. Provide aerobic digestion and dewatering. Use land application or provide a heat drying or composting facility to produce Class A biosolids.

Reliability

Under this alternative, each community that hauls its wastewater solids to another community's processing or treatment facility is dependent on the reliability of the processing community's system and management structure. The communities hauling solids thereby give up some control over their wastewater solids.

This alternative may offer some additional reliability by allowing all the communities to jointly land-apply their biosolids. It may be easier, more cost-effective, and more reliable to locate one land application site for all the cities than to locate a separate site for each community (alternative 1). This alternative also offers some additional reliability by processing solids in a central location, allowing the biosolids treatment facility or land application site to receive solids of consistent quality.

There are some differences in reliability between technologies. The end product of heat drying would potentially be more difficult to reuse than biosolids compost. Although both composting and heat drying process wastewater solids, digested biosolids are easier to handle than wastewater solids, are less odoriferous, and require less bulking agent (for composting). These differences are further discussed in Appendix C.

Cost

Estimated costs are provided in Appendix A, Tables A-5, A-6, and A-7. Costs for direct conveyance of wastewater and centralized wastewater treatment are provided in Herrera (1995b).

Hauling costs are estimated for hauling at 15 percent solids. These costs are included in the O&M costs under the total maximum and minimum costs. Dewatering is included prior to hauling. Without dewatering, hauling costs would be exorbitantly high.

Overall, heat drying and in-vessel composting are the biosolids processing technologies with the highest capital and O&M costs under Alternative 3—Centralized Wastewater Solids and Biosolids Processing. In contrast, land application of biosolids incurs the lowest costs for each community.

Under Option 3A, one facility would be located in Duvall. Dewatered solids would be hauled at 15 percent solids from Snoqualmie and North Bend to Duvall. Dewatered solids from Carnation would be hauled at 15 percent solids to Duvall. Solids would be digested for land application or further treated to produce Class A biosolids at each centralized facility.

The highest total cost for biosolids treatment under Option 3A involves dewatering, hauling, aerobic digestion, dewatering, and heat drying. Base capital costs are approximately $2,700,000 for North Bend and Snoqualmie with $450,000 annual O&M costs. Base capital costs are approximately $1,000,000 for Carnation and Duvall with $123,000 annual O&M costs.

The lowest total cost for biosolids treatment involves dewatering, hauling, aerobic digestion, dewatering, and land application. Base capital costs are approximately $1,000,000 for North Bend and Snoqualmie with $300,000 annual O&M costs. Base capital costs are approximately $525,000 for Carnation and Duvall with $65,000 annual O&M costs.

Under Option 3B, facilities would be located in Snoqualmie and Duvall. Dewatered solids would be hauled from Carnation to Duvall. North Bend would haul its dewatered solids to Snoqualmie.

The highest total cost for biosolids treatment under Option 3B involves dewatering, hauling, aerobic digestion, dewatering, and heat drying for North Bend and Snoqualmie. For Carnation and Duvall, the highest total cost involves aerobic digestion, dewatering, and in-vessel composting. Base capital costs are approximately $2,800,000 for North Bend and Snoqualmie and O&M costs are approximately $475,000. For Carnation and Duvall, base capital costs are approximately $985,000 and O&M costs are $225,000.

The lowest total cost for biosolids treatment involves dewatering, hauling, aerobic digestion, dewatering, and land application. Base capital costs are approximately $1,000,000 for North Bend and Snoqualmie and O&M costs are approximately $300,000. Base capital costs are approximately $675,000 for Carnation and Duvall with $84,000 annual O&M costs.

Under option 3C, facilities would be located at Echo Glen and in Duvall. Dewatered solids from Carnation would be hauled at 15 percent solids to Duvall. North Bend and Snoqualmie would haul their dewatered solids at 15 percent solids to the facility at Echo Glen.

The highest total cost for biosolids treatment under Option 3C involves aerobic digestion, dewatering, and heat drying for North Bend, Snoqualmie, and Echo Glen. For Carnation and Duvall, the highest total cost involves dewatering, hauling, aerobic digestion, dewatering, and in-vessel composting. Base capital costs are approximately $2,700,000 for North Bend and Snoqualmie and O&M costs are $510,000. Base capital and O&M costs for Echo Glen are $105,000 and $14,000, respectively. For Carnation and Duvall, base capital costs are approximately $1,000,000 and O&M costs are $225,000.

The lowest total cost for biosolids treatment involves dewatering, hauling, aerobic digestion, dewatering, and land application. Base capital costs for North Bend and Snoqualmie are approximately $1,000,000 and O&M costs are $310,000. Base capital and O&M costs for Echo Glen are approximately $37,000 and $6,500, respectively. Base capital costs are approximately $675,000 for Carnation and Duvall with $84,000 annual O&M costs.

As shown in Appendix A, compared to Alternative 1, this alternative offers a potential cost savings to each community due to the economy of scale from centralized facilities. For communities hauling solids to a central facility, hauling costs may be offset by cost savings due to the economy of scale for capital, land, and O&M costs. Communities where centralized facilities are located also benefit from the cost savings.

Federal Disposal Regulations

There is no significant difference between alternatives in regard to the federal disposal regulations. Regardless of whether the wastewater or biosolids treatment facility is centralized or decentralized, the four cities and Echo Glen Children's Center must comply with all federal, state, and local regulations pertaining to the use and disposal of wastewater solids. Snoqualmie would not need to produce Class B biosolids.

Overall Benefit to Community

There are benefits to be gained by each community in terms of recycling and sustainability from locally reusing its biosolids. These benefits would be gained by each community from reusing biosolids anywhere in the Snoqualmie Valley. Benefits to the community are anticipated to be the same under each management alternative.

Environmental Impacts

Under this alternative, the communities where facilities are located would bear the environmental impacts of the facility.

Centralized facilities would result in more traffic and traffic-related impacts than would decentralized facilities. However, no traffic impacts would occur with a centralized wastewater treatment facility as described by Herrera (1995b).

Potential environmental impacts may result from the chosen processing technology and reuse method. These impacts are discussed in Appendix C.

Advantages, Disadvantages, and Opportunities

Potential advantages of this alternative include:

- Aerobic digestion would take place at the centralized facility. The biosolids would then be easier to handle and less odoriferous. The additional costs incurred by digestion may be offset by costs incurred to locate a facility and gain public acceptance.

- One or two facilities would be constructed that would handle the wastewater flow projections through the year 2030.

- A central location would be provided for hauling to a land application site and for marketing the end product.

- Each community may realize a cost savings due to the economy of scale of centralized processing.

Potential disadvantages of this alternative include:

- The facility at each community would forfeit its autonomy.

- Each community must haul dewatered wastewater solids.

- Increased traffic-related impacts would occur.

Potential Opportunities

- This alternative may be considered jointly with centralized wastewater treatment facilities.

- Land costs may be reduced by locating a facility at Echo Glen.

- Land costs associated with land application may be substantially reduced with joint application of biosolids.

SUMMARY

This report compares three biosolids management alternatives through consideration of the following factors: reliability, cost, compliance with federal disposal regulations, overall benefit to the community, environmental impacts, and advantages and disadvantages.

Reliability is assessed by determining whether biosolids can be processed under one of the management alternatives more reliably than under another. However, the primary factor affecting the reliability of a given biosolids processing option is the technology used rather than whether processing facilities are centralized or decentralized. The differences in reliability among biosolids processing technologies relate to the consistency of the end product and its potential for reuse.

In implementing an alternative, citizens may have more confidence in Alternative 1—Decentralized Biosolids Processing, because the biosolids processing facility would be owned and operated by local government. Alternative 2—Centralized Biosolids Processing provides some local control, whereas Alternative 3—Centralized Wastewater Solids and Biosolids Processing provides the least amount of local control among all the alternatives.

Less significant differences in reliability between alternatives 1, 2, and 3 involve the number of truck trips required to haul wastewater solids and biosolids between facilities. Trucks hauling wastewater solids and biosolids are subject to vehicle disrepair, accidents, and delays due to inclement weather and traffic. Alternative 1—Decentralized Biosolids Processing involves the least amount of hauling, whereas Alternatives 2 and 3 involve the most.

Conceptual capital and operation and maintenance (O&M) costs are estimated for each management alternative. The type of technology and hauling are the primary factors that influence the cost of each management alternative. The highest total capital cost for heat drying, for example, is estimated to be approximately three times the cost of land application for most options presented in this report. (However, it should be noted that land costs are not included in the analysis.) The differences in cost between management alternatives usually involve hauling. Other then hauling, the highest and the lowest total cost for wastewater solids and biosolids treatment under each option are not significantly different.

For Carnation and Snoqualmie, Alternative 2—Centralized Biosolids Processing provides the lowest costs. These cities do not have to provide digestion and can haul dewatered solids to a central treatment facility. Carnation also appears to be able to offset hauling costs based on reductions in capital and O&M costs in Alternatives 2 and 3. Duvall benefits from economy of scale under both Alternatives 2 and 3 by accepting solids from other facilities. For North Bend, Alternative 1 appears to be most cost-effective. Hauling costs are typically greater for North Bend than the cost savings realized from joint processing of solids.

Whether centralized or decentralized, all facilities must comply with the federal (40 CFR 503) and state (70.95J RCW) regulations pertaining to the processing and reuse of biosolids. There are

no differences between management alternatives related to compliance with pertinent regulations.

The management alternatives are also assessed by the benefits derived from each management alternative to the community. Since processing and reuse of biosolids would occur within the Snoqualmie Valley, benefits in terms of recycling and sustainability are anticipated to be similar for each management alternative.

Impacts on the environment are a result of the location of the biosolids facility and the type of biosolids processing technology. Traffic-related impacts are higher for the decentralized alternatives (Alternatives 2 and 3). Also, impacts on surrounding land uses would result from locating a facility. Impacts such as noise, odor, and aesthetics would affect one or two cities under Alternatives 2 and 3, whereas impacts are similar among all cities in Alternative 1.

REFERENCES

Brown and Caldwell, and E&A. 1994. Metro Biosolids Long-Range Strategy and Facilities Plan: Task 2, Current and Emerging Technology Analysis. Final report, June 3, 1994. Prepared for King County Department of Metropolitan Services by Brown and Caldwell Consultants, Seattle, WA; and E&A Environmental Consultants, Bothell, WA.

Burke, P.L. 1993. Biosolids Management—West Coast Trends and Issues. Presented by Patrick L. Burke, Montgomery Watson, Bellevue WA, at Fifth Annual Biosolids Management Conference, Union, Washington, September 12-15, 1993. Sponsored by Northwest Biosolids Management Cooperative, Seattle, WA.

Cap, Dale. June 9, 1995. Personal communication (telephone conversation with Sheila Gortler, Herrera Environmental Consultants). Southwest Suburban Sewer District, Seattle, WA.

CASA. 1991. Sludge Disposal Practices in the State of California, 1991 Update, prepared by J.M. Montgomery Consulting Engineers, Inc. California Association of Sanitation Agencies (as cited by Burke 1993).

CH2M Hill. 1994. Draft LOTT Biosolids Management Plan. Prepared for LOTT Wastewater Management Partnership by CH2M Hill, Bellevue, WA.

Conrad, P. 1995. Winning Strategy for Biosolids Compost Marketing. Biocycle Journal of Composting & Recycling 35(5):46-48.

Dannar, Ivan. June 9, 1995. Personal communication (telephone conversation with Sheila Gortler, Herrera Environmental Consultants). City of Monroe wastewater treatment facility, Monroe, WA.

Deines, Arden. June 12, 1995. Personal communication (telephone conversation with Sheila Gortler, Herrera Environmental Consultants). Echo Glen Children's Center, Snoqualmie, WA.

E&A. 1994. Puget Sound Area Compost Product Marketing Information. Final Task 2 Submittal. Prepared for O'Neill & Company and Municipality of Metropolitan Seattle by E&A Environmental Consultants, Inc., Bothell, WA.

Ecology. 1993a. Draft Biosolids Management Guidelines. Washington Department of Ecology, Olympia, WA.

Ecology. 1993b. Draft Interim Guidelines for Compost Quality. Washington Department of Ecology, Olympia WA.

Eldredge, David. June 29, 1995 (hauling cost estimates provided to Joe Hicker, Herrera Environmental Consultants). Coastal Environmental Services, North Bend, WA.

Finger, Dick. May 1995. Personal communication (telephone conversation with Jeff Remily, Herrera Environmental Consultants). King County Department of Metropolitan Services, Seattle, WA.

Fitzhugh, L. 1993. Building Strategic Alliances in Biosolids Management Facilities Planning for Long-term Success in the Seattle Metropolitan Area. Presented by Lisa Fitzhugh, O'Neill & Company, Seattle, WA Fifth Annual Biosolids Management Conference, Union, Washington September 12-15 1993. Sponsored by the Northwest Biosolids Management Cooperative, Seattle, Washington.

Fitzhugh, L., M. Norton-Arnold, and V. Fischer. 1994. Examining Markets for Biosolids. Biocycle Journal of Composting & Recycling. 35(6):72-73.

Goldstein, N., D. Riggle, and R. Steuteville. 1994. 1994 Biocycle Biosolids Survey: Biosolids Composting Strengthens Its Base. Biocycle Journal of Composting & Recycling. 35(12):48-57.

Haines, J. 1995. Aspergillus in Compost: Straw Man or Fatal Flaw? Biocycle Journal of Composting & Recycling. 36(4):32-35.

Hayes, Bruce. June 8, 1995. Personal communication (telephone conversation with Sheila Gortler, Herrera Environmental Consultants). Granite Falls wastewater treatment facility, Granite Falls, WA.

Herrera. 1995a. Role of Metropolitan Services Department under Current Valley Cities Planning. Prepared for HDR Engineering and King County Department of Metropolitan Services by Herrera Environmental Consultants, Seattle, WA.

Herrera. 1995b. Snoqualmie Valley Wastewater Treatment Facilities and Operations. Prepared for HDR Engineering and King County Department of Metropolitan Services by Herrera Environmental Consultants, Seattle, WA.

Hetherington, Dick. June 27, 1995. Personal communication (telephone conversation with Sheila Gortler, Herrera Environmental Consultants). U.S. Environmental Protection Agency, Region 10, Seattle, WA.

Jenson, Eric. June 27, 1995. Personal communication (telephone conversation with Sheila Gortler, Herrera Environmental Consultants). City of Carnation, Community Development. Carnation, WA.

Jones, Leroy. June 26, 1995. Personal communication (telephone conversation with Sheila Gortler, Herrera Environmental Consultants). King County Farmland Preservation Program, Seattle, WA.

King County. 1993a. King County Solid Waste Regulations Title 10 Chapter 10.40.

King County. 1993b. King County's Farmland Preservation Program Acquisition Summary. King County Property Services Division. Department of Executive Administration, King County, WA.

Klein, Jerry. June 7, 1995. Personal communication (telephone conversation with Sheila Gortler, Herrera Environmental Consultants). Eastside Realty, Issaquah, WA.

Larkowski, Tim. June 27, 1995. Personal communication (telephone conversation with Sheila Gortler, Herrera Environmental Consultants). Weyerhaeuser Snoqualmie Tree Farm, Snoqualmie, WA.

Loutsis, Tom. July 5, 1995. Personal communication (telephone conversation with Sheila Gortler, Herrera Environmental Consultants). Coldwell Banker, Bain Associates, Duvall, WA.

Low, B., and P. Lackemacher. 1991. Indirect Heated Thermal Disc Processors for Wastewater Sludge Dehydration Prior to Combustion. Presented at Air & Waste Management Association, 84th Annual Meeting, June 19, 1991 (as cited by Metro and JMM 1993).

Merchant, John, June 8, 1995. Personal communication (telephone conversation with Joe Hicker, Herrera Environmental Consultants). Port Townsend wastewater treatment facility, Port Townsend, WA.

Metcalf & Eddy. 1991. Wastewater Engineering: Treatment, Disposal, and Reuse. Third edition. McGraw Hill, Inc., New York City, NY.

Metro and JMM. 1993. Wastewater Solids: Treatment and Processing Technology Assessment. Applied Wastewater Technology Program. Municipality of Metropolitan Seattle (Metro) and James M. Montgomery Consulting Engineers Inc., Bellevue, WA.

Metro. 1995. Biosolids Long-Range Strategy and Facilities Plan, Phase II. Recommended Future Market Scenarios. Prepared for Regional Wastewater Services Plan. King County Department of Metropolitan Services. Prepared by O'Neill & Company, Seattle, WA.

Moran, Daniel, June 9, 1995. Personal communication (telephone conversation with Sheila Gortler, Herrera Environmental Consultants). Seattle/King County Department of Public Health, Seattle, WA.

NBMA. 1993. Entering a New Era: Fifth Annual Biosolids Management Conference. Conference Abstracts. Union, Washington, September 12-14, 1993. Sponsored by the Northwest Biosolids Management Cooperative, Seattle, WA.

NBMC. 1989. Regional Sludge Survey, 1989 Update National Biosolids Management Cooperative, Seattle, WA. (as cited by Burke 1993).

Oregon ACWA. 1993. 1992 Biosolids Management Program Data Base. Oregon Association of Clean Water Agencies (as cited by Burke 1993).

Segal, L. 1994. In-Vessel Composting for Low Volume Generators. Biocycle Journal of Composting & Recycling. 35(12):61-66.

Sudderth, J. June 27, 1995. Personal communication (telephone conversation with Joe Hicker, Herrera Environmental Consultants), Coldwell Banker, Bain Associates, Duvall, WA.

Tong, C. 1994. Northwest Farmers See Benefits of Biosolids Use. Biocycle Journal of Composting & Recycling. 35(10):38-39.

Tyree, Richard. June 16, 1995. Personal communication (telephone conversation with Sheila Gortler, Herrera Environmental Consultants). Tyree Engineering, Seattle, WA. (Former project manager for BBBLENS, a regional organization of municipal wastewater treatment plants).

U.S. EPA. 1983. Final Environmental Impact Statement. Municipality of Metropolitan Seattle Sludge Management Plan. U.S. Environmental Protection Agency, Region 10, Seattle, WA.

U.S. EPA. 1985a. Composting of Municipal Wastewater Sludges. Seminar Publication. EPA 625/4-85-014. U.S. Environmental Protection Agency, Center for Environmental Research Information, Cincinnati, OH.

U.S. EPA. 1985b. EPA Handbook. Estimating Sludge Management Costs. EPA 625/6-85/010. Prepared for the U.S. Environmental Protection Agency by SCS Engineers, Inc., Long Beach, CA.

U.S. EPA. 1988. National Sewage Sludge Survey. U.S. Environmental Protection Agency, Washington, D.C.

WEF and ASCE. 1992. Design of Municipal Wastewater Treatment Plants, Volume II: Chapters 13-20. Prepared by Joint Task Force of the Water Environment Federation (formerly the Water Pollution Control Federation) and the American Society of Civil Engineers, with grant assistance from the U.S. Environmental Protection Agency.

APPENDIX A

Estimated Costs Incurred Under Each Alternative

Table A-1. Estimated costs incurred by each city under Alternative 1—Decentralized Biosolids Processing.[1]

	City of North Bend	City of Snoqualmie	City of Carnation	City of Duvall
Biosolids Quantities (2030) in gallons	6,915,000	5,006,000	1,584,000	2,074,000
Cost Estimates ($)[2]				
Aerobic Digestion[3]				
Base Capital	536,760	511,200	408,960	434,520
O&M	89,460	83,070	57,510	63,900
Dewatering[4]				
Base Capital	377,000	345,000	307,000	313,000
O&M	19,000	14,000	6,400	7,700
Hauling	NA	NA	37,130[5]	NA
Aerated Static Pile				
Base Capital	958,000	897,000	767,000	805,000
O&M	223,000	205,000	185,000	192,000
Windrow				
Base Capital	735,000	716,000	665,000	677,000
O&M	208,000	203,000	185,000	192,000
In Vessel[6]				
Base Capital	1,730,000	1,260,000	403,000	518,000
O&M	652,000	472,000	151,000	196,000
Heat Drying				
Base Capital	NP	NP	NP	NP
O&M				
Land Application[7]				
Base Capital	230,000	217,000	160,000	160,000
O&M	77,000	64,000	41,000	50,000
Total cost (maximum)				
Base Capital	2,643,760[8]	2,116,200[8]	1,482,960[9]	1,552,520[9]
O&M	760,460	569,070	214,910	263,600
Total Cost (minimum)[10]				
Base Capital	1,143,760	1,073,200	875,960	907,520
O&M	185,460	161,070	104,910	121,600

1 All facilities provide secondary treatment.
2 Costs are in 1995 dollars but are based on wastewater flows expected in the year 2030.
3 Aerobic digestion is optional but may be used prior to composting or heat drying to reduce aesthetic impacts and buffer requirements.
4 Dewatering is required at each facility. Costs are included in annual O&M under maximum and minimum total costs.
5 Estimated cost provided if Carnation hauls its wastewater solids at 15 percent solids to Duvall for further treatment.
6 Costs are based on an actual estimate provided by a vendor.
7 Aerobic digestion or the equivalent is required. Biosolids must meet Class B standards for land application.
8 Estimated maximum costs include aerobic digestion, dewatering, and in-vessel composting.
9 Estimated maximum costs include aerobic digestion, dewatering, and aerated static pile composting.
10 Estimated minimum costs include aerobic digestion, dewatering, and land application.
NA Not applicable. However, hauling costs would be incurred if 1) the biosolids treatment facility is not adjacent to the wastewater treatment plant and wastewater solids are not directly conveyed, and 2) land application is selected as the reuse method.
NP Not a practical option. Heat drying facilities typically do not process this small quantity of biosolids.

Table A-2. Estimated costs incurred by each city under Alternative 2—Centralized Biosolids Processing, Option 2A.

Option 2A. Centralized facility in Duvall[1]				
	City of North Bend	City of Snoqualmie	City of Carnation	City of Duvall
Biosolids Quantity (gallons)	6,915,000	5,006,000	1,584,000	2,074,000
Cost Estimates ($)[2]				
Aerobic Digestion[3]				
Base Capital	536,760	511,200[4]	408,960[4]	434,520
O&M	89,460	83,070	57,510	63,900
Dewatering[5]				
Base Capital	377,000	345,000	307,000	313,000
O&M	19,000	14,000	6,400	7,700
Hauling[6]	154,700	117,000	37,130	NA
Aerated Static Pile				
Base Capital	656,923	475,568	150,479	197,029
O&M	130,497	94,471	29,892	39,140
Windrow				
Base Capital	357,313	258,671	81,848	107,168
O&M	104,753	75,834	23,995	31,418
In-Vessel[7]				
Base Capital	1,731,080	1,253,187	396,533	519,199
O&M	648,045	469,142	148,446	194,367
Heat Drying				
Base Capital	2,117,244	1,532,744	484,990	635,021
O&M	258,330	187,014	59,175	77,480
Total cost (maximum)[8]				
Base Capital	3,031,004	2,388,944	1,200,950	1,382,541
O&M	521,490	401,084	160,215	149,080
Total Cost (minimum)				
Base Capital	1,271,073[9]	603,671[10]	388,848[10]	854,688[9]
O&M	367,913	206,834	67,525	103,018

1 Each city provides secondary treatment.
2 Costs are in 1995 dollars but are based on wastewater flows expected in the year 2030.
3 Duvall and North Bend use aerobic digestion.
4 Optional. Digestion is commonly used to reduce aesthetic impacts and buffers at the biosolids processing site.
5 Dewatering takes place at each facility prior to hauling.
6 Estimated cost for hauling at 15 percent solids. Costs are included in annual O&M under maximum and minimum total costs.
7 Costs are based on an actual estimate provided by a vendor.
8 Estimated maximum costs include aerobic digestion, dewatering, and heat drying based on percentage of biosolids quantity contributed by each city. Hauling costs are included for North Bend, Snoqualmie and Carnation.
9 Estimated minimum costs include aerobic digestion (only for North Bend and Duvall), dewatering, and windrow composting based on percentage of biosolids quantity contributed by each city. Hauling costs are included for North Bend, Snoqualmie and Carnation.
10 Estimated minimum costs include dewatering, and windrow composting based on percentage of biosolids quantity contributed by each city. Hauling costs are included for North Bend, Snoqualmie and Carnation.
NA Not applicable. However, hauling costs would be incurred if the biosolids treatment facility is not adjacent to the wastewater treatment plant.
NP Not a practical option. Heat drying facilities typically do not process this small quantity of biosolids.

Table A-3. Estimated costs incurred by each city under Alternative 2—Centralized Biosolids Processing, Option 2B.

Option 2B. Centralized facilities in Snoqualmie and Duvall[1]				
	City of North Bend	City of Snoqualmie	City of Carnation	City of Duvall
Biosolids Quantity (gallons)	6,915,000	5,006,000	1,584,000	2,074,000
Cost Estimate ($)[2]				
Aerobic Digestion[3]				
Base Capital	536,760	511,200[4]	408,960[4]	434,520
O&M	89,460	83,070	57,510	63,900
Dewatering[5]				
Base Capital	377,000	345,000	307,000	313,000
O&M	19,000	14,000	6,400	7,700
Hauling[6]	154,700	NA	37,130	NA
Aerated Static Pile				
Base Capital	684,400	495,600	374,133	489,867
O&M	144,420	104,580	85,739	112,261
Windrow				
Base Capital	444,860	322,140	304,416	398,584
O&M	129,920	94,080	85,739	112,261
In-Vessel[7]				
Base Capital	1,760,880	1,275,120	398,815	522,185
O&M	661,200	478,800	149,826	196,174
Heat Drying				
Base Capital	2,146,000	1,554,000	NP	NP
O&M	262,160	189,840		
Total cost (maximum)				
Base Capital	3,059,760[8]	2,410,200[8]	1,114,775[9]	1,269,705[9]
O&M	525,320	286,910	250,866	267,774
Total Cost (minimum)				
Base Capital	1,358,620[10]	667,140[11]	611,416[11]	1,146,104[10]
O&M	393,080	108,080	129,269	183,861

1 Each city provides secondary treatment.
2 Costs are in 1995 dollars but are based on wastewater flows expected in the year 2030.
3 Duvall and North Bend use aerobic digestion.
4 Optional. Digestion is commonly used to reduce aesthetic impacts and buffers at the biosolids processing site.
5 Dewatering takes place at each facility prior to hauling.
6 Estimated cost for hauling at 15 percent solids. Costs are included in annual O&M under maximum & minimum total costs.
7 Costs are based on an actual estimate provided by a vendor.
8 Estimated maximum costs include aerobic digestion, dewatering, and heat drying based on percentage of biosolids quantity contributed by each city. Hauling costs are included for North Bend.
9 Estimated maximum costs include aerobic digestion, dewatering, and in-vessel composting based on percentage of biosolids quantity contributed by each city. Hauling costs are included for Carnation.
10 Estimated minimum costs include aerobic digestion (only for North Bend and Duvall), dewatering, and windrow composting based on percentage of biosolids quantity contributed by each city.
11 Estimated minimum costs include dewatering, hauling and windrow composting based on percentage of biosolids quantity contributed by each city. Hauling costs are included in for Carnation.
NA Not applicable. However, hauling costs would be incurred if the biosolids treatment facility is not adjacent to the wastewater treatment plant.
NP Not a practical option. Heat drying facilities typically do not process this small quantity of biosolids.

Table A-4. Estimated costs incurred by each community under Alternative 2—Centralized Biosolids Processing, Option 2C.

Option 2C. Centralized biosolids treatment facilities at Echo Glen Children's Center and Duvall[1]					
	City of North Bend	City of Snoqualmie	Echo Glen Children's Center	City of Carnation	City of Duvall
Biosolids Quantity (gallons)	6,915,000	5,006,000	182,000	3,658,000	12,102,000
Cost Estimate ($)[2]					
Aerobic Digestion[3]					
Base Capital	536,760	511,200[4]	396,180[4]	408,960[4]	434,520[4]
O&M	89,460	83,070	55,000	57,510	63,900
Dewatering[5]					
Base Capital	377,000	345,000	8,960	307,000	313,000
O&M	19,000	14,000	600	6,400	7,700
Hauling[6]	154,700	117,000	NA	37,130	NA
Aerated Static Pile					
Base Capital	672,600	483,800	23,600	374,133	489,867
O&M	141,930	102,090	4,980	85,739	112,261
Windrow					
Base Capital	437,190	314,470	15,340	304,416	398,584
O&M	127,680	91,840	4,480	85,739	112,261
In-Vessel[7]					
Base Capital	1,730,520	1,244,760	60,720	398,815	522,185
O&M	649,800	467,400	22,800	149,826	196,174
Heat Drying					
Base Capital	2,109,000	1,517,000	74,000	NP	NP
O&M	257,640	185,320	9,040		
Total cost (maximum)					
Base Capital	3,022,760[8]	2,373,200[8]	888,100[8]	1,114,775[9]	1,269,705[9]
O&M	520,800	399,390	124,660	250,866	267,774
Total Cost (minimum)					
Base Capital	1,350,950[10]	659,470[11]	24,300[11]	611,416[11]	1,146,104[10]
O&M	390,840	222,840	5,080	129,269	183,861

1 Each city provides secondary treatment.
2 Costs are in 1995 dollars but are based on wastewater flows expected in the year 2030.
3 Duvall and North Bend use aerobic digestion.
4 Optional. Digestion is commonly used to reduce aesthetic impacts and buffers at the biosolids processing site.
5 Dewatering takes place at each facility prior to hauling.
6 Cost for hauling at 15 percent solids. Hauling costs are included in O&M costs under maximum & minimum costs.
7 Costs are based on an actual estimate provided by a vendor.
8 Estimated maximum costs include aerobic digestion, dewatering, and heat drying based on percentage of biosolids quantity contributed by each city. Hauling costs are included for North Bend.
9 Estimated maximum costs include aerobic digestion, dewatering, and in-vessel composting based on percentage of biosolids quantity contributed by each city. Hauling costs are included for Carnation.
10 Estimated minimum costs include aerobic digestion (only for North Bend and Duvall), dewatering, and windrow composting based on percentage of biosolids quantity contributed by each city. Hauling costs are included for North Bend and Snoqualmie.
11 Estimated minimum costs include dewatering, hauling, and windrow composting based on percentage of biosolids quantity contributed by each city. Hauling costs are included for Carnation.
NA Not applicable. However, hauling costs would be incurred if the biosolids treatment facility is not adjacent to the wastewater treatment plant.
NP Not a practical option. Heat drying facilities typically do not process this small quantity of biosolids.

Table A-5. Estimated costs incurred by each city under Alternative 3—Centralized Wastewater Solids and Biosolids Processing, Option 3A.

Option 3A Centralized wastewater solids treatment facility at Duvall[1]				
	City of North Bend	**City of Snoqualmie**	**City of Carnation**	**City of Duvall**
Biosolids Quantity (gallons)	6,915,000	5,006,000	1,584,000	2,074,000
Cost Estimates ($)[2]				
Dewatering[3] *				
Base Capital	377,000	345,000	307,000	313,000
O&M	19,000	14,000	6,400	7,700
Hauling[4] *	154,700	117,000	37,130	NA
Aerobic Digestion[5]				
Base Capital	340,446	246,460	77,984	102,109
O&M	82,115	59,446	18,809	24,629
Dewatering[6]				
Base Capital	326,145	237,196	74,124	96,361
O&M	28,116	20,448	6,390	8,307
Aerated Static Pile				
Base Capital	656,923	475,568	150,479	197,029
O&M	130,497	94,471	29,892	39,140
Windrow				
Base Capital	357,313	258,671	81,848	107,168
O&M	104,753	75,834	23,995	31,418
In-Vessel[7]				
Base Capital	1,731,080	1,253,187	396,532	519,199
O&M	648,045	469,142	148,445	194,367
Heat Drying				
Base Capital	2,117,244	1,532,744	484,989	635,021
O&M	258,330	187,014	59,174	77,480
Land Application				
Base Capital	176,215	127,568	40,364	52,852
O&M	51,045	36,953	11,692	15,310
Total Cost (maximum)[8]				
Base Capital	3,160,835	2,361,400	944,097	1,146,491
O&M	542,261	397,908	127,903	118,116
Total Cost (minimum)[9]				
Base Capital	1,219,806	956,224	499,472	564,322
O&M	334,976	247,847	80,421	55,946

1 Each city provides secondary treatment unless wastewater is directly conveyed to Duvall.
2 Costs are in 1995 dollars but are based on wastewater flows expected in the year 2030.
3 Solids are dewatered to 15 percent solids at each facility prior to hauling, unless wastewater is directly conveyed to Duvall.
4 Solids are hauled at 15 percent solids unless wastewater is directly conveyed to Duvall. Hauling costs are included in O&M under maximum and minimum total costs.
5 Wastewater solids are rehydrated (unless wastewater is directly conveyed to Duvall), and aerobic digestion is conducted in Duvall. Each city pays a percentage of the cost based on biosolids quantity. Digestion is included as a required cost because heat drying or composting unstabilized wastewater solids would result in significant aesthetic impacts and large buffer zones.
6 Dewatering takes place in Duvall. Wastewater solids at 6 percent solids are dewatered to 15 percent solids.
7 Costs are based on an actual estimate provided by a vendor.
8 Estimated maximum costs include aerobic digestion, dewatering, and heat drying based on percentage of biosolids quantity contributed by each city. Hauling costs are included for North Bend, Snoqualmie and Carnation.
9 Estimated minimum costs include aerobic digestion, dewatering, and land application based on percentage of biosolids quantity contributed by each city. Hauling costs are included for North Bend, Snoqualmie, and Carnation.
NA Not applicable. Facility is located in Duvall so no hauling costs would be incurred.
* These activities are only conducted if wastewater is not directly conveyed to the centralized facility in Duvall. These activities are an alternative to conveyance.

Table A-6. Estimated costs incurred by each city under Alternative 3—Centralized Wastewater Solids and Biosolids Processing, Option 3B.

Option 3B. Centralized wastewater treatment facilities at Snoqualmie and Duvall[1]				
	North Bend	Snoqualmie	Carnation	Duvall
Biosolids Quantity (gallons)	6,915,000	5,006,000	1,584,000	2,074,000
Cost Estimate ($)[2]				
Dewatering[3] *				
Base Capital	377,000	345,000	307,000	313,000
O&M	19,000	14,000	6,400	7,700
Hauling[4] *	154,700	NA	37,130	NA
Aerobic Digestion[5]				
Base Capital	392,740	284,317	204,820	268,180
O&M	81,797	59,215	32,044	41,956
Dewatering[6]				
Base Capital	340,970	246,909	164,862	218,538
O&M	26,684	19,323	5,495	7,284
Aerated Static Pile				
Base Capital	684,400	495,600	374,133	489,867
O&M	144,420	104,580	85,739	112,261
Windrow				
Base Capital	444,860	322,140	304,416	398,584
O&M	129,920	94,080	85,739	112,261
In-Vessel[7]				
Base Capital	1,760,880	1,275,120	398,815	522,185
O&M	661,200	478,800	149,826	196,174
Heat Drying				
Base Capital	2,146,000	1,554,000	NP	NP
O&M	262,160	189,840		
Land Application				
Base Capital	178,060	128,940	83,141	108,859
O&M	55,854	40,446	26,847	35,153
Total Cost (maximum)				
Base Capital	3,204,416[8]	2,392,369[8]	948,661[9]	1,155,832[9]
O&M	544,659	399,609	217,660	235,787
Total Cost (minimum)[10]				
Base Capital	1,236,476	967,309	632,987	742,506
O&M	338,353	250,215	94,681	74,766

1 Each city provides secondary treatment, unless wastewater is directly conveyed to Snoqualmie and Duvall.
2 Costs are in 1995 dollars but are based on wastewater flows expected in the year 2030.
3 Wastewater solids are dewatered to 15 percent solids at each facility prior to hauling, unless wastewater is directly conveyed to Snoqualmie and Duvall.
4 Wastewater solids are hauled at 15 percent solids, unless wastewater is directly conveyed to Snoqualmie and Duvall.
5 Wastewater solids are rehydrated (unless wastewater is directly conveyed) and aerobic digestion is conducted at the facilities in Snoqualmie and Duvall. Each city pays a percentage of the cost based on biosolids quantity. Digestion is included as a required cost because heat drying or composting unstabilized wastewater solids would result in significant aesthetic impacts and large buffer zones.
6 Dewatering takes place at the facilities in Snoqualmie and Duvall. Wastewater solids at 6 percent solids are dewatered to 15 percent solids.
7 Costs are based on an actual estimate provided by a vendor.
8 Estimated maximum costs include aerobic digestion, dewatering, and heat drying based on percentage of biosolids quantity contributed by each city. Hauling costs are included for North Bend and Carnation.
9 Estimated maximum costs include aerobic digestion, dewatering, and in-vessel composting based on percentage of biosolids quantity contributed by each city. Hauling costs are included for North Bend and Carnation.
10 Estimated minimum costs include aerobic digestion, dewatering, and land application based on percentage of biosolids quantity contributed by each city. Hauling costs are included for North Bend and Carnation.
NA Not applicable. Hauling costs are not incurred by the cities that host the facility.
NP Not a practical option. Heat drying is a process that is typically used for larger quantities of biosolids.
* These activities are only conducted if wastewater is not directly conveyed to the centralized facility in Snoqualmie and Duvall. These activities are an alternative to conveyance.

Table A-7. Estimated costs incurred by each community under Alternative 3—Centralized Wastewater Solids and Biosolids Processing, Option 3C.

Option 3C. Centralized wastewater treatment facilities at Echo Glen Children's Center and Duvall[1]					
	North Bend	**Snoqualmie**	**Echo Glen Children's Center**	**Carnation**	**Duvall**
Biosolids Quantity (gallons)	6,915,000	5,006,000	182,000	3,658,000	12,102,000
Cost Estimate ($)[2]					
Dewatering[3] *					
Base Capital	377,000	345,000	8,960	307,000	313,000
O&M	19,000	14,000	600	6,400	7,700
Hauling[4] *	154,700	117,000	NA	37,130	NA
Aerobic digestion[5]					
Base Capital	386,833	280,041	10,181	204,820	268,180
O&M	80,566	58,325	2,120	32,044	41,956
Dewatering[6]					
Base Capital	327,807	235,791	11,502	164,862	218,538
O&M	50,992	36,678	1,789	5,495	7,284
Aerated Static Pile					
Base Capital	672,600	483,800	23,600	374,133	489,867
O&M	141,930	102,090	4,980	85,739	112,261
Windrow					
Base Capital	437,190	314,470	15,340	304,416	398,584
O&M	127,680	91,840	4,480	85,739	112,261
In-Vessel[7]					
Base Capital	1,730,520	1,244,760	60,720	398,815	522,185
O&M	649,800	467,400	22,800	149,826	196,174
Heat Drying					
Base Capital	2,109,000	1,517,000	74,000	NP	NP
O&M	257,640	185,320	9,040		
Land Application[4, 5]					
Base Capital	174,990	125,870	6,140	83,141	108,859
O&M	54,891	39,483	1,926	26,847	35,153
Total Cost (maximum)					
Base Capital	3,154,253[8]	2,344,251[8]	104,643[8]	948,661[9]	1,115,832[9]
O&M	564,447	412,444	13,549	217,660	235,787
Total Cost (minimum)[10]					
Base Capital	1,220,243	953,121	36,783	632,987	742,506
O&M	361,698	266,607	6,435	94,681	74,766

1 Each city provides secondary treatment, unless wastewater is directly conveyed to Echo Glen and Duvall.
2 Costs are in 1995 dollars but are based on wastewater flows expected in the year 2030.
3 Solids are dewatered to 15 percent solids at each facility prior to hauling, unless wastewater is directly conveyed to Echo Glen and Duvall.
4 Solids are hauled at 15 percent solids unless wastewater is directly conveyed to Echo Glen and Duvall. Hauling costs are included in O&M under total maximum and minimum costs.
5 Wastewater solids are rehydrated (unless wastewater is conveyed) and aerobic digestion is conducted at Echo Glen and in Duvall. Each city pays a percentage of the cost based on biosolids quantity. Digestion is included as a required cost because heat drying or composting unstabilized wastewater solids would result in significant aesthetic impacts and large buffer zones.
6 Dewatering takes place at Echo Glen and in Duvall.
7 Costs are based on an actual estimate provided by a vendor.
8 Estimated maximum costs include aerobic digestion, dewatering, and heat drying based on percentage of biosolids quantity contributed by each city. Hauling costs are included for North Bend, Snoqualmie, and Carnation.
9 Estimated maximum costs include aerobic digestion, dewatering, and in-vessel composting based on percentage of biosolids quantity contributed by each city. Hauling costs are included for North Bend, Snoqualmie, and Carnation.
10 Estimated minimum costs include aerobic digestion, dewatering, and land application based on percentage of biosolids quantity contributed by each city. Hauling costs are included for North Bend, Snoqualmie, and Carnation.
NA Not applicable. Hauling costs are not incurred by the cities that host the facility.
NP Not a practical option. Heat drying is a process that typically uses larger quantities of biosolids.

APPENDIX B

Projected Hauling Costs to Metro Facility

Table B-1. Projected costs for biosolids hauled to Metro's wastewater treatment facility in Renton[1]

Facility	Biosolids		Septage		Total	
	2000	2030	2000	2030	2000	2030
North Bend	$70,000	$2,884,000	$35,500	$0	$105,000	$2,884,000
Snoqualmie	$0	$3,748,000	$23,700	$0	$23,700	$3,748,000
Carnation	$26,600	$1,186,000	$54,080	$15,192	$82,620	$1,201,192
Duvall	$39,000	$360,400	$7,233	$0	$46,233	$360,400

[1]Based on hauling costs between North Bend and Renton
Source: Herrera (1995a)

APPENDIX C

Biosolids Processing Technologies and Reuse Methods

CONTENTS

BIOSOLIDS PROCESSING TECHNOLOGIES AND REUSE METHODS

This appendix presents a description and evaluation of biosolids processing technologies and reuse methods that are commonly used in treating municipal wastewater solids. The two processing technologies are heat drying and composting. Land application is discussed as a reuse method. These three methods of treating biosolids represent the realistic possibilities for handling solids from wastewater treatment facilities in the Snoqualmie Valley.

CRITERIA FOR ASSESSING BIOSOLIDS PROCESSING TECHNOLOGIES AND REUSE METHODS

Heat drying, composting, and land application of aerobically digested biosolids are discussed through consideration of the following factors: reliability, cost, federal disposal regulations, land requirements, environmental impacts, benefits and drawbacks, and market potential. A brief discussion of the relevance of these factors, and how they are used to assess the biosolids handling technologies and disposal methods is provided in the following paragraphs.

Reliability

Reliability is evaluated by assessing the performance record of other biosolids handling facilities. Whenever possible, the experiences of facilities with wastewater flows comparable to those estimated for the four cities and Echo Glen Children's Center for the years 2000 and 2030 are used. Examples are cited from western Washington wastewater treatment facilities, and wastewater engineering literature.

Compliance with Federal Disposal Regulations

In February of 1993, the U.S. EPA published 40 CFR (Code of Federal Regulations) Part 503, Standards for the Use or Disposal of Sewage Sludge. The 503 regulations apply "to any person who prepares wastewater solids, applies wastewater solids to the land, or fires wastewater solids in a wastewater solids incinerator and the owner/operator of a surface disposal site." The 503 regulations specify acceptable wastewater solids treatments and applications to protect human health and the environment. They identify two levels of standards (Class A and Class B) for biosolids quality produced by the various treatment technologies based on three criteria: metals, pathogens and vector attraction reduction. Both standards are suitable for land application and have the same allowable limits for metals or trace elements. The 503 regulations also include the frequency of monitoring and record keeping requirements for wastewater solids land application, surface disposal, and incineration.

Class A biosolids meet more stringent pathogen requirements prior to land application and therefore have minimum restrictions on applications. Pathogen destruction of Class B biosolids is continued at the application site. Consequently, Class B land application sites are subject to

access restrictions. Class A biosolids that meet the most restrictive trace element criteria are classified as exceptional quality biosolids. These biosolids can be distributed in bulk or containers, and are not subject to loading restrictions.

Ten acceptable vector attraction reduction (VAR) alternatives for biosolids have been identified by the U.S. EPA. The alternative selected depends on the end use. Alternatives 1 through 8, for example, are acceptable for biosolids applied at any site including lawns and home gardens. Alternatives 9 and 10 require that biosolids are injected into the soil and are not acceptable for biosolids applied to lawns or home gardens.

Organic compounds are not currently regulated under the 503 regulations because U.S. EPA, based on a nationwide survey of sewage sludge, determined that these compounds are not present in sludge at levels that would be harmful to human health or the environment. Future research may result in the regulation of some organic compounds.

Several other government agencies are involved with permitting and regulating biosolids treatment and disposal. The Washington State Department of Ecology (Ecology) is the primary agency for the management of biosolids in Washington State. Other agencies, however, such as Soil Conservation Service and Department of Health also play a role in the management of biosolids (Ecology 1993a). The King County Department of Public Health is the agency responsible for permitting biosolids facilities. As a jurisdictional health department, they have the regulatory authority to impose more stringent guidelines.

Pertinent federal, state, and local regulations are discussed for each of the biosolids handling technologies and disposal methods. A detailed summary of the 503 regulations is discussed in Appendix D.

Land Requirements

Land requirements are estimated for a heat drying, composting, and for land application of aerobically digested biosolids (Table 3). Composting facility and land application requirements are based on typical site requirements described in Wastewater Engineering Treatment and Disposal by Metcalf and Eddy (1991). Land requirements for a heat drying facility are based on a report produced by CH2M Hill (1994). Buffer zone requirements are not included in these estimates.

Buffer zones are site-specific and may range from 50 to 1,500 feet. Factors that determine buffer zones include the type of facility or land application, the severity of odorous emissions, surrounding land use and proximity to environmentally sensitive areas.

Environmental Impacts

The federal 503 regulations promote practices for the beneficial use of biosolids while maintaining or improving environmental quality and protecting human health. All biosolids processing technologies and reuse methods are required to comply with the 503 regulations.

Potential environmental impacts are addressed for each solids handling technologies and disposal methods. These impacts include changes in land use and aesthetics; elevated levels of noise, odor, and dust; increased truck traffic; and health concerns related to the fungus *Aspergillus fumigatus*.

Advantages and Disadvantages

Advantages and disadvantages are assessed by changes in local land use due to the construction and operation of a biosolids processing facility and reuse method.

Overall, inherent benefits to the community, in terms of recycling and sustainability, may be derived from reusing biosolids that are locally generated.

Market Potential

Potential markets are described for heat dried and composted products and for land application of aerobically digested biosolids. This information is derived from western Washington biosolids processing facilities, Metro marketing reports, and recent wastewater engineering literature.

A successful biosolid management program is dependent on the biosolids quality, type, and availability of the final product. In addition, land application is dependent on the availability, proximity, and acreage of potential sites. The available market for each type of biosolids management strategy is an important consideration when evaluating processing technologies and reuse methods.

Marketing strategies for the disposal of heat dried and composted products should include the following information (WEF, ASCE 1992):

- Estimate of biosolids production
- Physical form of heat-dried or composted product (e.g. particle size, consistency, moisture)
- A competitive price (i.e. compared to other forms of compost)
- Storage locations
- Transportation methods for distribution
- Use of broker or distributor to market product.

If a broker is used to distribute or market the compost or heat dried product, the following issues should be addressed (WEF, ASCE 1992):

- Guarantee of product quality
- Selling price
- Storage
- Responsibility for unsold product.

BIOSOLIDS PROCESSING TECHNOLOGIES

HEAT DRYING

Heat drying technology or thermal drying uses a heat source to reduce the moisture content of dewatered wastewater solids. This technology produces either a thermal cake or a fully dried product. A thermal cake is produced by thermal dewatering between 35 to 50 percent total solids concentration. Full drying fully evaporates the moisture to a content less than 10 percent. Heat drying technology produces biosolids that are suitable for beneficial reuse in silviculture, agriculture and as a soil amendment. The three most used heat drying processes are direct drying, indirect drying, and special processes methods (Montgomery 1993).

In direct drying, moisture is evaporated when wastewater solids are contacted with hot gasses. The rotary kiln drying process, flash dryers, Sassi process, spray dryers, and toroidal dryers are examples of technologies that utilize this process (Montgomery 1993).

Moisture is evaporated in indirect drying processes by the contact of wastewater solids and a hot surface of a dryer. Examples of technologies that utilize this process include: Jacketed hollow-flight dryers, vertical thin film dryers, Carver-Greenfield process, steam dryers, tray dryers, and the horizontal thin film dryer (Montgomery 1993).

Special processes include those processes that use special carrier fluids to facilitate evaporation of water (Montgomery 1993). The Carver-Greenfield process is the most well known of special processes. This process combines biosolids with an oil carrier fluid and the water is evaporated in a multiple effect evaporator (Montgomery 1993).

Reliability

There is only one heat drying facility in the State of Washington. It is operated by PCL Constructors/Sludge Management, Inc. (PCL/SMI), a private firm located in Seattle that has been in operation since May 1993. It is currently relocating from the Duwamish area to the West Point Treatment Plant. Approximately 30,000 tons of digested solids are supplied by Metro to the PCL/SMI facility. PCL/SMI uses an indirect steam dryer to produce a Class A pelletized product. They are responsible for the marketing and distribution of the biosolids product for beneficial reuse.

A 12-dry ton per day heat drying facility is operated by the Clayton County Water Authority in Georgia. The heat drying facility is located at its 15 mgd water pollution control plant. Waste activated sludge (WAS)[1] is dewatered to 18 to 20 percent solids with a belt filter press. The WAS is dried in triple-pass rotary kilns to 98 percent dry solids and formed into pellets. The pellets are sold to a distributor as "AGRI-PLUS 6-5-0". The product is shipped to Florida by truck for application to crops as a soil conditioner and fertilizer. The distributor is responsible

[1] Waste activated sludge is equivalent to wastewater solids that have received secondary treatment

for shipping costs and pays the Authority about $85/ton of product. Approximately 4000 tons are sold each year (WEF, ASCE 1992).

Compliance with Federal Disposal Regulations

Thermal drying is considered a process to further reduce pathogens (PFRP) by the 503 regulations. This process typically meets the Class A standards for biosolids. As reported by Low and Lackemacher (1991), to achieve a Class A standard, the biosolids must be dried to a moisture content of less than 10 percent with either the biosolids temperature reaching in excess of 80 degrees C, or the wet bulb temperature of the gas at the discharge end of the dryer being greater than 80 degrees C. Additionally, pasteurization can be achieved if the biosolids are held at a minimum temperature of 70 degrees C for at least 30 minutes.

Land Requirements

The estimated land requirements for a heat drying facility are based on quantities of biosolids treated by the facility. Buffer zones are not included in these estimates.

Environmental Impacts

Impacts that potentially result from heat drying technologies include odor, energy consumption and dust. These impacts are further discussed in the following paragraphs.

Odor is the most significant and noticeable impact resulting from this technology. The main source of odors are the gaseous emissions from the dryer. Other sources of odors include the biosolids receiving bin, conveyance equipment, and product storage silos. The severity of odorous emissions from the dryer are contingent upon the type of drying process, and the operating temperature of the dryer (Montgomery 1993). Measures to mitigate odors that are generated during heat drying include: 1) containment of processes, 2) chemical and biological treatment, and 3) providing adequate buffer zones between the facility and surrounding land uses.

Energy usage for heat drying would be significantly higher than either composting or land application. A boiler or furnace requiring energy (e.g. natural gas) would be used as a heat source to cause evaporation of moisture in wastewater solids.

High dust content in the biosolids product and in the work area presents health and safety hazards. The dust content of the product is a result of the heat drying process and the degree of product dryness which can range from pellets to a fine powder. Dust in the work area results from product transfer and type of materials handling equipment. The following steps can be taken to avoid ignition and combustion in areas susceptible to dust explosions (Montgomery 1993):

- Electrically ground equipment

- Employ explosion protection methods to vent, suppress, or isolate an explosion
- Install temperature probes to monitor the temperature profile within product storage silos
- Use controls to automatically shut down equipment under excessively high temperatures
- Minimize transfer points of product
- Use a centralized vacuuming system
- Enclose all product handling and conveyance equipment
- Wet the dried product with a small quantity of oil during unloading operations.

Advantages and Disadvantages

Heat drying processes result in a biosolids product with a significantly reduced volume due to a reduced moisture content and lack of bulking agent. Consequently, the reduced volume results in lower transportation costs and increased storage capability. Other benefits of a heat drying facility include relatively minimal land required for the facility, Class A pathogen reduction, and marketability as a fertilizer and soil conditioner. It is also acceptable for landfill disposal or efficient incineration.

The disadvantages of thermal drying include relatively high capital and energy costs, high maintenance costs, and the requirement for expensive odor control equipment.

Heat drying technology produces biosolids pellets that can be used locally by the Snoqualmie Valley community as a fertilizer or soil amendment. The pellets can be used without obvious changes to land use. Aesthetics and noise impacts would be minimized because heat drying operations would be enclosed within a building. In addition, the largest projected land requirements for a heat drying facility are less than 2 acres. Land application and composting require a larger site for operations. These technologies are more obvious and therefore impact surrounding land uses.

Market Potential

Thermal dried biosolids are a potential revenue as a fertilizer-blend and soil amendment; however, revenues earned will not cover the full cost of processing and marketing efforts. Marketability of the final product will depend on the market (i.e. supply and demand) and product quality (e.g., nutrient content, particle size, moisture content and shape, particle durability, and price).

Four heat-dried biosolids products are currently bagged and marketed for use as an organic fertilizer in the United States. Several other products are sold in bulk to fertilizer blending companies for use as fertilizer bulking agents. The thermally dried biosolids are reported to have a higher product value than compost. This enables the pellets or thermally dried product to be transported longer distances to be marketed (Montgomery 1993).

PCL/SMI, a private heat drying facility, was unsuccessful in marketing the pelletized product in early 1994. The company was unable to obtain a consistent pellet of the right size and shape and could not sell the product for fertilizer blending. All of the material was landfilled (O'Neill 1995).

Currently PCL/SMI sells a portion of the pelletized product to a hops farmer in Washington state. The east coast markets are currently saturated and sell the blended product for $50 per ton although five years ago it sold for $200 per ton. The west coast markets are not saturated. PCL/SMI expects to successfully market their product once the material is at a preferable size and consistency (O'Neill 1995).

BIOLOGICAL CONVERSION OR COMPOSTING

Biological conversion or composting is a biological process used to degrade wastewater solids into a product suitable for beneficial reuse. Dewatered septage, wastewater solids, and Class B biosolids may be composted separately or together to meet the Class A requirements of the 503 regulations and state composting guidelines (Ecology 1993). The three categories of composting systems are windrow, static pile, and in-vessel.

The windrow system composts wastewater solids with a bulking agent mixture in long rows or windrows. The windrows are aerated by convective air movement and diffusion and are turned periodically by mechanical means to expose the organic matter (U.S. EPA 1985). Windrow piles are also a commonly used method of composting. More than 20 percent of facilities in operation throughout the United States are currently using the windrow method (Goldstein et al. 1994).

The static pile method composts wastewater solids and a bulking agent mixture using a forced-aeration system installed beneath the piles. This system maintains a minimum oxygen level throughout the compost mass (U.S. EPA 1985). The aerated static pile is one of the more commonly used methods of composting. According to a composting facilities survey (Goldstein et al. 1994), out of 198 biosolids composting facilities in operation throughout the United States, approximately 45 percent were using the aerated static pile method.

In-vessel composting systems are in various stages of development with many already being marketed and used. Applications for these systems include large institutions as well as commercial, industrial and agricultural generators. Many small in-vessel systems are portable and do not require a building to house them (Segal 1994). Other advantages of this composting method include improved odor control, improved public acceptance, and a reduction in hauling

costs and labor costs. Disadvantages may include higher capital costs making it difficult for generators of smaller flows to invest.

Bulking materials include materials such as sawdust, recycled compost, wood chips, paper fibers, and shredded wood waste. The type and amount of bulking agent used depends on the type of compost process (Montgomery 1993). These materials are used to provide structure to the dewatered solids for proper aeration, reduce the moisture content, provide a carbon or energy source and dilute the mixture (Montgomery 1993). The bulking agent also works to effectively compost the biosolids by raising the solids content up to a minimum of 40 percent. Of the 21 in-vessel facilities reported in a composting facilities survey (Goldstein et al. 1994), more than half use sawdust and recycled compost as their primary bulking agents. One in-vessel facility in New Jersey facility uses pulverized pallets processed into chips as a bulking agent. Another facility was reported to use recycled paper. Wood chips are the amendment most used by aerated static pile operations. Windrow composting facilities commonly use wood waste, leaves, sawdust, brush, and manure. With the proper equipment, the larger types of bulking agents, such as wood chips, can be recovered to reduce operating costs.

Reliability

Since the mid-1970's composting has been recognized as a cost-effective and environmentally-sound technology for stabilization and ultimate disposal of wastewater solids (Metcalf & Eddy 1991). According to a (December 1994) annual survey conducted by Biocycle (Goldstein et al. 1994), there were 198 biosolids composting facilities in the United States. The survey reported 23 in construction, 39 in permitting, design, planning or bidding, and 36 in consideration.

Information was obtained from several composting facilities in western Washington. These facilities produced biosolids quantities similar to those projected for the four cities for the years 2000 and 2030. The following cities in western Washington were contacted for information regarding operations at their biosolids composting facility: Granite Falls, Monroe, Seattle (SW Suburban Sewer District), and Port Townsend. In addition to the smaller composting facilities, operations at the composting facility in Portland, Oregon are discussed.

The wastewater treatment facility in Granite Falls has a design capacity of 0.5 mgd. The facility is currently operating at 85 percent of its design capacity. Wastewater treatment consists of a holding tank and a press that achieves 10 to 12 percent solids. The composting facility consists of eight bays on a cement pad covered by a roof but not enclosed. The bays are ten feet wide and 15 feet deep. A front end loader is used to form and turn the piles within the bays. Alder and sawdust and bark are purchased and used as an amendment in a 3: 1 ratio (the first number represents the proportion of amendment and the second number represents the proportion of wastewater solids). Runoff and leachate are collected and treated at the wastewater treatment plant. Approximately 20 cubic yards of biosolids are produced each week. The biosolids are stockpiled at the facility and not bagged or containerized. Tree farmers, landscapers and home users represent the largest proportion of end users. According to the wastewater treatment facility operator, the demand for biosolids for beneficial reuse exceeds the supply. There is no charge for the composted biosolids. As required by Snohomish County Health Department, all

end users are required to sign a hold harmless agreement and an explanation of how and where the biosolids are to be used. Word-of-mouth is the primary means by which the biosolids compost is distributed to the end users. There is no marketing program to distribute the compost (Hayes 1995 personal communication).

The wastewater treatment facility in Monroe has a design capacity of 4 mgd. It is currently operating at 1 mgd. Aerobic digestion is the method of wastewater solids treatment. The wastewater is dewatered to achieve 12 percent solids. The composting facility is located on an approximately 1 acre site at the state corrections center. (The wastewater treatment facility occupies a 3 acre site). The city of Monroe owns the buildings and equipment and the State of Washington Department of Corrections owns the land. The composting process is static piles with forced aeration. A roof covers the compost bin. Tractors and a front loader are used to turn the compost piles. Woodshavings are used in a 3:1 ratio (the first number represents the proportion of amendment and the second number represents the proportion of wastewater solids). Run-off and leachate from the composting facility is collected and returned to the wastewater plant for treatment. The biosolids product meets the 503 regulations Class A standards. Approximately 200 cubic yards of biosolids are produced and stockpiled each week. Home owners and contractors represent the largest proportion of end users. According to the wastewater treatment facility operator, the demand for biosolids for beneficial reuse exceeds the supply. As required by Snohomish County Health Department, all end users are required to sign a hold harmless agreement and an explanation of how and where the biosolids are to be used. Word-of-mouth is the primary means by which the biosolids compost is distributed to the end users. There is no marketing program to distribute the biosolids compost (Dannar 1995 personal communication).

The south west suburban sewer district treats sewage from two plants that operate at 3.5 mgd each. Anaerobic digestion and secondary treatment are used to stabilize the wastewater solids. The composting facility is adjacent to the wastewater treatment facility in Federal Way. The composting process is static pile. Front end loaders are used to turn and form the piles. Wood grindings are used as a bulking amendment. Local wood grinders pay the compost facility to haul away their wood grindings. Approximately 96 cubic yards of biosolids are produced and stockpiled each week. The biosolids are bagged and sold one dollar per two-thirds cubic feet. Any amount over 4 yards can be delivered. Profit is not generated by sales although the revenue helps to offset the operating costs of the composting facility. As required by the King County Health Department Title 10, the bags (or receipts when the biosolids are used in bulk) have labels on them that specify the contents, metal levels, and percent nitrogen and phosphorus. According to the wastewater treatment facility operator, the demand for biosolids for beneficial reuse far exceeds the supply. Word-of-mouth is the primary means by which the biosolids compost is distributed to the end users although promotional deals (i.e. 500 cubic yards of free biosolids compost) were conducted in the past to improve public relations (Cap 1995 personal communication).

The Port Townsend composting facility is located at the Jefferson County Sanitary Landfill. It has been in operation since December 1993. The facility is located on 7 acres of which 2 acres are dedicated to the composting area. The wastewater treatment facility has a maximum design capacity of 1.81 mgd. The wastewater solids received from the Jefferson County sewage system

are processed in an aerobic digester. The wastewater solids from the county septage haulers are dewatered at the landfill with a belt filter press to 10 percent solids reduction. The wastewater solids from the sewage system and the septage from the county septage haulers are then composted together. The composting method used is aerated static pile. Yard waste is the primary bulk amendment which is used in a ratio of 3 to 1 (the first number represents the volume of amendment and the second number is the volume of biosolids). The waste stream from the dewatering and composting processes are collected and treated. Approximately 900 cubic yards of Class A biosolids are produced each week. The primary end users are home owners. As with the other composting facility, the demand for biosolids compost exceeds the supply (Merchant 1995 personal communication).

The city of Portland Oregon uses an in-vessel composting method that produces up to 60 dry tons of biosolids per day. The city hired a vendor to market the compost in exchange for a positive cash flow for the city. The vendor successfully marketed biosolids to architects for use as a soil amendment and mulch to be used by landscapers. Eventually landscape contractors began using biosolids compost on a regular basis. Today, landscape applications account for about 85 percent of all sales with approximately 30 major customers. Several important marketing strategies included providing a consistent and quality product, setting up information at trade shows and professional award ceremonies, using test plots to demonstrate the product's effectiveness, providing a money-back guarantee if the compost didn't perform, and using a competitive price with leaf and spent mushroom composts (Conrad 1995).

Compliance with Federal Disposal Regulations

Compost feedstock can consist of dewatered septage, wastewater solids and class B biosolids. There are no federal or state regulations that restrict composting combinations of septage with wastewater solids and Class B biosolids (Dorsey 1995 personal communication).[2] Regardless of the combination, the compost must meet the criteria of the 503 regulations for metals, pathogens and vector attraction reduction.

Sampling of the composted material will determine if the composted material meets the metal and pathogen reduction criteria. Sampling times and frequency are recommended in the Interim Guidelines for Compost Quality (Ecology 1993b).

The Interim Guidelines for Compost Quality recommend consistent standards for compost quality and provide guidance to county jurisdictional health departments, producers of compost, and consumers. Evidence suggests that Ecology will use these guidelines to regulate biosolids compost processing and products (E&A 1994).

The King County Department of Health has the regulatory authority to implement more stringent guidelines for permitting and operating compost facilities. All composting facilities within King

[2] Septage and wastewater solids are highly malodorous, putrescible, and contain a higher moisture content and different C:N ratios than Class B biosolids. Buffer zones and bulking amendment ratios should be adjusted accordingly.

County must comply with the code of the King County Board of Health Title 10 Solid Waste Regulations (1993).

The King County Solid Waste regulations 10.28.085 state that septage must be disposed of directly into a sewage treatment works licensed by the Department of Ecology, or other facility as approved in writing by the health officer. However, according to the senior environmental health specialist, using dewatered septage as feedstock is permissible providing the facility meets requirements of Title 10, the Interim Compost Guidelines, and the 503 regulations (Moran personal communication 1995).

The interim guidelines are summarized in Appendix E.

Land Requirements

Evidence suggests that land requirements for composting facilities are often underestimated during the site selection process. Adequate area should be provided for bulking amendment and compost piles, and for aisles that are wide enough to maneuver front end loaders and rototillers. Frequently, the type of bulking agent, initial sludge moisture content, product storage requirements, and buffer requirements determine the area requirements (WEF, ASCE 1992).

Environmental Impacts

Environmental impacts resulting from the construction and operation of a composting facility vary somewhat depending on the type of composting facility. In general, potential impacts consist of health concerns related to *Aspergillus fumigatus*, odor, noise, dust, traffic, and aesthetics. Mitigation of these impacts are discussed below.

Aspergillus fumigatus is a very common fungus. It is found in the air near composting facilities and in the air elsewhere. It is one fungus found in biosolids compost along with hundreds of other fungi and bacteria. It is brought to composting sites on the leaves, grass, twigs, and wood chips. It's spores present a health hazard (but not it's vegetative form). The disease caused by A. fumigatus is known as aspergillosis. Reactions caused by aspergillosis can range from those similar to other airborne allergens (e.g., coughing, wheezing, chills, aches, and pains) to leukemia or lymphoma. Individuals susceptible to contracting aspergillosis are at risk wherever there are concentrations of A. fumigatus in the air, not just near compost facilities (Haines 1995). There can, however be potentially hazardous concentrations in the air where compost is being turned or mixed. Evidence indicates however, that most people are not affected by the relatively small amounts of *Aspergillus fumigatus* found in the air at a reasonable distance from even the largest composting facilities (Haines 1995).

To mitigate for any potential affects, a composting facility would not be located near a health care facility that houses aspergillosis susceptible individuals. In addition, those working directly with large amounts of compost on a daily basis and that are exposed to large amounts would have the option of being equipped with enclosed air-conditioned cabs, or with dust-filtering masks (Montgomery 1993). Particularly sensitive individuals (i.e., those with severe allergies, or

with recent renal or cardiac disease) should not be employed at the composting facility (Montgomery 1993). Other mitigation strategies include adding moisture and enclosing operations to minimize dust generation, and minimize agitation of compost materials (and then only during periods of low winds).

Odor is probably the most important factor in achieving public acceptance for the operation of a composting facility. Odor producing compounds (e.g., hydrogen sulfide and ammonia) generated from the composting facility would be mitigated by the use of physical and chemical odor control strategies. Odor studies may be necessary to identify the type and magnitude of the odor source, meteorological conditions, and dispersion. Physical strategies include containment and the use of buffer zones. Chemical strategies to mitigate for odors generating during composting include oxidation, scrubbing, and precipitation.

Noise, dust, traffic and aesthetics are also important considerations in siting a compost facility. Noise can be mitigated by the use of equipment designed for low noise levels and by enclosing operations that cause excessive noise (Montgomery 1993). Dust impacts would be mitigated by containment, adding moisture where necessary, and keeping the facility clean. Traffic generated from trucking dewatered solids, biosolids, and materials such as bulking agents would be mitigated by minimizing the number of trips per day. Aesthetic impacts of the site would be mitigated by the construction of non-obtrusive buildings that are obscured by tree or vegetation barriers.

Advantages and Disadvantages

Composting is a cost-effective alternative. Benefits include the slow release of nutrients, increased organic content of soils, and enhanced development of root systems and soil moisture retention (Montgomery 1993). In addition, bulking agents used to compost biosolids can consist of recycled products such yard waste. Bulking agents that are large enough can be recycled to lower O&M costs.

The drawbacks of composting include the uncertainty of a locating a composting facility in a publicly accepted site, and concerns of dust, odor, and noise from operations.

Market Potential

The markets for biosolids have grown considerably in the past few years. Market studies conducted for the Puget Sound region show that the need for compost currently exceeds its supply although most of this demand is for yard compost (Fitzhugh et al. 1994).

Potential end users for biosolids compost in the Snoqualmie Valley area include:

- Homeowners
- Nurseries

- Landscapers
- Local tree farms
- Public agencies (e.g., Washington Department of Transportation)
- Soil reclamation.

Wastewater treatment facilities contacted for this report indicated that formal marketing strategies were not necessary to dispose of biosolids compost. Most users heard about the compost by word-of-mouth (Cap 1995 personal communication).

Sawdust Supply Company has been producing GroCo, a biosolids compost for 19 years. Sawdust is used as the bulking agent. They produce approximately 35,000 cubic yards of GroCo each year. Landscaping is the primary end use as topsoil amendments for garden bed and lawns. Other end users include public agencies, cemeteries, golf courses and homeowners. In 1993, 12 percent of Metro's biosolids were composted at Sawdust Supply Company (Fitzhugh 1993).

Recently, 25,000 cubic yards of GroCo was used in the topsoil mix in landscaping at the Renton Wastewater Treatment facility. Other agencies interested in the future use of GroCo include: King County Department of Public Works, and the Mountain-to-Sound project. According to O'Neill & Company (1995), Saw Dust Supply Company has indicated it does not want to produce any more biosolids compost.

LAND APPLICATION

Biosolids that meet pathogen levels, trace element concentrations and vector attraction standards can be used for land application as an amendment in reclamation or fertilizer on crop land and forest land. The beneficial reuse of biosolids improves soil fertility, moisture retention and reduces the need for inorganic fertilizers.

Reliability

According to the National Sewage Sludge Survey (U.S. EPA 1988) land application of biosolids is the primary management practice used to dispose of biosolids. The states of California, Oregon, and Washington use the following wastewater solids management practices:

	% Land Application	% Incineration	% Surface Disposal[3]	% Miscellaneous
California[4]	41	7	52	-
Oregon[5]	99	-	<1	-
Washington[6]	77	13	6	4

Oregon and Washington were reported as leaders in the land application of biosolids due to major treatment plant enhancements and in response to increased population. Although California has also experienced increases in population and increased human consumption of crops, biosolids are primarily disposed of in landfills. California sends a larger quantity of wastewater solids to landfills than the total biosolids production in Oregon and Washington combined.

Currently, Metro uses 87 percent of its Class B cake biosolids in land application. Seventy-four percent is used for agriculture. The remainder is used in silviculture.

Agriculture

Metro has maintained an agricultural land application program in eastern Washington for the past three years. All farmers receiving Metro biosolids pay $1 per wet ton. Metro covers the cost of the 240 mile (one way) haul and the application which is $4.50/ton (Tong 1994). The class B cake is delivered to farmers in both Yakima and Douglas counties and is applied to both wheat and hops fields. In 1994, these markets collectively received 50,000 wet tons of Class B cake (O'Neill 1995). The farmers speculate that they could take quantities of approximately 100,000 tons per year.

Silviculture

For the past twenty years, Metro has conducted a silviculture program with biosolids. Metro has a current contract with Weyerhaeuser, with an extended commitment to use 25,000 tons of biosolids every year for the next six years. Approximately 25,000 tons of Class B cake (Silvigrow) are applied to a Weyerhaeuser tree farm in Snoqualmie. Deliveries for the past three years have averaged 10,000 tons annually (O'Neill 1995).

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[3] Includes lagoons and landfills.

[4] CASA 1991

[5] ACWA 1993

[6] NMBC 1989

Metro also has a contract with the Washington Department of Natural Resources (DNR) Mountains-to-Sound project. This project involves the transfer of land between Metro and the Department of Natural Resources and shared profits from timber harvests on DNR land. The DNR forest lands will receive 5,000 tons of biosolids in 1995, gradually increasing to a maximum of 30,000 tons in 2011. The DNR will pay Metro two dollars per ton for biosolids used on DNR lands (O'Neill 1995).

Several municipal wastewater treatment facilities were contacted that generate biosolids quantities equivalent to those projected for the years 2000 and 2030 in North Bend, Snoqualmie, Carnation, and Duvall. These facilities use land application to beneficially reuse and dispose of all or a portion of their biosolids. Information was obtained from the city of Bremerton, and a from a collective of cities located in northern Whatcom County.

The city of Bremerton generates over 5 million gallons/year of anaerobically digested biosolids. During the 1970s and 1980s, the city disposed of biosolids on private lands for beneficial reuse and landfills. In the late 1980s, the city set goals to 1) develop a forest land application program on its own land, and 2) beneficially reuse 100 percent of the biosolids generated from its wastewater treatment plant. Since June 1992, 100 percent of the biosolids generated from the wastewater treatment plant have been applied to a city-owned forest at an economical operating cost. The site is suitable for liquid applications of biosolids due to proximity to the wastewater treatment facility, soil conditions, topography and lack of surface water.

Before land application could begin, the city had to develop the site for its intended use. Prior to application, extensive monitoring of soils, groundwater, and surface water was conducted. Site development for the biosolids application included main access roads, application trails, and on-site storage for both liquid and dewatered biosolids.

The city-owned forest is a 500 acre site located 7 miles from Bremerton's wastewater treatment plant. The site contains 55 year old Douglas fir and younger stands of several age classes. The biosolids (2.5 percent solids) are applied with an Ag-Chem 2004 Ag-Gator. The dewatered material is applied with a truck-mounted side discharge Gehl manure spreader. Rates and frequency of application are based on nutrient uptake by the forest. The city conducts an on-going monitoring program that evaluates biosolids quality, groundwater, surface water, and soil to determine that the site is in compliance with the 503 regulations (NBMA 1993).

The other organization contacted was BBBLENS, a regional organization consisting of five small municipal wastewater treatment plants located in northern Whatcom County, Washington. It was formed in October 1990 by interlocal agreement for municipal biosolids disposal between the Birch Bay Water and Sewer District, City of Blaine, City of Lynden, City of Everson, City of Nooksack, and City of Sumas. The purpose of the interlocal agreement was to provide coordination for the efficient and mutually beneficial transportation, storage, and disposal of biosolids generated by the wastewater treatment plants located at Birch Bay, Blaine, Lynden and Everson[7]. BBBLENS responsibilities include monitoring of biosolids quantities and quality delivered and stored at each farm, biosolids quantities and quality applied, application

[7] Everson serves the city of Nooksack.

conditions, changes in soil characteristics, and water quality. BBBLENS is also responsible for preparing permits from the Whatcom County Health Department (NBMA 1993).

The wastewater treatment plant design flows total approximately 3.6 mgd. Annual average wastewater flows total about 2.7 mgd. The facilities serve a resident population of 13,600 people, a substantial tourist trade, and a number of food processing industries. Biosolids are hauled from the wastewater treatment plants at 1 to 4 percent solids. Annual biosolids application were 624 tons of total dry solids or 6.7 million gallons in 1992. The biosolids generated at the wastewater treatment facilities are transported by tank truck several times each week to storage tanks at two farmland utilization sites. The biosolids are stored for application during the months of March through October. They are applied by the big gun sprinkler method to grass forage and corn forage crops. (Big gun sprinklers were used because the farmers owned these and previously used them for liquid manure application.) Application rates depend on the season, the type of crop, soils, biosolids analysis, and groundwater depths. Cultural agricultural practices (e.g., crop rotation, silage harvest) were also used to determine application rates (NBMA 1993).

Although land application has been successful, BBBLENS is exploring other alternatives for beneficial reuse. These alternatives include purchasing agricultural land in Whatcom County that would be owned and operated by BBBLENS, hiring a private contractor to use biosolids on agricultural lands in Whatcom County, and composting (NBMA 1993).

According to Tyree (1995 personal communication), each wastewater treatment facility produces EQ biosolids. Some of the facilities, however, are not able to produce biosolids that meet the 503 regulations VAR standards. The biosolids that do not meet the VAR standards are injected or tilled into the soil in accordance with 503 regulations.

Reclamation

Biosolids are also used to stabilize and revegetate areas that have been impacted by activities such as logging, mining, landfilling, and construction. They are used to help revegetate and stabilize these areas. Biosolids have also been used to increase vegetation and prevent erosion on highway embankments and median strips. Evidence suggests that land application of biosolids for reclamation yields improved growth and nutritional quality of vegetation and reduced erosion.

Between 1970 and 1980, Metro used biosolids in several land reclamation projects. In the early 1970s, Metro hauled biosolids from the West Point treatment plant to the Cedar Hills regional landfill. The biosolids were mixed with sand and applied as a top dressing to assist in establishment of vegetation for erosion control. In the late 1970s, Metro hauled biosolids to a 22,000 acre coal strip mine in Lewis and Thurston counties for reclamation. In 1982, Metro supplied biosolids to the Duvall sanitary landfill for the purposes of soil improvement and as a land cover (EPA 1983).

Currently, land reclamation is not a widely used method of biosolids reuse in the state of Washington. Metro, however, is pursuing a market and a pilot program for the use of biosolids in land reclamation projects.

Compliance with Federal Disposal Regulations

Biosolids that are used for land application must meet the quality standards of the 40 CFR 503 regulations. These standards define biosolids quality by pathogen levels, trace element concentrations, and the potential for biosolids to attract vectors (e.g. flies and rodents. The class of biosolids produced depends on the method of processing and ultimately affects end use. All biosolids intended for land application must meet the Class A or B requirements.

Exceptional quality biosolids can be applied to lawns and home gardens and can be distributed in bulk, bags or containers for home use. They must meet Class A standards for pathogens and vector attraction reduction. Furthermore, EQ biosolids must meet stringent requirements for trace metals. There are fewer reporting and management requirements with no restrictions on the use of EQ biosolids.

Site Requirements

The following physical criteria are used to select a suitable site for land application of biosolids (Metcalf & Eddy 1991):

- Topography
- Soil permeability
- Site drainage
- Depth to ground water
- Subsurface geology
- Proximity to critical areas
- Accessibility.

Site availability for biosolids land application may present the biggest challenge for the Snoqualmie Valley communities. Site availability is determined by the farming practices (e.g., type and number of crops grown, crop rotation) in an area. Certain types of crops (and soil) may not be available for the application of biosolids (Metcalf & Eddy 1991). In addition, adequate permissible acreage is necessary for a land application program. Land requirements differ based on design loading rates, and buffer zones. Some counties in Washington State, such as Kittitas County, require Class A biosolids for land application. In addition, depending on the end use, one method of the ten vector attraction reduction alternatives for biosolids must be used.

Environmental Impacts

Land application of biosolids could potentially contribute minor amounts of contaminants such as metals, nutrients, and bacteria to stormwater runoff. The presence of synthetic organic compounds and trace metals are not anticipated due to the concentrations of these constituents in domestic sewage.

Land application activities would not be conducted in an area with a high number of sensitive flora and fauna. The site selected for land application would provide adequate buffers to help diminish odors and minor dust emissions.

Nitrogen is the nutrient of concern in most land application processes because of the potential for nitrate contamination of ground waters. Biosolids will be applied at rates that match the nutrient requirements of a crop. Proper application methods and scheduling would prevent the potential of run-off and leaching.

Advantages and Disadvantages

The benefits resulting from the land application include the following:

- Cost savings for fertilizer, between $15 and $20 per acre (O'Neill 1995)
- Proven technology that has been used successfully for many years
- Low capital costs
- Use of farmers' equipment
- Beneficial use of nutrients and organic matter present in biosolids
- Low energy consumption required (if the biosolids are applied locally).

Furthermore, land application of biosolids results in decreased soil erosion, addition of nutrients, improved soil tilth and structure, increased organic matter and moisture retention properties, and increased crop residue.

The disadvantages of the land application of biosolids include:

- Public opposition to land application
- Large land area requirements
- Perceived public health risks and environmental impacts from metals and pathogens.

Markets Potential

Several options may exist for the land application of biosolids in the Snoqualmie Valley area. These include:

- Local application to farms in the Snoqualmie Valley
- Teaming with Metro for local beneficial reuse.

Weyerhaeuser has a 6-year contract with Metro for the land application of biosolids to the Snoqualmie Tree Farm. There is no other acreage at the Snoqualmie Tree Farm available to the four cities for application of biosolids. According to the manager of the tree farm (Larkoski 1995 personal communication), it is the preference of Weyerhaeuser to deal with one large agency (e.g., Metro), that is responsible for any impacts or complaints related to biosolids, rather than individual municipalities.

The Mountains-to-Sound project will be using 5,000 tons of Metro biosolids on DNR forest lands in 1995, gradually increasing to a maximum of 30,000 tons in 2011. The DNR will pay Metro two dollars per ton for its biosolids (O'Neill 1995). It is unclear at this time whether DNR would establish contracts with individual municipalities.

FORESTED, AGRICULTURAL, AND VACANT LANDS IN THE SNOQUALMIE VALLEY

AGRICULTURAL LAND

The following partial listing is of agricultural lands over 50 acres that are located within King County and in the vicinity of North Bend, Snoqualmie, Carnation, and Duvall. Further research is required to determine the availability and suitability of these lands for land application of aerobically digested biosolids. Information regarding these properties was obtained primarily from the King County Farmland Preservation Program Acquisition Summary (1993).

In the vicinity of Snoqualmie and North Bend:

- Meadow Brook Farms/Norman Brook Dairy Farms (acreage unknown).

In the vicinity of Carnation:

- Douwe Van Ess, (179 acres)
- Donald DeBoer, (159 acres)
- Herman Harvold, (132 acres)
- Gary Remlinger (116 acres)
- Norbert Sauvage, (111 acres)
- Jake Groenweg, (95 acres)
- William Knutson, Jr. (78 acres)
- Lawrence DeBoer, (65 acres)

In the vicinity of Duvall:

- Ruth Bellamy Dairy Operation (255 acres)
- Scott Wallace (254 acres)
- Paul Zylstra (208 acres)
- Alfred Schoenbachler Farm (190 acres); this site was previously used for land application of biosolids by the city of Duvall

- Jerry DeJong (180 acres)
- George Geertsma (177 acres)
- Stan Chapman (161 acres)
- Walter DeJong (161 acres)
- Eldon Neilson (146 acres)
- Aurelius de Vries (139 acres)
- Ward Roney Farm, (132 acres); this site is currently being used by the city of Duvall for land application of biosolids
- James Roetcisoender (116 acres)
- John Bentham (108 acres)
- John Lindemulder (106 acres)
- Joseph Jobe et al (102 acres)
- William Wieland (100 acres)
- Kenneth Kosters (98 acres)
- Glenn Cook (86 acres)
- Charles Vanhulle (81 acres)
- Clarence Zylstra (79 acres)
- Ben Eppinga (72 acres)
- Lynn D. Stiles (53 acres).

FORESTED LAND

According to the King County Assessor's Office (Kritsonis 1995 personal communication), many forested parcels listed on the King County Assessors timber land valuation system are located in the unincorporated areas of North Bend, Snoqualmie, Carnation, and Duvall. Much of the forested land in the Snoqualmie Valley is owned by Weyerhaeuser Corporation, Burlington Northern Inc., and the Port Blakely Mill Company.

LAND COSTS IN THE SNOQUALMIE VALLEY AREA

Estimated property values in the Snoqualmie Valley area range from \$50,000 to \$75,000 an acre for industrially or commercially zoned lands. One 20-acre parcel with commercial zoning was available in North Bend. The listed cost for this parcel is \$652,400 (Eastside Realty 1995 personal communication).

According to one realtor (Coldwell Banker 1995 personal communication), estimated costs for agricultural land in the Snoqualmie Valley range between \$1,200 and \$2,500 per acre within the floodplain, and \$8,000 to \$9,000 per acre in the upland. Most agricultural parcels in the Snoqualmie Valley are dairy farms that are usually no smaller than 150 acres.

APPENDIX D

Regulations Pertaining to Biosolids Processing and Reuse

REGULATIONS PERTAINING TO BIOSOLIDS PROCESSING AND REUSE

This appendix discusses federal, state, and local regulations that govern biosolids treatment and application.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

In February of 1993, the U.S. EPA published 40 CFR (Code of Federal Regulations) Part 503, Standards for the Use or Disposal of Sewage Sludge. The 503 regulations apply "to any person who prepares wastewater solids, applies wastewater solids to the land, or fires wastewater solids in a wastewater solids incinerator and the owner/operator of a surface disposal site." The standards established by the 503 regulations include the frequency of monitoring and record keeping requirements for wastewater solids land application, surface disposal, and incineration. Also included are "reporting requirements for class I sludge management facilities, publicly owned treatment works (POTWs) with a design flow rate equal to or greater than one million gallons per day, and POTWs that serve 10,000 people or more."

Conformance with the standards and requirements of 503 is implemented through permits issued by the U.S. EPA or states in accordance with 40 CFR 501. The State Sludge Management Program Regulations, 40 CFR 501, specify the procedures for implementing the state-developed and administered wastewater solids management programs. Washington state is currently developing a program to meet the requirements of 501 and expects the rule to be published in late 1995. The rule is expected to take approximately one year for full implementation.

The U.S. EPA has promulgated regulations specifying acceptable wastewater solids treatments and applications to protect public health (40 CFR 257 and 40 CFR 503). 40 CFR 503 defines two standards, Class A and Class B, for land application of biosolids. These two classes are distinguished by pathogen levels and the potential to attract vectors such as flies and rodents. Both classes have the same allowable limits for trace elements. Biosolids that have especially low trace element concentrations are designated as "exceptional quality." Organic compounds are not currently regulated under the 503 regulations because U.S. EPA, based on a nationwide survey of sewage sludge, determined that these compounds are not present in sludge at levels that would be harmful to human health or the environment. Future research may result in the regulation of some organic compounds.

Class A biosolids have fecal coliform densities of less than 1,000 per gram of total solids, or Salmonella densities of less than 3 organisms per 4 grams of total solids. This standard for biosolids requires a higher level of pathogen destruction, which allows for less restricted use such as applications to home gardens and lawns.

Class B biosolids have fecal coliform densities of less than 2,000,000 most probable number per gram of total solids or 2,000,000 colony forming units per gram of total solids. Class B biosolids are restricted by waiting periods for grazing, crop consumption, and access, because final

removal or die-off of the pathogens occurs in the field. The waiting periods are determined by the survival rate of the pathogenic organisms on soil or vegetation surfaces. Helminth eggs, for example, are the hardiest and can survive adverse environmental conditions. All biosolids intended for land application must meet the Class A or B requirements. Table D-1 lists site restrictions required for class B biosolids as stated in the 503 regulations.

Table D-1. Class B site restrictions.

Restricted Activity	Waiting Period
• food crops with harvested parts that come in contact with the biosolids and are totally above land surface	• cannot be harvested for 14 months after application
• food crops with harvested parts below land surface (biosolids not incorporated into the soil for 4 months or longer)	• cannot be harvested for 20 months after application of biosolids
• food crops with harvested parts below land surface (biosolids incorporated into the soil in less than four months after application)	• cannot be harvested for 38 months after application of biosolids
• food crops, feed crops, and fiber crops	• cannot be harvested for 30 days after application of biosolids
• animal grazing	• no grazing for 30 days after application
• turf grown for use in areas with a high potential for public exposure, or a lawn	• cannot be harvested for one year after application
• public access to land with a high potential for exposure	• access shall be restricted for one year after application
• public access to land with a low potential for exposure	• access shall be restricted for 30 days after application

Concentration limits for trace elements are based on risk assessments developed for the beneficial reuse and disposal of biosolids. These assessments quantify the risk of metals through specific pathways into the food chain.

Trace metals or elements which can also serve as micronutrients occur naturally in soils and animal wastes. In small quantities many are essential to plant and animal growth but under certain conditions can become pollutants affecting plant growth, human or animal health, and the environment (Montgomery 1993). Ten of the trace elements that are potential pollutants in biosolids are of potential concern in land application because of their toxicity, persistence, and frequent presence in biosolids. These trace elements are regulated under 40 CFR 503 and must meet concentration limits for land application. These trace elements include: arsenic, selenium, and eight metals: cadmium, chromium, copper, lead, mercury, molybdenum, nickel, and zinc. Table D-2 lists the ceiling concentrations of these elements allowable in land applied biosolids.

Table D-2. Ceiling concentrations.

Element	Ceiling Concentration for exceptional quality biosolids (milligrams per kilogram)	Ceiling Concentration for all biosolids (milligrams per kilogram)
Arsenic	41	75
Cadmium	39	85
Chromium	1200	3000
Copper	1500	4300
Lead	300	840
Mercury	17	57
Molybdenum	18	75
Nickel	420	420
Selenium	36	100
Zinc	2800	7500

In order to monitor levels of these elements for biosolids application, the 503 regulations set loading limits for the above listed elements. There are two types of loading limits described in these regulations, annual limits and cumulative limits. Annual limits set the highest amount of each element that can be applied to one area in a single year. These limits are used only for biosolids that are sold or given away in bags or other containers (Table D-3). Cumulative limits set the highest amount of these elements that can be applied to a land application site and are applicable only for bulk biosolids applications (Table D-4).

Table D-3. Annual pollutant loading rates.

Element	kilograms per hectare per 365 day period (lbs/acre in parentheses)
Arsenic	2.0 (1.8)
Cadmium	1.9 (1.7)
Chromium	150 (134)
Copper	75 (67)
Lead	15 (13)
Mercury	0.85 (0.76)
Molybdenum	0.90 (0.80)
Nickel	21 (19)
Selenium	5.0 (4.5)
Zinc	140 (125)

Table D- 4. Cumulative pollutant loading rates.

Element	kilograms per hectare
Arsenic	41
Cadmium	39
Chromium	3000
Copper	1500
Lead	300
Mercury	17
Molybdenum	18
Nickel	420
Selenium	100
Zinc	2800

There are ten vector attraction reduction requirements that have been identified by the U.S. EPA. The first eight alternatives (Table D-5) describe vector attraction reduction requirements acceptable for biosolids applied at any site including lawns and home gardens. These alternatives also meet the exceptional quality (EQ) biosolid standards. Alternatives 9 and 10 of Table 5 reduce vector attraction by tilling or injecting biosolids into the soil. These biosolids should not be applied to lawns and home gardens and do not meet the EQ standards.

Table D-5. Alternatives for reducing vector attraction to biosolids.

Alternative	Description
1.	Biosolids digestion processes with greater than 38% volatile solids reduction.
2.	Test endproduct of anaerobic digestion process. Forty-day anaerobic test at 30-30°C. Acceptable stabilization if less than 17% volatile solids reduction occurs during the test.
3.	Test endproduct of aerobic digestion process having less than 2% solids. Thirty-day aerobic test at 20°C. Acceptable stabilization if less than 15% volatile solids reduction occurs during the test.
4.	Facilities with aerobic digestion. Specific oxygen uptake rate (SOUR) test using endproduct of digestion process. Acceptable stabilization if uptake is less than 1.5 milligram oxygen per gram total solids per hour at 20°C.
5.	Facilities with aerobic digestion. Time/temperature requirement: Fourteen days residence time at digestion temperatures greater than 40°C, with average digestion temperature greater than 45°C.
6.	High pH stabilization: Biosolids pH above 12 for 2 hours and greater than 11.5 for 24 hours.
7.	Treatment by drying. Not to include unstabilized primary wastewater solids. Total solids content greater than 75% before mixing with other material.
8.	Treatment by drying. Can include unstabilized primary wastewater solids. Total solids greater than 90% before mixing with other materials.
9.	Land application process. Injection into soil. No biosolids on soil surface 1 hour after application (class B) or 8 hours after application (class A).
10.	Land application process. Soil incorporation by tillage. Class A biosolids only. Soil incorporation by tillage within 6 hours of application.

WASHINGTON DEPARTMENT OF ECOLOGY

The Revised Code of Washington (RCW) Chapter 70.95J provides "the Department of Ecology and local governments with the authority and direction to meet federal regulatory requirements for municipal wastewater solids." This law requires Ecology to implement a biosolids management program within 12 months of the adoption of the federal regulation 40 CFR 503.

RCW 70.95J distinguishes between biosolids and sludge (i.e., wastewater solids), defining biosolids as "...municipal wastewater solids that is a primarily organic, semisolid product resulting from the wastewater treatment process, that can be beneficially recycled and meets all requirements of this chapter." This law defines municipal wastewater solids as "...a semisolid substance consisting of settled sewage solids combined with varying amounts of water and dissolved materials generated from a publicly owned wastewater treatment plant."

Chapter 70.95J also allows for public input into state and local permits pertaining to biosolids disposal; public education concerning the beneficial uses of biosolids; delegation of permitting authority to the local health districts; and Ecology review of the local health district permits.

On November 4, 1993, Ecology issued the draft Biosolids Management Guidelines for public review and comment. The guidelines cannot be published as final until the new state rule for biosolids management has been adopted. These guidelines are intended for use by landowners, treatment plant operators, biosolids managers and other involved parties to assist them with understanding and complying with the biosolids rules and laws. The guidelines include preparation of a site operation plan that discusses transportation, storage, and application of biosolids as well as monitoring and reporting. This plan is prepared on a site-specific basis and is intended to assure that biosolids are applied in a manner that is safe. Operation plans for large sites are required to include the following:

- biosolids quality
- treatment processes to reduce pathogens and vector attraction
- analyses of nitrogen and trace elements
- site location and characteristics
- location
- soils and soil limitations (e.g. slope, permeability)
- watershed information
- irrigation and drainage
- crop management
- local solid waste plan
- transportation and delivery
- haul route, including alternative routes
- vehicle construction
- on-site storage
- management practices
- storage facility, including, in some cases, engineering drawings
- biosolids application
- method and timing

- annual loading rate calculation
- public access and notification
- public access to site
- recreational use of site
- site management and administration
- contingency plans
- responsibilities of individuals
- environmental and public health monitoring
- pre-application monitoring
- post-application monitoring
- pre- and post-application nitrogen monitoring
- reporting.

There are two primary areas of difference between the federal 503 regulations and the proposed state biosolids regulations. These two areas are septage management and permitting. The 503 regulations do not require any type of screening of septage for removal of foreign items prior to land application. The state rule may require that some sort of screening, grit trapping or maceration of the biosolids be conducted prior to disposal. In addition, the state rule may require additional stabilization of septage through composting or lime application (Dorsey 1993 personal communication).

Currently, the state permitting process for septage management is handled through local health departments. The local health departments issue site-specific permits.

Ecology will propose in the 173-308 rule that local health departments vacate their site-specific permitting process. Facility permit applications will be prepared and submitted to Ecology and any other affected jurisdictions. Ecology will assemble all comments submitted by the jurisdictions and write the permit accordingly.

WAC 173-200 provides the Water Quality Standards for Ground Waters of the State of Washington. The regulation establishes ground water quality standards for the state and is applicable to biosolids management activities if there is a potential for transport of contaminants to ground water. WAC 248-54 sets drinking water standards for the state. Biosolids facilities must comply with the more stringent ground water standard for each parameter from WAC 173-200 and 248-54.

The Minimum Functional Standards for Solid Waste Handling, WAC 173-304, were adopted by Ecology in 1985 and are the most recent state regulations that address the handling of solid wastes. The purpose of this regulation is to protect public health, prevent land, air, and water pollution, and conserve the state's natural, economic, and energy resources. The regulation contains several sections which are directly applicable to biosolids activities. These sections include storage, collection and transportation standards (304-200), waste recycling facility standards (304-300), general facility requirements (304-405), piles used for storage and treatment facility standards (304-420), surface impoundment standards (304-430), and permit requirements for solid waste facilities (304-600).

LOCAL HEALTH DISTRICTS

Local health districts regulate and implement the solid waste and biosolids permitting processes. They accept permit applications for biosolids management at a specific site and forward the applications to Ecology for technical and administrative review. After its review, Ecology issues a notice of concurrence or nonoccurrence to the health department. Regardless of Ecology's position, the final authority and responsibility for issuing the permit rests with the health department. Ecology has the option to appeal an issued permit to the Pollution Control Hearings Board if it does not concur with issuance of the permit.

At this time the future role of local health departments in implementation of the upcoming Washington biosolids rule is uncertain. Local health district involvement that will be proposed by Ecology is discussed in the preceding section.

The Seattle/King County Department of Public Health has its own biosolids regulations that are part of the Title 10 King County Solid Waste Regulations (King County 1993). The King County biosolids regulations basically follow the federal 503 regulations, with the exception that Class A biosolids do not require a site permit because they are classified as fertilizers (Moran 1995). Class B biosolids require a site permit including a monitoring plan, design specifications, and restricted public access for 12 months.

APPENDIX E

Interim Compost Guidelines

INTERIM COMPOST GUIDELINES

Both Grade A and Grade B compost products must meet or exceed the federal 503 requirements for Class A biosolids. In addition, Grade A and Grade B compost must meet the allowable contaminant levels indicated in the Interim Guidelines. Grade A trace metal limits are typically half of the Grade B levels. The other difference between Grade A and Grade B compost is in the use of the end product. Grade A can be used for cultivating food crops and Grade B can be used only for cultivating non-food crops.

As described in the Interim Guidelines, composting facilities must analyze their products for the following parameters:

- trace metals
- synthetic organic compounds
- inorganic compounds
- total nitrogen
- pathogen indicators
- pH
- conductivity
- stability.

Biosolids facilities (or Type 2 facilities) that process under 10,000 tons of biosolids per year must test for trace metals, pathogen indicators, and synthetic organic compounds once each year.

The following table indicates the trace metal limits listed in the Interim Guidelines for Grade A and Grade B compost (Ecology 1993b):

Parameter	Grade A Compost (dry weight, ppm)	Grade B Compost (dry weight, ppm)
Percent inerts	<1	<1
Sharps	zero	zero
pH	6.0-8.0	6.0-8.0
Arsenic (mg/kg)	20	20
Cadmium	3	39
Copper	600	1200
Lead	150	300
Mercury	8	17
Molybdenum	9	18
Nickel	210	420
Selenium	18	36
Zinc	1400	2800
PCBs	1	1

Adapted from Interim Compost Guidelines (Ecology 1993b)

The following numerical limits have been adapted in the Interim Guidelines for the use of compost (Ecology 1993b):

- The bulk density of biosolids compost is 0.25 grams per cubic centimeter.
- Three inches per year or 190.5 metric tons per hectare per year will be applied to prevent contamination to ground water and leaching.
- The life of a site will be 20 years of application either consecutively or spread over many years.

The Interim Guidelines recommend that the processors of Grade A and B composts include with the sale of the product an information sheet that states the following:

- Grade A Compost
- Grade A Compost may be applied at a rate of up to 3 inches per year
- Acceptable for areas with high likelihood of direct human contact and repeated application sites, such as home gardens.
- Grade B Compost
- Grade B Compost may be applied at a rate of up to 3 inches per year
- Acceptable for topsoil blends, landscaping, ornamental, silvicultural purposes, sod farms, and all lawns and sport fields

Due to the low metals content in the wastewater solids, the four Snoqualmie Valley cities and Echo Glen Children's Center would most likely generate a biosolids compost that would meet the Grade A trace metal levels required by the Interim Guidelines.

SNOQUALMIE VALLEY CITIES REVIEW OF CURRENT AND ANTICIPATED REGULATIONS

Prepared by
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December 1995

King County Department of Metropolitan Services
Water Pollution Control Department
821 Second Avenue
Seattle, Washington 98104-1598

TO: Ellis McCoy, Metro

FROM: Craig Van Riper

CC: Gary Bleeker

DATE: December 15, 1995

SUBJECT: **SNOQUALMIE VALLEY CITIES -- SUBTASK 4.1 REVIEW OF CURRENT AND ANTICIPATED REGULATIONS**

INTRODUCTION

The purpose of this Technical Memorandum is to identify regulatory issues which will impact wastewater collection, treatment and disposal in the Snoqualmie Valley Cities.

The scope of this effort consisted of a review of existing regulations concerning water quality, NPDES permitting, collection system operation, biosolids disposal, groundwater, air quality, and water reuse. Potential changes in regulatory approach were also assessed to identify how these existing and anticipated future regulations may constrain wastewater services provision to the Snoqualmie Valley Cities.

A summary of this review is presented below, with primary emphasis placed on those regulatory requirements that are likely to have the most impact on wastewater treatment for the Valley Cities.

WATER QUALITY

Section 303 of the Federal Clean Water Act (FCWA) outlines the water quality standards program as a joint effort between the individual states and the U.S. Environmental Protection Agency (EPA). 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 FCWA. The states have the primary responsibility for establishing, reviewing, revising, and enforcing water quality standards. EPA can review and approve or disapprove state standards and enforce federal water quality standards where necessary.

The people of Washington State are supported in their goal for clean water by many state laws and regulations, including the state's Water Pollution Control Act (RCW 90.48), which declares that Washington state's policy is to "...maintain the highest possible standards to ensure the purity of all waters of the state consistent with public health and public enjoyment...the

propagation and protection of wildlife, birds, game, fish and other aquatic life, and the industrial development of the state." Washington's antidegradation policy states that discharges into a receiving water can not degrade the existing water quality of the water body. The natural conditions of a receiving water constitute the water quality criteria, whether the natural conditions are of higher or lower quality than the criteria assigned. Antidegradation is currently addressed through the use of water quality-based effluent limitations.

The Washington Water Pollution Control Act is the state statute through which the FCWA is implemented and state water quality standards are defined. The Water Pollution Control Act enables control of discharges into surface waters, such as the Snoqualmie River, through issuance of waste disposal permits by Ecology, the state's primary environmental agency. Water quality-related permits, permit triggering activities, and contact agencies are summarized in Table 1.

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 NPDES permit program requirements, establishes discharge standards that represent all known, available, and reasonable methods of prevention, control, and treatment (AKART) for domestic wastewater facility discharges.

Ecology conducted an extensive monitoring program on the Snoqualmie River during low-flow conditions, beginning in 1989. 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. In addition to water quality sampling, the study included modeling simulations to predict future water quality conditions in the Snoqualmie River. Additional monitoring and follow-up investigations were conducted over the following three years to estimate load capacities for biochemical oxygen demand (BOD) ammonia, and fecal coliform during the critical low flow months of August through October.

The 1989 study concluded that, 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 may also increase in frequency in the future. Replacing side-bank outfalls with midstream diffusers at existing wastewater treatment plants was predicted to result in a reduction in likelihood of violations of expected mixing zone permit conditions for ammonia.

Additional monitoring was also recommended by Ecology in the May 1994 *Snoqualmie River Total Maximum Daily Load Study* report, attached, to develop soluble reactive phosphorus (SRP) loading capacities in the future. The loading capacities will require waste load allocations (WLAs) of BOD and ammonia when the three existing municipal wastewater treatment plants of the lower river basin expand. Implementation of a nonpoint source management plan for the

mainstem and some tributaries will be necessary immediately to meet Class A surface water fecal coliform criteria and to meet BOD and ammonia load allocations (LAs).

NPDES PERMITTING

The National Pollutant Discharge Elimination System (NPDES) permit program (WAC 173-220) regulates the point source discharge of pollutants into the surface waters of Washington state. The permit program was developed to operate under state law as part of the FCWA NPDES program. Permits issued under the authority of WAC 173-220 are designed to satisfy the requirements of the FCWA as amended and RCW 90.48, 90.50, and 90.52.

NPDES permits are issued by Ecology under delegated authority from EPA. The NPDES permitting process is described in the December 1995 Wastewater 2020 Plus: Snoqualmie Valley Cities -- Subtask 4.2 Letter Report (HDR).

The permit application requires information on water supply volumes, water utilization, wastewater flow, characteristics and disposal methods, planned improvements, storm water treatment, plant operation, materials and chemicals used, production, and other relevant information. Ecology generally requires public ownership, operation, and maintenance of domestic wastewater facilities. Processing time for an NPDES permit ranges from about 180 days to one year, but varies depending on project complexity. A public hearing may be required.

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. Ecology's increased local community application of the total maximum daily load (TMDL)/WLA/LA process discussed above also is expected to reduce the impact of wastewater discharges on the Snoqualmie River system.

Facility-specific water quality-based effluent limits are likely to be included in future NPDES permits to maintain high quality surface waters. For example, Ecology has allotted anticipated Carnation treatment plant pollutant loadings for low flow periods of the Snoqualmie River (August through October). The anticipated effluent limits for a flow of 0.2 million gallons per day (mgd) are 2 to 2.5 mg/L for SRP, 5 to 9 mg/L for ammonia as nitrogen, and 15 mg/L for BOD during the low flow periods. No nutrient removal requirements are anticipated outside of the low flow period. A phased TMDL has been recommended by Ecology to make adjustments to the WLAs/LAs as nonpoint source controls are implemented and as additional water quality and growth pattern data become available.

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 NPDES permit process.

Ecology may, if necessary, modify existing permits in the future to impose numerical limitations to meet water quality standards, sediment quality standards, or based on new information

obtained from sources such as inspections, effluent monitoring, outfall studies, and effluent mixing studies. Ecology may also modify a permit as a result of new or amended state or federal regulations. Permit modifications may also be required when a facility's operational changes result in changes in effluent volumes or character.

COLLECTION SYSTEM OPERATION

WAC 173-240 establishes requirements for engineering reports, plans and specifications, and general sewer plans for construction of wastewater facilities including wastewater collection systems. This regulation also provides for review and approval of proposed methods of operation and maintenance.

Discharge of industrial or commercial wastes into municipal collection systems is regulated through state waste discharge permits. Permit application information requirements are similar to those listed above for NPDES permits. Annual fees charged by Ecology vary depending on size, complexity, and/or type of permitted facility. Public ownership, operation, and maintenance of domestic wastewater facilities is generally required.

BIOSOLIDS DISPOSAL

The FCWA mandates that EPA establish national standards for the use and disposal of sewage biosolids. These standards have been established (40 CFR 503, published in February 1993) 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 was applicable in cases that required construction of a pollution control facility to comply with the regulation.

The 503 regulations specify acceptable wastewater solids treatment processes and applications to protect human health and the environment. The standards established by the regulations also include the frequency of monitoring and record-keeping requirements for wastewater solids land application, surface disposal, and incineration.

The 503 regulations specify a two-tiered standard for biosolids quality based on three criteria: metals, pathogens, and vector attraction reduction. The two standards, Class A and Class B, are each suitable for land application. Both standards have the same allowable limits for metals or trace elements. Class A biosolids meet stringent pathogen requirements and therefore have minimum restrictions on application or reuse. Class B standards have less stringent pathogen requirements since pathogen destruction of Class B biosolids is assumed to continue at the application site. Consequently, Class B land application sites are subject to access restrictions. Class A biosolids that meet the most restrictive trace element criteria are classified as exceptional quality biosolids. These biosolids can be distributed in bulk or containers and are not subject to loading restrictions.

Organic compounds are not currently regulated under the 503 regulations because EPA, based on a nationwide survey of sewage sludge, determined that these compounds are not present in

sludge at levels that would be harmful to human health or the environment. Future research may result in the regulation of some organic compounds.

Ecology is the primary agency for the management of biosolids in Washington state. Other agencies, however, such as the U.S. Soil Conservation Service and the local health department, also play a role in the management of biosolids. Currently, the Seattle/King County Department of Public Health is the agency responsible for site-specific permitting of biosolids facilities in the Snoqualmie Valley. As a jurisdictional health department, it has the regulatory authority to impose more stringent guidelines. Ecology provides technical and administrative permit review and issues a notice of concurrence or nonconcurrence to the health department.

Conformance with the standards and requirements of 503 is implemented through permits issued by EPA or states in accordance with 40 CFR 501. The State Sludge Management Program Regulations, 40 CFR 501, specify the procedures for implementing the state-developed and administered wastewater solids management programs. Washington state is currently developing a program to meet the requirements of 501 and expects the rule to be published in late 1995. The rule is expected to take approximately one year for full implementation.

On November 4, 1993, Ecology issued the draft Biosolids Management Guidelines for public review and comment. The guidelines cannot be published as final until the new state rule for biosolids management has been adopted. These guidelines are intended for use by landowners, treatment plant operators, biosolids managers and other involved parties to assist them with understanding and complying with the biosolids rules and laws. The guidelines include requirements for preparation of a site operation plan that discusses transportation, storage, and application of biosolids as well as monitoring and reporting. This plan is prepared on a site-specific basis and is intended to assure that biosolids are applied in a manner that is safe.

There are two primary areas of difference between the federal 503 regulations and the proposed state biosolids regulations. These two areas are septage management and permitting. The 503 regulations do not require any type of screening of septage for removal of foreign items prior to land application. The state rule may require that some sort of screening, grit trapping or maceration of the biosolids be conducted prior to disposal. In addition, the state rule may require additional stabilization of septage through composting or lime application.

The Seattle/King County Department of Public Health has its own biosolids regulations that are part of the Title 10 King County Solid Waste Regulations. The King County biosolids regulations basically follow the federal 503 regulations, with the exception that Class A biosolids do not require a site permit because they are classified as fertilizers. Class B biosolids require a site permit including a monitoring plan, design specifications, and restricted public access for 12 months.

At this time, the future role of local health departments in implementation of the state biosolids rule is uncertain. Ecology is expected to propose in the WAC 173-308 rule that local health departments vacate their site-specific permitting process. Facility permit applications would be prepared and submitted to Ecology and any other affected jurisdictions. Ecology would then assemble all comments submitted by the jurisdictions and write the permit accordingly.

The Minimum Functional Standards for Solid Waste Handling, WAC 173-304, were adopted by Ecology in 1985 and are the most recent state regulations that address the handling of solid wastes. The purpose of this regulation is to protect public health, prevent land, air, and water pollution, and conserve the state's natural, economic, and energy resources. The regulation contains several sections which are directly applicable to biosolids activities. These sections include storage, collection and transportation standards (304-200), waste recycling facility standards (304-300), general facility requirements (304-405), piles used for storage and treatment facility standards (304-420), surface impoundment standards (304-430), and permit requirements for solid waste facilities (304-600).

GROUNDWATER

WAC 173-200 establishes groundwater quality standards for the state of Washington. The primary goal of the standards is to protect and maintain existing and future beneficial uses of all groundwater, based on the assumption that all groundwater is a potential source of drinking water.

Ecology published implementation guidance for the standards in 1994. While Ecology's initial focus is on the land application of wastewater, the standards apply to any activity which has a potential to adversely impact groundwater quality. Facilities which are not covered by a general permit or regulated by an approved Ecology guideline or policy must perform a hydrogeologic study to assess the current condition of the hydrogeologic environment and characterize the facility's activities. Monitoring plans are required to define ambient conditions and to determine compliance with the standards. Compliance is determined by demonstrating that all wastes meet AKART and by complying with Ecology's antidegradation policy. While the antidegradation policy allows an incremental increase of contaminant concentrations under specific conditions, it prohibits degradation of the state's water up to numeric and narrative criteria. Contingency plans are also required to describe actions necessary to remedy the impacts of a violation of the standards.

State groundwater standards may be applicable to wastewater and biosolids management activities if there is a potential for transport of contaminants to groundwater. WAC 248-54 sets drinking water standards for the state. Biosolids facilities must comply with the more stringent groundwater standard for each parameter from WAC 173-200 and 248-54. Assessment of groundwater quality in land application projects is not made until the water has passed through the root zone and is no longer available for plant uptake. The point of enforcement of water quality can be anywhere on the property below the root zone, rather than at a specific place such as a monitoring well.

RCW 90.48 governs the discharge or disposal of industrial, commercial, or municipal liquid and solid waste into groundwater. A state waste disposal permit for any such discharge is required. Regulations governing onsite disposal systems (WAC 248-96) have also been adopted by the Washington State Board of Health under the authority of RCW 90.48. The state has authority to issue permits for onsite systems receiving flows of 3,500 or more gallons per day (gpd). Local health departments issue permits for smaller systems.

In the Snoqualmie Valley, control of individual onsite disposal systems receiving less than 3,500 gpd 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.

Health department 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 the City 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 EPA standards.

AIR QUALITY

The Federal Clean Air Act (FCAA), the Washington Clean Air Act (WCAA), their respective amendments, and their implementing regulations govern projects and facilities having significant impact on air quality in Washington state. Most of the provisions of the WCAA mirror the federal law and authorize Ecology and local air pollution control authorities to implement programs consistent with the FCAA.

EPA has responsibility over federal regulation of air pollution sources and sets national air quality standards. Ecology and nine local air pollution control authorities (APCAs) have state authority over air pollution sources. The APCA having jurisdiction over King County and the Snoqualmie Valley Cities is the Puget Sound Air Pollution Control Agency (PSAPCA). PSAPCA issues source permits and enforces Ecology's uniform minimum air quality standards. PSAPCA may also set standards that are more stringent than those established by Ecology. Ecology and PSAPCA regulations supersede the authority of local governments over air pollution, but not over nuisance, land use, or health and safety issues. Air quality-related permits, permit triggering activities, and contact agencies are summarized in Table 1.

Since municipal wastewater treatment and disposal facilities of small capacity generally are not considered major sources of air pollutant emissions, there are few air quality regulations which would apply to such facilities in the Snoqualmie Valley. Recent trends in wastewater facility design have included odor control covers over agitated or open treatment process units such as clarifiers and aeration chambers, especially if they are very close to neighborhood areas or if local odor complaints are expected. PSAPCA is charged with determining whether or not odors unreasonably interfere with the use or enjoyment of adjacent properties. Where odor control air scrubbers or other "stack" type air treatment equipment are installed, the resulting pollutant releases are considered point source emissions and require operating permits from PSAPCA. In such cases, PSAPCA is responsible for permitting and inspection of the facility, while Ecology provides quality control on emission check stations and oversight to ensure that federal emissions standards are met. Flaring or burning anaerobic digester gas in a sludge boiler to heat digesters or to provide other process heat also requires a permit from PSAPCA if emissions are from stack sources.

In Snoqualmie Valley Cities having chlorinated water supplies, chloroform emissions from aerated wastewater treatment process units may exceed new source ambient impact levels published in WAC 173-460. Such cases may warrant priority pollutant scans and/or toxics fate modeling to determine fence-line pollutant levels. Chloroform or other air toxics exceeding WAC 173-460 levels may require buffer zones around the plant, covering, scrubbing, or other control methods. Such fence-line determinations are typically not of issue in remote sites having adequate buffer area.

Additional air quality regulatory requirements affecting Snoqualmie Valley wastewater treatment facilities are not anticipated in the near future. New source performance standards for landfills are currently being rewritten and are expected to be published in the Federal Register soon. However, these standards will not apply to wastewater treatment plants unless they include operating sludge incinerators. Federal presumptive maximum achievable control technology standards may be proposed in the future for new wastewater treatment plants but will only apply to plants of over 200-mgd capacity.

WATER REUSE

The overriding consideration in developing a reuse system is that the quality of the reclaimed water be appropriate for its intended use. Higher level uses, such as irrigation of public access parks, school yards, and golf courses, require a higher level of wastewater treatment prior to reuse than will lower level uses, such as pasture irrigation.

Currently, there are no federal regulations directly governing water reuse practices in the United States. Water reuse regulations have, however, been developed by many of the states. These regulations vary considerable from state to state. Some states, such as Arizona, California, Florida, Oregon, Texas, and Washington have developed regulations that strongly encourage water reuse as a water resources conservation strategy. These states have developed comprehensive regulations specifying water quality requirements, treatment processes, or both for the full spectrum of reuse applications. The objective in these states is to derive the maximum resource benefits of the reclaimed water while protecting the environment and public health.

The state of Washington Water Reclamation and Reuse Interim Standards protect public health by requiring a specific level of water quality and treatment corresponding to each beneficial use of reclaimed water. Four classes of reclaimed water allowed, as appropriate, for a variety of irrigation, commercial, industrial, and other beneficial uses. Class A Reclaimed Water has the highest level of treatment and quality, requiring oxidation (secondary treatment), coagulation, filtration, and disinfection, with a median number of total coliform organisms not exceeding 2.2 per 100 ml. Reclaimed water Classes B, C, and D require oxidation and disinfection, with median numbers of total coliform organisms not exceeding 2.2, 23, and 240, respectively, per 100 ml. Class A Reclaimed Water would be required for open access area landscape irrigation (e.g., golf courses, parks, playgrounds, schoolyards, and residential landscapes) in the Snoqualmie Valley Cities, while Class C Reclaimed Water would be allowed for restricted access areas irrigation (e.g., cemeteries and roadway landscapes).

In addition, the Washington reuse standards include requirements for treatment reliability to prevent the distribution of any reclaimed water that may not be adequately treated because of a process upset, power outage, or equipment failure. Reliability requirements include provisions for alarms, standby power supplies, multiple or standby unit treatment processes, emergency storage or disposal provisions, and standby replacement equipment.

The Washington standards also include operations, sampling and analysis, engineering report, and use area requirements, as well as general requirement of design. Dual distribution systems (i.e., reclaimed water distribution systems that parallel a potable water system) must also incorporate safeguards to prevent cross connections of reclaimed water and potable water lines and misuse of reclaimed water. For example, piping, valves, and hydrants must be marked or color-coded to differentiate reclaimed water from potable water, and backflow prevention devices must be installed.

Washington Senate Bill 5606, an amendment to the 1992 Reclaimed Water Act which mandated the state development of the above-described reuse standards, passed in May 1995. This bill further encourages the use of reclaimed water to replace potable water in nonpotable applications, to supplement existing surface and groundwater supplies, and to assist in meeting the future water requirements of the state. The bill allows reclaimed water intended for beneficial reuse to be discharged for streamflow augmentation, allows reclaimed water to be beneficially used for surface spreading (i.e., the controlled application of water to the ground surface for the purpose of replenishing groundwater), and allows Class A Reclaimed Water to be beneficially used for discharge into created wetlands (i.e., wetlands intentionally created from nonwetland sites to produce or replace natural habitat). In Addition, the bill mandates the state development of additional reuse standards for the discharge of reclaimed water to wetlands (including natural wetland areas) and for direct recharge of groundwater using reclaimed water by June 30, 1996 and December 31, 1996, respectively.

Table 1. Permit Requirements Arranged by Resource Category

PERMIT NAME	TRIGGER/ACTIVITY	CONTACT AGENCY
	Air Quality	
Air Contaminant Source Registration	Emitting pollutants into the air	Ecology
Air Quality Permit (Open Burning)	Open burning of any kind	Ecology or local air authority
Burning Permit (Fire Protection)	Burning forest slash, starting recreational fires	Natural Resources
New Source Construction Approval	Releasing contaminants into air .	Ecology or local air authority
Prevention of Significant Deterioration (PSD)	Increasing air contaminants in an area (generally more than 100 tons per year)	Ecology
Solid Fuel Burning Device Standards	Using woodstoves, fireplace inserts, or other burning devices	Ecology
	Aquatic Resources	
Aquaculture Permit and Aquaculture Disease Control	Culturing food fish, shellfish, and certain aquatic animals	Department of Fisheries
Aquatic Lease	Using state owned aquatic lands (includes harbors, state tidelands, shorelands, and beds of navigable waters)	Natural Resources
Coastal Zone Management Certification	Conducting Corps authorized projects and/or applying for certain federal permits or funding	Federal government/Ecology
Fish Screen Requirement	Taking water into a water-diversion device	Fisheries
Hydraulic Project Approval	Preforming work that uses, diverts, obstructs, or changes the natural flow or bed of state waters	Fisheries or Wildlife
	Archaeology and Historic Preservation	
Archaeological Excavation Permit	Excavation altering Native Indian archaeological resources or grave sites	Department of Community Development
Section 106 Review	Receiving federal funding, license, or permit; or undertaking federal project	Department of Community Development

Table 1. Permit Requirements Arranged by Resource Category (Continued)

PERMIT NAME	TRIGGER/ACTIVITY	CONTACT AGENCY
	City/County Environment	
Building Permit	Constructing or making additions to permanent buildings	Local government
Conditional Use Permit	Undertaking development when special conditions require consideration	Local government
Floodplain Development Permit	Constructing within identified floodplain	Local government
Miscellaneous Local Permits	Operating a commercial or private business	Local government
Noise Ordinances	Exceeding established noise levels	Local government
Shoreline Permit	Developing or constructing within shoreline	Local government
Subdivision Approval	Dividing land for residential or other purposes	Local government
Zoning Code Variance	Requesting variance from an ordinance that will impose a specific and unusual hardship	Local government
	Hazardous/Dangerous/Solid Waste	
Certification of Inspectors of Solid Waste Incinerator and Landfill Facilities	Working as a solid waste incinerator or landfill facility inspector	Ecology
Certification of Operators of Solid Waste Incinerator and Landfill Facilities	Working as an operator of a solid waste incinerator or landfill facility	Ecology
Dangerous Waste Designation	Generating waste that may be designated as a regulated hazardous waste	Ecology
Dangerous Waste Permit	Handling dangerous waste	Ecology
Emergency Planning and Community Right to Know	Businesses possessing hazardous substances	Ecology
Generator/Transporter Identification Number and Reporting Requirements	Generating and transporting hazardous waste	Ecology
Hazardous Waste Release Notification	Spilling or releasing hazardous substances	Ecology
Underground Storage Tank Notification	Installing an underground storage tank, and/or having an existing underground tank on-site	Ecology

Table 1. Permit Requirements Arranged by Resource Category (Continued)

PERMIT NAME	TRIGGER/ACTIVITY	CONTACT AGENCY
	Hazardous/Dangerous/Solid Waste (Continued)	
Waste Tire Carrier License/Waste Tire Storage Site Owner License	Hauling tires to and/or owning tire storage site	Licensing
	Land Resources	
Forest Practices Approval	Conducting forest practices such as harvesting, reforesting, or road building	Natural Resources
Surface Mine Permit	Surface mining	Natural Resources
	Livestock	
Public Livestock Market License	Operating a public livestock market	Agriculture
Animal Feeding Operations, NPDES/Waste Discharge Permit	Conducting concentrated animal feeding operation that discharges to state or federal waters	Ecology
	Pesticides	
Commercial Pesticide Applicator License	Operating a business that applies pesticide to your or your supervisor's land	Agriculture
Commercial Pesticide Operator License	Applying pesticides as a government employee	Agriculture
Private Commercial Applicators License	Applying or supervising application of pesticide to your or your supervisor's land	Agriculture
Public Pesticide Operator License	Applying pesticides as a government employee	Agriculture
	Water Quality	
Accreditation of Environmental Laboratories	Environmental laboratories providing water quality data to Ecology	Ecology
National Pollutant Discharge Elimination System (NPDES) Permit	Discharging pollutants, through a point source, into surface waters	Ecology
On-Site Sewage Disposal* Permit	Treating and disposing of sewage through septic tanks and subsurface disposal fields	Ecology, Health (state), and local health departments (depending on design flow)
State Waste Discharge Permit	Discharging industrial/commercial/municipal waste to water bodies, or industrial/commercial waste into municipal sewer system	Ecology

Table 1. Permit Requirements Arranged by Resource Category (Continued)

PERMIT NAME	TRIGGER/ACTIVITY	CONTACT AGENCY
	Water Quality (Continued)	
Temporary Modification of Water Quality Criteria	Construction violating water quality criteria for short time; also, applying aquatic pesticides	Ecology
Wastewater Plant Operator's Certification	Working as a waste treatment plant operator	Ecology
Water Quality Certification	Applying for federal permit if project might result in discharge to surface water	Ecology
	Water Resources	
Dam Safety Approval	Constructing, modifying, or repairing dams	Ecology
Public Water Supply Approval	Building/modifying public water systems	Health (state, or local health department)
Reservoir Permit	Constructing a barrier across a stream, channel, or watercourse	Ecology
Water Right Permit	Appropriating water (tapping into surface or ground water resources)	Ecology
Water Well Construction and Operator's License	Operating a water well construction business	Ecology
Waterworks Operator Certification	Work as a waterworks operator	Health

A Department of Ecology Report

WASHINGTON STATE DEPARTMENT OF ECOLOGY

Snoqualmie River Total Maximum Daily Load Study

Abstract

The Snoqualmie is a river system with high water quality and multiple aquatic resources located within 15 miles (24 km) of the Seattle-Bellevue metropolitan area. The Snoqualmie River Valley is undergoing rapid changes in land use with additional waste load discharges projected for the river. Since 1989, the Washington State Department of Ecology has conducted several water quality investigations on 44.5 mi (71.6 km) of the lower river basin to define present and potential water quality problems during the summer low flow season. These investigations and water quality simulations, using the model QUAL2E, have resulted in estimating load capacities for biochemical oxygen demand (BOD), ammonia, and fecal coliform during the critical low flow months of August through October. Additional monitoring is also recommended to develop soluble reactive phosphorus (SRP) loading capacities in the future. The loading capacities will require waste load allocations (WLAs) of BOD and ammonia when the three existing municipal wastewater treatment plants (WWTPs) expand. Implementation of a nonpoint source (NPS) management plan for the mainstem and some tributaries will be necessary immediately to meet Class A fecal coliform criteria, and to meet BOD and ammonia load allocations (LAs). Interim point and nonpoint source SRP monitoring and future water quality-based effluent limits on phosphorus are likely to maintain high quality surface waters. A phased total maximum daily load (TMDL) was recommended to make adjustments to the WLAs/LAs as NPS controls are implemented, and as additional water quality and growth pattern data become available.

Background

Total Maximum Daily Loads (TMDLs)

Section 303(d) of the federal Clean Water Act requires states to identify waterbodies that are water quality limited (*i.e.* waterbodies that do not meet, or are not expected to meet, applicable water quality standards after sources have undergone technology-based controls). The United States Environmental Protection Agency (USEPA) also encourages states to protect good quality waters which are threatened with degradation (USEPA, 1991a). Both types of waterbodies are primary candidates for total maximum daily load (TMDL) evaluations.

by Joe Joy
May 1994

Waterbody Numbers WA-07-1060, -1062, -1066, -1100, -1102, -1104, -1106, -1108, -1110

Ecology Report #94-71

The TMDL is a mechanism for establishing water quality-based controls on all point and nonpoint sources (NPS) of pollutants within a water quality-limited basin, sub-basin, or hydrographic segment. The TMDL evaluation uses monitoring data and water quality models to estimate the pollutant load that a waterbody can receive and continue to meet water quality standards. This loading capacity is then apportioned among all point sources through waste load allocations (WLAs), and among NPS and background sources through load allocations (LAs). The TMDL is defined by USEPA as the sum of all WLAs, LAs, and any safety margin. The margin of safety can incorporate future growth options or data and modeling uncertainty.

Where a large NPS component is included in the TMDL, or where data contain a high degree of uncertainty, a phased TMDL approach is appropriate (USEPA, 1991a). The loading capacity, WLAs, and LAs are refined in a phased TMDL as specific NPS problems undergo control measures, and as additional data are obtained.

The loading capacities, WLA, and LA recommendations are presented to dischargers and the public, and are subject to comment and revisions. Upon approval, the TMDL with its associated WLAs and LAs are implemented through NPDES permits, NPS action plans, and grant projects. A phased TMDL also contains an implementation schedule for monitoring and review.

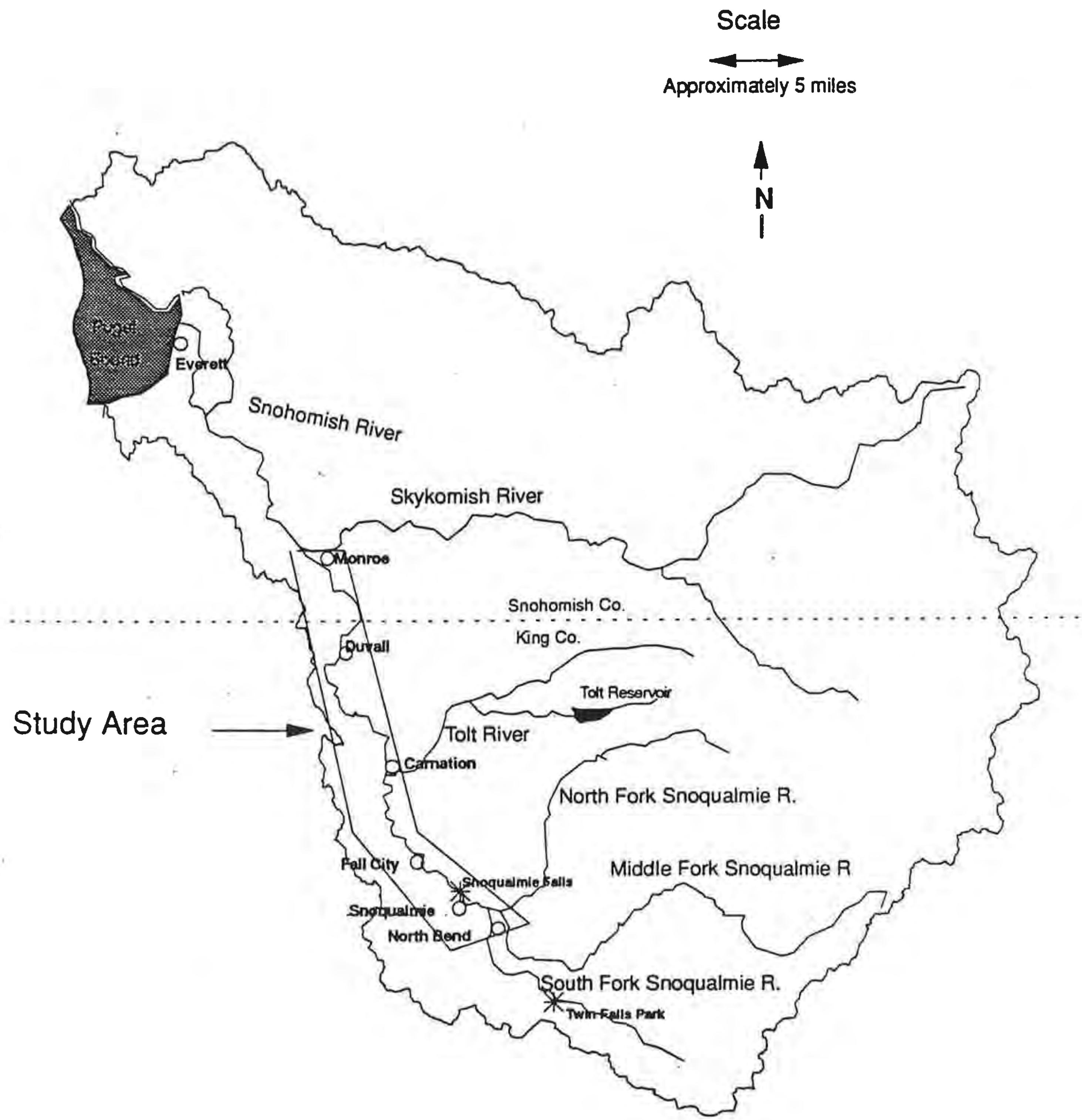
The Snoqualmie River system is highly valued for its recreational, aquatic habitat, and domestic water supply uses. The basin was targeted by the Washington State Department of Ecology (Ecology) for a TMDL evaluation because it is located within 15 miles of the Seattle-Bellevue metropolitan area, and it is expected to undergo an era of rapid growth as the metropolitan area expands (King County Planning, 1988). The communities of North Bend, Snoqualmie, Fall City, Carnation, and Duvall are located in the lower basin, and have historically relied on agricultural and logging based economies. Now they are becoming the focal points for residential, commercial, and industrial projects which require increased wastewater services. Additional wastewater and NPS impacts from land use changes threaten to degrade water quality in the basin. A study of the lower Snoqualmie River was necessary to describe baseline water quality, identify current problems, and to establish any TMDLs necessary to maintain and protect a high level of water quality for existing beneficial uses.

This report is a culmination of work by Ecology's Environmental Investigations and Laboratory Services (EILS) Program. EILS' involvement began with a 1989 low flow water quality study of the Snoqualmie River (Joy *et al.*, 1991). Some recommendations from that study were implemented with specific monitoring and follow-up investigations over the following three years (Appendix A; Das, 1992; Hopkins, 1992; Patterson and Dickes, 1993). This report summarizes the findings of the past work, and outlines the recommendations to complete TMDLs for the lower Snoqualmie River basin.

Study Area Description

The Snoqualmie River system drains 700 square miles (mi^2) [1,813 square kilometers (km^2)] in King and Snohomish Counties before meeting the Skykomish River to create the Snohomish River (Figure 1). The upper basin, the area above the three forks confluence at North Bend, is mostly forest land managed privately and by the U.S. Forest Service; commercial and residential pockets in the upper basin are becoming more common along the Interstate 90 corridor. Population centers and mixed agricultural uses such as dairies, berry fields, pastures, and row crop fields are numerous in the lower valley. Wildlife reserves, golf courses, and other recreational facilities are also present

Figure 1. Location of the Snoqualmie River low flow study and total maximum daily load (TMDL) evaluation within the Snohomish River basin.



along the river. The slopes and upland sub-drainage areas of the lower valley have supported forestry and water supply uses, but are being converted to residential developments. Snoqualmie Falls, a drop of 268 feet (81.7 m), is a predominant feature of the river at river mile (RM) 40.4. The Tolt River, which drains a 101 mi^2 (262 km^2) basin, is the largest tributary to the lower river.

The Snoqualmie River and its tributaries are designated Class A waters from the mouth to the west border of Twin Falls State Park at river mile (RM) 9.1 on the South Fork (Figure 1). The entire Middle Fork and North Fork Snoqualmie Rivers, and South Fork Snoqualmie River above RM 9.1 are Class AA waters. The South Fork Tolt River system is also Class AA, with a special condition on the South Fork Tolt (a Seattle water supply) above RM 6.9 prohibiting any waste discharge. The criteria and beneficial uses for these waterbody classifications are summarized in Table 1.

The study area is located in the lower 44.5 miles (71.6 km) of the river from RM 2 of the South Fork Snoqualmie River above North Bend (elevation 430 feet/131 meters), to the confluence of Snoqualmie River with the Skykomish River at Monroe (elevation 15 ft./4.6 m) (Figure 2). The lower river was the focus of Ecology's efforts because permitted wastewater discharge are present, multiple beneficial uses are supported, land use patterns are rapidly changing in the sub-drainages, and riverside communities are experiencing rapid population growth.

Ecology staff assumed impacts from point source discharges and some NPS would be most evident in the lower river during the summer-fall low flow season. Other NPS impacts would be more evident during higher run-off periods, but they were not considered in this study. Assessment of the lower river sub-drainages was limited to summarizing tributary impacts on the mainstem river. Future studies may cover these additional issues as resources and priorities allow.

There are six permitted wastewater discharges in the study area (Figure 2). Effluent limits for each National Pollutant Discharge Elimination System (NPDES) or state discharge permit are presented in Table 2. Three NPDES permits regulate municipal wastewater treatment plant (WWTP) discharges from the communities of North Bend, Snoqualmie, and Duvall. One state permit regulates process and stormwater discharges to and from the Weyerhaeuser mill pond. A permit covers the Washington State Department of Fisheries and Wildlife hatchery at Tokul Creek. The domestic wastewater and dairy manure from the Carnation Research Farms are applied to spray fields after treatment under limits set by a state permit. The three municipal plants discharge directly to the Snoqualmie River throughout year. The Weyerhaeuser mill pond discharges intermittently to the river as the pond level clears the outlet weir. The Tokul Fish Hatchery discharges to Tokul Creek. The Carnation spray fields are located in the Ames-Sikes Creek sub-drainage, but direct discharge of wastewater to surface waters is not allowed.

Nonpoint source problems in several lower river sub-drainages have been documented from agricultural, residential and silvicultural areas. The King and Snohomish Conservation Districts, state, tribal, and local government agencies have worked to control them. However, watershed or sub-basin nonpoint management plans have not been written or implemented in the study area.

Table 1. Class AA (extraordinary) and Class A (excellent) fresh water quality standards and characteristic uses (WAC 173-201A).

	CLASS AA	CLASS A
General Characteristic:	Shall markedly and uniformly exceed the requirements for all, or substantially all uses.	Shall meet or exceed the requirements for all, or substantially all uses.
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; wildlife habitat; primary contact recreation, sport fishing, boating, and aesthetic enjoyment; and commerce and navigation.	Same as AA
<u>Water Quality Criteria</u>		
Fecal Coliform:	Shall not exceed a geometric mean value of 50 organisms/100 mL, with not more than 10% of samples exceeding 100 organisms/100 mL.	Shall not exceed a geometric mean value of 100 organisms/100 mL, with not more than 10% of samples exceeding 200 organisms/100 mL.
Dissolved Oxygen:	Shall exceed 9.5 mg/L.	Shall exceed 8.0 mg/L.
Total Dissolved Gas:	Shall not exceed 110% saturation	Same as AA.
Temperature:	Shall not exceed 16.0°C due to human activities. When natural conditions exceed 16.0°C, no temperature increase will be allowed which will raise the receiving water temperature by greater than 0.3°C. Increases from non-point sources shall not exceed 2.8°C.	Shall not exceed 18.0°C due to human activities. When natural conditions exceed 18.0°C, no temperature increase will be allowed which will raise the receiving water temperature by greater than 0.3°C. Increases from non-point sources shall not exceed 2.8°C.
pH:	Shall be within the range of 6.5 to 8.5 with a man-caused variation with a range of less than 0.2 units.	Shall be within the range of 6.5 to 8.5 with a man-caused variation with 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% increase in turbidity when the background is more than 50 NTU.	Same as AA.
Toxic, Radioactive, or Deleterious Material:	Shall be below concentrations which have the potential singularly or cumulatively to adversely affect characteristic water uses, cause acute or chronic conditions to the most sensitive aquatic biota, or adversely affect public health.	Same as AA.
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.	Same as AA.

Figure 2. Snoqualmie River low flow study and TMDL evaluation area 1989 and 1991.

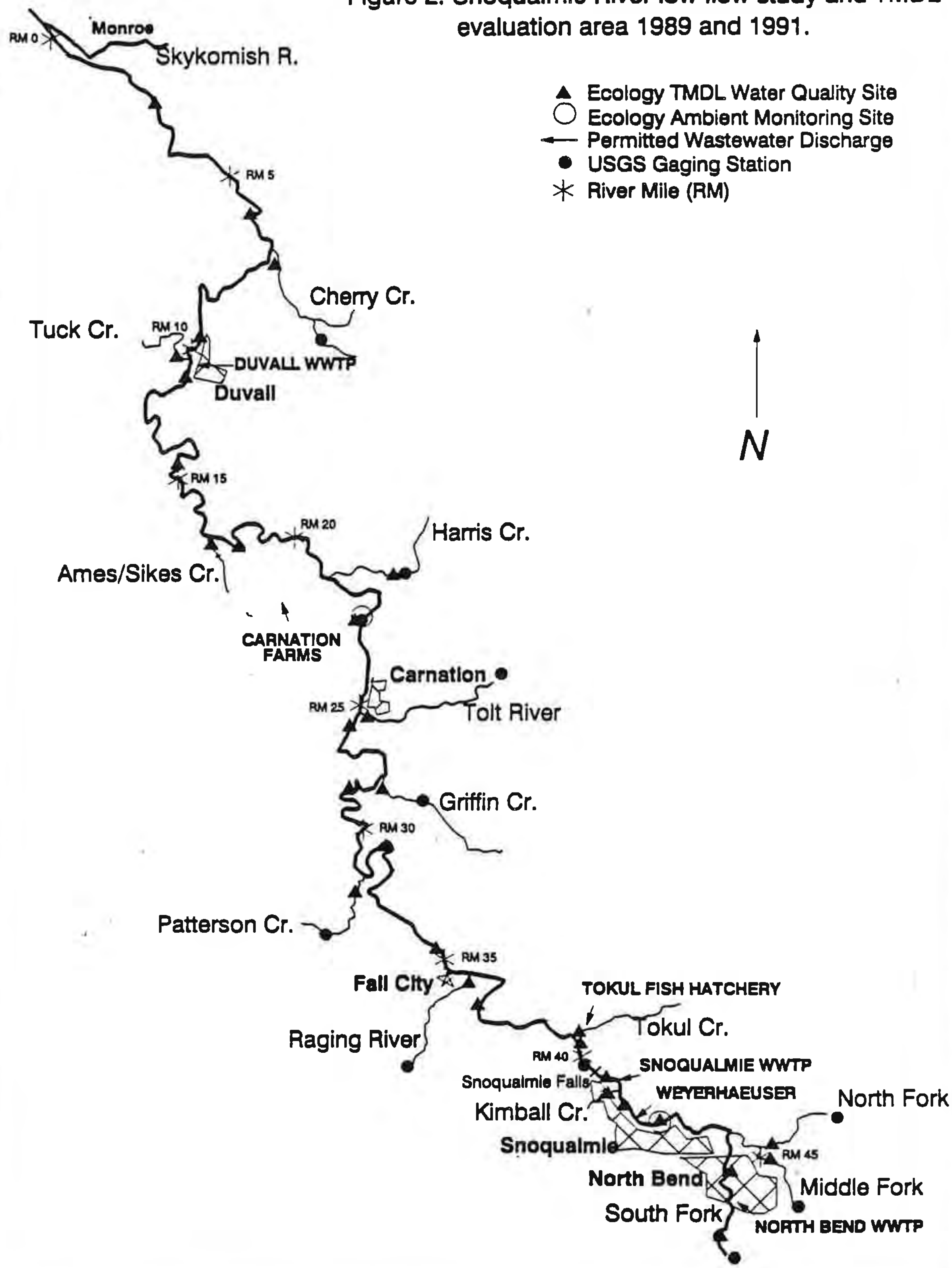


Table 2. Wastewater dischargers in the Snoqualmie River total maximum daily load (TMDL) study area with National Pollutant Discharger Elimination System (NPDES) and state permits.

Name/Permit No.	Issued	Expire	Flow (MGD)	BOD Monthly	BOD Weekly	Solids Monthly	Solids Weekly	Ammonia Monthly	Ammonia Weekly	Fecal Coliform Monthly	Fecal Coliform Weekly	pH
City of Duvall WA-002951-3	1992	1997	0.9	30 mg/L 226 lbs/day	45 mg/L 340 lbs/day	30 mg/L 226 lbs/day	45 mg/L 340 lbs/day	5 mg/L	8 mg/L	200	100	6-9
Carnation Research Farms ST5139	1985	1990	*	30 mg/L**	45 mg/L**	30 mg/L	45 mg/L	--	--	--	--	6.5-8.5
Washington State Dept. of Fisheries and Wildlife Tokul Fish Hatchery WAG13-3004	1990	1995	4.55	--	--	5 mg/L composite Settleable:	15 mg/L instantaneous 100 mg/L on pond drawdown 0.1 mL/L weekly average 1.0 mL/L on pond drawdown	--	--	--	--	--
Town of Snoqualmie WA-002240-3	1977	1982	.213**	60 mg/L 107 lbs/day	90 mg/L 160 lbs/day	70 mg/L 125 lbs/day	105 mg/L 187 lbs/day	--	--	200	400	6.5-8.5
Weyerhaeuser Co.+ Mill and Log Pond WA-000173-21	1986	1991	1.73++	--	20 mg/L++ 228 lbs/day		110 mg/L 1,585 lbs/day	--	--	--	--	6-9
City of North Bend WA-002935-1	1987	1992	0.4	30 mg/L 100 lbs/day	45 mg/L 150 lbs/day	30 mg/L	45 mg/L	--	--	200	400	6-9

* Application rate of mixed livestock manure and sanitary wastewater: 13,600 gal./acre.
** Limits apply to sanitary wabtewater only.
*** Average dry weather flow; peak flow 0.619 MGD.
\+ Most recent permit is being contested.
\+ + Daily maximum limit.

Project Goals and Objectives

The goals of this study are to protect the water quality and aquatic communities in the Snoqualmie River, and to enhance the water quality of those areas not consistently meeting standards. To reach these goals, the following objectives were formed:

- evaluate low flow period water quality in the Snoqualmie River system by analyzing historical data and conducting synoptic and routine water quality monitoring surveys,
- construct a mathematical water quality model of the system to understand some basic water quality relationships and predict the response of the river to different types of wastewater loading under critical low flow conditions,
- develop loading capacities for those waterbodies which are threatened by degradation from point and nonpoint sources (NPS) during low flow conditions, and
- recommend how the TMDL/WLA/LA process can be applied by Ecology and local communities to reduce the impact of wastewater on the Snoqualmie River system.

Historical water quality data had indicated potential violations of Class A standards for dissolved oxygen (D.O.), pH, fecal coliform, and aesthetic values (e.g., nutrient enrichment) (URS, 1977; PEI Consultants, 1987; Ecology, 1988; Thornburg *et al.*, 1991; STORET, 1993). Therefore, these conventional pollutants were selected as the focus of the study, and only limited efforts were put towards evaluating problems from chlorine, metals, and pesticides toxicity.

Historical Data and Critical Conditions

One objective of Ecology's studies has been to review historical data and collect additional information to determine the water quality characteristics of the river. These data assessments identified portions of the study area that did not meet standards or were potentially sensitive to contaminants. The assessments also provided the raw data for estimates of critical low flow design conditions; estimates for headwater and source flows, physical channel characteristics, temperatures, pHs, and background chemical concentrations. These inputs were used in a steady-state water quality model or in general mixing zone evaluations to determine contaminant concentrations and allowable loading capacities that avoid water quality criteria violations.

Ecology has long-term water quality monitoring stations at RM 23 and RM 42.3, and has also monitored an additional seven stations at monthly intervals for at least four months from 1990 to 1992 (Hopkins, 1992; STORET, 1993). Data from Joy *et al.* (1991) intensive surveys in 1989 were supplemented with similar EILS surveys in 1991 (Appendix A; Das, 1992). In addition, a bacterial study was conducted by EILS at swimming areas in the lower valley (Patterson and Dickes, 1993), and a eutrophication criteria study is in progress (Joy, 1993). Water quality and ground water resource data have been collected from the Snoqualmie River system by others (URS, 1977; PEI Consultants, 1987; Thornburgh *et al.*, 1991; Puget Sound Power and Light, 1991; Lane *et al.*, 1993; Turney *et al.*, in press). The assessments based on these data are summarized in this section of the report.

Discharge

Two long-term U.S. Geological Survey (USGS) stations located along the mainstem at RM 23 and RM 40 provided daily discharge data (EarthInfo, 1992) (Figure 2). Long-term USGS discharge stations on the Middle, North, and South Forks of the Snoqualmie River, the Raging River, and the Tolt River also provided discharge data. Other smaller tributaries or key reaches on the mainstem have had periods of flow measurement concurrent with long-term gage sites. Extended low flow records were generated for these reaches by performing regressions with long-term stations (Joy *et al.*, 1991).

The lowest flows in the mainstem Snoqualmie River occur in the months of August, September, and October (Figure 3). Lower flows mean less dilution and longer residence times for pollutants, and more sensitivity of the river to solar warming. Some regulation of flows occurs at the City of Seattle water supply reservoir on the Tolt River system, and at Snoqualmie Falls at the Puget Sound Power and Light Company (PP&L) hydroelectric facility. Routing and storage of water at Snoqualmie Falls is being negotiated under PP&L's license renewal and new project modification application with the Federal Energy Regulatory Commission.

Ecology has established an instream flow protection program with consumptive appropriation limits for some surface waters of the Snoqualmie River basin in Chapter 173-507 (WAC). These consumptive use limits are more restrictive (higher flow limits) than the seven-day ten-year (7Q10) annual low flow, or seven-day twenty-year (7Q20) seasonal low flow statistics used to evaluate TMDL critical conditions (Table 3). However, the consumptive limits are not generally applicable towards regulating waste water dilution and dispersion in this river system. The 7Q20 low flow for the months of August, September, and October will be used for the Snoqualmie River TMDL evaluations. The 7Q20 provides a seasonal risk equivalent to an annual 7Q10 (GKY and Associates, 1984).

Temperature, Dissolved Oxygen, and pH

Peak water temperatures and minimum dissolved oxygen concentrations occur in the months of July and August (EarthInfo, 1992; STORET, 1993). High water temperatures can naturally create lower D.O. concentrations because of decreased gas solubility. However, primary productivity also increases in summer. Photosynthesis can create D.O. supersaturation during the day, and respiration can cause depressed D.O. concentrations at night in productive reaches. Oxygen demand rates also increase with temperature and can cause greater oxygen depletion. Furthermore, D.O. losses from lower reaeration rates can occur when velocities are reduced in pool areas during low flows.

Instream temperatures in several areas of the study area do not meet Class A and Class AA criteria (Table 4). Excursions over the criteria are seasonal and not caused by point or nonpoint thermal wastewater inputs. Several physical conditions create elevated temperatures through direct solar heating. These conditions include:

- channelization for flood control has decreased velocities in some reaches,
- riparian cover has been reduced by land development and for flood control, and
- long, shallow, exposed reaches are naturally sensitive.

Figure 3. Monthly flow statistics for the Snoqualmie River at Snoqualmie 1958 - 1992

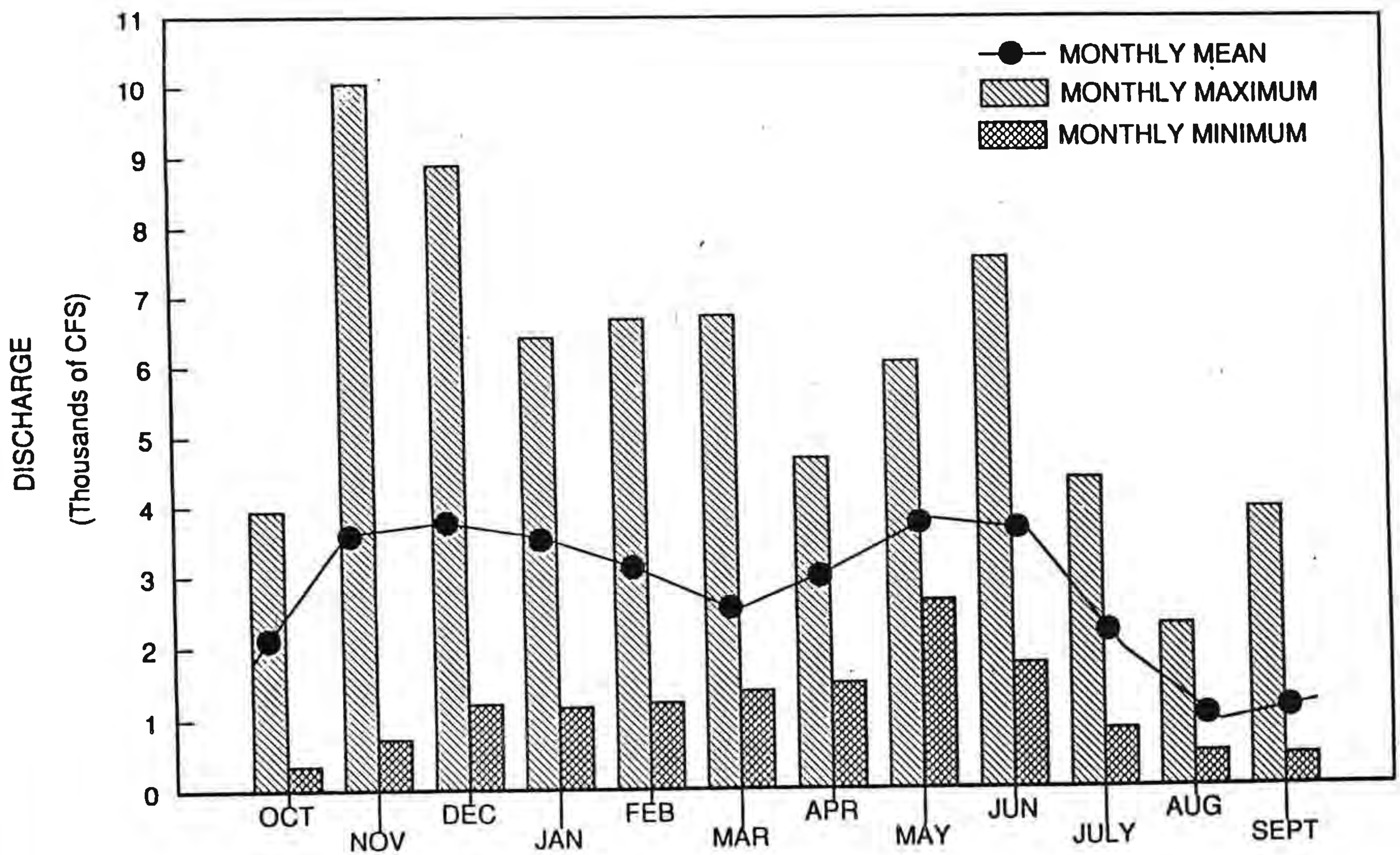


Table 3. Instream flow limits and low flow statistics for the Snoqualmie River study area. Instream flow limits apply to consumptive water uses.

	INSTREAM FLOW LIMITS*										FLOW STATISTICS	
	July		August		September		October		November		Annual	Aug-Oct
	1	15	1	15	1	15	1	15	1	15	7Q10	7Q20
South Fork Snoqualmie	--	--	--	--	--	--	--	--	--	--	79	81
North Fork Snoqualmie **	300	195	130	130	130	130	130	165	210	260	75	73
	200	140	100	100	100	100	130	165	200	200		
Middle Fork Snoqualmie	--	--	--	--	--	--	--	--	--	--	125	130
Snoqualmie R. at Snoqualmie	1550	1100	770	600	600	600	820	1100	1550	1550	346	343
Raging River	--	--	--	--	--	--	--	--	--	--	7.2	7.7
Tolt River **	280	240	170	120	120	120	190	280	280	280	72	65
	140	120	120	120	120	120	185	190	190	190		
Snoqualmie R. at Carnation	1850	1300	950	700	700	700	1050	1650	2500	2500	443	456
Snoqualmie at mouth	2180	1550	1080	800	800	800	1200	1850	2800	2800		

* WAC 173-507-020 Instream Resources Protection Program - Snohomish River Basin, WRIA 7

** First line of flows are for normal year; second line represents critical year flows.

Table 4. Portions of the Snoqualmie River system listed in Washington State's 1992 305(b) report for exceeding water quality standards (Ecology, 1992: Appendix E).

WATERBODY NUMBER	WATERBODY NAME	SOURCE	PARAMETERS EXCEEDING CRITERIA
WA-07-1060	Snoqualmie River	Nonpoint	pH, Fecal Coliform, Temperature
WA-07-1062	Cherry Creek	Nonpoint	pH, Fecal Coliform
WA-07-1066	Ames Creek	Nonpoint	pH, Fecal Coliform
WA-07-1100	Snoqualmie River	Nonpoint	pH, Fecal Coliform
WA-07-1102	Patterson Creek	Nonpoint	Dissolved oxygen, pH, Fecal Coliform
WA-07-1108	Kimball Creek	Nonpoint	Fecal Coliform

D.O. sensitive environments in the mainstem and tributaries were identified from the EILS surveys and historical data sources. The pools above Snoqualmie Falls, upstream of the Tolt River, and on the last three miles of diked river channel have slow velocities, low reaeration rates, high sediment oxygen demand potential, high temperatures, and the lowest D.O. concentrations. D.O. concentrations below the Class A criterion of 8.0 mg/L have been recorded in the pool above Snoqualmie Falls (PEI, 1987; PP&L, 1991). Ecology monitoring at RM 2.7, near the confluence of the Skykomish River, recorded a mid-day D.O. concentration of 8.4 mg/L at a temperature of 21°C (STORET, 1993). Based on diurnal data collected in the same reach during the 1989 and 1991 EILS surveys, the minimum D.O. concentration that day was probably lower than the 8.0 mg/L criterion. Some of the smaller tributaries can be easily overwhelmed by oxygen demanding materials because of their poor dilution potential. D.O. violations have been observed by researchers sampling in Kimball, Patterson, and Cherry Creeks (Thornburgh *et al.*, 1991; Lane *et al.*, 1993).

Historical data indicate slightly higher mean pH values in the river during the months of August through October (STORET, 1993). Again, instream primary productivity can result in large diurnal pH swings. Higher pH values also increase the toxicity of ammonia to aquatic organisms. Several waterbodies are listed with pH Class A criteria violations (Table 4). High pH values (greater than Class A criterion of 8.5) observed in the Raging River could be caused by benthic algae productivity. The source of the algal stimulation has not been intensively investigated by Ecology. The mainstem Snoqualmie River, Cherry Creek, and Patterson Creek have had pH levels lower than the Class A criterion of 6.5, generally outside the low flow period (Thornburgh *et al.*, 1991).

Fecal Coliform Bacteria

Fecal coliform bacteria counts violate Class A and AA criteria at various times of the year in the Snoqualmie basin (URS, 1977; Thornburgh, *et al.*, 1991; STORET, 1993). During dry periods (late July through October) less water is available for dilution, so violations occur when fecal wastes are directly discharged into the river or tributaries. During extended rainstorms or flood conditions, fecal wastes are washed into water courses directly off the land. Ames Creek, Cherry Creek, Kimball Creek, Patterson Creek, Raging River, and portions of the mainstem Snoqualmie River do not meet Class A standards because of fecal coliform violations (Table 4). Joy *et al.* (1991) found both nonpoint (NPS) and point sources contributing to the bacterial problems in the mainstem Snoqualmie River in 1989. However, Das (1992) reported reductions in point source bacterial loading in 1991 through significant improvements in effluent disinfection at the three main sewage treatment plants. Nonpoint sources were still creating localized bacterial contamination problems in both 1991 (Appendix A) and 1992 (Patterson and Dickes, 1993).

Nutrients

Increased phytoplankton, periphyton, and macrophyte productivity occur during periods of warmer water temperatures, stable periods of low to moderate water velocity, high water clarity, longer daylight hours, ~~low populations of grazing organisms,~~ and adequate nutrient availability. These conditions can potentially be met on the Snoqualmie River from late July through October. However, Joy *et al.* (1991) suggested that low concentrations of inorganic nitrogen and dissolved phosphorus were generally limiting productivity and preventing eutrophication problems in most of the mainstem Snoqualmie River. In EILS's 1989 and 1991 surveys (Joy *et al.*, 1991; Appendix A, Table A1), the average soluble reactive phosphorus (SRP) concentration for mainstem stations was 4 μg/L. Water

column chlorophyll *a* concentrations were below 0.1 mg/m^3. Light-dark bottle experiments also indicated measurable phytoplankton production was low. Periphyton biomass measurements taken at mainstem stations were far below a nuisance guideline of 100 - 150 mg chlorophyll a/m^2 suggested by researchers (Horner *et al.*, 1983; Welch *et al.*, 1988).

On the other hand, nutrients appeared to be having an effect on biomass in some limited areas of the mainstem. Large macrophyte beds were present in the pools above the confluences with the Tolt and Skykomish Rivers. The mainstem reach between Snoqualmie Falls and the Raging River, affected by nutrient inputs from the Snoqualmie WWTP, Tokul Creek, and other sources showed rapid SRP uptake by the benthic community and the greatest gross productivity as measured through diurnal D.O. monitoring.

Many tributaries also showed signs of nutrient enrichment (Thornburgh *et al.*, 1991; Joy *et al.*, 1991). Periphyton biomass measurements in the South Fork Snoqualmie River below the North Bend WWTP exceeded the nuisance guideline, probably in response to the effluent phosphorus. Ames-Sikes Creek, Patterson Creek, Tuck Creek, and Cherry Creek had elevated nutrient concentrations and visual evidence of heavy periphyton growth.

Ammonia and Chlorine

Ammonia toxicity occurs near wastewater sources when high pH, elevated background ammonia concentrations, low dilution, and high temperatures are present. The ammonia concentrations with the greatest toxicity potential during the surveys were from the Duvall WWTP and Ames-Sikes Creek (Joy *et al.*, 1991; Das, 1992; Appendix A, Table A1). The other municipal WWTPs and NPS also noticeably raised ammonia concentrations in localized mainstem areas and in tributaries. Otherwise, ammonia concentrations at most of the mainstem Snoqualmie River stations during the 1989 low flow season were between 10 $\mu g/L$ and 30 $\mu g/L$ (Joy *et al.*, 1991), and less than 10 $\mu g/L$ in 1991 (Appendix A, Table A1).

Chlorine toxicity can occur below municipal treatment plant outfalls during periods of low flow. Low total chlorine residual (TRC) concentrations can be difficult to balance with adequate disinfection when effluents contain algae or heavy solids concentrations. Heffner (1991) reported a wide range of TRC values (<0.1 - 1.3 mg/L) for WWTP effluents sampled during the 1989 EILS surveys. When concentrations were low, effluent fecal coliform NPDES permit limit were often exceeded. Das (1992) reported TRCs of 0.2 - 2 mg/L in the 1991 EILS survey, and all fecal coliform NPDES limits were met. High TRC concentrations could create potentially toxic conditions in effluent mixing zones, especially since current outfall placements do not effectively disperse effluents during low flow conditions.

Critical Conditions Summary

Most low flow-critical conditions for contaminant loading and standards violations occur during the months of August, September, and October. The contaminant concentrations and ancillary parameters used to determine loading capacities are summarized for key reaches, tributaries, NPS and point sources in Table 5.

Table 5. Snoqualmie River QUAL2E model critical conditions for selected parameters from major river, tributary, point and nonpoint sources. River and tributary flows are seven-day, 20-year lows for August through October.

LOCATION	Flow cfs	Temp. °C	pH s.u.	D.O. mg/L	NH3-N mg/L	Organic N mg/L	BOD5 mg/L	SRP µg/L	Total P µg/L	Fecal Coli. cfu/100mL
S.F. Snoqualmie R.	81	18.1	7.9	9.5	0.012	0.001	0.7	4.5	15	27
North Bend WWTP *	0.62	--	--	6	15	5	45	4000	7000	400
North Bend WWTP **	2.16	--	--	6	11	5	45	4000	7000	400
N.F.& M.F. Snoqualmie R.	260	18.6	8.1	9.2	0.011	0.001	0.5	2	5	21
Mainstem Nonpoint Source	0.02	--	--	2	1.5	3	90	1400	4000	300000
Kimball Creek	0.95	--	--	8	0.018	--	1.4	8	16	1448
Snoqualmie RM 40.6	343	19.2	7.7	--	--	--	--	--	--	--
Snoqualmie WWTP *	0.4	--	--	6	15	9	90	1300	6000	400
Snoqualmie WWTP **	2.55	--	--	6	15	5	45	4000	7000	400
Tokul Creek	16.6	--	--	9.8	0.041	0.05	0.6	20	42	10
Raging River	8	--	--	8.8	0.015	0.1	1.4	5	5	31
Fall City WWTP **	0.31	--	--	6	15	5	45	4000	7000	400
Mainstem Nonpoint Source	0.1	18	--	2	15	30	90	1400	4000	300000
Patterson Creek	7.4	--	--	8	0.03	0.15	2	50	63	207
Mainstem Nonpoint Source	0.1	--	--	2	15	30	90	1400	4000	300000
Snoqualmie RM 25.2	385	19.9	7.8	--	--	--	--	--	--	--
Tolt River	66	--	--	9.9	0.01	0.001	0.6	2	5	15
Carnation WWTP **	0.31	--	--	6	15	5	45	4000	7000	400
Ames-Sikes Creek	2.1	--	--	8	0.19	0.54	3	300	870	6550
Mainstem Nonpoint Source	0.3	--	--	2	15	30	90	1400	4000	300000
Snoqualmie RM 10.7	465	20.3	7.8	--	--	--	--	--	--	--
Duvall WWTP***	0.54	--	--	6	8	5	45	4000	7000	400
Duvall WWTP***	1.16	--	--	6	8	5	45	4000	7000	400
Mainstem Nonpoint Source	0.15	--	--	2	15	30	90	1400	4000	300000
Cherry Creek	5	--	--	8.5	0.041	0.2	1.4	13	37	530
Mainstem Nonpoint Source	0.1	--	--	2	15	30	90	1400	4000	300000
Snoqualmie RM 0.2	475	20.5	7.8	--	--		--	--	--	--

* Maximum monthly average flow observed in the months of August through October (1989 - 1993).
** Proposed or projected growth scenario: dry weather monthly average flow.
*** Duvall WWTP has recently expanded and is permitted to discharge 1.39 cfs (0.9 MGD). Maximum monthly dry weather flows for near and far future were estimated.

As stated earlier, the seasonal 7Q20 low flow statistics were calculated for the major river and tributary flow inputs. Background and tributary water quality parameters were selected at the appropriate seasonal 90th or 10th percentiles of large monitoring records, or the highest or lowest values observed during the field surveys previously mentioned. Municipal point source BOD, ammonia, and fecal coliform values were taken from weekly or maximum permit limits. Maximum monthly average and maximum daily WWTP flows for August through October were calculated or estimated from available records. Technology-based treatment data were used to estimate WWTP nutrient concentrations.

Waste loads from Weyerhaeuser, Tokul Fish Hatchery, and Carnation Farms were not assessed for the low flow period. Weyerhaeuser Mill Pond does not normally discharge to the river during the low flow period, so its discharge is represented only by an insignificant place holding value in the loading assessment. Tokul Fish Hatchery and Carnation Farms were not assessed in the field surveys, so their contributions are assumed to be unquantified portions of Tokul Creek and Ames-Sikes Creek loads.

Contaminant concentrations from mainstem NPS were characterized by Joy *et al.* (1991), and the NPS input volumes and locations were based on 1991 field data. Since they are gross allotments of NPS and not specific source types, only the volume of the NPS inputs will be manipulated in the model for load allocations.

TMDL/WLA/LA Development

The field data indicate most reaches of the Snoqualmie River study area meet applicable Class A and Class AA water quality standards during low flow periods. Temperatures and dissolved oxygen concentrations at some mainstem sites do not meet Class A criteria, but the contribution of waste sources from human activities compared to natural background sources is not known. NPS and poorly dispersed WWTP effluent create most of the localized bacterial and nutrient enrichment problems on the mainstem, and in some tributaries. Municipal point source load contributions in 1989 and 1991 appear to be fairly minor, except for the North Bend WWTP nutrient loads to the South Fork Snoqualmie River. However, increased wastewater input from growing communities in the basin, and existing NPS problems could expand areas of degraded water quality. A TMDL evaluation is needed to maintain and protect the high water quality and valuable aquatic communities found throughout most of the basin, and to direct restoration of those areas not meeting standards.

The Snoqualmie River TMDL evaluation has been conducted in two stages. Joy *et al.* (1991) performed the first stage with a low flow assessment:

- Sensitive reaches within the basin were identified, especially those not meeting water quality standards. Reaches impaired by point and nonpoint sources were identified. Background and NPS load contributions were estimated. Current point source loads were calculated, and future loads from new or expanded WWTPs were estimated.

- QUAL2E, a one-dimensional steady-state numerical model, was calibrated using 1989 low flow survey data. Total phosphorus, D.O., ammonia, and fecal coliform bacteria profiles in the river were simulated under a variety of scenarios.

- Based on field data and model results, a full TMDL evaluation and WLA/LA analysis was recommended for the low flow period.

The second stage of the Snoqualmie TMDL evaluation is described in the remainder of this report:

- Data collected in 1991 were used to test the QUAL2E model's ability to simulate D.O., ammonia, fecal coliform, and SRP under low flow conditions.

- Cumulative point and NPS water quality degradation was re-evaluated with QUAL2E simulations of the following scenarios using the revised critical condition data:

  - 7Q20 seasonal low flow and critical instream (e.g., D.O., temperature) conditions with existing WWTPs at seasonal design conditions and existing NPS effects,

  - 7Q20 seasonal low flow and critical instream conditions with various WWTP capacities designed to accommodate projected population growth, with and without NPS management in place.

- Margins of safety were established to: 1) prevent diurnal D.O. excursions below the 8.0 mg/L criterion, and 2) prevent violations of both levels of the fecal coliform criteria.

- Preliminary mixing zone evaluations were performed for WWTP discharges. Ammonia and TRC WLAs necessary to avoid toxicity to aquatic organisms were estimated for current and projected WWTP seasonal capacities. The ammonia WLAs were then compared to water quality-based limits needed to avoid far-field D.O. depletion from the effects of ammonia as nitrogenous oxygen demand.

- WLAs and LAs for BOD_5, ammonia, and fecal coliform are recommended to meet current and future TMDL goals. Instream SRP guidelines and monitoring plans are suggested.

Model Simulation Results

QUAL2E Calibration and Verification

The QUAL2E model of the Snoqualmie River has been previously described in detail (Joy *et al.*, 1991). The basic Snoqualmie River model reach and input structure is shown in Figure 4. Data collected from individual stations along the mainstem river, tributaries, and point sources during the four EILS survey runs in 1989 were used to calibrate the model. Reaction rates, hydraulic coefficients, and nonpoint inputs were calculated based on the field data or literature values (Appendix B).

Water quality data were collected from the mainstem, tributary, and point source stations on September 23-25, 1991 (Appendix A, Table A1) to test model predictions during low flow conditions. Discharges at the South Fork (117 cfs) and at RM 23 (620 cfs) were approximately 75% of those used for the calibrated model, but higher than the 7Q20 seasonal flows (Table 3). Discharge at RM 40 was 50% of that used in the calibrated model, and the 336 cfs flow was lower than the

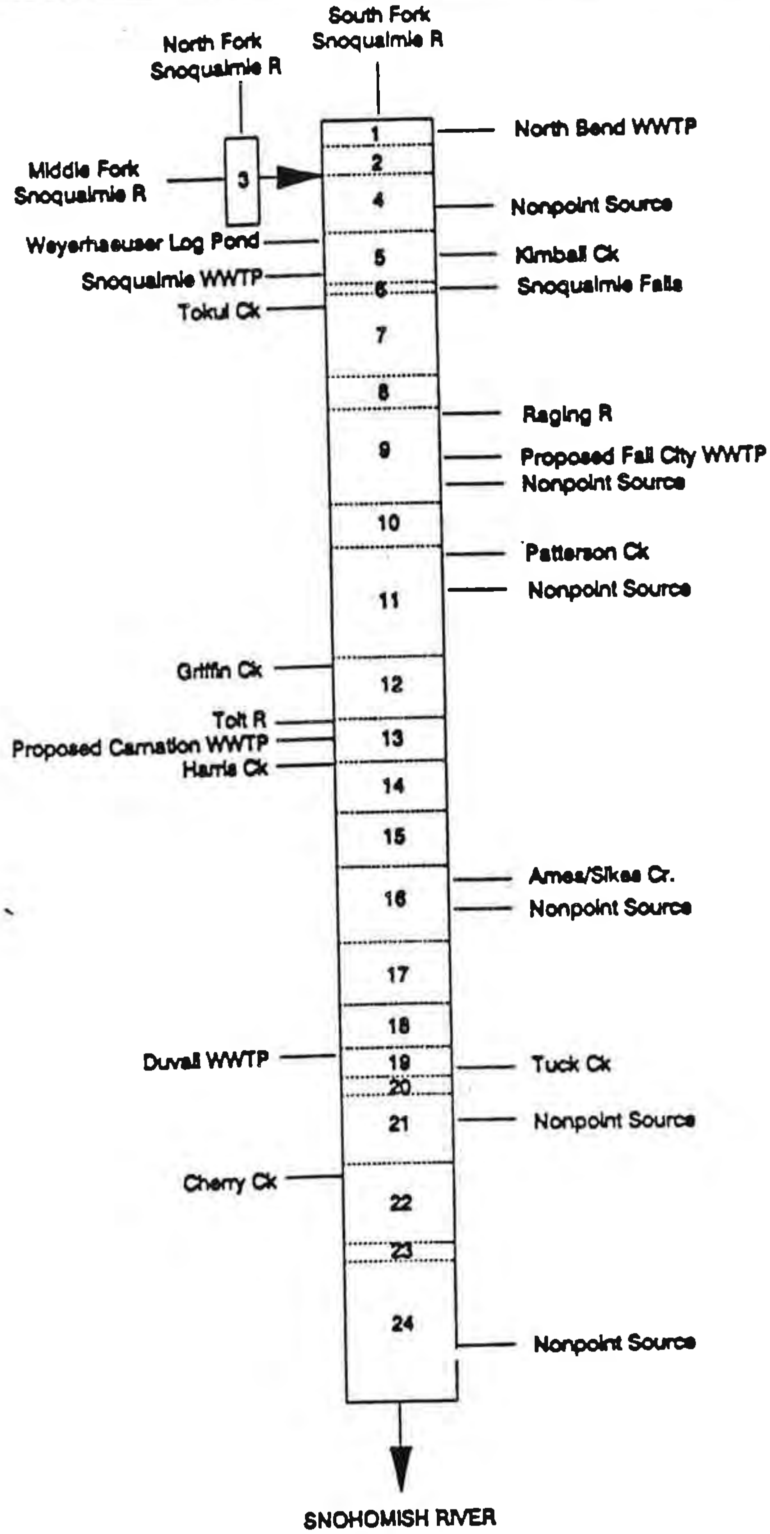


Figure 4 Schematic diagram of model reaches and loading sources for QUAL2E modeling of the Snoqualmie River system.

seasonal 7Q20. Reach temperatures were approximately 5°C cooler than critical conditions. Headwater, tributary, NPS and point source characteristics were supplied to the model from field data. Since channel depth and velocities effect reaeration rates, a few reaches with channel depths significantly different from 1989 calibration depths required rate adjustment. Groundwater inputs to the model were necessary to achieve a correct mass water balance between the mainstem gages at RM 40 and RM 23. (Groundwater was not evident in 1989, and was not included in the model.) All other coefficients were kept as in the calibrated model.

Field data and model results were compared as recommended by Reckhow, Clements, and Dodd (1986). The root mean squared error (RMSE) of the observed and modeled D.O., temperature, chloride, fecal coliform, SRP and total nitrogen were calculated (Appendix B, Table B1). Bivariate plots of observed and modeled data were made (Appendix B). Comparisons of 1991 field data to the calibrated model are summarized as follows:

- D.O. field data and model simulations had an overall RMSE of 0.7 mg/L. The model more accurately simulated D.O. from North Bend to the Tolt River (RMSE = 0.2 mg/L) than it did in the lower study area reaches (RMSE = 0.9 mg/L). These RMSE values are similar to the variability observed in duplicate measurements (0.2 mg/L) or from diurnal D.O. concentrations (0.3 to 2 mg/L).

- Chloride and temperature simulations closely matched field data with low RMSEs (chloride = 0.03 mg/L and temperature = 0.05°C).

- Mainstem NPS proved difficult to predict in location and contaminant strength. Water quality at mainstem stations influenced by NPS had high daily variability. Deviations between observed and modeled fecal coliform (RMSE = 1.22 cfu/100 mL log scale), total nitrogen (RMSE = 45 μg/L), SRP (RMSE = 0.7 μg/L), and D.O. values were probably affected by the errors associated with NPS inputs. However, deviation represented by these RMSE were similar to deviations between 1989 duplicate samples (Joy *et al.*, 1991).

- Total nitrogen and ammonia concentrations at mainstem stations in 1991 were consistently lower than detected in 1989. Model results overestimated field data at stations downstream of RM 20 (Total N RMSE = 70 μg/L). A RMSE for ammonia could not be calculated because too many field data were below analytical detection limits (< 10 μg/L).

The QUAL2E model was able to reasonably simulate most water quality parameters of interest during the low flow conditions in the Snoqualmie River. Overall model and observed variability expressed as RMSEs were similar to pooled standard deviations of duplicate samples, or natural diurnal variability. The models predictive strengths and weaknesses were better identified. Mainstem NPS inputs were recognized as important influences on river water quality that create a high degree of variability. A previously undetected groundwater component was identified. Through the verification process, the QUAL2E model of the Snoqualmie River has demonstrated it can provide simulations for a broader range of conditions during the low flow period than previously recognized.

Background, Current, and Future Conditions

Three types of D.O., fecal coliform, SRP, and ammonia simulations were run with the QUAL2E model to evaluate loading capacities under critical conditions. The simulation conditions were:

- river profiles without any mainstem WWTP or NPS inputs, and with reduced sub-basin contaminant inputs to simulate natural background conditions;
- existing NPS discharges and the three municipal point sources at seasonal design limits; and
- projections of future wastewater loads with two additional municipal point sources and currently permitted sources expanded, with and without water quality-based discharge limits and NPS controls.

The following estimates were made of the projected expansion of the three existing WWTPs and the size of theoretical Fall City and Carnation WWTPs:

- North Bend WWTP expansion from 0.4 mgd seasonal flow to 1.4 mgd,
- Snoqualmie WWTP expansion from 0.26 mgd seasonal flow to 1.65 mgd,
- Duvall WWTP growth from 0.35 mgd seasonal flow to 0.75 mgd, and
- Fall City and Carnation WWTP construction with discharges of 0.2 mgd each.

The results of these simulations are shown in Figures 5 to 8. Criteria for evaluating the results and a brief analysis follow.

Dissolved Oxygen

As discussed earlier, daily minimum D.O. concentrations in the pool above Snoqualmie Falls and the slow-moving reaches of the river below RM 5 have occasionally violated the 8 mg/L Class A criterion. Diurnal D.O. ranges reported for these areas were typically 1 mg/L.. Therefore, since the model only reports average daily D.O. concentrations, a Class A criterion violation would be likely in these two areas at average concentrations less than 8.5 mg/L.

An additional 0.2 mg/L margin of safety is recommended for evaluating D.O. concentrations in reaches below RM 5. As discussed, some of the greater deviation between modeled and observed D.O. was caused by NPS in the lower reaches of the study area. Also, the effects of future increased nutrient loading on productivity was not modeled, but needs to be addressed in some way. The total 0.7 mg/L (0.5 mg/L + 0.2 mg/L) margin of safety is needed to account for both the diurnal range and uncertainty in the model results.

Considering the margins of safety, the D.O. modeling results (Figures 5 and 6) indicate:

- Dissolved oxygen concentrations for all simulated conditions including natural background conditions, were below 100 percent saturation in the three sensitive pool reaches identified earlier.

Figure 5. Snoqualmie River QUAL2E model D.O. profiles under seasonal 7-day, 20-yr. low flow conditions. Existing point sources at maximum average monthly flow and permit limits and existing nonpoint source (NPS) impacts are compared to 100% saturation and no source profiles. Margin of safety levels are also shown (see text).

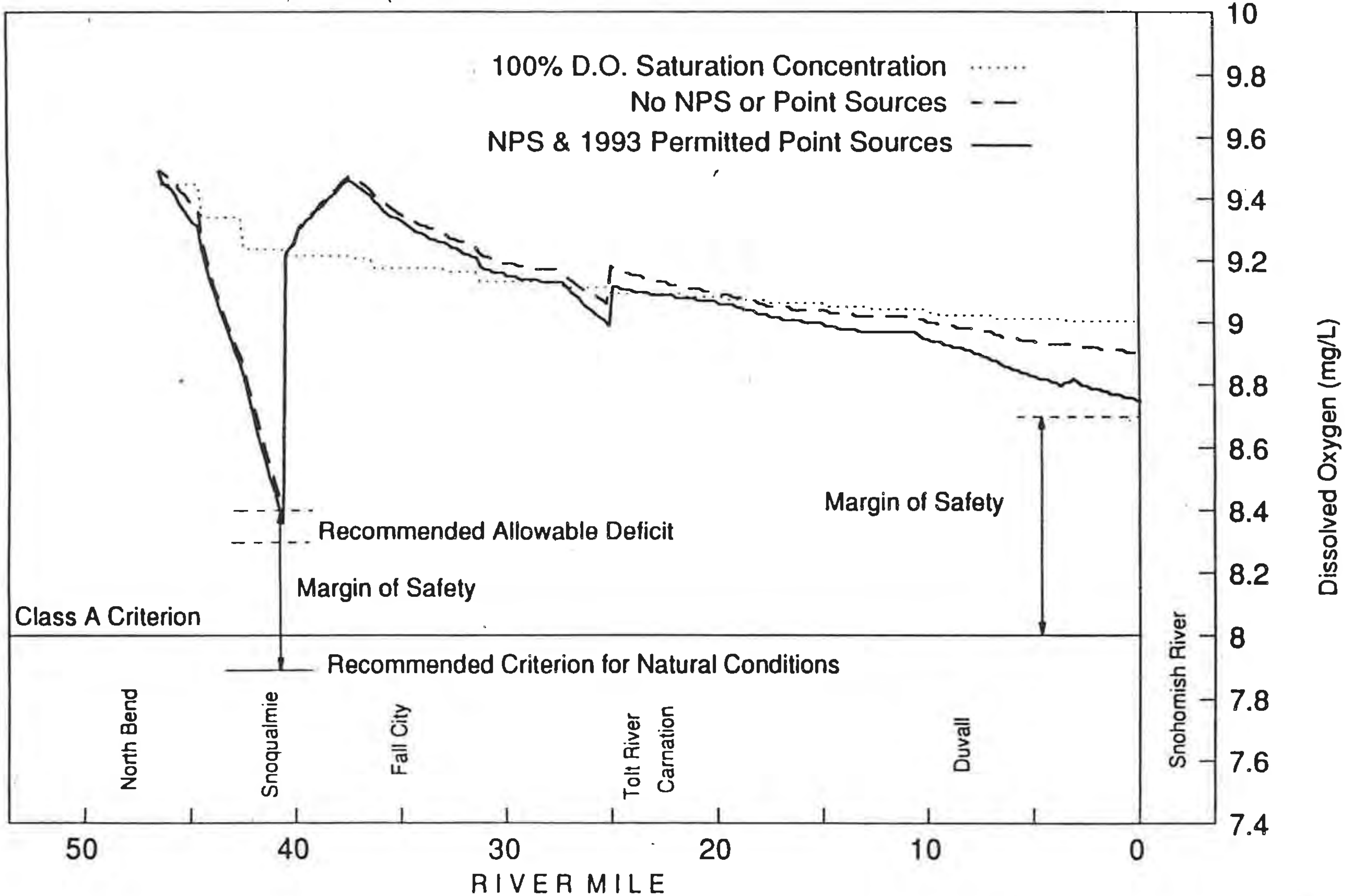


Figure 6. Snoqualmie River TMDL evaluation: Dissolved oxygen concentrations in response to future wastewater treatment plant (WWTP) expansion. QUAL2E model results with BOD and ammonia limits for WWTPs as recommended for waste load allocations (WLAs) compared to standard permit limits.

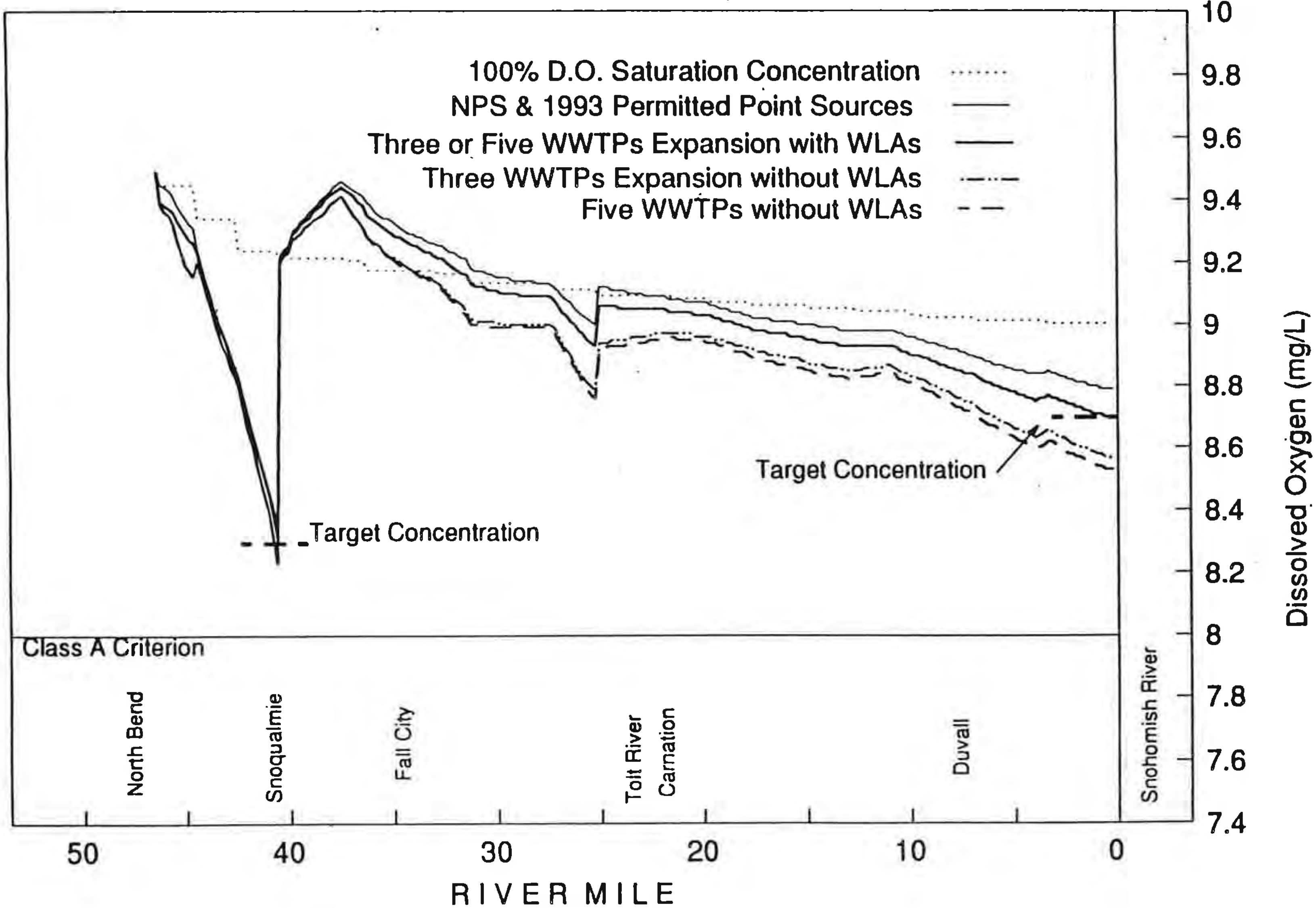


Figure 7. Snoqualmie River TMDL evaluation: Fecal coliform bacteria counts under critical low flow conditions. Current nonpoint source (NPS) load impacts and the effect of load allocations (LAs) are compared. Class A fecal coliform criteria and the model result target count are shown.(see text)

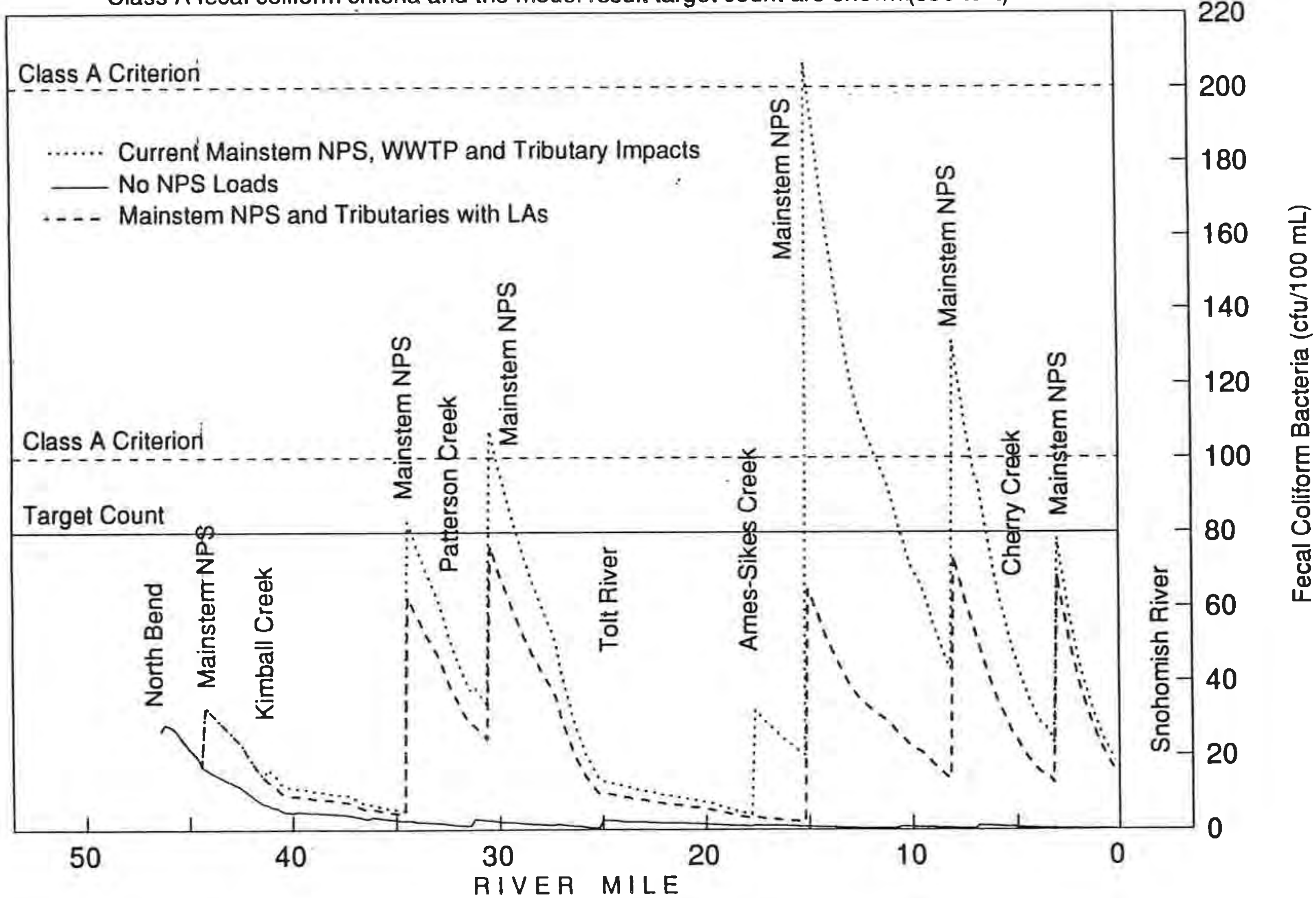
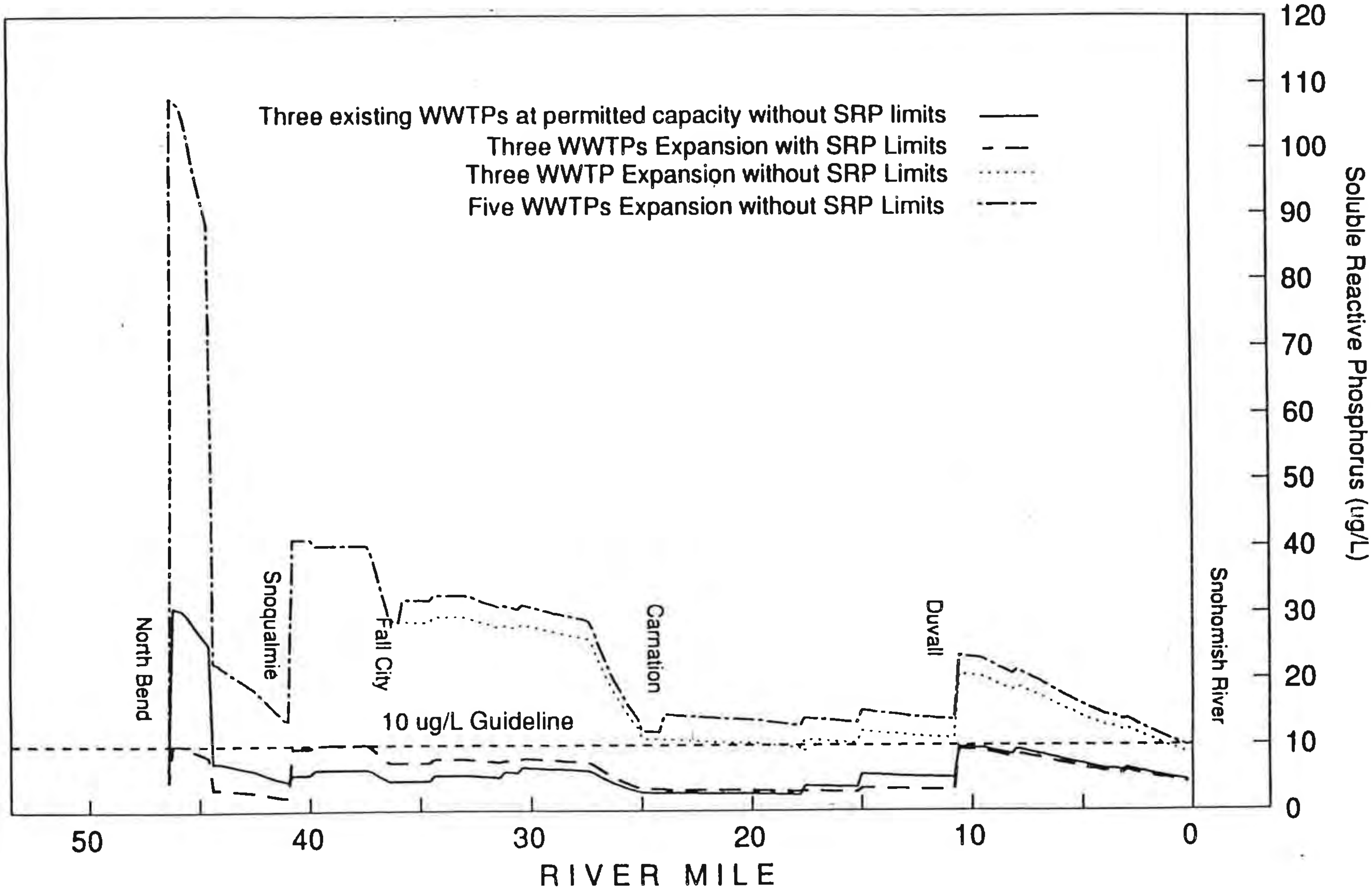


Figure 8. Snoqualmie River TMDL evaluation: Soluble reactive phosphorus (SRP) concentrations under critical low flow. SRP impacts of existing loads and future WWTP expansion under a SRP waste load limit are shown SRP response to WWTP expansion without limiting instream concentrations to 10ug/L is also shown (see text).



- All simulated conditions resulted in D.O. concentrations of 8.4 mg/L or less in the pool above Snoqualmie Falls. Class A criterion violations are predicted by the model if the 0.5 mg/L margin of safety is applied. According to state water quality standards (WAC 173-201A-070), the D.O. "natural condition" would become the water quality criterion (*i.e.*, 7.9 mg/L).

  Existing point sources and NPS inputs do not strongly affect D.O. concentrations in the pool (less than 0.05 mg/L deficit below natural background). Nonetheless, a criterion needs to be set to evaluate D.O. deficits by human-caused loading. An interim allowable deficit of 0.1 mg/L (*i.e.*, a D.O. model concentration target of 8.3 mg/L) is recommended. The 0.1 mg/L allowable loss and 7.8 mg/L minimum D.O. concentration would: 1) maintain all known beneficial uses of the pool reach; 2) be within the 0.2 mg/L RMSE calculated for model and field data differences in the upper study area; and 3) be more restrictive than the 0.2 mg/L deficit allowed from human activities in Class A marine waters with naturally occurring D.O. concentrations below the criterion [WAC 173-201A-030(2)(c)].

- At the confluence of the Snoqualmie and Skykomish Rivers, BOD_5 and ammonia loads from the three existing point sources at dry weather design capacity, plus mainstem and tributary NPD inputs create a 0.15 mg/L deficit below background conditions. The resulting 8.75 mg/L concentration complies with the target concentration of 8.7 mg/L for the confluence reaches.

- Projected municipal WWTP load increases will create greater deficits in the Snoqualmie Falls and Tolt River pools, and at the confluence with the Skykomish River. D.O. criterion violations (based on target concentrations) in the Snoqualmie Falls pool and at the confluence could occur unless BOD_5 and ammonia limits are established.

Fecal Coliform

Both parts of the fecal coliform criteria need to be considered when evaluating the model simulations. Since the model was calibrated to median fecal coliform counts, criteria violations could occur at locations with modeled counts less than 200 or 100 cfu/100 mL. EILS' field data indicated fecal coliform count variability was such that stations with median counts less than 80 cfu/100 mL were likely to meet both parts of the fecal coliform standard. Therefore, a 20 cfu/100 mL margin of safety is recommended, which equates to an 80 cfu/100 mL target fecal coliform model result.

Fecal coliform bacteria simulations clearly showed that instream counts were driven by nonpoint sources located on the mainstem and on tributaries (Figure 7). In addition, the simulations indicate:

- Current and projected WWTP loads were inconsequential in comparison to NPS loads as long as the effluent concentrations did not exceed the maximum permit limit of 400 cfu/100 mL.

- Eliminating or reducing mainstem NPS bacteria sources would bring mainstem bacterial water quality within Class A criteria and the 80 cfu/100 mL model target.

- Additional improvements to the mainstem bacterial water quality would be made if Kimball Creek, Patterson Creek, Griffin Creek, Ames Creek, and Cherry Creek fecal coliform concentrations were brought within the model target of 80 cfu/100 mL.

Soluble Reactive Phosphorus and Ammonia

Model results indicate existing point sources at average seasonal design capacity would contribute 55% of the SRP to the Snoqualmie River, which would increase average mainstem SRP concentration from 3.9 μg/L (1991 field results) to 5.4 μg/L (Figure 8). Reaches below WWTP outfalls, especially below the North Bend WWTP, could have concentrations several times higher than this. Projected SRP loads from expanded WWTPs may increase average mainstem SRP concentration to 19.4 μg/L unless water quality-based controls are implemented.

The increased SRP loads would be available for primary production. Based on data collected from the South Fork (Joy *et al.*, 1991) and from work performed on other river systems (Welch *et al.*, 1989; Watson *et al.*, 1990; Dodds, 1991; Welch *et al.*, 1992), the increased SRP loads could create unacceptable levels of periphyton growth in the river. However, Washington State has no nutrient or benthic biomass criteria. A recommended SRP concentration guideline of 10 μg/L will be discussed in detail later in this report (Recommended Waste Load Allocations–Soluble Reactive Phosphorus).

Ambient ammonia concentrations remained lower than aquatic toxicity criteria for all simulations. Mixing zone criteria and technology-based limits at the WWTPs could be more stringent than limits needed to address far-field ambient toxicity concerns. This is evaluated in the next section (Waste Load Allocations Based on Mixing Zone Regulations). However, WWTP ammonia limits may be needed on WWTPs and NPS to ensure D.O. criteria compliance through the control of nitrogenous oxygen demand loads.

In summary, QUAL2E model results suggest that NPDES permits for WWTPs at current seasonal capacity, and the lack of nonpoint management actions, have not seriously jeopardized water quality in the Snoqualmie River during critical low flow conditions. However, localized D.O., fecal coliform, and nutrient enrichment problems will continue or become more severe with WWTP expansion. The problems will persist unless water quality-based limits are placed on future WWTP loads, and unless NPS loads are controlled.

In the following two sections, WWTP mixing zone considerations will be evaluated, and an overall strategy for establishing WLAs and LAs to improve and maintain water quality will be recommended.

Waste Load Allocations Based on Mixing Zone Regulations

Point sources with all known, available, and reasonable methods of prevention, control and treatment (AKART) can be granted a clearly defined mixing zone as part of their NPDES permit (WAC 173-201A-100). The mixing zone is a limited area where some brief and non-lethal water quality violations may occur as effluent is diluted by receiving waters. Water quality standards must be met at the mixing zone boundary.

Because critical discharge conditions, plant effluent quality, and background concentrations of pollutants of concern are site specific, the maximum allowable pollutant effluent load into a mixing zone can vary between point sources. Furthermore, the limits placed on effluent to meet mixing zone considerations may or may not be more restrictive than limits needed to meet total assimilative capacity of a waterbody with multiple point sources and NPS.

Although intensive, site-specific mixing zone analyses are needed for permits, an estimate is presented here to judge whether mixing zone or far-field limits would be more restrictive for ammonia loads from the three municipal WWTPs. The information gained in the evaluation can be considered for the overall TMDL evaluation. Total residual chlorine (TRC) toxicity and effluent limits to meet mixing zone criteria are also estimated.

Dilution factors (DF) for Snoqualmie River point sources allowed under WAC 173-201A-100 were calculated using the following equations:

$$\text{Chronic criteria DF} = (Q_{NPDESc} + (0.25 \times 7Q10)) / Q_{NPDESc}$$

$$\text{Acute criteria DF} = (Q_{NPDESa} + (0.025 \times 7Q10)) / Q_{NPDESa}$$

where Q_{NPDESc} is the seasonal maximum monthly design flow, and $_{NPDESa}$ is the maximum daily seasonal flow. The 0.25 and 0.025 are the proportions of critical receiving water flow (7Q10 low flow) allowed by WAC 173-201A-100 for the mixing zone and acute criteria zone, respectively.

(Note: The percentage of critical flow mixing zone criterion was used for the general purposes of this report. An actual mixing zone study would need to evaluate whether flow volume, width, or downstream distance would be the most restricting factor for an individual mixing zone. Joy *et al.*, (1991) performed an idealized preliminary assessment (center outfall diffuser) of these factors for Snoqualmie River point sources. All three municipal WWTPs now have side-bank discharges rather than center diffusers, but will probably be asked to modify them within the next 10 years.)

A simple mass balance equation was used with the dilution factor to calculate TRC and ammonia (acute and chronic) mixing zone WLAs for the individual WWTP as follows:

$$\text{Mixing Zone WLA} = (WQS \times DF) - (CA \times (DF - 1))$$

where the WQS is the acute or chronic water quality standard, and the CA is background receiving water concentration of pollutant in question. Critical temperatures, pH values, and background concentrations used to calculate the ammonia criteria are listed in Table 5.

The long-term average concentrations needed to meet mixing zone WLAs were then calculated with consideration for effluent variability, sampling frequency, and criterion duration (USEPA, 1991b). The resultant estimated permit concentrations based on this analysis are presented in Table 6.

With the exception of North Bend, the long-term average ammonia concentrations necessary for the existing WWTPs at seasonal capacity to meet the mixing zone WLA are generally higher than technology-based concentrations. The North Bend estimated monthly average ammonia permit limit would be near the 15 mg/L technology-based concentration. Future expansion may require ammonia limits for mixing zone considerations, especially at North Bend and Snoqualmie. However, North Bend and Snoqualmie WWTPs have demonstrated nitrification capabilities, and have achieved effluent concentrations of less than 1 mg/L ammonia (Heffner, 1991; Das, 1992). In conclusion, these ammonia mixing zone WLAs may prevent near-field aquatic toxicity, but they may be inadequate for deterring far-field D.O. deficits created by nitrogenous oxygen demand. This will be evaluated in the D.O. discussion in the next section.

Table 6. Mixing zone WLAs calculated for total residual chlorine (TRC) and total ammonia (NH3) based on aquatic toxicity criteria.

TRC	Acute Design Flow (MGD)	Acute Criterion (mg/L)	Acute Dilution Factor	Daily* Max. TRC (mg/L)	Chronic Design Flow (MGD)	Chronic Criterion (mg/L)	Chronic Dilution Factor	Monthly* Avg. TRC (mg/L)	Mass Load** of Limiting WLA (lbs./day)
NORTH BEND (Current)	0.44	0.019	4	0.07	0.35	0.011	38	0.03	0.09
(Projected)	1.75	0.019	2	0.03	1.4	0.011	10	0.01	0.12
SNOQUALMIE (Current)	0.28	0.019	21	0.39	0.22	0.011	247	0.15	0.28
(Projected)	2.1	0.019	4	0.07	1.65	0.011	34	0.03	0.41
FALL CITY (Proposed)	0.25	0.019	24	0.46	0.2	0.011	289	0.18	0.30
CARNATION (Proposed)	0.25	0.019	30	0.6	0.2	0.011	362	0.2	0.37
DUVALL (Current)	0.44	0.019	18	0.33	0.35	0.011	209	0.13	0.38
(Projected)	0.94	0.019	9	0.16	0.75	0.011	98	0.06	0.38

TOTAL AMMONIA-N	Acute Design Flow (MGD)	Acute Criterion (mg/L)	Acute Dilution Factor	Daily* Max. NH3 (mg/L)	Chronic Design Flow (MGD)	Chronic Criterion (mg/L)	Chronic Dilution Factor	Monthly* Avg. NH3 (mg/L)	Mass Load** of Limiting WLA (lbs./day)
NORTH BEND (Current)	0.44	7.01	4	27	0.35	1.088	38	14	41
(Projected)	1.75	7.01	2	11	1.4	1.088	10	6	70
SNOQUALMIE (Current)	0.28	9.138	21	187	0.22	1.315	247	93	171
(Projected)	2.1	9.138	4	33	1.65	1.315	34	16	220
FALL CITY (Proposed)	0.25	7.822	24	187	0.2	1.095	289	93	155
CARNATION (Proposed)	0.25	7.815	30	232	0.2	1.064	362	115	192
DUVALL (Current)	0.44	7.65	18	132	0.35	1.041	209	66	193
(Projected)	0.94		9	66	0.75	1.041	98	32	200

* Calculated mixing zone waste load allocation (WLA) before long-term average concentration adjustment.

** Most limiting concentration from long-term average calculation (not shown), based on EPA (1991b).

Because the municipal plants using chlorine disinfection are distant, TRC has no cumulative effect in any reach of the river and no TMDL is required. The municipal WWTPs may have difficulty meeting the long-term average TRC effluent concentrations in Table 6. At existing seasonal capacity, all WWTPs will require TRC of less than 0.2 mg/L based on the assumptions of this analysis. The expanded WWTPs will need to purchase more sophisticated TRC monitoring equipment or they may need to dechlorinate effluent as TRC limits drop below 0.1 mg/L.

Recommended Waste Load Allocations

The BOD_5, ammonia, SRP, and fecal coliform loading capacities and WLA/LAs for low flow conditions on the Snoqualmie River are summarized in Tables 7, 8, and 9. These WLA/LAs apply to the months of August, September, and October when the critical conditions defined for the river are likely to occur. Water quality problems in the Snoqualmie River system have not been identified and investigated by Ecology for other seasons of the year.

A phased TMDL approach is recommended for the Snoqualmie River system as defined by USEPA guidance (USEPA, 1991a). The phased approach is appropriate where a large NPS component is included in the TMDL, or where some data contain a high degree of uncertainty. The TMDL is refined as specific NPS problems undergo control measures, or as additional data are obtained. The approach should work well with the five year basin review cycle being used by Ecology's Water Quality Program. Four major reasons a phased approach is recommended for this system are:

1. The Snoqualmie River LAs have "gross allotments" to NPS loads both along the mainstem and as portions of the tributary loads. A systematic identification of specific nonpoint loading sources will take an altogether different type of monitoring effort to separate livestock access, manure management, on-site septic system failure, golf course runoff, general agriculture, and residential runoff impacts. Once a NPS source is located, it is subject to intensive education, negotiation, or enforcement procedures which require a large commitment of resources from local agencies and Ecology regional staff. It is difficult to estimate the effectiveness of nonpoint source controls since data are not readily available, and effectiveness may vary greatly between locations.

2. The basin is in a uncertain state of population growth and land development. The water quality of the river will respond differently to equivalent additional waste loads depending on their point of entry. For example, increased waste loads at North Bend have different impacts and considerations than waste load increases in the lower valley. In addition to location-specific impacts, different NBOD and CBOD combinations will affect downstream D.O. differently. The scenarios simulated here approximate future development, but revised projections based on project specific engineering will be needed.

3. A TMDL effort is currently underway for the Snohomish River (Cusimano, 1993). This effort could result in modifications of the TMDLs on the Snoqualmie River in order to meet Snohomish River water quality goals.

Table 7. Summary of estimated contaminant loads to the Snoqualmie River during critical low flow: August, September, and October (units of lbs/day).
Existing (1994) municipal wastewater treatment plant (WWTP) at seasonal capacity and nonpoint sources are evaluated. Recommended permit or loading changes are outlined.

CURRENT CONDITIONS NO LIMITS

	Concentrations					Loads			
	Flow (cfs)	BOD5 (mg/L)	NH3-N (mg/L)	SRP (mg/L)	Fecal* Coliform	BOD5 (lbs/d)	NH3-N (lbs/d)	SRP (lbs/d)	Fecal* Coliform
POINT SOURCES									
North Bend	0.62	45	15	4	400	150	50.1	13	6.1E+09
Weyerhaeuser	0.01	4.7	0.08	0.03	6	0.25	0.004	0.002	1.5E+06
Snoqualmie	0.4	45	15	1.3	400	97	32.3	3	3.9E+09
Duvall	0.54	45	8	4	400	131	23.3	12	5.3E+09
Point Source Loads						379	106	28	1.5E+10
MAINSTEM NONPOINT SOURCES									
Three forks area	0.02	60	1.5	1.4	3E+05	6	0.2	0.2	1.5E+11
Below Fall City	0.1	60	15	1.4	3E+05	32	8.1	0.8	7.4E+11
Below Patterson Cr.	0.1	60	15	1.4	3E+05	32	8.1	0.8	7.4E+11
Novelty Hill Bridge	0.3	60	15	1.4	3E+05	97	24.3	2.3	2.2E+12
Cherry Creek area	0.15	60	15	1.4	3E+05	49	12.1	1.1	1.1E+12
High Bridge Area	0.1	60	15	1.4	3E+05	32	8.1	0.8	7.4E+11
Mainstem Nonpoint Loads						249	61	6	5.7E+12
BACKGROUND & TRIBUTARIES									
S.F. Background	81	0.6	0.012	0.0045	27	262	5.2	2.0	5.4E+10
Middle Fork	187	0.6	0.011	0.002	21	605	11.1	2.0	9.7E+10
North Fork	73	0.6	0.011	0.002	21	236	4.3	0.8	3.8E+10
Kimball Cr.	0.95	1.4	0.018	0.008	1448	7	0.1	0.0	3.4E+10
Tokul Cr.	16.6	0.6	0.041	0.02	10	54	3.7	1.8	4.1E+09
Raging R.	8	1.4	0.015	0.005	31	60	0.6	0.2	6.1E+09
Patterson Cr.	7.4	2	0.03	0.05	207	80	1.2	2.0	3.8E+10
Griffin Cr.	1.75	1.4	0.031	0.008	238	13	0.3	0.1	1.0E+10
Tolt R.	66	0.6	0.014	0.002	15	213	5.0	0.7	2.4E+10
Harris Cr.	1.46	1.4	0.016	0.015	50	11	0.1	0.1	1.8E+09
Ames-Sikes Cr.	2.1	3	0.19	0.3	6550	34	2.2	3.4	3.4E+11
Tuck Cr.	0.34	1.4	0.051	0.067	74	3	0.1	0.1	6.2E+08
Cherry Cr.	5	1.4	0.041	0.013	530	38	1.1	0.4	6.5E+10
Tributary and Background Loads						1616	35	14	7.1E+11
Total Load						2243	202	47	6.4E+12

NPS AND SRP CONTROLS

	Concentrations					Loads			
	Flow (cfs)	BOD5 (mg/L)	NH3-N (mg/L)	SRP (mg/L)	Fecal* Coliform	BOD5 (lbs/d)	NH3-N (lbs/d)	SRP (lbs/d)	Fecal* Coliform
North Bend	0.62	45	15	0.73	400	150	50.1	2	6.1E+09
Weyerhaeuser	0.01	4.7	0.08	0.03	6	0.25	0.004	0.002	1.5E+06
Snoqualmie	0.4	45	15	1.3	400	97	32.3	3	3.9E+09
Duvall	0.54	45	8	4	400	131	23.3	12	5.3E+09
Point Source Loads						379	106	17	1.5E+10
Three forks area	0.02	60	1.5	1.4	3E+05	6	0.2	0.2	1.5E+11
Below Fall City	0.08	60	15	1.4	3E+05	24	6.1	0.6	5.5E+11
Below Patterson Cr.	0.07	60	15	1.4	3E+05	23	5.7	0.5	5.2E+11
Novelty Hill Bridge	0.1	60	15	1.4	3E+05	32	8.1	0.8	7.4E+11
Cherry Creek area	0.1	60	15	1.4	3E+05	32	8.1	0.8	7.4E+11
High Bridge Area	0.1	60	15	1.4	3E+05	32	8.1	0.8	7.4E+11
Mainstem Nonpoint Loads						150	36	4	3.4E+12
S.F. Background	81	0.6	0.012	0.005	27	262	5.2	2.0	5.4E+10
Middle Fork	187	0.6	0.011	0.002	21	605	11.1	2.0	9.7E+10
North Fork	73	0.6	0.011	0.002	21	236	4.3	0.8	3.8E+10
Kimball Cr.	0.95	1.4	0.018	0.008	80	7	0.1	0.0	1.9E+09
Tokul Cr.	16.6	0.6	0.041	0.02	10	54	3.7	1.8	4.1E+09
Raging R.	8	1.4	0.015	0.005	31	60	0.6	0.2	6.1E+09
Patterson Cr.	7.4	1.4	0.03	0.02	80	56	1.2	0.8	1.5E+10
Griffin Cr.	1.75	1.4	0.031	0.008	80	13	0.3	0.1	3.4E+09
Tolt R.	66	0.6	0.014	0.002	15	213	5.0	0.7	2.4E+10
Harris Cr.	1.46	1.4	0.02	0.015	50	11	0.2	0.1	1.8E+09
Ames-Sikes Cr.	2.1	2	0.03	0.02	80	23	0.3	0.2	4.1E+09
Tuck Cr.	0.34	1.4	0.03	0.02	74	3	0.1	0.0	6.2E+08
Cherry Cr.	5	1.4	0.03	0.013	80	38	0.8	0.4	9.8E+09
Tributary and Background Loads						1580	33	9	2.6E+11
Total Load						2109	175	30	3.7E+12

* Fecal coliform units of cfu/100mL and loads of cfu/day: E+05 designates scientific notation: 20,000 = 2.0E+04

Table 8. Summary of estimated contaminant loads to the Snoqualmie River during critical low flow: August, September, and October (units of lbs/day). Expansion to five municipal wastewater treatment plant (WWTP) to projected seasonal capacity and nonpoint sources are evaluated. Recommended controls are outlined.

PROJECTED WWTP EXPANSION WITH CONTROLS - NO NPS CONTROLS

	Concentrations					Loads			
	Flow (cfs)	BOD5 (mg/L)	NH3-N (mg/L)	SRP (mg/L)	Fecal* Coliform	BOD5 (lbs/d)	NH3-N (lbs/d)	SRP (lbs/d)	Fecal* Coliform
POINT SOURCES									
North Bend	2.16	15	5	0.2	400	175	58.2	2	2.1E+10
Weyerhaeuser	0.01	4.7	0.08	0.03	6	0.25	0.004	0.002	1.5E+06
Snoqualmie	2.55	15	5	1.05	400	206	68.7	14	2.5E+10
Fall City	0.31	15	5	1.4	400	25	8.4	2	3.1E+09
Carnation	0.31	15	5	2	400	25	8.4	3	3.1E+09
Duvall	1.16	15	5	1.2	400	94	31.3	8	1.1E+10
Point Source Loads						525	175	30	6.4E+10
MAINSTEM NONPOINT SOURCES									
Three forks area	0.02	60	1.5	1.4	3E+05	6	0.2	0.2	1.5E+11
Below Fall City	0.1	60	15	1.4	3E+05	32	8.1	0.8	7.4E+11
Below Patterson Cr.	0.1	60	15	1.4	3E+05	32	8.1	0.8	7.4E+11
Novelty Hill Bridge	0.3	60	15	1.4	3E+05	97	24.3	2.3	2.2E+12
Cherry Creek area	0.15	60	15	1.4	3E+05	49	12.1	1.1	1.1E+12
High Bridge area	0.1	60	15	1.4	3E+05	32	8.1	0.8	7.4E+11
Mainstem Nonpoint Loads						249	61	6	5.7E+12
BACKGROUND & TRIBUTARIES									
S.F. Background	81	0.6	0.012	0.005	27	262	5.2	2.0	5.4E+10
Middle Fork	187	0.6	0.011	0.002	21	605	11.1	2.0	9.7E+10
North Fork	73	0.6	0.011	0.002	21	236	4.3	0.8	3.8E+10
Kimball Cr.	0.95	1.4	0.018	0.008	1448	7	0.1	0.04	3.4E+10
Tokul Cr.	16.6	0.6	0.041	0.02	10	54	3.7	1.8	4.1E+09
Raging R.	8	1.4	0.015	0.005	31	60	0.6	0.2	6.1E+09
Patterson Cr.	7.4	2	0.03	0.05	207	80	1.2	2.0	3.8E+10
Griffin Cr.	1.75	1.4	0.031	0.008	238	13	0.3	0.1	1.0E+10
Tolt R.	66	0.6	0.014	0.002	15	213	5.0	0.7	2.4E+10
Harris Cr.	1.46	1.4	0.016	0.015	50	11	0.1	0.1	1.8E+09
Ames-Sikes Cr.	2.1	3	0.19	0.3	6550	34	2.2	3.4	3.4E+11
Tuck Cr.	0.34	1.4	0.051	0.067	74	3	0.1	0.1	6.2E+08
Cherry Cr.	5	1.4	0.041	0.013	530	38	1.1	0.4	6.5E+10
Tributary and Background Loads						1616	35	14	7.1E+11
Total Loads						2390	271	49	6.5E+12

WWTP AND NPS CONTROLS

	Concentrations					Loads			
	Flow (cfs)	BOD5 (mg/L)	NH3-N (mg/L)	SRP (mg/L)	Fecal* Coliform	BOD5 (lbs/d)	NH3-N (lbs/d)	SRP (lbs/d)	Fecal* Coliform
POINT SOURCES									
North Bend	2.16	15	9	0.22	400	175	104.8	3	2.1E+10
Weyerhaeuser	0.01	4.7	0.08	0.03	6	0.25	0.004	0.002	1.5E+06
Snoqualmie	2.55	15	9	1.05	400	206	123.7	14	2.5E+10
Fall City	0.31	15	9	2.5	400	25	15.0	4	3.1E+09
Carnation	0.31	15	9	2.5	400	25	15.0	4	3.1E+09
Duvall	1.16	15	8	2	400	94	50.0	13	1.1E+10
Point Source Loads						525	309	38	6.4E+10
MAINSTEM NONPOINT SOURCES									
Three forks area	0.02	60	1.5	1.4	3E+05	6	0.2	0.2	1.5E+11
Below Fall City	0.075	60	15	1.4	3E+05	24	6.1	0.6	5.5E+11
Below Patterson Cr.	0.07	60	15	1.4	3E+05	23	5.7	0.5	5.2E+11
Novelty Hill Bridge	0.1	60	15	1.4	3E+05	32	8.1	0.8	7.4E+11
Cherry Creek area	0.1	60	15	1.4	3E+05	32	8.1	0.8	7.4E+11
High Bridge area	0.1	60	15	1.4	3E+05	32	8.1	0.8	7.4E+11
Mainstem Nonpoint Loads						150	36	4	3.4E+12
BACKGROUND & TRIBUTARIES									
S.F. Background	81	0.6	0.012	0.0045	27	262	5.2	2.0	5.4E+10
Middle Fork	187	0.6	0.011	0:002	21	605	11.1	2.0	9.7E+10
North Fork	73	0.6	0.011	0.002	21	236	4.3	0.8	3.8E+10
Kimball Cr.	0.95	1.4	0.018	0.008	80	7	0.1	0.04	1.9E+10
Tokul Cr.	16.6	0.6	0.041	0.02	10	54	3.7	1.8	4.1E+09
Raging R.	8	1.4	0.015	0.005	31	60	0.6	0.2	6.1E+09
Patterson Cr.	7.4	1.4	0.03	0.02	80	56	1.2	0.8	1.5E+10
Griffin Cr.	1.75	1.4	0.031	0.008	80	13	0.3	0.1	3.4E+09
Tolt R.	66	0.6	0.014	0.002	15	213	5.0	0.7	2.4E+10
Harris Cr.	1.46	1.4	0.02	0.015	50	11	0.2	0.1	1.8E+09
Ames-Sikes Cr.	2.1	2	0.03	0.02	80	23	0.3	0.2	4.1E+09
Tuck Cr.	0.34	1.4	0.03	0.02	74	3	0.1	0.04	6.2E+08
Cherry Cr.	5	1.4	0.03	0.013	80	38	0.8	0.4	9.8E+09
Tributary and Background Loads						1580	33	9	2.6E+11
Total Loads						2256	378	50	3.7E+12

- Fecal coliform units of cfu/100mL and loads of cfu/day: E+05 designates scientific notation: 20,000 = 2.0E+04

Table 9. Summary of estimated contaminant loads to the Snoqualmie River during critical low flow: August, September, and October (units of lbs/day). Expansion of three municipal wastewater treatment plant (WWTP) to projected seasonal capacity and nonpoint sources are evaluated. Recommended controls are outlined.

PROJECTED WWTP EXPANSION WITH CONTROLS - NO NPS CONTROLS

	Concentrations					Loads			
	Flow (cfs)	BOD5 (mg/L)	NH3-N (mg/L)	SRP (mg/L)	Fecal* Coliform	BOD5 (lbs/d)	NH3-N (lbs/d)	SRP (lbs/d)	Fecal* Coliform
POINT SOURCES									
North Bend	2.16	15	7	0.22	400	175	81.5	3	2.1E+10
Weyerhaeuser	0.01	4.7	0.08	0.03	6	0.25	0.004	0.002	1.5E+06
Snoqualmie	2.55	15	7	1.05	400	206	96.2	14	2.5E+10
Duvall	1.16	15	7	1.75	400	94	43.8	11	1.1E+10
Point Source Loads						475	221	28	5.8E+10
MAINSTEM NONPOINT SOURCES									
Three forks area	0.02	60	1.5	1.4	3E+05	6	1.6	0.2	1.5E+11
Below Fall City	0.1	60	15	1.4	3E+05	32	8.1	0.8	7.4E+11
Below Patterson Cr.	0.1	60	15	1.4	3E+05	32	8.1	0.8	7.4E+11
Novelty Hill Bridge	0.3	60	15	1.4	3E+05	97	24.3	2.3	2.2E+12
Cherry Creek area	0.15	60	15	1.4	3E+05	49	12.1	1.1	1.1E+12
High Bridge area	0.1	60	15	1.4	3E+05	32	8.1	0.8	7.4E+11
Mainstem Nonpoint Loads						249	61	6	5.7E+12
BACKGROUND & TRIBUTARIES									
S.F. Background	81	0.6	0.012	0.005	27	262	5.2	2.0	5.4E+10
Middle Fork	187	0.6	0.011	0.002	21	605	11.1	2.0	9.7E+10
North Fork	73	0.6	0.011	0.002	21	236	4.3	0.8	3.8E+10
Kimball Cr.	0.95	1.4	0.018	0.008	1448	7	0.1	0.04	3.4E+10
Tokul Cr.	16.6	0.6	0.041	0.02	10	54	3.7	1.8	4.1E+09
Raging R.	8	1.4	0.015	0.005	31	60	0.6	0.2	6.1E+09
Patterson Cr.	7.4	2	0.03	0.05	207	80	1.2	2.0	3.8E+10
Griffin Cr.	1.75	1.4	0.031	0.008	238	13	0.3	0.1	1.0E+10
Tolt R.	66	0.6	0.014	0.002	15	213	5.0	0.7	2.4E+10
Harris Cr.	1.46	1.4	0.016	0.015	50	11	0.1	0.1	1.8E+09
Ames-Sikes Cr.	2.1	3	0.19	0.3	6550	34	2.2	3.4	3.4E+11
Tuck Cr.	0.34	1.4	0.051	0.067	74	3	0.1	0.1	6.2E+08
Cherry Cr.	5	1.4	0.041	0.013	530	38	1.1	0.4	6.5E+10
Tributary and Background Loads						1616	35	14	7.1E+11
Total Loads						2348	317	47	6.5E+12

WWTP AND NPS CONTROLS

	Concentrations					Loads			
	Flow (cfs)	BOD5 (mg/L)	NH3-N (mg/L)	SRP (mg/L)	Fecal* Coliform	BOD5 (lbs/d)	NH3-N (lbs/d)	SRP (lbs/d)	Fecal* Coliform
POINT SOURCES									
North Bend	2.16	20	10	0.22	400	233	116.4	3	2.1E+10
Weyerhaeuser	0.01	4.7	0.08	0.03	6	0.25	0.004	0.002	1.5E+06
Snoqualmie	2.55	20	10	1.05	400	275	137.4	14	2.5E+10
Duvall	1.16	20	8	2.5	400	125	50.0	16	1.1E+10
Point Source Loads						633	304	33	5.8E+10
MAINSTEM NONPOINT SOURCES									
Three forks area	0.02	60	1.5	1.4	3E+05	6	0.2	0.2	1.5E+11
Below Fall City	0.075	60	15	1.4	3E+05	24	6.1	0.6	5.5E+11
Below Patterson Cr.	0.07	60	15	1.4	3E+05	23	5.7	0.5	5.2E+11
Novelty Hill Bridge	0.1	60	15	1.4	3E+05	32	8.1	0.8	7.4E+11
Cherry Creek area	0.1	60	15	1.4	3E+05	32	8.1	0.8	7.4E+11
High Bridge area	0.1	60	15	1.4	3E+05	32	8.1	0.8	7.4E+11
Mainstem Nonpoint Loads						150	36	4	3.4E+12
BACKGROUND & TRIBUTARIES									
S.F. Background	81	0.6	0.012	0.0045	27	262	5.2	2.0	5.4E+10
Middle Fork	187	0.6	0.011	0.002	21	605	11.1	2.0	9.7E+10
North Fork	73	0.6	0.011	0.002	21	236	4.3	0.8	3.8E+10
Kimball Cr.	0.95	1.4	0.018	0.008	80	7	0.1	0.04	1.9E+09
Tokul Cr.	16.6	0.6	0.041	0.02	10	54	3.7	1.8	4.1E+09
Raging R.	8	1.4	0.015	0.005	31	60	0.6	0.2	6.1E+09
Patterson Cr.	7.4	1.4	0.03	0.02	80	56	1.2	0.8	1.5E+10
Griffin Cr.	1.75	1.4	0.031	0.008	80	13	0.3	0.1	4.3E+09
Tolt R.	66	0.6	0.014	0.002	15	213	5.0	0.7	2.4E+10
Harris Cr.	1.46	1.4	0.02	0.015	50	11	0.2	0.1	1.8E+09
Ames-Sikes Cr.	2.1	2	0.03	0.02	80	23	0.3	0.2	4.1E+09
Tuck Cr.	0.34	1.4	0.03	0.02	74	3	0.1	0.04	6.2E+08
Cherry Cr.	5	1.4	0.03	0.013	80	38	0.8	0.4	9.8E+09
Tributary and Background Loads						1580	33	9	2.4E+11
Total Loads						2364	373	45	3.7E+12

* Fecal coliform units of cfu/100mL and loads of cfu/day: E+05 designates scientific notation: 20,000 = 2.0E+04

4. The response of the river to increased nutrient loading is uncertain. For example, additional nutrient loads may create a greater range in diurnal D.O. concentrations through increased primary productivity. On the other hand, a larger macroinvertebrate population or other factors may control the biomass growth and prevent excessive productivity. The SRP guideline and D.O. margins of safety in this assessment may need adjustment as monitoring data reveals the river's response.

The loading capacities and WLAs/LAs discussed in the following sections should be incorporated into current NPDES permits and any upcoming NPS management plans as part of the TMDL. The long-term average concentrations for the NPDES permit limits may vary from the WLAs when effluent variability and design flow data are used in the limit calculation (USEPA, 1991b). Modifications and refinements (*i.e.*, the phased TMDL) may be required after implementing the WLAs and LAs to more effectively meet water quality goals as new data are obtained through ongoing monitoring and pollution control activities.

Dissolved Oxygen: BOD and Ammonia

The target D.O. concentrations and Class A criterion in the Snoqualmie River will be met with existing NPS and permitted municipal loads of approximately 2,243 lbs/day BOD_5 and 202 lbs/day ammonia (Table 7). The loads assume existing municipal WWTPs will perform at maximum seasonal monthly average capacities with weekly averages of 45 mg/L BOD_5 and technology-based or permit ammonia concentrations of 8 to 15 mg/L. Mixing zone ammonia WLA concentrations calculated earlier in this report to avoid aquatic toxicity are similar or less restrictive than the technology based concentrations. Approximately 13% of the BOD_5 load and 31% of the ammonia load are contributed by NPS. If 135 lbs/day BOD_5 and 27 lbs./day ammonia are eliminated from mainstem and tributary NPS loads through fecal coliform source control measures (see discussion below), a small D.O. improvement may occur in the lowest river reaches.

Several future scenarios were modeled to estimate the loading capacity of the river as municipal WWTPs expand. Based on these results, approximately 96 to 254 lbs/day BOD_5, and 69 to 203 lbs/day ammonia may be available for additional municipal loading. The available loads are dependent on source location, effluent BOD and ammonia characteristics, and NPS management activities in the study area. Headwater ammonia, BOD, organic nitrogen loads (e.g., Middle and North Forks), or good quality tributary loads (e.g., Tolt R. and Tokul Creek) were considered constant in all scenarios modeled.

D.O. model results indicate unacceptable deficits will occur at the two compliance points in the river if additional wastewater volumes are discharged from municipal WWTPs at a standard secondary treatment weekly average BOD_5 concentration of 45 mg/L (Figure 6). Additional oxygen demand loads from new WWTPs or from the expansion of existing WWTPs can meet D.O. target concentrations if NPS LAs and point source WLAs of BOD_5 and ammonia are allocated carefully. Several combinations of BOD_5 and ammonia allocation are possible depending upon the expansion pattern in the valley. Two examples of WLA/LAs under greater waste loads in the future are demonstrated.

In the first scenario, where the future growth capacity is allocated to two additional WWTPs and to expansion of existing WWTPs, effluent BOD_5 concentrations of 15 mg/L and ammonia concentrations

of 5 mg/L will be needed (Table 8). This assumes no NPS controls were implemented. The allowable loads from all sources would be 2,390 lbs/day BOD_5 and 271 lbs/day ammonia. Mainstem and tributary NPS controls to meet fecal coliform criteria could reduce BOD and ammonia loads by 40%. If reallocated to the WWTPs, effluent ammonia could be increased to 9 mg/L.

The municipal treatment plants would have little difficulty meeting these limits during the low flow season if they perform as well as they did in 1991 (Das, 1992). Literature values also suggest that extraordinary technological measures to meet these WLAs would be unnecessary if the activated sludge plants were run with single stage nitrification (Metcalf and Eddy, 1991: Table 11-3).

The second scenario assumes expansion of only the three existing WWTPs (Figure 6 and Table 9). To meet the target D.O. concentrations at the compliance points, effluent BOD_5 concentrations of 15 mg/L and ammonia concentrations of 7 mg/L would be required if no NPS controls were in place. The total load capacity from all sources would be 2,340 lbs/day BOD_5 and 317 lbs/day ammonia. With NPS control and reallocation of pollutant loads to the WWTPs, an effluent BOD_5 of 20 mg/L and ammonia of 8 to 10 mg/L would be allowable at the WWTPs. As with the first scenario, well-run activated sludge plants with single stage nitrification should not have difficulty meeting these effluent concentrations in the low flow period.

The two scenarios demonstrate the reason the load capacities and WLAs/LAs are expressed as approximate values. Several combinations of BOD and ammonia loading will result in D.O. compliance. The specific combinations need to be evaluated for each new plant or plant expansion, since it is the combination of these two effluent components along with the discharge location which affect downstream D.O. concentrations. Permit managers also need to be aware that there is not a simple one to one equivalence between the BOD and NBOD components.

Further control of mainstem and tributary nonpoint sources, or limits on point sources beyond what is projected in the scenarios will provide additional BOD and ammonia loads for reallocation. They could be reallocated as an additional margin of safety for meeting D.O. criteria at the confluence, as support for future growth, as adjustment for increases in diurnal D.O. ranges if instream productivity rises, or for Snohomish River TMDL requirements. Residential development and resultant NPS loads along the three forks above the study area may require modification of the upstream background conditions assumed in the model. These adjustments and reallocations would be a normal part of the phased TMDL process.

Fecal Coliform

As discussed earlier, a target fecal coliform model result of 80 cfu/100 mL would likely meet the Class A fecal coliform criteria geometric mean of 100 cfu/100 mL with not more than ten percent over the 200 cfu/100 mL). This target count would be met in mainstem reaches if mainstem NPS fecal coliform loads were reduced by 40% (Table 7 and Figure 7). Reducing the fecal coliform load in a few tributaries would further reduce mainstem concentrations and bring the tributaries into compliance with standards. The latter would be accomplished by setting LAs for each of five tributaries:

- Kimball Creek
- Ames-Sikes Creek
- Patterson Creek
- Cherry Creek
- Griffin Creek

The LAs would be based on compliance with the 80 cfu/100 mL fecal coliform target.

A nonpoint management plan is necessary to accomplish the LA goal and improve water quality by bringing NPS on mainstem reaches and tributaries into compliance with best management practice standards. The two priority mainstem areas are located between Fall City and Griffin Creek, and between Duvall and the confluence with the Skykomish River (Figure 7). Kimball Creek and Ames-Sikes Creek are tributaries with the highest fecal coliform counts. To improve bacterial water quality, the plan should address controls for livestock access to waterbodies, manure management, and on-site septic system maintenance. Controls for these waste sources would reduce fecal coliform and other contaminants such as BOD, ammonia, and SRP.

In addition, point source discharges should maintain low fecal coliform effluent counts to protect public health at downstream beaches (Patterson and Dickes, 1993). It is promising that Das (1992) reported improved disinfection in 1991 compared to 1989 results reported by Heffner (1991). As discussed earlier, however, the low TRC values necessary to meet mixing zone WLAs may compromise effective disinfection unless the system is closely managed or dechlorination units are installed.

Soluble Reactive Phosphorus

Washington State does not have specific water quality criteria for phosphorus, nitrogen, or algal biomass. Eutrophication can be indirectly controlled using D.O. and pH criteria, or by using references in WAC 173-201A-030 to "deleterious materials . . . adversely affecting characteristic water uses" and impairment of "aesthetic values." More direct criteria are used by other states for nutrient and eutrophication control. Phosphorus standards for rivers and streams range from 5μg/L in British Columbia to 100 μg/L in several states. Wastewater discharges to the Great Lakes in Michigan are limited to 1 mg/L total phosphorus to prevent eutrophication.

The data review earlier in this report indicated the Snoqualmie River system may have several physical attributes making it sensitive to nuisance growths of periphyton and macrophytes during the low flow period. Joy *et al*. (1991) reported nuisance growths of periphyton on the South Fork Snoqualmie River below the North Bend WWTP, where average concentrations of SRP were greater than 10 μg/L. This concentration is consistent with reports from British Columbia (B.C.) rivers where SRP concentrations as low as 5 μg/L have stimulated heavy algal biomass accumulations (Nordin, 1985).

The biomass response to SRP on the mainstem river may be quite different from the South Fork and some B.C. rivers. For example, depth and velocity characteristics may limit periphyton accumulations more than nutrient availability. However, the aquatic life and aesthetic resources of the Snoqualmie River system require careful consideration before damage is caused by additional nutrient loading. Therefore, to protect these resources we propose a maximum instream concentration guideline of 10 μg/L SRP during the low flow season. In river reaches where one or more point and nonpoint discharges are in close proximity, the 10 μg/L limit would need to be met below the discharge site located the farthest downstream.

If the guideline is exceeded, dischargers would need to demonstrate the increased SRP load has no deleterious effect on the river. Increased algal biomass monitoring during the low flow period would be initiated, and alternative ways to reduce phosphorus loads would be investigated.

The cumulative SRP load for the Snoqualmie River system is about 46 lbs/day under critical flow and current source loading conditions. The only study reach out of compliance with the 10 μg/L SRP guideline in this scenario is the South Fork (Figure 8). The allowable SRP capacity for the South Fork Snoqualmie River below North Bend is 4.25 lbs/day. Forty-seven percent of this is allocated to background, and 54% is available to North Bend WWTP or other sources. North Bend would need to reduce its 4 mg/L effluent SRP concentration to 0.84 mg/L, or reduce its SRP load by 10 lbs/day to comply with the instream guideline (Table 7).

Future growth scenarios were explored (Table 8 and 9). The cumulative SRP load from all sources for these scenarios is around 50 lbs/day. All WWTPs would need SRP effluent concentrations less than 2.5 mg/L (or commensurate load reductions) to meet the 10 μg/L SRP instream guideline. For example, the waste load allocation for North Bend WWTP would not change as the WWTP expanded so the effluent SRP concentration would need to be reduced to 0.22 mg/L. The Snoqualmie WWTP loads could increase from 2 lbs/day to 14 lbs/day if SRP effluent concentrations were reduced from 1.3 mg/L (as the current lagoon system) to 1.05 mg/L (new facility). Duvall, Fall City, and Carnation WWTPs would need to have a final mixed SRP concentration lower than 10 μg/L because of their close proximity to mainstem and tributary NPS (Figure 8). Resultant effluent SRP concentrations of 1.4 to 2.5 mg/L would be necessary.

The most restrictive effluent concentrations and loads for Fall City, Carnation, and Duvall WWTPs would occur if NPS control measures were not implemented, or if the measures used to control bacteria were not effective on SRP loads. Controlling NPS phosphorus loads in the lower river would obviously provide relief to these point source dischargers. Removing 2 lbs/day SRP from mainstem NPS and 5 lbs/day from the problem tributaries would reduce reach concentrations and allow approximately 8 lbs/day SRP for WWTP use. On the other hand, upstream development, NPS, and background SRP increases above Snoqualmie Falls may increase background SRP and further limit North Bend and Snoqualmie WWTP loads. This could eventually expand NPS management actions into the greater North Bend/Snoqualmie area.

The relative locations of the nutrient sources are important since SRP uptake rates vary along the river, and inputs are not strictly additive. In the phased TMDL process, the dischargers and regulators could negotiate the priority of nonpoint control actions and point source permit limits, and the resultant allocation of the SRP loads. As nonpoint source controls are established, the removed NPS loads of SRP could be reserved for future growth, held for a measure of safety, or reallocated to an existing discharger.

Monitoring

Monitoring will be an essential part of maintaining the Snoqualmie TMDLs. A phased TMDL approach relies on monitoring data to refine WLAs and determine effectiveness of control actions. Several types of monitoring programs are needed, and should be coordinated within the TMDL/WLA/LA program structure, and within the five-year basin cycle Ecology is using for water quality management.

Effluent flow, BOD_5, ammonia, phosphorus, and TRC data will be needed as a part of an expanded NPDES discharger monitoring program during August, September, and October. Instream data above and below the plants will be also important for establishing equitable WLAs, and checking compliance. A twice monthly frequency for water column samples, and a weekly effluent monitoring program will probably be adequate. If phosphorus loading exceeds the guideline, benthic biomass needs to be measured a few times through the low flow season at sites with similar physical characteristics above and below the discharge.

Monitoring and synoptic investigations of nonpoint sources in the priority areas will be needed to formulate meaningful nonpoint source management plans. The monitoring can be used to help conservation district staff with farm plans, help local agencies justify funding for control projects, or help with enforcement actions. Monitoring will also be needed to measure effectiveness of the controls once they are implemented. This monitoring will be important for checking the goals and assumptions set in the TMDLs for nonpoint source LAs, and also for refining WLAs. Land use monitoring and evaluation will be an important component of the NPS management portion of the TMDL as well.

As currently placed, ambient monitoring stations on the Snoqualmie River do not provide the best data to check WLA and LA compliance. Additional or modified monitoring programs should build from analyses of the ambient network and synoptic survey data. Diurnal D.O. monitoring should be conducted at the Highway 202 bridge above the Falls (RM 40.7) and at the High Rock bridge at RM 2.7. Fecal coliform ambient sampling would best be concentrated in the lower valley in coordination with the nonpoint source monitoring. An integrated monitoring program using periphyton and macrophyte biomass measurements would be important to evaluate the effectiveness of the SRP guideline in preventing eutrophication.

Conclusions and Recommendations

- Most reaches of the Snoqualmie River study area currently meet applicable Class A or Class AA water quality standards during low flow periods. Temperatures and dissolved oxygen concentrations at some mainstem sites do not meet Class A criteria, but the contribution from human activities to these problems compared to natural background sources is not well understood. NPS and poorly dispersed WWTP effluent create most of the localized bacterial and nutrient enrichment problems on the mainstem, and in some tributaries.

- Municipal point sources at existing seasonal discharge capacities require few additional controls to meet dissolved oxygen (D.O.), fecal coliform, ammonia and nutrient criteria or target concentrations in the receiving water during the critical low flow period of August, September, and October. Existing mainstem and tributary nonpoint sources (NPS) require controls to ensure that all parts of the Snoqualmie River will meet Class A fecal coliform criteria.

- Field data and model results show dissolved oxygen concentrations in the pool above Snoqualmie Falls drop below the Class A criterion of 8.0 mg/L during critical conditions when a diurnal range of 1 mg/L is applied. Model results further indicate the loss also occurs without upstream municipal wastewater loading. A target minimum daily D.O. concentration

of 7.9 mg/L was suggested for the pool, with not more than an additional 0.1 mg/L deficit allowed for human-caused sources. For the purposes of interpreting water quality model results, a model concentration of 8.3 mg/L was used as the minimum acceptable mean value to evaluate waste load effects on D.O. in the pool.

- Field data and model results for the Snoqualmie River reaches at the confluence with the Skykomish River also indicate susceptibility to Class A D.O. criterion violations. To interpret model results and waste loading estimates, a 0.7 mg/L margin of safety was recommended in these lower reaches. Model concentrations of 8.7 mg/L were considered minimum acceptable mean values that would account for model uncertainty caused by diurnal range estimates and NPS source variability.

- Fecal coliform bacteria field data and model results clearly showed that instream counts were driven by nonpoint sources located on the mainstem and on several problem tributaries. Existing and projected municipal point source loads (within permit limits) were inconsequential by comparison. Several reaches of the river experience frequent, but unpredictable, fecal coliform criteria violations. As a result of this unpredictability, a model result of 80 cfu/100 mL was used as a target to acheive fecal coliform criteria compliance.

- Effluent phosphorus controls will be needed at North Bend WWTP to eliminate nuisance growths of periphyton in the South Fork Snoqualmie River. Model results of projected phosphorus loads from expanded municipal sources within the study area showed elevated levels of SRP capable of stimulating unacceptable periphyton and macrophyte growth in other areas of the river. Washington State has no phosphorus or eutrophication criteria to manage this potential source of degradation. A 10 μg/L SRP guideline is recommended as a trigger for increased monitoring and facilities planning until more is known about the biomass response to increased nutrient loading.

- A general mixing zone analysis of ammonia and total residual chlorine (TRC) for the municipal discharges was presented using idealized outfall construction assumptions. Low TRC concentrations or dechlorination will be required in the near future to prevent toxicity to aquatic organisms. The effluent ammonia limits needed to prevent ammonia toxicity in the WWTP mixing zones for current seasonal capacities are less restrictive than expected technology-based effluent quality, or concentrations needed to control far-field oxygen demands. North Bend and Snoqualmie WWTPs may need to reduce ammonia loads for mixing zone considerations as their capacity expands.

- WLA/LAs for BOD_5, ammonia, fecal coliform and SRP should apply only to the months of August, September, and October when the critical conditions defined for the model are likely to occur. Water quality problems in the Snoqualmie River system have not been identified and investigated by Ecology for other seasons of the year.

- A phased TMDL approach is recommended for the Snoqualmie River system as defined by USEPA guidance. The phased approach is recommended because NPS is a large component of the TMDL, population growth (and wastewater discharge) patterns in the basin are uncertain, the Snohomish River TMDL effort may affect Snoqualmie River load allocations, and high uncertainty remains concerning water column D.O. and benthic biomass response to increased nutrient loading. The phased TMDL requires periodic checking and adjustment as

specific NPS control measures are implemented, or as additional water quality and growth projection data become available. The requirements of a phased TMDL need to be incorporated into Ecology's five-year basin cycle.

- The sum of WLAs/LAs and background to maintain adequate D.O. at the two compliance points in the river for current source conditions are approximately 2,243 lbs/day BOD_5 and 202 lbs/day ammonia. The WLAs assume municipal effluent limits of 45 mg/L BOD_5, and 8-15 mg/L ammonia. The reserve load capacity for the river will be increased if controls placed on fecal coliform loading remove 135 lbs/day BOD_5 and 27 lbs/day ammonia from mainstem and tributary NPS.

- Projected WWTP expansion scenarios were modeled for D.O. response. Several combinations of BOD and ammonia loads will result in continued D.O. target concentration compliance. Lower permitted effluent concentrations of BOD_5 (15-20 mg/L) and ammonia (5-10 mg/L) will be necessary, especially if NPS controls are not implemented. However, all the resulting concentrations appeared to be achievable using activated sludge plants with single-stage nitrification. Both BOD and ammonia loads will need to be evaluated for each new plant or plant expansion, since it is the combination of the two along with the discharge location which affect downstream D.O. concentrations. However, there is not a simple one to one equivalence between the two components to assure D.O. compliance.

- Mainstem and tributary NPS will require LAs implemented through a nonpoint management plan to reduce the current fecal coliform load and achieve Class A compliance. Mainstem nonpoint source loads need to be reduced by 40%, and instream concentration reductions to 80 cfu/100mL are necessary in the following tributaries: Kimball Creek, Patterson Creek, Griffin Creek, Ames-Sikes Creek, and Cherry Creek. Control measures implemented to reduce bacterial loading may also significantly reduce BOD, ammonia, and phosphorus loads.

- Using the recommended maximum instream concentration of 10 μg/L SRP for all river reaches during the low flow season, the estimated SRP load capacity from all sources is 50 lbs/day. A portion of that is an allowable South Fork Snoqualmie River SRP load capacity below North Bend WWTP of 4.25 lbs/day. North Bend WWTP will have difficulty meeting the 10 μg/L criterion at its current seasonal discharge capacity. Monitoring programs and facility options need to be explored. According to model results of projected future waste loads, the other WWTPs (Snoqualmie, Fall City, Carnation, and Duvall) will need to reduce SRP effluent concentrations to less than 2.5 mg/L to comply with the guideline. They will also need to adjust their SRP loads in response to nearby NPS loads.

- Monitoring will be an essential part of maintaining the Snoqualmie TMDLs. A phased TMDL approach relies on monitoring data to refine WLAs and determine effectiveness of control actions. Several types of monitoring programs are needed, and should be coordinated within the TMDL/WLA/LA program and five-year cycle structures.

References

Cusimano, B., 1993. "Proposal for Snohomish River Basin Dry Season TMDL Study." Washington State Department of Ecology, Environmental Investigations and Laboratory Services Program, July 1993, Olympia, WA.

Das, T., 1992. Snoqualmie River Basin Class II Inspections at North Bend, Snoqualmie, and Duvall Wastewater Treatment Plants. Washington State Department of Ecology, Environmental Investigations and Laboratory Services Program, Olympia, WA. 9 pp.

Dodds, W., 1991. "Factors associated with dominance of the filamentous green alga *Cladophora glomerata*." Water Res. 25 (11): 1325-1332.

EarthInfo, 1992. Hydrodata. Compact disk read only memory. USGS discharge information of the western United States. EarthInfo, Inc.

Ecology, 1988. Statewide Water Quality Assessment 305(B) Report. Washington State Department of Ecology, Water Quality Program, Olympia, WA.

-----, 1991. Guidance for Determination and Allocation of Total Maximum Daily Loads (TMDL) in Washington State. Washington State Department of Ecology, Environmental Investigations and Laboratory Services Program, Olympia, WA. 25 pp.

-----, 1992. Statewide Water Quality Assessment 305(B) Report. Washington State Department of Ecology, Water Quality Program, Olympia, WA.

-----, 1993. "Implementation of Total Maximum Daily Loads." Washington State Department of Ecology, Water Quality Program Guidelines, August 1993, Olympia, WA.

-----, unpublished. "Table of Phosphorus and Nitrogen Criteria for U.S. and B.C., Canada." Washington State Department of Ecology, Water Quality Program, Olympia, WA.

GKY and Associates, 1984. Technical Guidance Manual for Performing Waste Load Allocations: Book IX, Innovative Waste Load Allocations. Final Report to the U.S. Environmental Protection Agency, Washington, D.C.

Heffner, M., 1991. Snoqualmie River NPDES Dischargers Inspection Report: July - September 1989. Washington State Department of Ecology, Environmental Investigations and Laboratory Services Program, Olympia, WA. 128 pp.

Hopkins, B., 1992. "Upper Snoqualmie River Special Study." Memorandum to D. Wright, January 30. Washington State Department of Ecology, Environmental Investigations and Laboratory Services Program, Olympia, WA. 7 pp.

Horner, R.R., E.B. Welch, and R.B. Veenstra, 1983. "Development of nuisance periphytic algae in laboratory streams in relation to nutrient enrichment and velocity" pp. 121-134 *In:* R.G. Wetzel, ed. Periphyton of Freshwater Ecosystems Dr. W. Junk Publishers, The Hague, Netherlands.

Joy, J., 1991. "Snoqualmie River TMDL Project Proposal." Memorandum to Will Kendra, July 1991. Washington State Department of Ecology, Environmental Investigations and Laboratory Services Program, Olympia, WA.

——, unpublished. Snoqualmie and Yakima River basin data collected June to October 1993 for the Nutrient and Eutrophication study. Washington State Department of Ecology, Environmental Investigations and Laboratory Services Program, Olympia, WA.

——, G. Pelletier, R. Willms, M. Heffner, and E. Aroner, 1991. Snoqualmie River Low Flow Water Quality Assessment July - September 1989. Washington State Department of Ecology, Environmental Investigations and Laboratory Services Program, Olympia, WA. 117 pp.

——, 1993. "Project proposal for lotic waters nutrient and eutrophication criteria development." Memorandum to W. Kendra, May 26. Washington State Department of Ecology, Environmental Investigations and Laboratory Services Program, Olympia, WA 19 pp.

King County Planning, 1988. Snoqualmie Valley Community Plan and Area Zoning - Proposed. King County Planning and Community Development Division, Seattle, WA.

Lane, C., D. Allen, and R. R. Horner, 1993. Snoqualmie River Water Quality Management Project, Project Summary. Prepared by the University of Washington Center for Urban Water Resources Management for the Washington State Department of Ecology and King County Community Planning Division, Seattle, WA., 12 pp.

Metcalf and Eddy, 1991. Wastewater Engineering Treatment, Disposal, and Reuse. Third Edition. McGraw-Hill, Inc., San Francisco, CA.

Nordin, R.N., 1985. Water Quality Criteria for Nutrients and Algae: Technical Appendix. British Columbia Ministry of the Environment, Water Management Branch. Victoria, B.C. Canada, 104 pp.

Patterson, B. and B. Dickes, 1993. Snoqualmie River Bacteria Study. Washington State Department of Ecology, Environmental Investigations and Laboratory Services Program, Olympia, WA 13 pp.

PEI, 1987. "Field Data for City of Snoqualmie Wastewater Treatment Plant Outfall: Sept. 10, 1987." Reported by R.T. Tyree, PEI Consultants, Inc. Seattle, WA. 8 pp.

Puget Sound Power and Light, 1991. Snoqualmie Falls Project Volume 2 Exhibit E. FERC Project No. 2493, November 1991, Bellevue, WA.

Reckhow, K.H., J.T. Clements, and R. Dodd, 1986. "Statistical Goodness-of-Fit Measures for Waste Load Allocation Models" Draft. Work Assignment Number 33. U.S. Environmental Protection Agency, Contract Number 68-01-6904

STORET, 1993. Data retrieval from the STORET water quality database system, Washington State Department of Ecology, Environmental Investigations and Laboratory Services Program, Olympia, WA

Thornburgh, K., K. Nelson, K. Rawson, and G. Lucchetti, 1991. Snohomish System Water Quality Study 1987-90. Tulalip Fisheries Department progress report, Marysville, WA. 36 pp.

Turney, G., S. Kahle, and N. Dion, in press. "East King County Groundwater Study." U.S. Geological Survey, Water Resources Division, Tacoma, WA.

URS, 1977. SNOMET King County 208 Areawide Water Quality Plan: Technical Appendix II. Prepared by URS Company for Snohomish County, King County, and the City of Everett. November 1977. 167 pp.

USEPA, 1991a. Guidance for Water Quality-based Decisions: The TMDL Process. U.S. Environmental Protection Agency, Office of Water, Washington, D.C. 59 pp.

——, 1991b. Technical Support Document for Water Quality-based Toxics Control. U.S. Environmental Protection Agency, EPA/505/2-90-001, Office of Water, Washington, D.C.

Watson, V., P. Berlind, and L. Bahls, 1990. "Control of algal standing crop by P and N in the Clark Fork River." Pages 47-62 *In*: Proceedings of the 1990 Clark Fork River Symposium, MT.

Welch, E.B., G.M. Jacoby, R.R. Horner, and M.R. Seeley, 1988. "Nuisance biomass levels of periphytic algae in streams." Hydrobiologia 157: 161-168.

——, R.R. Horner, and C.R. Patmont, 1989. "Prediction of nuisance periphytic biomass: a management approach." Water Research 23(4): 401-405.

——, J.M. Quinn, and C.W. Hickey, 1992. "Periphyton biomass related to point-source nutrient enrichment in seven New Zealand streams." Water Research 26(5): 669-675.

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Appendix A

Table A-1. Water quality survey data taken from the Snoqualmie River in July and Sept. 1991.

Station Location	Station Number	River Mile	Date	Time	Temp °C.	pH s.u.	Spec.Cond. umhos/cm	D.O. mg/L	% D.O. satur.	Total P ug/L	SRP ug/L	NH3-N ug/L	NO2+3-N ug/L	Total N TPN	Chloride mg/L	Fecal Coli cfu/100mL
M444020	1	46.4	91-09-23	08:45	10.2	7.44	85	10.25	91.2	10 U	4.8	10 U	304	303	1.4	26
M444001	2	44.5	91-09-23	09:20	10.4	7.05	89	10.35	92.6	14	8.9	11	309	340	1.4	13
M423	4	42.3	91-09-23	09:55	11.8	7.17	64	9.85	91.0	14	6.1	10 U	174	240	1.2	19
M412	5	41.2	91-09-23	10:20	12.4	7.07	64	9.85	92.2	10	3.5	10 U	166	226	1.2	15
M397	6	39.7	91-09-23	10:45	12.6	7.18	66	10.4	97.8	10 U	3.7	10 U	159	198	1.2	16
M373	8	37.3	91-09-23	11:40	13.1	7.55	72	11.5	109.4	10 U	4.2	10 U	161	201	1.2	12
M3535	9	35.35	91-09-23	12:00	12.7	7.41	73	10.95	103.2	10 U	3.5	10 U	172	209	1.3	13
M341	10	34.1	91-09-23	12:25	12.7	7.41	74	11	103.7	10 U	4	10 U	172	216	1.4	10
M323	11	32.3	91-09-24	10:05	12.6	7.38	76	10.25	96.4	10 U	3.3	10 U	169	233	1.3	6
M308	13	30.8	91-09-24	11:00	13	7.51	80	10.45	99.2	10 U	4.7	10 U	185	233	1.5	13
M279	14	27.9	91-09-24	12:00	14.1	7.55	78	10.4	101.1	12	4.9	10 U	161	289	1.4	29
M251	15	25.1	91-09-24	12:35	14.2	7.51	75	10.5	102.3	10 U	2.9	10 U	158	219	1.5	32
M2301	17	23.01	91-09-24	13:35	15	7.56	75	11.05	109.6	10 U	3.5	10 U	159	227	1.4	18
M205	18	20.5	91-09-25	10:15	14.1	7.25	75	10.35	100.6	10 U	2.3	10 U	155	210	1.3	31
M1825	19	18.25	91-09-25	10:40	14.4	7.07	78	10	97.9	10 U	1.9	10 U	150	202	1.3	47
M147	21	14.7	91-09-25	11:25	15.4	7.53	78	10.2	102.0	11	3.9	14	148	228	1.5	49
M107	22	10.7	91-09-25	12:05	15.3	7.52	79	10.05	100.3	11	2.9	10 U	140	200	1.4	45
M098	23	9.8	91-09-25	12:20	15.6	7.54	80	10.25	103.0	15	4.8	12	138	213	1.4	51
M058	25	5.8	91-09-25	13:15	15.6	7.56	81	10.6	106.5	12	3.1	10 U	125	195	1.4	32
M027	26	2.7	91-09-25	14:20	16.3	7.5	80	10.55	107.6	18	4.8	24	117	234	1.5	1600
M444020	1	46.4	91-09-23	13:35	13	7.32	85	10.55	100.1	10 U	4.1	10 U	288	310	1.3	10
M444001	2	44.5	91-09-23	14:00	12.5	7.33	90	10.85	101.8	20	13.8	10 U	296	325	1.5	7
M423	4	42.3	91-09-23	14:30	13.3	7.26	72	10.75	102.7	10 U	3.4	10 U	169	213	1.1	6
M412	5	41.2	91-09-23	14:50	13.5	7.27	66	10.3	98.8	10 U	2.8	10 U	166	211	1.1	6
M397	6	39.7	91-09-23	15:15	13.1	7.33	67	10.55	100.3	10 U	3	10 U	158	196	1.1	11
M373	8	37.3	91-09-23	15:40	14.4	7.81	73	11.6	113.5	10	7	10 U	156	205	1.2	7
M3535	9	35.35	91-09-23	16:00	14.2	7.62	73	11.6	113.1	10 U	6.3	10 U	155	203	1.3	2
M341	10	34.1	91-09-23	16:20	13.9	7.53	74	11.45	110.9	10 U	7.6	10 U	162	209	1.3	3
M323	11	32.3	91-09-24	14:00	14.1	7.22	76	11.05	107.5	10 U	3.3	10 U	164	219	1.4	88
M308	13	30.8	91-09-24	14:45	14	7.56	77	11.2	108.7	10 U	3.8	10 U	178	238	1.4	29
M279	14	27.9	91-09-24	15:30	14.5	7.57	74	10.95	107.4	10 U	2.9	10 U	156	212	1.4	12
M251	15	25.1	91-09-24	16:05	15	7.51	78	10.85	107.6	10 U	2.8	10 U	150	209	1.4	14
M2301	17	23.01	91-09-24	16:55	15.9	7.57	74	11.05	111.7	10 U	2.4	10 U	153	218	1.3	120
M205	18	20.5	91-09-25	15:10	16	7.57	78	11	111.4	10 U	3.2	10 U	147	202	1.4	25
M1825	19	18.25	91-09-25	15:25	15.8	7.44	78	10.75	108.4	10 U	4.7	10 U	143	202	1.3	56
M147	21	14.7	91-09-25	15:55	16.2	7.54	79	10.5	106.8	13	3.1	10 U	145	215	1.4	17
M107	22	10.7	91-09-25	16:30	16.3	7.5	79	10.45	106.5	19	2.7	10	137	198	1.4	39
M098	23	9.8	91-09-25	16:45	16.4	7.53	79	10.55	107.8	11	4	10 U	135	197	1.4	36
M058	25	5.8	91-09-25	17:15	16.2	7.65	79	11.2	114.0	15	3.5	10 U	120	183	1.5	40
M027	26	2.7	91-09-25	18:15	16.3	7.46	81	10.3	105.0	28	4.8	23	120	235	1.5	160
T445	3	44.5	91-09-23	09:30	11.7	7.1	50	10.2	94.0	10 U	1.7	10 U	122	154	0.97	12
T396	7	39.6	91-09-23	10:50	10.6	7.89	170	11.5	103.3	31	14.7	21	451	514	1.5	12
T312	12	31.2	91-09-24	10:45	10.7	7.6	167	10.05	90.5	39	29.8	14	928	1050	2.9	190
T249	16	24.9	91-09-24	13:00	13.8	7.73	60	10.8	104.3	10 U	1.1	10 U	123	161	0.97	14
T175	20	17.5	91-09-25	11:00	12.3	7.28	182	8.7	81.3	124	76.5	229	794	1300	3.4	3100
T067	24	6.7	91-09-25	12:50	13.9	7.44	120	9.9	95.9	26	11	20	525	673	2.3	85
T445	3	44.5	91-09-23	14:10	13.4	7.16	52	10.5	100.5	10 U	0.8	10 U	118	151	0.97	13
T396	7	39.6	91-09-23	15:20	12.3	8.07	157	11.05	103.2	28	14.2	36	445	533	1.4	13

T312	12	31.2	91-09-24	14:25	12.1	7.73	158	10.55	98.1	39	32.2	10	919	1050	2.9	88
T249	16	24.9	91-09-24	16:35	16.4	7.72	57	10.2	104.2	10 U	1	10 U	113	170	0.95	120
T175	20	17.5	91-09-25	15:35	14.7	7.48	180	8.45	83.3	135	65.6	216	784	1220	3.4	1800
T067	24	6.7	91-09-25	17:05	14.6	7.35	110	9.8	96.3	27	8.9	16	508	660	2.6	96
M4005	1	40.05	91-07-30	08:05	14.2	6.23	42			10 U	4.9	11	100	140	0.73	
M397	2	39.7	91-07-30	09:17	14.4	6.82	43	10.85	106.2	10 U	3.1	11	104	140	0.77	
M3864	4	38.64	91-07-30	09:50	14.9	7.2	51	9.9	98.0	10	3	10 U	116	177	0.87	
M373	5	37.3	91-07-30	10:10	15.2	7.32	49	10.2	101.6	10 U	2.7	10 U	107	147	0.86	
M367	6	36.7	91-07-30	10:28	15.2	7.16	49	10.1	100.6	10 U	3.8	10 U	107	153	0.81	
M363	7	36.3	91-07-30	10:45	15.6	7.02	50	10	100.5	10 U	3	10 U	105	157	0.87	
M3535	9	35.35	91-07-30	11:17	15.7	7.56	80	10.25	103.2	10 U	2.9	10 U	105	148	0.91	
M341	10	34.1	91-07-30	11:47	16.1	7.03	43	10.4	105.6	10 U	3.3	10 U	107	151	0.91	
M326	11	32.6	91-07-30	12:15	16.4	7.03	50	10.05	102.7	10 U	2.4	10 U	107	160	0.95	
M279	12	27.9	91-07-30	14:15	17.4	7.01	55	9.7	101.2	10 U	2.6	10 U	112	158	1	
M260	14	26	91-07-30	15:04	17.7	7.59	50	9.55	100.3	10 U	2.3	10 U	119	166	1	
M251	15	25.1	91-07-30	15:30	17.7	7.52	50	9.55	100.3	10 U	2.2	10 U	118	182	7.42	
M235	17	23.5	91-07-30	16:45	18	6.96	52	9.7	102.5	10 U	5	13	152	199	0.98	
M2301	18	23.01	91-07-30	17:10	18.4	7.12	56	9.75	103.8	10 U	3.1	10 U	123	181	1.11	
M1925	20	19.25	91-07-30	17:55	18.7	7.1	54	9.7	103.9	10 U	2.2	10 U	122	177	1	
M1825	21	18.25	91-07-30	17:30	18.8	7.17	54	9.75	104.7	10 U	2.8	10 U	128	184	1.05	
M1825QA	QA	18.25	91-07-30	17:30	18.8	7.17	54	9.75	104.7		2.9	10 U	122	187	0.99	
M4005	1	40.05	91-07-31	15:10	16.1	7.5	45	9.4	95.4	10 U	4	13	106	144	0.77	
M397	2	39.7	91-07-31	15:40	16.4	7.3	66	9.6	98.1	10 U	3.9	12	113	141	0.77	
M3864 .	4	38.64	91-07-31	16:10	16.6	7.5	78	9.9	101.6	10 U	3.3	10 U	126	188	0.82	
M373	5	37.3	91-07-31	16:30	17.2	7.32	50	10.1	104.9	10 U	3.5	10 U	117	187	1	
M367	6	36.7	91-07-31	16:55	17.2	7.43	48	10.2	106.0	10 U	3.2	10 U	119	179	0.84	
M363	7	36.3	91-07-31	17:15	17.3	7.19	48	9.95	103.6	10 U	3.4	10 U	117	191	0.89	
M3535	9	35.35	91-07-31	17:40	17.5	7.63	50	10.1	105.6	10 U	3.5	10 U	116	156	0.93	
M341	10	34.1	91-07-31	18:10	17.7	7.51	50	10.1	106.0	10 U	5.4	10 U	116	170	0.92	
M326	11	32.6	91-07-31	18:50	17.8	7.29	48	10.1	106.2	10 U	3.3	10	118	164	0.96	
M279	12	27.9	91-07-31	09:25	16	7.25	51	9.35	94.7	20	3	10 U	123	257	1	
M260	14	26	91-07-31	10:20	16	7.38	53	9.45	95.7	10 U	2.9	11	127	184	0.99	
M251	15	25.1	91-07-31	10:45	16.1	7.02	53	9.4	95.4	10 U	3	10 U	123	186	0.94	
M235	17	23.5	91-07-31	11:50	16.4	7.52	77	9.7	99.1	10 U	8.6	10 U	162	211	1	
M2301	18	23.01	91-07-31	12:15	17.1	7.57	67	9.8	101.6	10 U	3	10 U	129	193	1	
M205	19	20.5	91-07-31	12:45	17.6	7.58		9.85	103.2	10 U	2.4	10 U	125	176	1.02	
M1925	20	19.25	91-07-31	13:30	17.8	7.56	80	9.7	102.0	10 U	2.4	10	124	167	1.02	
M1825	21	18.25	91-07-31	13:05	17.7	7.56	77	9.85	103.4	10 U	2.8	10 U	123	173	1.03	
M3864QA	QA	38.64	91-07-31	16:10	16.6	7.5	78	9.75	100.0	10 U	3.1	12	118	159	0.86	
T396	3	39.6	91-07-30	09:22	13.2	7.55	137	10.4	99.1	17	6.4	10 U	476	552	1.47	
T362	8	36.2	91-07-30	10:52	16.9	8.1	90	10.7	110.5	10	4.4	10 U	165	247	4.78	
T272	13	27.2	91-07-30	14:42	21.6	7.6	129	9.5	107.8	21	9.9	36	352	518	1.72	
T249	16	24.9	91-07-30	16:13	19.1	7.53	61	9.4	101.5	10 U	1.2	10 U	134	179	0.89	
T396	3	39.6	91-07-31	15:45	16.4	7.94	137	10	102.2	12	8.8	11	475	572	1.4	
T362	8	36.2	91-07-31	17:20	24.5	8.83	86			11	7.7	10 U	145	251	4.46	
T272	13	27.2	91-07-31	09:50	15.6	7.42	97	10.15	102.0	15	9.2	34	397	539	1.7	
T249	16	24.9	91-07-31	11:25	15	7.64	73	10.3	102.1	10 U	1.4	10 U	143	196	0.91	

Summary of diurnal water quality data for the Snoqualmie River 1991.

River Mile	Date	N		Temp (degC)	pH (S.U.)	D.O. (mg/L)
1.0	7/22-23	23	ave	18.1	-	9.75
			min	17.9 (0700)	6.95 (0700)	9.60 (0600)
			max	18.4 (1700)	7.20 (1300)	9.90 (1400)
3.5	7/22-23	22	ave	18.1	-	9.85
			min	17.8 (1400)	7.00 (0900)	9.70 (1100)
			max	18.2 (2300)	7.20 (1400)	10.05 (2100)
4.5	7/22-24	47	ave	18.6	-	9.75
			min	17.8 (1500)	6.95 (1100)	9.30 (0900)
			max	19.2 (2100)	7.20 (1400)	10.10 (2000)
6.1	7/23-24	25	ave	18.8	-	9.65
			min	17.9 (1200)	7.00 (1300)	9.35 (0800)
			max	19.1 (1900)	7.10 (2000)	9.90 (1800)
7.5	7/23-24	25	ave	18.8	-	9.55
			min	18.0 (1300)	7.00 (0900)	9.30 (0700)
			max	19.1 (0200)	7.05 (2300)	9.85 (1600)
10.5	8/5-6	24	ave	18.4	-	9.20
			min	17.5 (0800)	7.05 (1000)	9.05 (1200)
			max	19.1 (1800)	7.15 (1200)	9.30 (1900)
11.0	8/5-6	24	ave	18.3	-	9.15
			min	17.4 (0800)	6.90 (1100)	8.95 (1200)
			max	19.0 (1800)	7.10 (2300)	9.25 (1900)
12.5	8/5-7	48	ave	18.2	-	9.35
			min	17.3 (0800)	7.05 (1000)	9.10 (0900)
			max	19.1 (1700)	7.15 (2100)	9.55 (2000)
14.2	8/6-7	24	ave	17.9	-	9.35
			min	17.2 (0700)	7.05 (0700)	9.10 (0700)
			max	18.8 (1900)	7.15 (2000)	9.60 (1800)
16.0	8/6-7	24	ave	17.8	-	9.30
			min	17.2 (0700)	7.00 (1200)	9.05 (0700)
			max	18.7 (1800)	7.20 (2100)	9.60 (1700)
25.2	7/30-31	25	ave	17.2	-	9.70
			min	16.1 (0900)	7.10 (1100)	9.50 (0900)
			max	18.1 (2000)	7.20 (2200)	9.95 (0000)
27.2	7/30-31	24	ave	17.0	-	9.80
			min	15.6 (0800)	7.00 (1000)	9.45 (1000)
			max	18.0 (1900)	7.25 (2100)	10.15 (2100)
36.3	7/30-8/1	48	ave	16.7	-	9.60
			min	16.0 (0900)	7.15 (0700)	8.95 (0300)
			max	17.3 (1700)	7.40 (1900)	10.35 (1500)
37.0	7/31-8/1	24	ave	16.9	-	9.65
			min	16.3 (0900)	7.20 (0600)	9.15 (0200)
			max	17.3 (0200)	7.45 (1800)	10.20 (1400)
39.0	7/31-8/1	24	ave	16.7	-	9.65
			min	16.1 (0900)	7.15 (0700)	9.20 (0300)
			max	17.4 (0100)	7.40 (1800)	10.15 (1500)

N = number of hours monitored. Measurements were recorded hourly.
Values in parenthesis indicate time of day.

Appendix B

Table B1. Root mean square error values for QUAL2E model results compared to field data collected from the Snoqualmie River, 9/91. Number of comparisons (field stations) for each group are inside ( ).

	CHLORIDE	DO(log)	D.O.	SRP	Total N	FC (log)	Temp	NH3	log SRP
RMSE FOR ALL STATIONS (19	0.034	0.029	0.696	0.684	44.745	1.219	0.048	12.237	0.041
MEAN RESPONSE	1.35	1.0085	10.20	4.35	235.01	1.6758	14.60	15.66	0.61
% MEAN RESPONSE	2.6%	2.9%	6.8%	15.7%	19.0%	72.8%	0.1%	78.1%	6.7%
RMSE: S.F. TO TOLT R.(12)	0.012	0.009	0.212	0.774	2.226	1.408	0.122	0.710	0.072
MEAN RESPONSE	1.30	1.01820	10.43	5.24	229.83	1.53	13.35	10.61	0.68665
% MEAN RESPONSE	0.9%	0.9%	2.0%	14.8%	1.0%	92.1%	0.9%	6.7%	10.5%
RMSE: TOLT R. TO MOUTH (7	0.042	0.037	0.869	0.113	70.804	0.165	0.080	19.231	0.027
MEAN RESPONSE	1.39	1.00012	10.00	3.59	239.45	1.80	15.67	19.99	0.53642
% MEAN RESPONSE	3.0%	3.7%	8.7%	3.2%	29.6%	9.2%	0.5%	96.2%	5.0%

Figure B1. QUAL2E model results compared to field data collect September 1991 on the Snoqualmie RiverDissolved oxygen concentration results are shown.

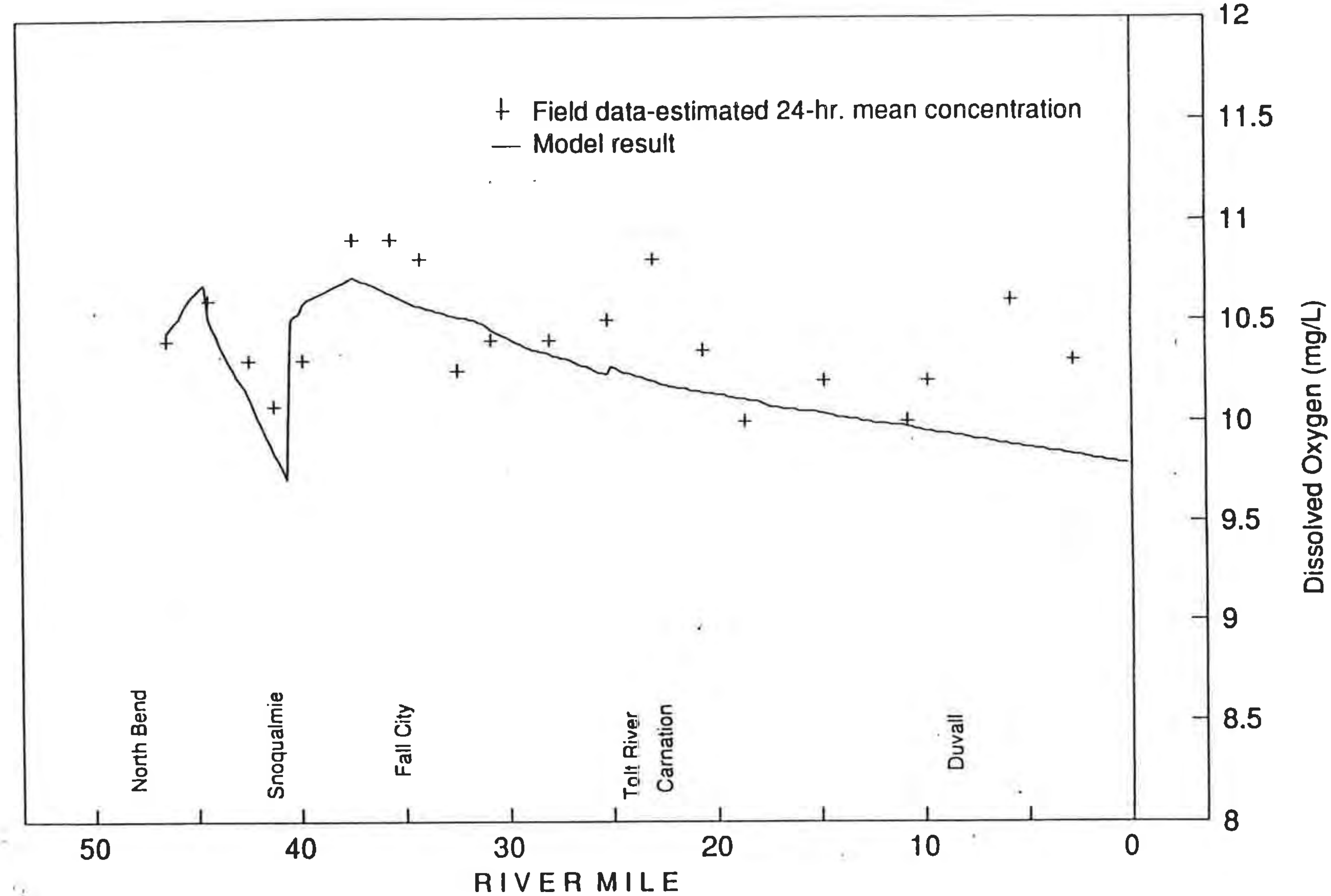


Figure B2. QUAL2E model results compared to field data collect September 1991 on the Snoqualmie River. Fecal coliform bacteria results are shown.

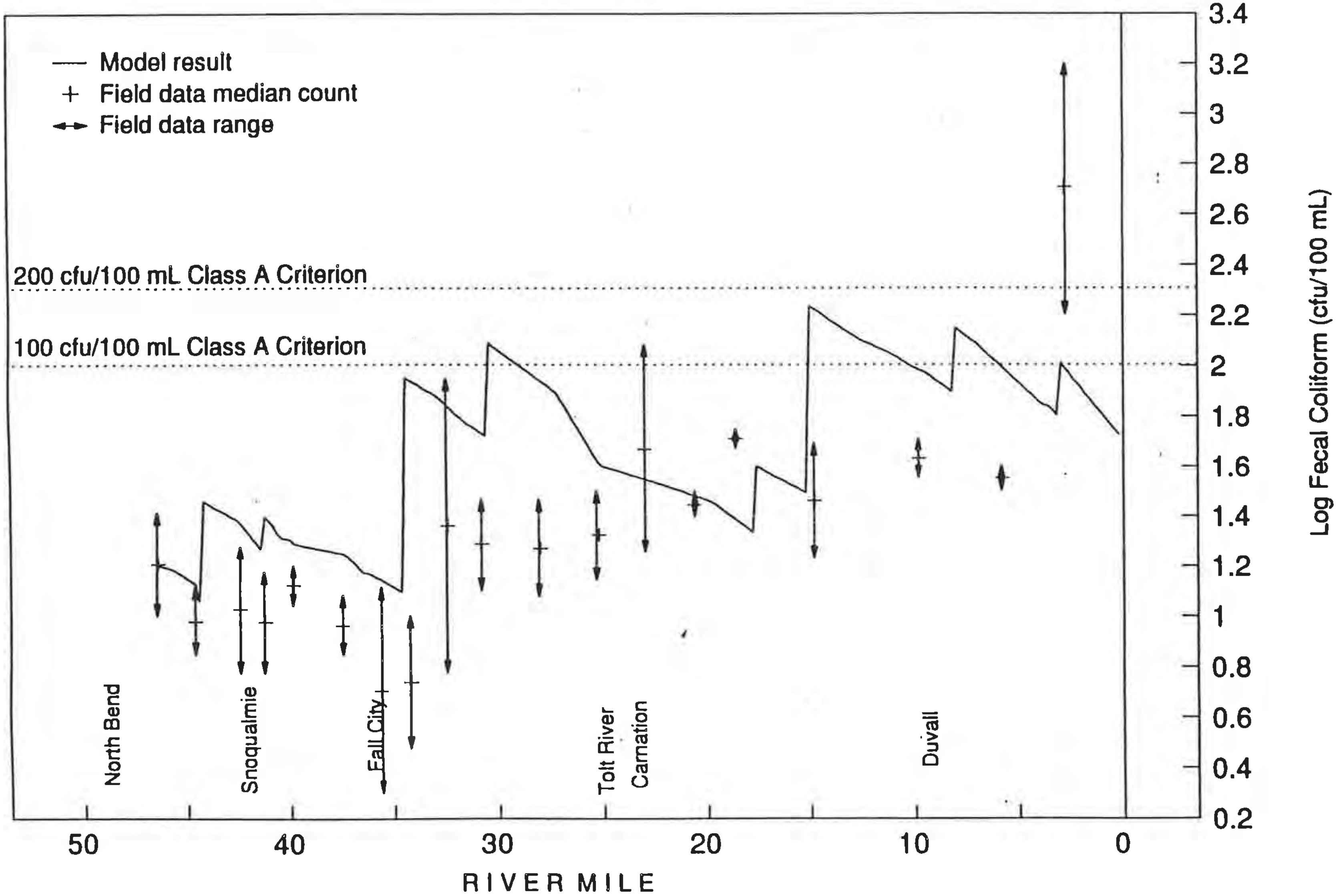


Figure B3. QUAL2E model results compared to field data collect September 1991 on the Snoqualmie River. Soluble reactive phosphorus concentration results are shown.

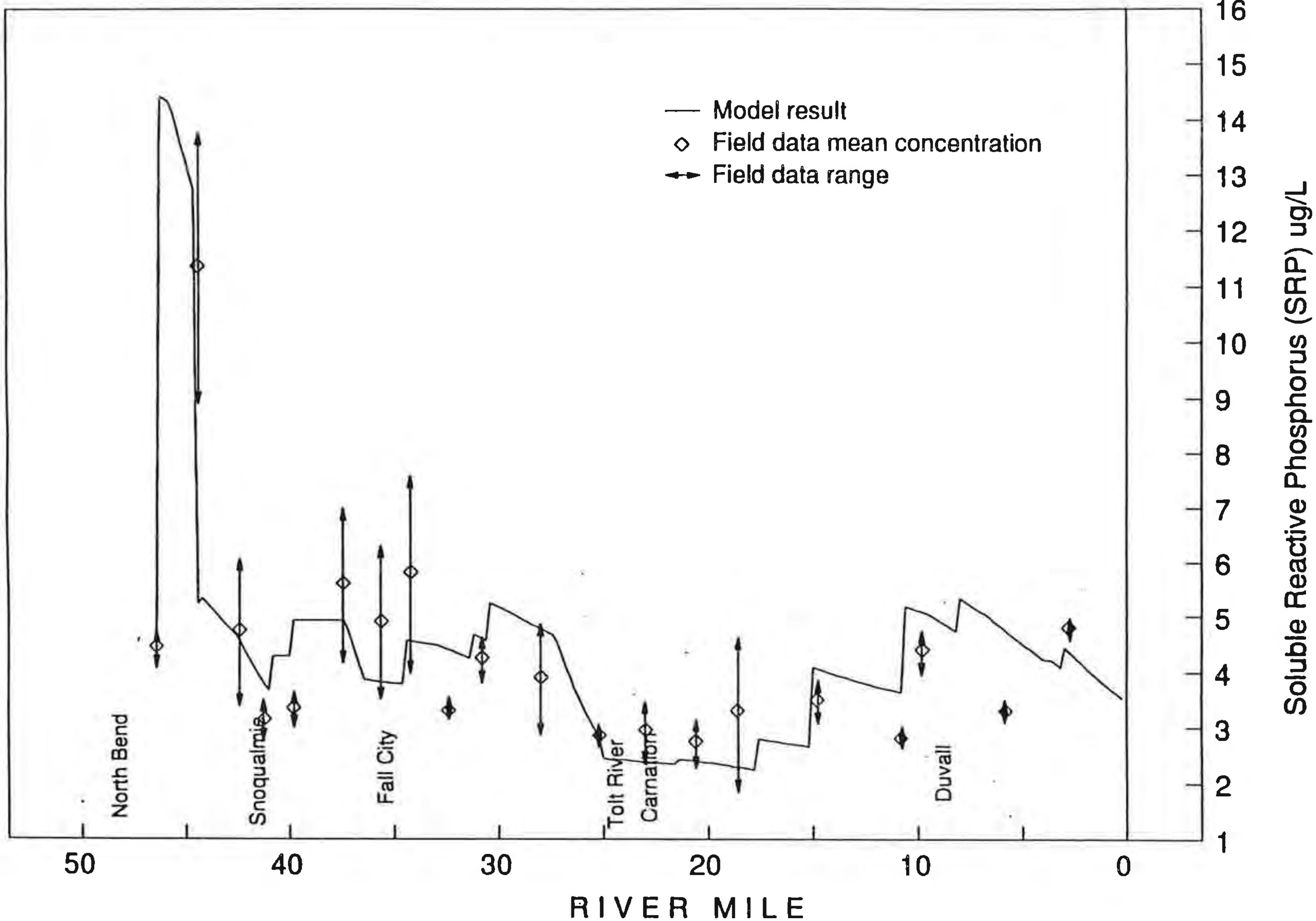
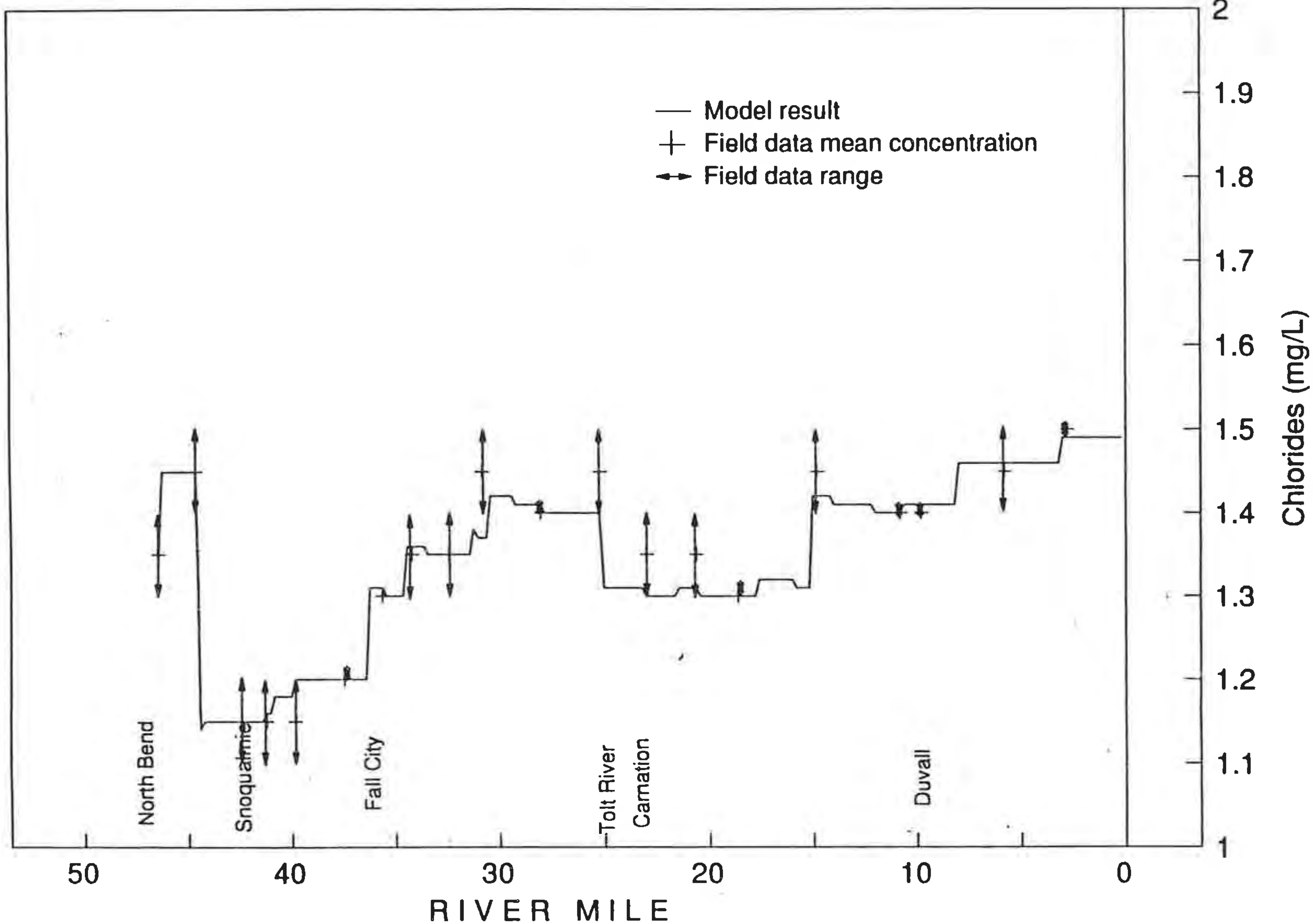


Figure B4. QUAL2E model results compared to field data collect September 1991 on the Snoqualmie River. Chloride concentration results are shown.



TITLE01 SNOQUALMIE RIVER STEADY STATE MODEL: AUGUST 1990
TITLE02 VALIDATION USING SEPT. 1991 SURVEY DATA W/SRP
TITLE03 YES CONSERVATIVE MINERAL I CL MG/L
TITLE04 NO CONSERVATIVE MINERAL II
TITLE05 NO CONSERVATIVE MINERAL III
TITLE06 NO TEMPERATURE
TITLE07 YES BIOCHEMICAL OXYGEN DEMAND
TITLE08 NO ALGAE AS CHL-A IN UG/L
TITLE09 NO PHOSPHORUS CYCLE AS P IN MG/L
TITLE10 (ORGANIC-P, DISSOLVED-P)
TITLE11 YES NITROGEN CYCLE AS N IN UG/L
TITLE12 (ORGANIC-N, AMMONIA-N, NITRITE-N, NITRITE-N)
TITLE13 YES DISOLVED OXYGEN IN MG/L
TITLE14 YES FECAL COLIFORMS IN NO./100 ML
TITLE15 YES ARBITRARY NON-CONSERVATIVE SRP UG/L

LIST DATA INPUT	0.00000		0.00000
WRITE OPTIONAL SUMMARY	0.00000		0.00000
NO FLOW AUGMENTATION	0.00000		0.00000
STEADY STATE	0.00000		0.00000
DISCHARGE COEFFICIENTS	0.00000		0.00000
NO PRINT SOLAR/LCD DATA	0.00000		0.00000
NO PLOT DO AND BOD	0.00000		0.00000
FIXED DNSTM COND (YES=1)=	0.00000	5D-ULT BOD CONV K COEF =	0.23000
INPUT METRIC (YES=1) =	0.00000	OUTPUT METRIC (YES=1) =	0.00000
NUMBER OF REACHES =	24.00000	NUMBER OF JUNCTIONS =	1.00000
NUM OF HEADWATERS =	2.00000	NUMBER OF POINT LOADS =	23.00000
TIME STEP (HOURS) =	0.00000	LNTH COMP ELEMENT (DX)=	0.20000
MAXIMUM ITERATIONS =	30.00000	TIME INC. FOR RPT2 (HRS)=	0.00000
LATITUDE OF BASIN (DEG) =	47.54000	LONGITUDE OF BASIN (DEG)=	121.83000
STANDARD MERIDIAN (DEG) =	75.00000	DAY OF YEAR START TIME =	240.00000
EVAP. COEFF. (AE) =	0.00068	EVAP. COEFF. (BE) =	0.00027
ELEV. OF BASIN (ELEV) =	250.00000	DUST ATTENUATION COEF. =	0.13000

DATA TYPE 1A (ALGAE PRODUCTION AND NITROGEN OXIDATION CONSTANTS)

O UPTAKE BY NH3 OXID(MG O/UG N)=	0.0034	O UPTAKE BY NO2 OXID(MG O/UG N)=	0.0011
O PROD BY ALGAE (MG O/MG A) =	1.6000	O UPTAKE BY ALGAE (MG O/MG A) =	2.0000
N CONTENT OF ALGAE (MG N/MG A) =	0.0850	P CONTENT OF ALGAE (MG P/MG A) =	0.0140
ALG MAX SPEC GROWTH RATE(1/DAY)=	2.0000	ALGAE RESPIRATION RATE (1/DAY) =	0.0500
N HALF SATURATION CONST (MG/L) =	0.2000	P HALF SATURATION CONST (MG/L)=	0.0400
LIN ALG SHADE CO (1/FT-UGCHA/L=)	0.0000	NLIN SHADE(1/FT-(UGCHA/L)**2/3)=	0.0000
LIGHT FUNCTION OPTION (LFNOPT) =	1.0000	LIGHT SAT'N COEF (BTU/FT2-MIN) =	0.0300
DAILY AVERAGING OPTION (LAVOPT)=	2.0000	TOTAL DAILY SOLAR RADTN (INT) =	0.9200
NUMBER OF DAYLIGHT HOURS (DLH) =	14.0000	TOTAL DAILY SOLR RAD (BTU/FT-2)=	400.0000
ALGY GROWTH CALC OPTION(LGROPT)=	1.0000	ALGAL PREF FOR NH3-N (PREFN) =	0.9000
ALG/TEMP SOLR RAD FACTOR(TFACT)=	0.4400	NITRIFICATION INHIBITION COEF =	0.6000

DATA TYPE 1B (TEMPERATURE CORRECTION CONSTANTS FOR RATE COEFFICIENTS)

CARD TYPE	RATE CODE	THETA VALUE	
THETA(1)	BOD DECA	1.047	DFLT
THETA(2)	BOD SETT	1.024	DFLT
THETA(3)	OXY TRAN	1.024	DFLT
THETA(4)	SOD RATE	1.000	USER
THETA(5)	ORGN DEC	1.047	DFLT
THETA(6)	ORGN SET	1.024	DFLT
THETA(7)	NH3 DECA	1.083	DFLT
THETA(8)	NH3 SRCE	1.074	DFLT
THETA(9)	NO2 DECA	1.047	DFLT
THETA(10)	PORG DEC	1.047	DFLT

THETA(11)	PORG SET	1.024	DFLT
THETA(12)	DISP SRC	1.074	DFLT
THETA(13)	ALG GROW	1.047	DFLT
THETA(14)	ALG RESP	1.047	DFLT
THETA(15)	ALG SETT	1.024	DFLT
THETA(16)	COLI DEC	1.047	DFLT
THETA(17)	ANC DECA	1.000	DFLT
THETA(18)	ANC SETT	1.024	DFLT
THETA(19)	ANC SRCE	1.000	DFLT

DATA TYPE 2 (REACH IDENTIFICATION)

CARD TYPE	REACH ORDER AND IDENT			R. MI/KM		R. MI/KM
STREAM REACH	1.0	RCH=SF, ABV.NORTH BE	FROM	46.4	TO	45.6
STREAM REACH	2.0	RCH=BLW.NB TO CONFLU	FROM	45.6	TO	44.4
STREAM REACH	3.0	RCH=M.F,WITH N.F CON	FROM	1.0	TO	0.0
STREAM REACH	4.0	RCH=JUNC. 3 FKS-MBBR	FROM	44.4	TO	42.4
STREAM REACH	5.0	RCH=SNOQ. FALLS POOL	FROM	42.4	TO	40.6
STREAM REACH	6.0	RCH=TO FALLS	FROM	40.6	TO	40.4
STREAM REACH	7.0	RCH=TO RAGING R POOL	FROM	40.4	TO	37.2
STREAM REACH	8.0	RCH=RAGING R. POOL	FROM	37.2	TO	36.2
STREAM REACH	9.0	RCH=RIFFLE BLW RAGIN	FROM	36.2	TO	32.8
STREAM REACH	10.0	RCH=CHAN TO PATTERSO	FROM	32.8	TO	31.2
STREAM REACH	11.0	RCH=PATTER TO GRIFFI	FROM	31.2	TO	27.2
STREAM REACH	12.0	RCH=TOLT RIVER POOL	FROM	27.2	TO	25.0
STREAM REACH	13.0	RCH=CARNATION AREA	FROM	25.0	TO	21.4
STREAM REACH	14.0	RCH=BLW HARRIS SHALL	FROM	21.4	TO	19.6
STREAM REACH	15.0	RCH=POOL ABV AMES CK	FROM	19.6	TO	17.6
STREAM REACH	16.0	RCH=SHALLOW BLW AMES	FROM	17.6	TO	14.8
STREAM REACH	17.0	RCH=NOVELTY RD AREA	FROM	14.8	TO	12.6
STREAM REACH	18.0	RCH=SHALLOW ABV DUVA	FROM	12.6	TO	11.0
STREAM REACH	19.0	RCH=DUVALL AREA RUN	FROM	11.0	TO	10.0
STREAM REACH	20.0	RCH=DUVALL BR. RIFFL	FROM	10.0	TO	9.4
STREAM REACH	21.0	RCH=CHAN TO CHERRY C	FROM	9.4	TO	6.8
STREAM REACH	22.0	RCH=CHERRY C TO EDDY	FROM	6.8	TO	3.8
STREAM REACH	23.0	RCH=PEARSON EDDY SHA	FROM	3.8	TO	3.4
STREAM REACH	24.0	RCH=HIGH BRIDGE POOL	FROM	3.4	TO	0.0

DATA TYPE 4 (COMPUTATIONAL REACH FLAG FIELD)

CARD TYPE	REACH	ELEMENTS/REACH	COMPUTATIONAL FLAGS
FLAG FIELD	1.	4.	1.6.2.2.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.
FLAG FIELD	2.	6.	2.2.2.2.2.3.0.0.0.0.0.0.0.0.0.0.0.0.0.0.
FLAG FIELD	3.	5.	1.2.6.2.3.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.
FLAG FIELD	4.	10.	4.6.2.2.2.2.2.2.2.2.0.0.0.0.0.0.0.0.0.0.
FLAG FIELD	5.	9.	2.2.2.6.2.2.6.2.6.0.0.0.0.0.0.0.0.0.0.0.
FLAG FIELD	6.	1.	2.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.
FLAG FIELD	7.	16.	2.2.2.6.2.2.2.2.2.2.2.2.2.2.2.2.0.0.0.0.
FLAG FIELD	8.	5.	2.2.2.2.2.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.
FLAG FIELD	9.	17.	6.2.6.2.2.2.2.2.2.6.2.2.2.2.2.2.2.0.0.0.
FLAG FIELD	10.	8.	2.2.2.2.2.2.2.2.0.0.0.0.0.0.0.0.0.0.0.0.
FLAG FIELD	11.	20.	6.2.2.2.6.2.2.2.2.2.2.2.2.2.2.2.2.2.2.2.
FLAG FIELD	12.	11.	6.2.2.2.2.2.2.2.2.2.2.0.0.0.0.0.0.0.0.0.
FLAG FIELD	13.	18.	6.2.2.2.2.6.2.2.2.2.2.2.2.2.2.2.2.2.0.0.
FLAG FIELD	14.	9.	6.2.2.2.2.2.2.2.2.0.0.0.0.0.0.0.0.0.0.0.
FLAG FIELD	15.	10.	2.2.2.2.2.2.2.2.2.2.0.0.0.0.0.0.0.0.0.0.
FLAG FIELD	16.	14.	6.2.2.2.2.2.2.2.2.2.2.2.2.6.0.0.0.0.0.0.
FLAG FIELD	17.	11.	2.2.2.2.2.2.2.2.2.2.2.0.0.0.0.0.0.0.0.0.
FLAG FIELD	18.	8.	2.2.2.2.2.2.2.2.0.0.0.0.0.0.0.0.0.0.0.0.
FLAG FIELD	19.	5.	2.2.6.6.2.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.
FLAG FIELD	20.	3.	2.2.2.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.

FLAG FIELD	21.	13.	2.2.2.2.2.2.2.6.2.2.2.2.2.2.0.0.0.0.0.0.0.0.
FLAG FIELD	22.	15.	6.2.2.2.2.2.2.2.2.2.2.2.2.2.2.2.0.0.0.0.0.0.
FLAG FIELD	23.	2.	2.2.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.
FLAG FIELD	24.	17.	2.2.6.2.2.2.2.2.2.2.2.2.2.2.2.2.2.5.0.0.0.

DATA TYPE 5 (HYDRAULIC DATA FOR DETERMINING VELOCITY AND DEPTH)

CARD TYPE	REACH	COEF-DSPN	COEFQV	EXPOQV	COEFQH	EXPOQH	CMANN
HYDRAULICS	1.	0.00	0.190	0.500	0.431	0.169	0.020
HYDRAULICS	2.	0.00	0.060	0.500	0.861	0.169	0.020
HYDRAULICS	3.	0.00	0.045	0.500	0.197	0.406	0.020
HYDRAULICS	4.	0.00	0.045	0.500	0.197	0.406	0.020
HYDRAULICS	5.	0.00	0.003	0.800	2.094	0.150	0.020
HYDRAULICS	6.	0.00	0.002	0.800	3.202	0.150	0.020
HYDRAULICS	7.	0.00	0.120	0.500	1.789	0.094	0.020
HYDRAULICS	8.	0.00	0.004	0.800	2.227	0.168	0.020
HYDRAULICS	9.	0.00	0.045	0.500	0.210	0.453	0.020
HYDRAULICS	10.	0.00	0.005	0.800	2.544	0.120	0.020
HYDRAULICS	11.	0.00	0.037	0.500	0.225	0.380	0.020
HYDRAULICS	12.	0.00	0.002	0.800	6.056	0.066	0.020
HYDRAULICS	13.	0.00	0.070	0.500	0.221	0.310	0.020
HYDRAULICS	14.	0.00	0.063	0.500	0.606	0.260	0.020
HYDRAULICS	15.	0.00	0.004	0.800	2.252	0.070	0.020
HYDRAULICS	16.	0.00	0.040	0.500	1.770	0.033	0.020
HYDRAULICS	17.	0.00	0.005	0.800	1.746	0.153	0.020
HYDRAULICS	18.	0.00	0.057	0.500	1.118	0.152	0.020
HYDRAULICS	19.	0.00	0.005	0.800	2.333	0.110	0.020
HYDRAULICS	20.	0.00	0.057	0.500	1.080	0.153	0.020
HYDRAULICS	21.	0.00	0.004	0.800	5.890	0.010	0.020
HYDRAULICS	22.	0.00	0.003	0.800	3.378	0.131	0.020
HYDRAULICS	23.	0.00	0.057	0.500	0.108	0.510	0.020
HYDRAULICS	24.	0.00	0.002	0.800	3.455	0.114	0.020

DATA TYPE 6 (REACTION COEFFICIENTS FOR DEOXYGENATION AND REAERATION)

CARD TYPE	REACH	K1	K3	SOD RATE	K2OPT	K2	COEQK2 OR TSIV COEF OR FOR OPT 8	EXPQK2 OR SLOPE FOR OPT 8
REACT COEF	1.	0.87	0.00	0.000	8.	0.00	0.054	0.00190
REACT COEF	2.	0.87	0.00	0.000	8.	0.00	0.054	0.00300
REACT COEF	3.	0.50	0.00	0.000	8.	0.00	0.054	0.00300
REACT COEF	4.	0.44	0.00	0.200	3.	0.00	0.000	0.00000
REACT COEF	5.	0.44	0.00	0.200	3.	0.00	0.000	0.00000
REACT COEF	6.	0.44	0.00	0.200	3.	0.00	0.000	0.00000
REACT COEF	7.	0.43	0.00	-0.208	2.	0.00	0.054	0.00281
REACT COEF	8.	0.43	0.00	-0.025	3.	0.00	0.054	0.00076
REACT COEF	9.	0.42	0.00	-0.023	8.	0.00	0.054	0.00092
REACT COEF	10.	0.42	0.00	-0.018	3.	0.00	0.054	0.00026
REACT COEF	11.	0.42	0.00	-0.012	3.	0.00	0.054	0.00007
REACT COEF	12.	0.42	0.00	-0.005	3.	0.00	0.054	0.00014
REACT COEF	13.	0.38	0.00	0.000	8.	0.00	0.054	0.00080
REACT COEF	14.	0.38	0.00	-0.001	3.	0.00	0.054	0.00080
REACT COEF	15.	0.38	0.00	-0.002	3.	0.00	0.054	0.00045
REACT COEF	16.	0.38	0.00	-0.003	8.	0.00	0.054	0.00029
REACT COEF	17.	0.38	0.00	-0.004	3.	0.00	0.054	0.00010
REACT COEF	18.	0.38	0.00	-0.004	3.	0.00	0.054	0.00013
REACT COEF	19.	0.38	0.00	0.003	3.	0.00	0.054	0.00017
REACT COEF	20.	0.38	0.00	0.014	8.	0.00	0.054	0.00016
REACT COEF	21.	0.38	0.00	0.000	3.	0.00	0.054	0.00010
REACT COEF	22.	0.38	0.00	0.000	3.	0.00	0.054	0.00013
REACT COEF	23.	0.38	0.00	0.000	3.	0.00	0.054	0.00014

REACT COEF	24.	0.38	0.00	0.000	3.	0.00	0.054	0.00013

DATA TYPE 6A (NITROGEN AND PHOSPHORUS CONSTANTS)

CARD TYPE	REACH	CKNH2	SETNH2	CKNH3	SNH3	CKNO2	CKPORG	SETPORG	SPO4
N AND P COEF	1.	0.20	0.10	0.45	0.00	0.45	0.00	0.00	0.00
N AND P COEF	2.	0.20	0.10	0.45	0.00	0.45	0.00	0.00	0.00
N AND P COEF	3.	0.20	0.10	0.40	0.00	0.40	0.00	0.00	0.00
N AND P COEF	4.	0.20	0.10	0.30	0.00	0.30	0.00	0.00	0.00
N AND P COEF	5.	0.20	0.10	0.20	0.00	0.20	0.00	0.00	0.00
N AND P COEF	6.	0.20	0.10	0.20	0.00	0.20	0.00	0.00	0.00
N AND P COEF	7.	0.20	0.10	0.40	0.00	0.40	0.00	0.00	0.00
N AND P COEF	8.	0.20	0.10	0.25	0.00	0.25	0.00	0.00	0.00
N AND P COEF	9.	0.20	0.10	0.30	0.00	0.30	0.00	0.00	0.00
N AND P COEF	10.	0.20	0.10	0.25	0.00	0.25	0.00	0.00	0.00
N AND P COEF	11.	0.20	0.10	0.35	0.00	0.35	0.00	0.00	0.00
N AND P COEF	12.	0.20	0.10	0.20	0.00	0.20	0.00	0.00	0.00
N AND P COEF	13.	0.20	0.10	0.45	0.00	0.45	0.00	0.00	0.00
N AND P COEF	14.	0.20	0.10	0.40	0.00	0.40	0.00	0.00	0.00
N AND P COEF	15.	0.20	0.10	0.25	0.00	0.25	0.00	0.00	0.00
N AND P COEF	16.	0.20	0.10	0.40	0.00	0.40	0.00	0.00	0.00
N AND P COEF	17.	0.20	0.10	0.25	0.00	0.25	0.00	0.00	0.00
N AND P COEF	18.	0.20	0.10	0.35	0.00	0.35	0.00	0.00	0.00
N AND P COEF	19.	0.20	0.10	0.25	0.00	0.25	0.00	0.00	0.00
N AND P COEF	20.	0.20	0.10	0.35	0.00	0.35	0.00	0.00	0.00
N AND P COEF	21.	0.20	0.10	0.25	0.00	0.25	0.00	0.00	0.00
N AND P COEF	22.	0.20	0.10	0.25	0.00	0.25	0.00	0.00	0.00
N AND P COEF	23.	0.20	0.10	0.35	0.00	0.35	0.00	0.00	0.00
N AND P COEF	24.	0.20	0.10	0.25	0.00	0.25	0.00	0.00	0.00

DATA TYPE 6B (ALGAE/OTHER COEFFICIENTS)

CARD TYPE	REACH	ALPHAO	ALGSET	EXCOEF	CK5 CKCOLI	CKANC	SETANC	SRCANC
ALG/OTHER COEF	1.	15.00	0.00	0.01	2.00	0.30	0.30	0.00
ALG/OTHER COEF	2.	15.00	0.00	0.01	2.00	0.70	0.50	0.00
ALG/OTHER COEF	3.	15.00	0.00	0.01	2.00	0.00	0.30	0.00
ALG/OTHER COEF	4.	15.00	0.00	0.01	2.00	0.70	0.50	0.00
ALG/OTHER COEF	5.	15.00	0.00	0.01	2.00	0.70	0.30	0.00
ALG/OTHER COEF	6.	15.00	0.00	0.01	2.00	0.00	0.00	2.00
ALG/OTHER COEF	7.	15.00	0.00	0.01	2.00	0.00	0.00	1.50
ALG/OTHER COEF	8.	15.00	0.00	0.01	2.00	1.70	0.50	0.00
ALG/OTHER COEF	9.	15.00	0.00	0.01	2.00	0.00	0.00	0.70
ALG/OTHER COEF	10.	15.00	0.00	0.01	2.00	0.00	0.30	0.00
ALG/OTHER COEF	11.	15.00	0.00	0.01	2.00	0.00	0.30	0.00
ALG/OTHER COEF	12.	15.00	0.00	0.01	2.00	0.70	0.50	0.00
ALG/OTHER COEF	13.	15.00	0.00	0.01	2.00	0.00	0.30	0.00
ALG/OTHER COEF	14.	15.00	0.00	0.01	2.00	0.00	0.30	0.00
ALG/OTHER COEF	15.	15.00	0.00	0.01	2.00	0.00	0.30	0.00
ALG/OTHER COEF	16.	15.00	0.00	0.01	2.00	0.00	0.30	1.50
ALG/OTHER COEF	17.	15.00	0.00	0.01	2.00	0.00	0.30	0.00
ALG/OTHER COEF	18.	15.00	0.00	0.01	2.00	0.00	0.30	0.00
ALG/OTHER COEF	19.	15.00	0.00	0.01	2.00	0.00	0.30	0.00
ALG/OTHER COEF	20.	15.00	0.00	0.01	2.00	0.00	0.30	0.00
ALG/OTHER COEF	21.	15.00	0.00	0.01	2.00	0.30	0.30	0.00
ALG/OTHER COEF	22.	15.00	0.00	0.01	2.00	0.30	0.30	0.00
ALG/OTHER COEF	23.	15.00	0.00	0.01	2.00	0.00	0.30	0.00
ALG/OTHER COEF	24.	15.00	0.00	0.01	2.00	0.30	0.30	0.00

DATA TYPE 7 (INITIAL CONDITIONS)

CARD TYPE	REACH	TEMP	D.O.	BOD	CM-1	CM-2	CM-3	ANC	COLI
INITIAL COND-1	1.	52.90	10.00	1.00	1.30	0.00	0.00	13.00	60.00
INITIAL COND-1	2.	52.70	10.00	1.00	1.30	0.00	0.00	13.00	60.00
INITIAL COND-1	3.	54.60	10.00	1.00	1.30	0.00	0.00	13.00	60.00
INITIAL COND-1	4.	54.60	10.00	1.00	1.30	0.00	0.00	13.00	60.00
INITIAL COND-1	5.	54.70	10.00	1.00	1.30	0.00	0.00	13.00	60.00
INITIAL COND-1	6.	55.40	10.00	1.00	1.30	0.00	0.00	13.00	60.00
INITIAL COND-1	7.	55.70	10.00	1.00	1.30	0.00	0.00	13.00	60.00
INITIAL COND-1	8.	56.30	10.00	1.00	1.30	0.00	0.00	13.00	60.00
INITIAL COND-1	9.	56.20	10.00	1.00	1.30	0.00	0.00	13.00	60.00
INITIAL COND-1	10.	56.30	10.00	1.00	1.30	0.00	0.00	13.00	60.00
INITIAL COND-1	11.	57.70	10.00	1.00	1.30	0.00	0.00	13.00	60.00
INITIAL COND-1	12.	58.30	10.00	1.00	1.30	0.00	0.00	13.00	60.00
INITIAL COND-1	13.	59.00	10.00	1.00	1.30	0.00	0.00	13.00	60.00
INITIAL COND-1	14.	59.20	10.00	1.00	1.30	0.00	0.00	13.00	60.00
INITIAL COND-1	15.	59.20	10.00	1.00	1.30	0.00	0.00	13.00	60.00
INITIAL COND-1	16.	59.80	10.00	1.00	1.30	0.00	0.00	13.00	60.00
INITIAL COND-1	17.	60.40	10.00	1.00	1.30	0.00	0.00	13.00	60.00
INITIAL COND-1	18.	60.40	10.00	1.00	1.30	0.00	0.00	13.00	60.00
INITIAL COND-1	19.	60.60	10.00	1.00	1.30	0.00	0.00	13.00	60.00
INITIAL COND-1	20.	60.80	10.00	1.00	1.30	0.00	0.00	13.00	60.00
INITIAL COND-1	21.	60.80	10.00	1.00	1.30	0.00	0.00	13.00	60.00
INITIAL COND-1	22.	61.00	10.00	1.00	1.30	0.00	0.00	13.00	60.00
INITIAL COND-1	23.	61.10	10.00	1.00	1.30	0.00	0.00	13.00	60.00
INITIAL COND-1	24.	61.30	10.00	1.00	1.30	0.00	0.00	13.00	60.00

DATA TYPE 7A (INITIAL CONDITIONS FOR CHOROPHYLL A, NITROGEN, AND PHOSPHORUS)

CARD TYPE	REACH	CHL-A	ORG-N	NH3-N	NO2-N	NO3-N	ORG-P	DIS-P
INITIAL COND-2	1.	0.00	55.00	20.00	0.00	131.00	0.00	0.00
INITIAL COND-2	2.	0.00	55.00	20.00	0.00	130.00	0.00	0.00
INITIAL COND-2	3.	0.00	55.00	20.00	0.00	130.00	0.00	0.00
INITIAL COND-2	4.	0.00	55.00	20.00	0.00	130.00	0.00	0.00
INITIAL COND-2	5.	0.00	55.00	20.00	0.00	130.00	0.00	0.00
INITIAL COND-2	6.	0.00	55.00	20.00	0.00	130.00	0.00	0.00
INITIAL COND-2	7.	0.00	55.00	20.00	0.00	130.00	0.00	0.00
INITIAL COND-2	8.	0.00	55.00	20.00	0.00	130.00	0.00	0.00
INITIAL COND-2	9.	0.00	55.00	20.00	0.00	130.00	0.00	0.00
INITIAL COND-2	10.	0.00	55.00	20.00	0.00	130.00	0.00	0.00
INITIAL COND-2	11.	0.00	55.00	20.00	0.00	130.00	0.00	0.00
INITIAL COND-2	12.	0.00	55.00	20.00	0.00	130.00	0.00	0.00
INITIAL COND-2	13.	0.00	55.00	20.00	0.00	130.00	0.00	0.00
INITIAL COND-2	14.	0.00	55.00	20.00	0.00	130.00	0.00	0.00
INITIAL COND-2	15.	0.00	55.00	20.00	0.00	130.00	0.00	0.00
INITIAL COND-2	16.	0.00	55.00	20.00	0.00	130.00	0.00	0.00
INITIAL COND-2	17.	0.00	55.00	20.00	0.00	130.00	0.00	0.00
INITIAL COND-2	18.	0.00	55.00	20.00	0.00	130.00	0.00	0.00
INITIAL COND-2	19.	0.00	55.00	20.00	0.00	130.00	0.00	0.00
INITIAL COND-2	20.	0.00	55.00	20.00	0.00	130.00	0.00	0.00
INITIAL COND-2	21.	0.00	55.00	20.00	0.00	130.00	0.00	0.00
INITIAL COND-2	22.	0.00	55.00	20.00	0.00	130.00	0.00	0.00
INITIAL COND-2	23.	0.00	55.00	20.00	0.00	130.00	0.00	0.00
INITIAL COND-2	24.	0.00	55.00	20.00	0.00	130.00	0.00	0.00

DATA TYPE 8 (INCREMENTAL INFLOW CONDITIONS)

CARD TYPE	REACH	FLOW	TEMP	D.O.	BOD	CM-1	CM-2	CM-3	ANC	C
INCR INFLOW-1	1.	0.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
INCR INFLOW-1	2.	0.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
INCR INFLOW-1	3.	0.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
INCR INFLOW-1	4.	0.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0

INCR INFLOW-1	5.	0.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INCR INFLOW-1	6.	0.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INCR INFLOW-1	7.	0.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INCR INFLOW-1	8.	0.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INCR INFLOW-1	9.	20.000	50.00	10.00	0.00	1.10	0.00	0.00	1.00	10.00
INCR INFLOW-1	10.	5.000	50.00	10.00	0.00	1.10	0.00	0.00	1.00	10.00
INCR INFLOW-1	11.	40.000	50.00	10.00	0.00	1.10	0.00	0.00	1.00	10.00
INCR INFLOW-1	12.	10.000	50.00	10.00	0.00	1.10	0.00	0.00	1.00	10.00
INCR INFLOW-1	13.	10.000	50.00	10.00	0.00	1.10	0.00	0.00	1.00	10.00
INCR INFLOW-1	14.	10.000	50.00	10.00	0.00	1.10	0.00	0.00	1.00	10.00
INCR INFLOW-1	15.	10.000	50.00	10.00	0.00	1.10	0.00	0.00	1.00	10.00
INCR INFLOW-1	16.	10.000	50.00	10.00	0.00	1.10	0.00	0.00	1.00	10.00
INCR INFLOW-1	17.	20.000	50.00	10.00	0.00	1.10	0.00	0.00	1.00	10.00
INCR INFLOW-1	18.	20.000	50.00	10.00	0.00	1.10	0.00	0.00	1.00	10.00
INCR INFLOW-1	19.	5.000	50.00	10.00	0.00	1.10	0.00	0.00	1.00	10.00
INCR INFLOW-1	20.	5.000	50.00	10.00	0.00	1.10	0.00	0.00	1.00	10.00
INCR INFLOW-1	21.	5.000	50.00	10.00	0.00	1.10	0.00	0.00	1.00	10.00
INCR INFLOW-1	22.	5.000	50.00	10.00	0.00	1.10	0.00	0.00	1.00	10.00
INCR INFLOW-1	23.	0.000	50.00	10.00	0.00	1.10	0.00	0.00	1.00	10.00
INCR INFLOW-1	24.	10.000	50.00	10.00	0.00	1.10	0.00	0.00	1.00	10.00

DATA TYPE 8A (INCREMENTAL INFLOW CONDITIONS FOR CHLOROPHYLL A, NITROGEN, AND PHOSPHORUS)

CARD TYPE	REACH	CHL-A	ORG-N	NH3-N	NO2-N	NO3-N	ORG-P	DIS-P
INCR INFLOW-2	1.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INCR INFLOW-2	2.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INCR INFLOW-2	3.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INCR INFLOW-2	4.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INCR INFLOW-2	5.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INCR INFLOW-2	6.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INCR INFLOW-2	7.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INCR INFLOW-2	8.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INCR INFLOW-2	9.	0.00	0.00	0.00	0.00	120.00	0.00	0.00
INCR INFLOW-2	10.	0.00	0.00	0.00	0.00	120.00	0.00	0.00
INCR INFLOW-2	11.	0.00	0.00	0.00	0.00	120.00	0.00	0.00
INCR INFLOW-2	12.	0.00	0.00	0.00	0.00	120.00	0.00	0.00
INCR INFLOW-2	13.	0.00	0.00	0.00	0.00	120.00	0.00	0.00
INCR INFLOW-2	14.	0.00	0.00	0.00	0.00	120.00	0.00	0.00
INCR INFLOW-2	15.	0.00	0.00	0.00	0.00	120.00	0.00	0.00
INCR INFLOW-2	16.	0.00	0.00	0.00	0.00	120.00	0.00	0.00
INCR INFLOW-2	17.	0.00	0.00	0.00	0.00	120.00	0.00	0.00
INCR INFLOW-2	18.	0.00	0.00	0.00	0.00	120.00	0.00	0.00
INCR INFLOW-2	19.	0.00	0.00	0.00	0.00	120.00	0.00	0.00
INCR INFLOW-2	20.	0.00	0.00	0.00	0.00	120.00	0.00	0.00
INCR INFLOW-2	21.	0.00	0.00	0.00	0.00	120.00	0.00	0.00
INCR INFLOW-2	22.	0.00	0.00	0.00	0.00	120.00	0.00	0.00
INCR INFLOW-2	23.	0.00	0.00	0.00	0.00	120.00	0.00	0.00
INCR INFLOW-2	24.	0.00	0.00	0.00	0.00	120.00	0.00	0.00

DATA TYPE 9 (STREAM JUNCTIONS)

CARD TYPE	JUNCTION ORDER AND IDENT .		UPSTRM	JUNCTION	TRIB
STREAM JUNCTION	1.	JNC= START MAINSTEM	10.	16.	15.

DATA TYPE 10 (HEADWATER SOURCES)

CARD TYPE	HDWTR ORDER	NAME	FLOW	TEMP	D.O.	BOD	CM-1	CM-2	CM-3
HEADWTR-1	1.	SOUTH FORK	117.00	52.90	10.40	1.00	1.35	0.00	0.00
HEADWTR-1	2.	MIDDLE FORK	161.00	54.60	10.40	1.00	0.97	0.00	0.00

DATA TYPE 10A (HEADWATER CONDITIONS FOR CHLOROPHYLL, NITROGEN, PHOSPHORUS, COLIFORM AND SELECTED NON-CONSERVATIVE CONSTITUENT)

CARD TYPE	HDWTR ORDER	ANC	COLI	CHL-A	ORG-N	NH3-N	NO2-N	NO3-N	ORG-P	DIS-P
HEADWTR-2	1.	4.50	16.00	0.00	0.00	8.00	0.00	296.00	0.00	0.00
HEADWTR-2	2.	1.30	12.00	0.00	0.00	5.00	0.00	120.00	0.00	0.00

DATA TYPE 11 (POINT SOURCE / POINT SOURCE CHARACTERISTICS)

CARD TYPE	POINT LOAD ORDER	NAME	EFF	FLOW	TEMP	D.O.	BOD	CM-1	CM-2	CM-3
POINTLD-1	1.	NOR BEND WTP	0.00	0.34	0.00	6.00	3.70	35.40	0.00	0.00
POINTLD-1	2.	NORTH FORK	0.00	56.00	0.00	10.40	1.00	0.97	0.00	0.00
POINTLD-1	3.	MANURE NPS	0.00	0.02	0.00	2.00	90.00	220.00	0.00	0.00
POINTLD-1	4.	WEYCO POND	0.00	0.01	0.00	6.00	6.90	7.40	0.00	0.00
POINTLD-1	5.	KIMBALL CK	0.00	1.80	0.00	10.20	1.00	2.10	0.00	0.00
POINTLD-1	6.	SNOQUAL WTP	0.00	0.21	0.00	6.00	25.00	31.70	0.00	0.00
POINTLD-1	7.	TOKUL CK	0.00	23.00	0.00	11.20	1.00	1.50	0.00	0.00
POINTLD-1	8.	RAGING R	0.00	10.00	0.00	10.70	1.00	5.30	0.00	0.00
POINTLD-1	9.	FALL CIT WTP	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
POINTLD-1	10.	MANURE NPS	0.00	0.10	0.00	2.00	90.00	220.00	0.00	0.00
POINTLD-1	11.	PATTERSON CK	0.00	7.00	0.00	10.30	1.00	2.90	0.00	0.00
POINTLD-1	12.	MANURE NPS	0.00	0.10	0.00	2.00	90.00	220.00	0.00	0.00
POINTLD-1	13.	GRIFFIN CK	0.00	4.00	0.00	11.00	1.00	1.80	0.00	0.00
POINTLD-1	14.	TOLT R	0.00	120.00	0.00	10.50	1.00	0.96	0.00	0.00
POINTLD-1	15.	CARNATIO WTP	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
POINTLD-1	16.	HARRIS CK	0.00	3.00	0.00	10.60	1.00	2.00	0.00	0.00
POINTLD-1	17.	AMES/SIKES	0.00	5.00	0.00	8.60	1.00	3.40	0.00	0.00
POINTLD-1	18.	MANURE NPS	0.00	0.30	0.00	2.00	90.00	220.00	0.00	0.00
POINTLD-1	19.	DUVALL WTP	0.00	0.26	0.00	6.00	6.00	37.40	0.00	0.00
POINTLD-1	20.	TUCK CK	0.00	0.70	0.00	8.30	1.00	2.60	0.00	0.00
POINTLD-1	21.	MANURE NPS	0.00	0.15	0.00	2.00	90.00	220.00	0.00	0.00
POINTLD-1	22.	CHERRY CK	0.00	4.00	0.00	9.80	1.00	2.50	0.00	0.00
POINTLD-1	23.	MANURE NPS	0.00	0.10	0.00	2.00	90.00	220.00	0.00	0.00

DATA TYPE 11A (POINT SOURCE CHARACTERISTICS - CHLOROPHYLL A, NITROGEN, PHOSPHORUS, COLIFORMS AND SELECTED NON-CONSERVATIVE CONSTITUENT)

CARD TYPE	POINT LOAD ORDER	ANC	COLI	CHL-A	ORG-N	NH3-N	NO2-N	NO3-N	ORG-P	DIS-P
POINTLD-2	1.	3400.00	9.00	0.00	860.00	20.00	0.00	5940.00	0.00	0.00
POINTLD-2	2.	1.30	12.00	0.00	0.00	5.00	0.00	120.00	0.00	0.00
POINTLD-2	3.	3000.00	3000.00	0.00	3000.00	1500.00	0.00	5000.00	0.00	0.00
POINTLD-2	4.	40.00	6.00	0.00	0.00	78.00	0.00	23.00	0.00	0.00
POINTLD-2	5.	4.00	1448.00	0.00	0.00	18.00	0.00	340.00	0.00	0.00
POINTLD-2	6.	1200.00	3.00	0.00	3080.00	540.00	0.00	450.00	0.00	0.00
POINTLD-2	7.	14.50	10.00	0.00	50.00	29.00	0.00	448.00	0.00	0.00
POINTLD-2	8.	4.00	31.00	0.00	100.00	15.00	0.00	86.00	0.00	0.00
POINTLD-2	9.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
POINTLD-2	10.	3000.00	300000.00	0.00	30000.00	15000.00	0.00	5000.00	0.00	0.00
POINTLD-2	11.	31.00	130.00	0.00	115.00	120.00	0.00	923.00	0.00	0.00
POINTLD-2	12.	3000.00	300000.00	0.00	30.00	15000.00	0.00	5000.00	0.00	0.00
POINTLD-2	13.	5.00	238.00	0.00	90.00	31.00	0.00	340.00	0.00	0.00
POINTLD-2	14.	1.10	41.00	0.00	52.00	3.00	0.00	113.00	0.00	0.00
POINTLD-2	15.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
POINTLD-2	16.	20.00	50.00	0.00	90.00	16.00	0.00	610.00	0.00	0.00
POINTLD-2	17.	71.00	2360.00	0.00	250.00	223.00	0.00	1260.00	0.00	0.00
POINTLD-2	18.	3000.00	300000.00	0.00	30000.00	15000.00	0.00	5000.00	0.00	0.00

POINTLD-2	19.	4000.00	10.00	0.00	3000.00	10000.00	0.00	20.00	0.00	0.00
POINTLD-2	20.	21.00	74.00	0.00	260.00	51.00	0.00	40.00	0.00	0.00
POINTLD-2	21.	3000.00	300000.00	0.00	30000.00	15000.00	0.00	5000.00	0.00	0.00
POINTLD-2	22.	10.00	90.00	0.00	130.00	18.00	0.00	516.00	0.00	0.00
POINTLD-2	23.	3000.00	300000.00	0.00	30000.00	15000.00	0.00	5000.00	0.00	0.00

DATA TYPE 12 (DAM CHARACTERISTICS)

	DAM	RCH	ELE	ADAM	BDAM	FDAM	HDAM
DAM DATA	1.	7.	1.	1.80	1.05	1.00	268.00

SNOQUALMIE VALLEY CITIES NPDES PERMIT PROCESS

Prepared by
Craig Van Riper, PE
HDR Engineering

December 1995

King County Department of Metropolitan Services
Water Pollution Control Department
821 Second Avenue
Seattle, Washington 98104-1598

HDR

December 14, 1995

Mr. Ellis McCoy, Project Manager
King County Department of Metropolitan Services
821 Second Avenue, M.S. 81
Seattle, WA 98104

Re: Wastewater 2020 Plus: Snoqualmie Valley Cities – Subtask 4.2 Letter Report NPDES Permit Process

Dear Ellis:

The purpose of this letter report is to describe the National Pollutant Discharge Elimination System (NPDES) permitting process as it relates to wastewater disposal in the Snoqualmie Valley Cities. The scope of this effort was limited to a review of Washington State Department of Ecology NPDES guidelines and associated literature to develop the information necessary to describe the permitting process. A summary of this review is presented below.

Permit Program Overview

The Washington State Department of Ecology (Ecology) is the state's primary environmental agency. Ecology's mission is "to protect, preserve and enhance Washington's environment and promote the wise management of our air, land and water for the benefit of current and future generations." To accomplish this mission, Ecology operates programs concerned with hazardous waste investigations and cleanup, nuclear and mixed waste management, air quality, water quality, shorelands and coastal zone management, solid and hazardous waste management, water resources, waste reduction, recycling and litter control, water quality financial assistance, technical services, central operations services, and operations and support services.

Ecology's responsibilities include those that are legislatively mandated as well as those delegated by the federal government. Four regional offices located in Yakima, Spokane, Redmond, and Tumwater provide local service, issue permits, and enforce regulations related to all Ecology programs. The Northwest Regional Office located in Redmond provides such service to King County and Snoqualmie Valley Cities.

Ecology administers wastewater discharge permit programs under the Federal Clean Water Act, the State Water Pollution Control Act (Chapter 90.48 RCW), and associated regulations (see Subtask 4.1 Memorandum (HDR) for a review of current and anticipated regulations). The program is administered out of the Water Quality Program of the Office of Water and Shorelands.

Wastewater sources include municipal wastewater treatment plants and industrial dischargers that vary widely in size and type.

Chapter 173-220, attached, implements the authority delegated by the U.S. Environmental Protection Agency (EPA) to Ecology to issue NPDES permits. NPDES permits are required for the point source discharge of pollutants, including municipal wastewater, into any navigable water of the state. The definition of "navigable waters" encompasses all surface waters of the state, including the Snoqualmie River.

The permit is a comprehensive service package. It establishes specific limits on the quantity and concentration of contaminants allowed to be discharged together with requirements for monitoring, spill prevention, etc. The permit can take up to a year to write. These requirements necessitate compliance inspection, review of discharge monitoring reports submitted by permittees and other means to assure permit compliance, and appropriate and effective enforcement actions.

NPDES Permitting Process

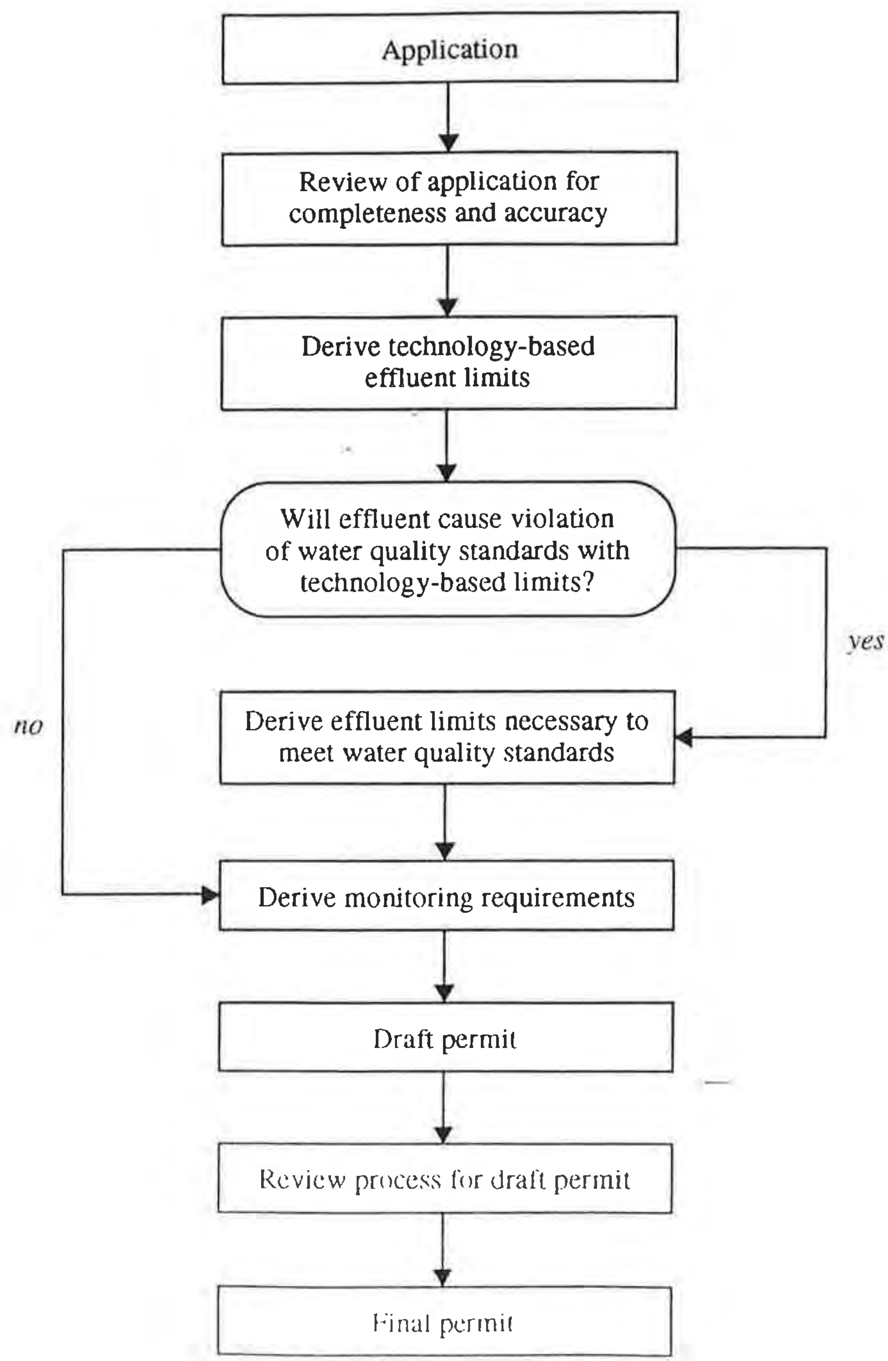
An overview of the NPDES permitting process is presented in Figure 1. New dischargers are required to complete a permit application at least 180 days before the discharge begins or in sufficient time prior to discharge to ensure compliance with federal and state effluent limitations and water quality standards. New dischargers may alternatively request to be covered by a general permit where Ecology issues such general permits to cover categories of dischargers or geographic areas having similar operations and wastes that require the same effluent limitations, conditions, and monitoring.

Permit applications are often complex and may be accompanied by detailed engineering or environmental reports. Applications must include results of analyses of pollutants in the effluents, effluent toxicity data, and other technical information about a facility and its operating procedures. Upon reviewing an application for completeness and accuracy, Ecology may require applicants to conduct studies to gather more information about their processes and discharges before an application is accepted.

Following application, Ecology prepares tentative staff determinations in advance of public notice of the proposed issuance or denial of a permit. If the determination is to issue the permit, the following items are included in the draft permit:

- Proposed effluent limitations for those pollutants proposed to be limited
- A proposed schedule of compliance, including interim dates and requirements, for meeting the proposed effluent limitations

Overview of the NPDES Permitting Process



- A brief description of any other proposed special conditions which will have a significant impact upon the discharge described in the application

Ecology and the applicant must give public notice of draft determinations for a period of not less than 30 days to inform the public of the planned discharge and allow public comment. Ecology also notifies other state agencies and the EPA regional administrator. A public hearing may be required, if deemed warranted by Ecology, as requested by any interested person or entity.

A flowchart illustrating the complete permitting process is presented in Figure 2. In addition to those items contained in the draft permit listed above, final permits include monitoring requirements, reporting requirements including a requirement to report any new or increased discharge of pollutants, and any conditions necessary to prevent or control discharges. Recent permits have also included conditions for monitoring and controlling toxic pollutants, such as biomonitoring, sediment monitoring, and dilution analysis. Abbreviations used in Figure 2 include: AKART, all known, available, and reasonable methods of treatment; BAT, best available technology; BCT, best conventional technology; BMP, best management practices; BPJ, best professional judgment; and SEPA, State Environmental Policy Act.

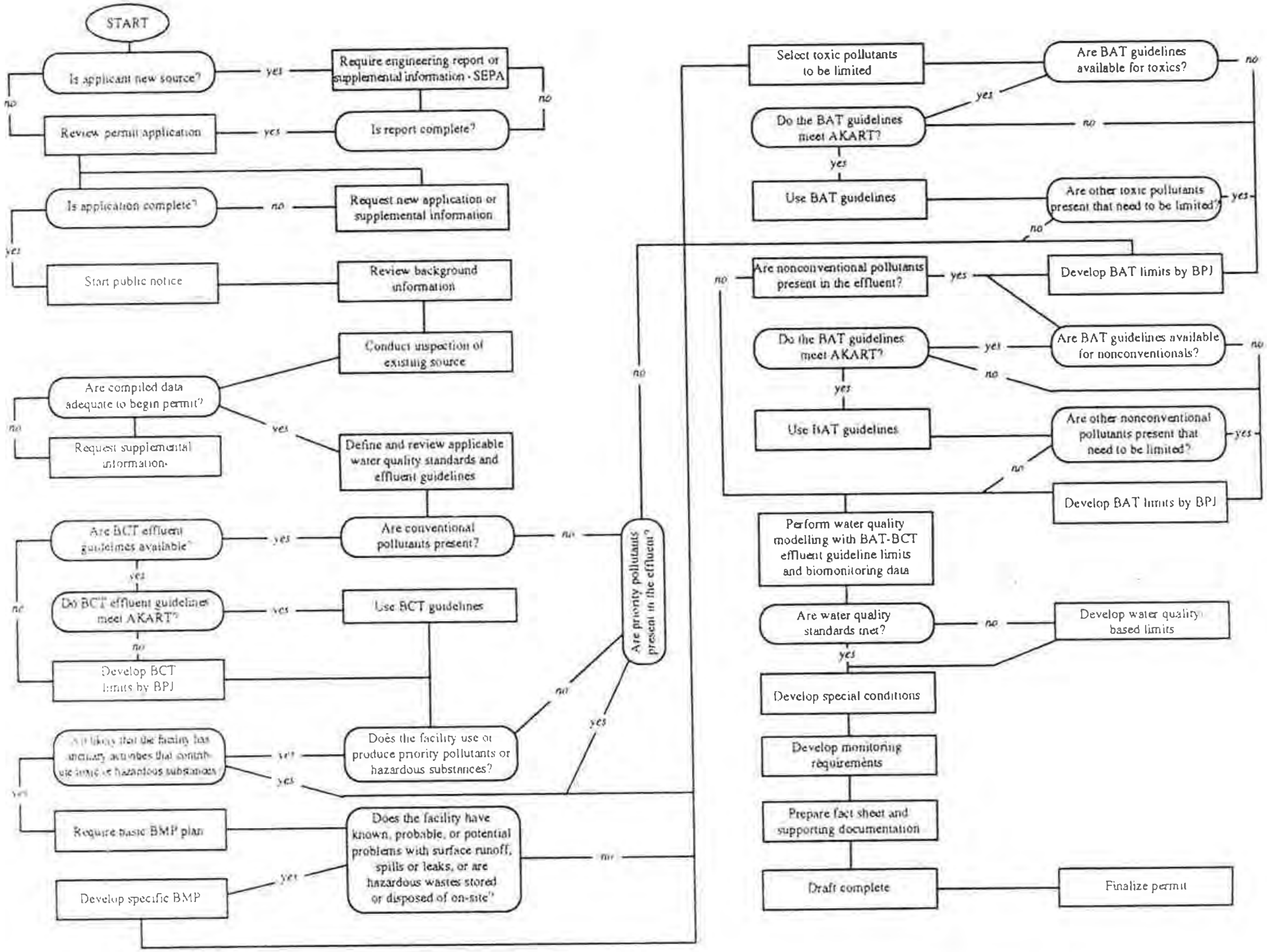
Permits are issued for fixed terms not exceeding five years. The conditions of a permit can be appealed after the permit has been issued. An appeal may result in changes in the final permit. Permit renewals must be applied for at least 180 days before expiration. Expiring permits generally remain in effect and enforceable until the application has been denied or a replacement permit has been issued.

Permit Fees

Since the beginning of the Washington state waste discharge permit program in 1955, the distribution of program funding has shifted significantly from state general funds with some federal grant support, toward increased support from permit fees. WAC 173-224 establishes a fee system for NPDES permits issued by Ecology including fee categories and amounts. The annual permit fee for a permit held by a municipality and issued under RCW 90.48 for a domestic wastewater facility accommodating up to 250,000 residential equivalents (REs) is $1.23 per RE. In addition to the municipal annual permit fee, a biosolids surcharge amounting to five percent of the annual permit fee will also be assessed for municipalities who do not incinerate their sludge.

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. Existing law (RCW 90.48.465)

NPDES Permitting Process Flowchart



places a cap on permit fees. The annual fee paid by a municipality for all domestic wastewater facility permits shall not exceed the total of a maximum of fifteen cents per month per residence or RE contributing to the municipality's wastewater system.

Application Forms

NPDES permit application forms and instructions are attached to this letter report. Additional information outlining the permit process and opportunities for public involvement, along with a list of Ecology office contacts, is presented in the attached Ecology Report *Wastewater Discharge Permits in Washington State*. Sample Snoqualmie Valley Cities (North Bend, Snoqualmie, and Duvall) NPDES permits on file are also attached for your information.

We appreciate this opportunity to summarize the NPDES permitting process as it relates to wastewater disposal in the Snoqualmie Valley Cities. Feel free to contact us if you are in need of additional information at this time.

Very truly Yours,

HDR ENGINEERING, INC.

Gary L. Bleeker, P.E.
Project Manager

Attachments
CVR/cvr

Chapter 173-220 WAC
NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM PERMIT PROGRAM

DISPOSITION OF SECTIONS FORMERLY CODIFIED IN THIS CHAPTER

173-220-045 General permits. [Statutory Authority: RCW 90.54.020 and chapter 90.48 RCW. 88-22-059 (Order 88-9), § 173-220-045, filed 11/1/88. Statutory Authority: Chapter 43.21A RCW. 86-06-040 (Order 86-03), § 173-220-045, filed 3/4/86. Statutory Authority: RCW 90.48.035 and 90.48.260. 82-24-078 (Order DE 82-39), § 173-220-045, filed 12/1/82.] Repealed by 93-10-099 (Order 92-55), filed 5/5/93, effective 5/19/93. Statutory Authority: Chapter 90.48 RCW.

173-220-220 Control of disposal of pollutants into wells. [Statutory Authority: Chapter 90.48 RCW. 84-11-024 (Order DE 84-19), § 173-220-220, filed 5/11/84. Statutory Authority: RCW 90.48.035 and 90.48.260. 82-24-078 (Order DE 82-39), § 173-220-220, filed 12/1/82; Order DE 74-1, § 173-220-220, filed 2/15/74.] Repealed by 88-22-059 (Order 88-9), filed 11/1/88. Statutory Authority: RCW 90.54.020 and chapter 90.48 RCW.

WAC 173-220-010 Purpose. The purpose of this chapter is to establish a state individual permit program, applicable to the discharge of pollutants and other wastes and materials to the surface waters of the state, operating under state law as a part of the National Pollutant Discharge Elimination System (NPDES) created by section 402 of the Federal Water Pollution Control Act (FWPCA). Permits issued under this chapter are designed to satisfy the requirements for discharge permits under both section 402(b) of the FWPCA and chapter 90.48 RCW.

[Statutory Authority: Chapter 90.48 RCW. 93-10-099 (Order 92-55), § 173-220-010, filed 5/5/93, effective 5/19/93. Statutory Authority: RCW 90.54.020 and chapter 90.48 RCW. 88-22-059 (Order 88-9), § 173-220-010, filed 11/1/88; Order DE 74-1, § 173-220-010, filed 2/15/74.]

WAC 173-220-020 Permit required. No pollutants shall be discharged to any surface water of the state from a point source, except as authorized by an individual permit issued pursuant to this chapter or as authorized by a general permit issued pursuant to chapter 173-226 WAC.

[Statutory Authority: Chapter 90.48 RCW. 93-10-099 (Order 92-55), § 173-220-020, filed 5/5/93, effective 5/19/93. Statutory Authority: RCW 90.54.020 and chapter 90.48 RCW. 88-22-059 (Order 88-9), § 173-220-020, filed 11/1/88. Statutory Authority: RCW 90.48.035 and 90.48.260. 82-24-078 (Order DE 82-39), § 173-220-020, filed 12/1/82; Order DE 74-1, § 173-220-020, filed 2/15/74.]

WAC 173-220-030 Definitions. For purposes of this chapter, the following definitions shall be applicable:

(1) "Administrator" means the administrator of the United States Environmental Protection Agency.

(2) "Combined waste treatment facility" means any publicly owned waste treatment facility in which the maximum monthly average influent from any one industrial category, or categories producing similar wastes, constitutes over eighty-five percent of the design load for biochemical oxygen demand or suspended solids. Each single industrial category must contribute a minimum of ten percent of the applicable load.

(3) "Department" means department of ecology.

(4) "Director" means the director of the department of ecology or his/her authorized representative.

(5) "Discharge of pollutant" and the term "discharge of pollutants" each means (a) any addition of any pollutant or combination of pollutants to surface waters of the state from any point source, (b) any addition of any pollutant or combination of pollutants to the waters of the contiguous zone or the ocean from any point source, other than a vessel or other floating craft which is being used as a means of transportation.

(6) "Discharger" means owner or operator of any facility or activity subject to regulation under the NPDES program.

(7) "Domestic wastewater" means water carrying human wastes, including kitchen, bath, and laundry wastes from residences, buildings, industrial establishments or other places, together with such groundwater infiltration or surface waters as may be present.

(8) "Domestic wastewater facility" means all structures, equipment, or processes required to collect, carry away, treat, reclaim or dispose of domestic wastewater together with

such industrial waste as may be present. This term applies only to facilities discharging to surface water.

(9) "Effluent limitation" means any restriction established by the state or administrator on quantities, rates, and concentrations of chemical, physical, biological, and other constituents which are discharged from point sources into surface waters of the state.

(10) "FWPCA" means the Federal Water Pollution Control Act as amended, 33 U.S.C. 1251 et seq.

(11) "General permit" means a permit which covers multiple dischargers of a point source category within a designated geographical area, in lieu of individual permits being issued to each discharger.

(12) "Individual permit" means a permit for a single point source or a single facility.

(13) "Major discharger" means any discharger classified as such by the administrator in conjunction with the director and published in the annual state-EPA agreement.

(14) "Minor discharger" means any discharger not designated as major or covered under a general permit.

(15) "NPDES" means the National Pollutant Discharge Elimination System.

(16) "Permit" means an authorization, license, or equivalent control document issued by the director to implement this chapter.

(17) "Person" includes any political subdivision, local, state, or federal government agency, municipality, industry, public or private corporation, partnership, association, firm, individual, or any other entity whatsoever.

(18) "Point source" means any discernible, confined and discrete conveyance, including but not limited to any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock, concentrated animal feeding operation, or vessel or other floating craft, from which pollutants are or may be discharged. This term does not include return flows from irrigated agriculture.

(19) "Pollutant" means dredged spoil, solid waste, incinerator residue, sewage, garbage, sewage sludge, munitions, chemical wastes, biological materials, radioactive materials, heat, wrecked or discarded equipment, rock, sand, cellar dirt and industrial, municipal and agricultural waste discharged into water. This term does not include sewage from vessels within the meaning of section 312 of the FWPCA nor does it include dredged or fill material discharged in accordance with a permit issued under section 404 of the FWPCA.

(20) "Regional administrator" means the regional administrator of Region X of the Environmental Protection Agency (EPA) or his/her authorized representative.

(21) "Surface waters of the state" means all waters defined as "waters of the United States" in 40 CFR 122.2 that are within the boundaries of the state of Washington. This includes lakes, rivers, ponds, streams, inland waters, wetlands, ocean, bays, estuaries, sounds, and inlets.

(22) "Water quality standards" means the state of Washington's water quality standards for surface waters of the state, which are codified in chapter 173-201 WAC.

[Statutory Authority: Chapter 90.48 RCW. 93-10-099 (Order 92-55), § 173-220-030, filed 5/5/93, effective 5/19/93. Statutory Authority: RCW 90.54.020 and chapter 90.48 RCW. 88-22-059 (Order 88-9), § 173-220-030, filed 11/1/88. Statutory Authority: Chapter 90.48 RCW. 84-11-024 (Order DE 84-19), § 173-220-030, filed 5/11/84. Statutory Authority: RCW 90.48.035 and 90.48.260. 82-24-078 (Order DE 82-39), § 173-220-030, filed 12/1/82; Order DE 74-1, § 173-220-030, filed 2/15/74.]

WAC 173-220-040 Application for permit. (1) Any person presently discharging pollutants to surface waters of the state must file an application with the department on a form prescribed by the department. For the purpose of satisfying the requirements of this subsection, any completed application filed with the Environmental Protection Agency prior to the approval by the administrator under section 402(b) of the FWPCA of this state permit program shall constitute a filing with the department.

(2) Any person proposing to commence a discharge of pollutants to surface waters of the state must file an application with the department on a form prescribed by the department, (a) no less than one hundred eighty days in advance of the date on which it is desired to commence the discharge of pollutants, or (b) in sufficient time prior to commencement of the discharge of pollutants to insure compliance with the requirements of section 306 of the FWPCA and any other applicable water quality standards or effluent standards and limitations.

(3) The applicant must pay any applicable fees required pursuant to RCW 90.48.610.

(4) The requirement for permit application will be satisfied if the discharger files:

(a) A complete application form which is appropriate for the type, category, or size of discharge per 40 CFR 122.21; or

(b) A complete request for coverage under a general permit; and

(c) Any additional information required by the department pertaining to pollutant discharge.

(5) The application form shall bear a certification of correctness to be signed:

(a) In the case of corporations, by a responsible corporate officer.

(b) In the case of a partnership, by a general partner.

(c) In the case of sole proprietorship, by the proprietor.

(d) In the case of a municipal, state, or other public facility, by either a principal executive officer or ranking elected official.

(6) Applications for permits for domestic wastewater facilities that are either owned or operated by, or under contract to, a public entity shall be submitted by the public entity.

(7) No discharge of pollutants into the surface waters of the state is authorized until such time as a permit has been issued consistent with the terms and conditions of this chapter.

[Statutory Authority: Chapter 90.48 RCW. 93-10-099 (Order 92-55), § 173-220-040, filed 5/5/93, effective 5/19/93. Statutory Authority: RCW 90.54.020 and chapter 90.48 RCW. 88-22-059 (Order 88-9), § 173-220-040, filed 11/1/88. Statutory Authority: Chapter 43.21A RCW. 86-06-040 (Order 86-03), § 173-220-040, filed 3/4/86. Statutory Authority: RCW 90.48.035 and 90.48.260. 82-24-078 (Order DE 82-39), § 173-220-040, filed 12/1/82; Order DE 74-1, § 173-220-040, filed 2/15/74.]

WAC 173-220-050 Public notice. (1) Public notice of every draft permit determination regarding an individual permit shall be circulated in a manner designed to inform interested and potentially affected persons of the proposed

discharge and of the proposed determination to issue or deny a permit for the proposed discharge, as follows:

(a) Notice shall be circulated within the geographical area of the proposed discharge; such circulation may include any or all of the following, as directed by the department:

(i) Posting by the applicant for a period of thirty days in the post office, public library, and public places of the municipality nearest the premises of the applicant in which the effluent source is located;

(ii) Posting by the applicant for a period of thirty days near the entrance of the applicant's premises and nearby places;

(iii) Publishing by the applicant, at his own cost within such time as the director shall prescribe, through a notice form provided by the department, in major local newspapers of general circulation serving the area in which the discharge occurs: *Provided*, That if an applicant fails to publish notice within thirty days of the time prescribed by the director, the department may publish the notice and bill the applicant for the cost of publication;

(iv) Publishing by the applicant of paid advertisements;

(v) Publishing by the department of news releases or newsletter articles.

(b) Notice shall be mailed to any person upon request; and

(c) The department shall add the name of any person upon request to a mailing list to receive copies of notices within the state or within a certain geographical area.

(2) The department shall provide a period of not less than thirty days following the date of the public notice during which time interested persons may submit their written views on a draft permit determination. All written comments submitted during the thirty-day comment period shall be retained by the department and considered in the formulation of its final determination with respect to the application. The period for comment may be extended at the discretion of the department.

(3) The department shall prepare the contents of the public notice, which shall, at a minimum, summarize the following:

(a) Name, address, phone number of agency issuing the public notice;

(b) Name and address of each applicant, and if different, of the facility or activity to be regulated;

(c) Each applicant's activities or operations which result in a discharge (e.g., municipal waste treatment, steel manufacturing, drainage from mining activities);

(d) Name of waterway to which each discharge is made and the location of each discharge on the waterway, indicating whether such discharge is a new or an existing discharge;

(e) The tentative determination to issue or deny a permit for the discharge;

(f) The procedures for the formulation of final determinations, including the thirty-day comment period required by subsection (2) of this section and any other means by which interested persons may comment upon those determinations; and

(g) Address and phone number of state premises at which interested persons may obtain further information.

(4) The department shall provide copies of permit applications, draft permit determinations, and final permits.

(5) The department shall notify the applicant and persons who have submitted written comments or requested notice of the final permit decision. This notification shall include response to comments received and reference to the procedures for contesting the decision.

[Statutory Authority: Chapter 90.48 RCW. 93-10-099 (Order 92-55), § 173-220-050, filed 5/5/93, effective 5/19/93. Statutory Authority: RCW 90.54.020 and chapter 90.48 RCW. 88-22-059 (Order 88-9), § 173-220-050, filed 11/1/88. Statutory Authority: RCW 90.48.035 and 90.48.260. 82-24-078 (Order DE 82-39), § 173-220-050, filed 12/1/82; Order DE 76-20, § 173-220-050, filed 5/19/76; Order 74-7, § 173-220-050, filed 5/1/74; Order DE 74-1, § 173-220-050, filed 2/15/74.]

WAC 173-220-060 Fact sheets. (1) The department shall prepare a fact sheet for every draft permit determination. Such fact sheets shall, at a minimum, summarize the following:

(a) The type of facility or activity which is the subject of the application;

(b) The location of the discharge in the form of a sketch or detailed description;

(c) The type and quantity of the discharge, including at least the following:

(i) The rate or frequency of the proposed discharge;

(ii) For thermal discharges, the average summer and winter temperatures; and

(iii) The average discharge in pounds per day, or other appropriate units, of any pollutants which are present in significant quantities or which are subject to limitations or prohibition under RCW 90.48.010, 90.52.040, 90.54.020 and sections 301, 302, 306, or 307 of the FWPCA and regulations published thereunder;

(d) The conditions in the proposed permit;

(e) The legal and technical grounds for the draft permit determination, including an explanation of how conditions meet both the technology-based and water quality-based requirements of the FWPCA and chapters 90.48, 90.52, and 90.54 RCW;

(f) The effluent standards and limitations applied to the proposed discharge;

(g) The applicable water quality standards, including identification of the uses for which receiving waters have been classified;

(h) How the draft permit addresses use or disposal of residual solids generated by wastewater treatment; and

(i) The procedures for the formulation of final determinations (in more detailed form than that given in the public notice) including:

(i) The thirty-day comment period required by WAC 173-220-050(2);

(ii) Procedures for requesting a public hearing and the nature thereof; and

(iii) Any other procedures by which the public may participate in the formulation of the final determinations.

(2) The department shall send a fact sheet to the applicant and, upon request, to any other person.

(3) The department shall add the name of any person upon request to a mailing list to receive copies of fact sheets.

[Statutory Authority: Chapter 90.48 RCW. 93-10-099 (Order 92-55), § 173-220-060, filed 5/5/93, effective 5/19/93. Statutory Authority: RCW 90.54.020 and chapter 90.48 RCW. 88-22-059 (Order 88-9), § 173-220-060, filed 11/1/88. Statutory Authority: Chapter 43.21A RCW. 86-06-040

(Order 86-03), § 173-220-060, filed 3/4/86. Statutory Authority: RCW 90.48.035 and 90.48.260. 82-24-078 (Order DE 82-39), § 173-220-060, filed 12/1/82; Order DE 74-1, § 173-220-060, filed 2/15/74.]

WAC 173-220-070 Notice to other government agencies. The department shall notify other appropriate government agencies of each draft permit determination and shall provide such agencies an opportunity to submit their written views and recommendations. Such notification shall include the following:

(1) Unless the regional administrator has agreed to waive review, transmission of an application, fact sheet, and draft permit to the regional administrator for comment or objection within thirty days, or a longer period if requested up to a maximum of ninety days.

(2) At the time of issuance of public notice pursuant to WAC 173-220-050, transmission of the public notice to any other states whose waters may be affected by the issuance of a permit. Each affected state shall be afforded an opportunity to submit written recommendations to the department and to the regional administrator which the department may incorporate into the permit if issued. Should the department fail to incorporate any written recommendations thus received, it shall provide to the affected state or states (and to the regional administrator) a written explanation of its reasons for failing to accept any of the written recommendations.

(3) Unless waived by the respective agency, the public notice shall be sent to the appropriate district engineer of the Army Corps of Engineers, the United States Fish and Wildlife Service, the National Marine Fisheries Service, the state departments of fisheries, natural resources, wildlife, and social and health services, the archaeology and historic preservation office, the agency responsible for the preparation of an approved plan pursuant to section 208(b) of the FWPCA, applicable Indian tribes and any other applicable government agencies.

(4) A copy of any written agreement between the department and an agency identified in subsection (3) of this section which waives the receipt of public notices shall be forwarded to the regional administrator and shall be made available to the public for inspection and copying.

(5) Copies of public notices shall be mailed to any other federal, state, or local agency, Indian tribe or any affected country, upon request. Such agencies shall have an opportunity to respond, comment, or request a public hearing pursuant to WAC 173-220-090.

[Statutory Authority: Chapter 90.48 RCW. 93-10-099 (Order 92-55), § 173-220-070, filed 5/5/93, effective 5/19/93. Statutory Authority: RCW 90.54.020 and chapter 90.48 RCW. 88-22-059 (Order 88-9), § 173-220-070, filed 11/1/88. Statutory Authority: RCW 90.48.035 and 90.48.260. 82-24-078 (Order DE 82-39), § 173-220-070, filed 12/1/82; Order DE 74-1, § 173-220-070, filed 2/15/74.]

WAC 173-220-080 Public access to information. (1) In accordance with chapter 42.17 RCW, the department shall make records relating to NPDES permits available to the public for inspection and copying.

(2) The department shall protect any information (other than information on the effluent) contained in its NPDES permit records as confidential upon a showing by any person that such information, if made public, would divulge methods or processes entitled to protection as trade secrets of such person.

(3) Any information accorded confidential status, whether or not contained in an application form, shall be disclosed, upon request, to the regional administrator.

(4) The department shall provide facilities for the inspection of information relating to NPDES permits and shall insure that employees honor requests for such inspection promptly without undue requirements or restrictions. The department shall either (a) insure that a machine or device for the copying of papers and documents is available for a reasonable fee, or (b) otherwise provide for or coordinate with copying facilities or services such that requests for copies of nonconfidential documents may be honored promptly.

[Statutory Authority: RCW 90.54.020 and chapter 90.48 RCW. 88-22-059 (Order 88-9), § 173-220-080, filed 11/1/88. Statutory Authority: RCW 90.48.035 and 90.48.260. 82-24-078 (Order DE 82-39), § 173-220-080, filed 12/1/82; Order DE 74-1, § 173-220-080, filed 2/15/74.]

WAC 173-220-090 Public hearings. The applicant, any affected state, any affected interstate agency, any affected country, the regional administrator, or any interested agency or person may request a public hearing with respect to a draft permit determination. Any such request for a public hearing shall be filed within the thirty-day period prescribed in WAC 173-220-050(2) and shall indicate the interest of the party filing such request and the reasons why a hearing is warranted. The department shall hold a hearing if it determines there is a significant public interest. Instances of doubt will be resolved in favor of holding the hearing. Any hearing brought pursuant to this subsection shall be held at a time and place deemed appropriate by the department.

[Statutory Authority: Chapter 90.48 RCW. 93-10-099 (Order 92-55), § 173-220-090, filed 5/5/93, effective 5/19/93. Statutory Authority: RCW 90.54.020 and chapter 90.48 RCW. 88-22-059 (Order 88-9), § 173-220-090, filed 11/1/88. Statutory Authority: RCW 90.48.010, 90.48.035, and 90.58.260. 83-10-063 (Order DE 83-14), § 173-220-090, filed 5/4/83; Order DE 74-1, § 173-220-090, filed 2/15/74.]

WAC 173-220-100 Public notice of public hearings. (1) The department shall circulate public notice of any hearing held pursuant to WAC 173-220-090 at least as widely as was the notice pursuant to WAC 173-220-050. Procedures for the circulation of public notice for hearings held under WAC 173-220-090 shall include at least the following:

(a) Notice shall be published in at least one major local newspaper of general circulation within the geographical area of the discharge;

(b) Notice shall be sent to all persons and government agencies who received a copy of the notice pursuant to WAC 173-220-050 or the fact sheet;

(c) Notice shall be mailed to any person upon request; and

(d) Notice shall be effected pursuant to (a) and (c) of this subsection at least thirty days in advance of the hearing.

(2) The contents of public notice of any hearing held in pursuant to WAC 173-220-090 shall include at least the following:

(a) Name, address, and phone number of agency holding the public hearing;

(b) A reference to the public notice issued pursuant to WAC 173-220-050, including identification number and date of issuance;

(c) The time and location for the hearing;

(d) The purpose of the hearing;

(e) Address and phone number of premises at which interested persons may obtain information;

(f) The nature of the hearing;

(g) The issues raised by the persons requesting the hearing, and any other appropriate issues which may be of interest to the public;

(h) The name and address of each applicant whose proposed discharge will be considered at the hearing;

(i) The name of waterway to which each discharge is made and the location of each discharge on the waterway.

[Statutory Authority: Chapter 90.48 RCW. 93-10-099 (Order 92-55), § 173-220-100, filed 5/5/93, effective 5/19/93. Statutory Authority: RCW 90.54.020 and chapter 90.48 RCW. 88-22-059 (Order 88-9), § 173-220-100, filed 11/1/88. Statutory Authority: RCW 90.48.035 and 90.48.260. 82-24-078 (Order DE 82-39), § 173-220-100, filed 12/1/82; Order DE 74-1, § 173-220-100, filed 2/15/74.]

WAC 173-220-110 Permit preparation. The department will prepare tentative staff determinations with respect to a permit application in advance of public notice of the proposed issuance or denial of a permit. Such tentative determinations shall include at least the following:

(1) A proposed determination to issue or deny a permit for the discharge described in the application; and

(2) If the determination is to issue the permit, the following shall be included in a draft permit:

(a) Proposed effluent limitations for those pollutants proposed to be limited;

(b) A proposed schedule of compliance, including interim dates and requirements, for meeting the proposed effluent limitations; and

(c) A brief description of any other proposed special conditions which will have a significant impact upon the discharge described in the application.

[Statutory Authority: Chapter 90.48 RCW. 93-10-099 (Order 92-55), § 173-220-110, filed 5/5/93, effective 5/19/93. Statutory Authority: RCW 90.48.035 and 90.48.260. 82-24-078 (Order DE 82-39), § 173-220-110, filed 12/1/82; Order DE 74-1, § 173-220-110, filed 2/15/74.]

WAC 173-220-120 Prohibited discharges. No permit issued by the department shall authorize any person to:

(1) Discharge any radiological, chemical or biological warfare agent or high-level radioactive waste into surface waters of the state;

(2) Discharge any pollutants which the secretary of the army acting through the chief, corps of engineers, finds would substantially impair anchorage and navigation;

(3) Discharge any pollutant to which the regional administrator, not having waived his/her right to object pursuant to section 402(e) of the FWPCA, has objected in writing pursuant to section 402(d) of the FWPCA;

(4) Discharge from a point source any pollutant which is in conflict with the plan or amendment thereto approved pursuant to section 208(b) of the FWPCA;

(5) Discharge any pollutant subject to a toxic pollutant discharge prohibition under section 307 of FWPCA.

[Statutory Authority: RCW 90.54.020 and chapter 90.48 RCW. 88-22-059 (Order 88-9), § 173-220-120, filed 11/1/88. Statutory Authority: RCW 90.48.035 and 90.48.260. 82-24-078 (Order DE 82-39), § 173-220-120, filed 12/1/82; Order DE 74-1, § 173-220-120, filed 2/15/74.]

WAC 173-220-130 Effluent limitations, water quality standards and other requirements for permits. (1) Any permit issued by the department shall apply and insure compliance with all of the following, whenever applicable:

(a) All known, available, and reasonable methods of treatment required under RCW 90.52.040, 90.54.020 (3)(b), and 90.48.520; including effluent limitations established under sections 301, 302, 306, and 307 of the FWPCA. The effluent limitations shall not be less stringent than those based upon the treatment facility design efficiency contained in approved engineering plans and reports or approved revisions thereto. The effluent limitations shall reflect any seasonal variation in industrial loading. Modifications to technology-based effluent limitations for specific discharge categories are as follows:

(i) For combined waste treatment facilities, the effluent limitations for biochemical oxygen demand or suspended solids may be adjusted upwards to a maximum allowed by applying effluent limitations pursuant to sections 301 (b)(1)(B) of the FWPCA to the domestic portion of the influent and effluent limitations pursuant to sections 301 (b)(1)(A)(i), 301 (b)(2)(A), and 301 (b)(2)(E) of the FWPCA or standards of performance pursuant to section 306 of the FWPCA to the industrial portion of the influent: *Provided*, That the following additional condition is met:

Fecal coliform levels shall not exceed a monthly geometric mean of 200 organisms per 100 ml with a maximum weekly geometric mean of 400 organisms per 100 ml;

(ii) For municipal water treatment plants located on the Chehalis, Columbia, Cowlitz, Lewis, or Skagit river, the effluent limitations shall be adjusted, in accordance with RCW 90.54.020 (3)(b), to reflect credit for substances removed from the plant intake water if:

(A) The municipality demonstrates that the intake water is drawn from the same body of water into which the discharge is made; and

(B) The municipality demonstrates that no violation of receiving water quality standards or appreciable environmental degradation will result.

(b) Any more stringent limitation, including those necessary to:

(i) Meet water quality standards, treatment standards or schedules of compliance established pursuant to any state law or regulation under authority preserved to the state by section 510 of the FWPCA; or

(ii) Meet any federal law or regulation other than the FWPCA or regulations thereunder; or

(iii) Implement any applicable water quality standards; such limitations to include any legally applicable requirements necessary to implement total maximum daily loads established pursuant to section 303(d) and incorporated in the continuing planning process approved under section 303(e) of the FWPCA and any regulations and guidelines issued pursuant thereto;

(iv) Prevent or control pollutant discharges from plant site runoff, spillage or leaks, sludge or waste disposal, or materials handling or storage; and

(v) Meet the permit by rule provisions of the state dangerous waste regulation, WAC 173-303-802 (4) or (5).

(c) Any more stringent legal applicable requirements necessary to comply with a plan approved pursuant to section 208(b) of the FWPCA; and

(d) Prior to promulgation by the administrator of applicable effluent standards and limitations pursuant to sections 301, 302, 306, and 307 of the FWPCA, such conditions as the department determines are necessary to carry out the provisions of the FWPCA.

(2) In any case where an issued permit applies the effluent standards and limitations described in subsection (1)(a) of this section, the department shall make a finding that any discharge authorized by the permit will not violate applicable water quality standards.

(3) In the application of effluent standards and limitations, water quality standards and other legally applicable requirements pursuant to subsections (1) and (2) of this section, each issued permit shall specify:

(a) For industrial wastewater facilities, average monthly and maximum daily quantitative mass and/or concentration limitations, or other such appropriate limitations for the level of pollutants and the authorized discharge;

(b) For domestic wastewater facilities, average weekly and monthly quantitative concentration and mass limitations, or other such appropriate limitations for the level of pollutants and the authorized discharge; and

(c) If a dilution zone is authorized within which water quality standards are modified, the dimensions of such dilution zone.

[Statutory Authority: RCW 90.54.020 and chapter 90.48 RCW. 88-22-059 (Order 88-9), § 173-220-130, filed 11/1/88. Statutory Authority: RCW 90.48.035 and 90.48.260. 82-24-078 (Order DE 82-39), § 173-220-130, filed 12/1/82; Order DE 74-1, § 173-220-130, filed 2/15/74.]

WAC 173-220-135 Signing of permits. Permits authorized for issuance under chapter 173-220 WAC may be signed by the director or any person designated in WAC 173-06-030.

[Order DE 74-1, § 173-220-135, filed 2/15/74.]

WAC 173-220-140 Schedules of compliance. (1) The department shall establish schedules and permit conditions as follows to achieve compliance with applicable effluent standards and limitations, water quality standards, and other legally applicable requirements:

(a) With respect to any discharge which is found not to be in compliance with applicable effluent standards and limitations, applicable water quality standards, or other legally applicable requirements listed in WAC 173-220-130, the permittee shall be required to take specific steps to achieve compliance with the following:

Any legally applicable schedule of compliance contained in:

(i) Section 301 of FWPCA;

(ii) Applicable effluent standards and limitations;

(iii) Water quality standards; and

(iv) Applicable requirements listed in WAC 173-220-130, 173-220-150, and 173-220-210;

(b) Schedules of compliance, shall set forth the shortest, reasonable period of time, to achieve the specified requirements, such period to be consistent with the guidelines and requirements of the FWPCA.

(2) In any case where the period of time for compliance specified in subsection (1)(a) of this section exceeds one year, a schedule of compliance shall be specified in the permit which will set forth interim requirements and the dates for their achievement; however, in no event shall more than one year elapse between interim dates. If the time necessary for completion of the interim requirement (such as construction of a treatment facility) is more than one year and is not readily divided into stages of completion, interim dates shall be specified for the submission of reports of progress toward completion of the interim requirement.

(3) Either before or up to fourteen days following each interim date and the final date of compliance, the permittee shall provide the department with written notice of the permittee's compliance or noncompliance with the interim or final requirement.

(4) On the last day of the months of February, May, August, and November, the department shall transmit to the regional administrator a list of all instances in the previous ninety days of failure or refusal of a major permittee to comply with an interim or final requirement. Such list shall be available to the public for inspection and copying and shall contain at least the following information on each instance of noncompliance:

(a) Name and address of each noncomplying permittee;

(b) A short description of each instance of noncompliance (e.g., failure to submit preliminary plans, delay in commencement of construction of treatment facility, failure to notify department of compliance with an interim requirement, etc.)

(c) A short description of any actions or proposed actions by the permittee or the department to comply or enforce compliance with the interim or final requirement; and

(d) Any details which explain or mitigate an instance of noncompliance with an interim or final requirement.

(5) If a permittee fails or refuses to comply with an interim or final requirement in a permit, such noncompliance shall constitute a violation of the permit for which the department may modify or revoke the permit or take direct enforcement action.

[Statutory Authority: RCW 90.54.020 and chapter 90.48 RCW. 88-22-059 (Order 88-9), § 173-220-140, filed 11/1/88. Statutory Authority: RCW 90.48.035 and 90.48.260. 82-24-078 (Order DE 82-39), § 173-220-140, filed 12/1/82; Order DE 74-1, § 173-220-140, filed 2/15/74.]

WAC 173-220-150 Other terms and conditions. (1) In addition to the requirements of WAC 173-220-130 and 173-220-140, each issued permit shall require that:

(a) All discharges authorized by the permit shall be consistent with the terms and conditions of the permit;

(b) Any facility expansions, production increases or process modifications which would result in new or increased discharges of pollutants causing effluent limitations in the permit to be exceeded must be reported to the department by submission of a new application or supplement

thereto; or, if such discharge does not violate effluent limitations specified in the permit, by submission to the department of notice of such new or increased discharges of pollutants;

(c) Any discharge of any pollutant more frequent than or at a level in excess of that identified and authorized by the permit shall constitute a violation of the terms and conditions of the permit;

(d) The permit may be modified or revoked in whole or in part during its terms for cause including, but not limited to, the following:

(i) Violation of any term or condition of the permit;

(ii) Obtaining a permit by misrepresentation or failure to disclose fully all relevant facts;

(iii) A change in any condition that requires either a temporary or permanent reduction or elimination of the permitted discharge;

(iv) A determination that the permitted activity endangers human health or the environment, or contributes to water quality standards violations;

(v) Incorporation of an approved local pretreatment program into a municipality's permit;

(vi) Establishment of a toxic effluent standard or prohibition (including any schedule of compliance specified in such effluent standard or prohibition) under section 307(a) of the FWPCA for a toxic pollutant which is more stringent than any limitation upon such pollutant in the permit;

(vii) Failure or refusal of the permittee to allow entry as required in RCW 90.48.090; and

(viii) Nonpayment of permit fees assessed pursuant to RCW 90.48.610.

(e) The permittee shall allow the department or its authorized representative upon the presentation of credentials and at reasonable times:

(i) To enter upon permittee's premises in which an effluent source is located or in which any records are required to be kept under terms and conditions of the permit, subject to any access restrictions due to the nature of the project;

(ii) To have access to, and copy at reasonable cost, any records required to be kept under terms and conditions of the permit;

(iii) To inspect any monitoring equipment or method required in the permit; and

(iv) To sample any discharge of pollutants.

(f) If the permit is for a discharge from a publicly owned treatment works, the permittee shall provide notice to the department of the following:

(i) Any new introduction of pollutants into such treatment works from a source which would be a new source as defined in section 306 of the FWPCA if such source were discharging pollutants;

(ii) Except as to such categories and classes of point sources or discharges specified by the department, any new introduction of pollutants into such treatment works from a source which would be subject to section 301 of the FWPCA if such source were discharging pollutants;

(iii) Any substantial change in volume or character of pollutants being introduced into such treatment works by a source existing at the time of issuance of the permit.

Such notice shall include information on:

(A) The quality and quantity of effluent to be introduced into such treatment works; and

(B) Any anticipated impact of such change in the quantity or quality of effluent to be discharged from such publicly owned treatment works.

(g) The permittee shall at all times properly operate and maintain any facilities or systems of control installed by the permittee to achieve compliance with the terms and conditions of the permit. Where design criteria have been established, the permittee shall not allow flows or waste loadings to exceed approved design criteria, or approved revisions thereto.

(2) Every permit shall be conditioned to insure that any industrial user of any publicly owned treatment works will comply with sections 204(b), 307, and 308 of the FWPCA.

(3) When deemed necessary by the department, any publicly owned treatment works shall be required to develop a full or partial local pretreatment program as specified in 40 CFR Part 403. Permit conditions for a municipality which has received full local pretreatment program approval shall include:

(a) Granting of authority to issue permits under chapter 173-208 WAC;

(b) A requirement to develop, adopt, and enforce a program that is at least as stringent as the department's program under chapter 173-216 WAC; and

(c) A requirement to report to the department at a specified frequency on the status of its implementation.

(4) Permits for domestic wastewater facilities shall be issued only to a public entity, except in the following circumstances:

(a) Facilities existing or approved for construction with private operation on or before the effective date of this chapter, until such time as the facility is expanded; or

(b) Facilities that serve a single nonresidential, industrial, or commercial establishment. Commercial/industrial complexes serving multiple owners or tenants and multiple residential dwelling facilities such as mobile home parks, apartments, and condominiums are not considered single commercial establishments for the purpose of the preceding sentence.

(5) For facilities that are owned by nonpublic entities and under contract to a public entity, the permit shall be issued to the public entity.

[Statutory Authority: RCW 90.54.020 and chapter 90.48 RCW. 88-22-059 (Order 88-9), § 173-220-150, filed 11/1/88. Statutory Authority: Chapter 43.21A RCW. 88-12-035 (Order 88-8), § 173-220-150, filed 5/26/88, effective 7/1/88; 86-06-040 (Order 86-03), § 173-220-150, filed 3/4/86. Statutory Authority: Chapter 90.48 RCW. 84-11-024 (Order DE 84-19), § 173-220-150, filed 5/11/84. Statutory Authority: RCW 90.48.035 and 90.48.260. 82-24-078 (Order DE 82-39), § 173-220-150, filed 12/1/82; Order DE 74-1, § 173-220-150, filed 2/15/74.]

WAC 173-220-160 Transmission of issued permit to regional administrator. Immediately following issuance, the department shall transmit a copy of every issued permit along with any and all terms, conditions, requirements, or documents which are a part of such permit or which affect the authorization by the permit of the discharge of pollutants to the regional administrator.

[Statutory Authority: RCW 90.54.020 and chapter 90.48 RCW. 88-22-059 (Order 88-9), § 173-220-160, filed 11/1/88. Statutory Authority: RCW

90.48.035 and 90.48.260. 82-24-078 (Order DE 82-39), § 173-220-160, filed 12/1/82; Order DE 74-1, § 173-220-160, filed 2/15/74.]

WAC 173-220-170 Relationship with non-NPDES permits. Discharges of pollutants or other wastes that require permits from the department under RCW 90.48.160, which are not satisfied through permits issued under this chapter, shall be subject to the permit requirements of RCW 90.48.160, et seq. Except where permits under RCW 90.48.160 are issued by a municipal corporation pursuant to chapter 173-208 WAC, permit requirements under this chapter and permit requirements under RCW 90.48.160 shall be contained in a single permit document.

[Statutory Authority: RCW 90.48.035 and 90.48.260. 82-24-078 (Order DE 82-39), § 173-220-170, filed 12/1/82; Order DE 74-1, § 173-220-170, filed 2/15/74.]

WAC 173-220-180 Duration and replacement of existing permit. (1) Permits shall be issued for fixed terms not exceeding five years.

(2) Any permittee shall make application for replacement to an existing permit or continuation of a discharge beyond the expiration date of his/her permit by filing with the department an application for replacement of the permit at least one hundred eighty days prior to its expiration.

(3) The scope and manner of any review of an application for replacement of a permit by the department shall be sufficiently detailed as to insure the following:

(a) That the permittee is in substantial compliance with all of the terms, conditions, requirements and schedules of compliance of the expired permit;

(b) That the department has up-to-date information on the permittee's production levels; permittee's waste treatment practices; nature, content and frequencies of permittee's discharge; either pursuant to the submission of new forms and applications or pursuant to monitoring records and reports resubmitted to the department by the permittee; and

(c) That the discharge is consistent with applicable effluent standards and limitations, water quality standards, and other legally applicable requirements listed in WAC 173-220-130.

(4) The notice and public participation procedures specified in WAC 173-220-050 through 173-220-100 are applicable to each draft replacement permit.

(5) When a permittee has made timely and sufficient application for the renewal of a permit, an expiring permit remains in effect and enforceable until the application has been denied or a replacement permit has been issued by the department.

(6) Notwithstanding any other provision in this chapter, any point source, the construction of which is commenced after the date of enactment of the Federal Water Pollution Control Act amendments of 1972 and which is so constructed as to meet all applicable standards of performance, shall not be subject insofar as the FWPCA is concerned to any more stringent standard of performance during a ten year period beginning on the date of completion of such construction or during the period of depreciation or amortization of such facility for the purposes of section 167 or 169 (or both) of the Internal Revenue Code of 1954, whichever period ends first.

[Statutory Authority: RCW 90.54.020 and chapter 90.48 RCW. 88-22-059 (Order 88-9), § 173-220-180, filed 11/1/88. Statutory Authority: RCW 90.48.035 and 90.48.260. 82-24-078 (Order DE 82-39), § 173-220-180, filed 12/1/82; Order DE 74-1, § 173-220-180, filed 2/15/74.]

WAC 173-220-190 Modification and revocation of permits. (1) Any permit issued under this chapter can be modified or revoked in whole or in part by the department for cause including, but not limited to, the causes listed in WAC 173-220-150 (1)(d) or when remanded to the department for modification by the pollution control hearings board.

(2) The department may, upon request of the permittee, modify a schedule of compliance or an operating condition in an issued permit if it determines good and valid cause exists for such revision (such as an act of God, strike, flood, materials shortage, or other event over which the permittee has little or no control and for which there is no other reasonably available remedy).

(3) The department shall modify or revoke permits only after public notice and opportunity for public hearing as provided in this chapter in those instances where changes are proposed which lessen the stringency of effluent limitations. In all other instances, the form of public notice and public participation, if any, shall be determined by the department on a case-by-case basis according to the significance of the proposed action.

[Statutory Authority: RCW 90.54.020 and chapter 90.48 RCW. 88-22-059 (Order 88-9), § 173-220-190, filed 11/1/88. Statutory Authority: RCW 90.48.035 and 90.48.260. 82-24-078 (Order DE 82-39), § 173-220-190, filed 12/1/82; Order DE 74-1, § 173-220-190, filed 2/15/74.]

WAC 173-220-200 Transfer of permit. (1) A permit is automatically transferred to a new discharger if:

(a) A written agreement between the old and new discharger containing a specific date for transfer of permit responsibility, coverage, and liability is submitted to the director; and

(b) The director does not notify the old and new discharger of his/her intent to modify, or revoke and reissue the permit. If this notice is not given, the transfer is effective on the date specified in the agreement mentioned in (a) of this subsection.

(2) Unless a permit is automatically transferred according to subsection (1) of this section, a permit may be transferred only if modified or revoked and reissued to identify the new permittee and incorporate such other requirements as may be necessary.

[Statutory Authority: RCW 90.54.020 and chapter 90.48 RCW. 88-22-059 (Order 88-9), § 173-220-200, filed 11/1/88. Statutory Authority: RCW 90.48.035 and 90.48.260. 82-24-078 (Order DE 82-39), § 173-220-200, filed 12/1/82; Order DE 74-1, § 173-220-200, filed 2/15/74.]

WAC 173-220-210 Monitoring, recording and reporting. (1) Monitoring.

(a) Any discharge authorized by a permit may be subject to such monitoring requirements as may be reasonably required by the department, including the installation, use, and maintenance of monitoring equipment or methods (including, where appropriate, biological monitoring methods). These monitoring requirements would normally include:

(i) Flow (in gallons per day);

(ii) Pollutants (either directly or indirectly through the use of accepted correlation coefficients or equivalent measurements) which are subject to reduction or elimination under the terms and conditions of the permit;

(iii) Pollutants which the department finds could have a significant impact on the quality of surface waters; and

(iv) Pollutants specified by the administrator, in regulations issued pursuant to the FWPCA, as subject to monitoring.

(b) Each effluent flow or pollutant required to be monitored pursuant to (a) of this subsection shall be monitored at intervals sufficiently frequent to yield data which reasonably characterizes the nature of the discharge of the monitored effluent flow or pollutant.

Variable effluent flows and pollutant levels may be monitored at more frequent intervals than relatively constant effluent flows and pollutant levels which may be monitored at less frequent intervals.

(c) Monitoring of intake water, influent to treatment facilities, internal waste streams, and/or receiving waters may be required when determined necessary by the department to verify compliance with net discharge limitations or removal requirements, to verify that proper waste treatment or control practices are being maintained, or to determine the effects of the discharge on the surface waters of the state.

(2) Recording of monitoring activities and results. Any permit which requires monitoring of the authorized discharge shall require that:

(a) The permittee shall maintain records of all information resulting from any monitoring activities required of him in his permit;

(b) Any records of monitoring activities and results shall include for all samples:

(i) The date, exact place, and time of sampling;

(ii) The dates analyses were performed;

(iii) Who performed the analyses;

(iv) The analytical techniques/methods used; and

(v) The results of such analyses; and

(c) The permittee shall be required to retain for a minimum of three years any records of monitoring activities and results including all original strip chart recording for continuous monitoring instrumentation and calibration and maintenance records. 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 department or regional administrator.

(3) Reporting of monitoring results.

(a) The permittee shall periodically report (at a frequency of not less than once per year) on the proper reporting form, the monitoring results obtained pursuant to monitoring requirements in a permit. In addition to the required reporting form, the department at its discretion may require submission of such other results as it determines to be necessary.

(b) Monitoring reports shall be signed by:

(i) In the case of corporations, by a responsible corporate officer or his duly authorized representative, if such representative is responsible for the overall operation of the facility from which the discharge originates.

(ii) In the case of a partnership, by a general partner.

(iii) In the case of a sole proprietorship, by the proprietor.

(iv) In the case of a municipal, state or other public facility, by either a principal executive officer, ranking elected official, or other duly authorized employee.

(4) Use of registered or accredited laboratories:

(a) Except as established in (c) of this subsection, monitoring data submitted to the department in accordance with this chapter shall be prepared by a laboratory accredited under the provisions of chapter 173-50 WAC no later than indicated by the appropriate date below:

July 1, 1992, major dischargers;

July 1, 1993, all permittees with a permitted average flow rate greater than five million gallons per day.

These requirements are effective and binding on all permittees under the authority of rule, regardless of whether they have been included as conditions of a permit.

(b) Except as established in (c) of this subsection, monitoring data submitted to the department in accordance with this chapter shall be prepared by a laboratory registered or accredited under the provisions of chapter 173-50 WAC no later than July 1, 1994, for all NPDES permittees not covered under (a) of this subsection.

These requirements are effective and binding on all permittees under the authority of rule, regardless of whether they have been included as conditions of a permit.

(c) The following parameters need not be accredited or registered:

(i) Flow;

(ii) Temperature;

(iii) Settleable solids;

(iv) Conductivity, except that conductivity shall be accredited if the laboratory must otherwise be registered or accredited;

(v) pH, except that pH shall be accredited if the laboratory must otherwise be registered or accredited; and

(vi) Parameters which are used solely for internal process control.

[Statutory Authority: RCW 43.21A.230. 93-20-011 (Order 92-53), § 173-220-210, filed 9/22/93, effective 10/23/93; 90-21-090 (Order 90-21), § 173-220-210, filed 10/19/90, effective 11/19/90. Statutory Authority: RCW 90.54.020 and chapter 90.48 RCW. 88-22-059 (Order 88-9), § 173-220-210, filed 11/1/88. Statutory Authority: Chapter 90.48 RCW. 84-11-024 (Order DE 84-19), § 173-220-210, filed 5/11/84. Statutory Authority: RCW 90.48.035 and 90.48.260. 82-24-078 (Order DE 82-39), § 173-220-210, filed 12/1/82; Order DE 74-1, § 173-220-210, filed 2/15/74.]

WAC 173-220-225 Appeals. Individual permits are subject to appeals as specified in chapter 43.21B RCW.

[Statutory Authority: Chapter 90.48 RCW. 93-10-099 (Order 92-55), § 173-220-225, filed 5/5/93, effective 5/19/93. Statutory Authority: RCW 90.54.020 and chapter 90.48 RCW. 88-22-059 (Order 88-9), § 173-220-225, filed 11/1/88. Statutory Authority: RCW 90.48.035 and 90.48.260. 82-24-078 (Order DE 82-39), § 173-220-225, filed 12/1/82.]

WAC 173-220-230 Enforcement. (1) The department, with the assistance of the attorney general, may sue in courts of competent jurisdiction to enjoin any threatened or continuing violations of any permits or conditions thereof without the necessity of a prior revocation of the permit;

(2) The department may enter any premises in which an effluent source is located or in which records are required to be kept under terms or conditions of a permit, and otherwise

be able to investigate, inspect, or monitor any suspected violations of water quality standards, or effluent standards and limitations, or of permits or terms or conditions thereof;

(3) The department may assess or, with the assistance of the attorney general, sue to recover in court, such civil fines, penalties, and other civil relief as may be appropriate for the violation by any person of (a) any effluent standards and limitations or water quality standards, (b) any permit or term or condition thereof, (c) any filing requirements, (d) any duty to permit or carry out inspection, entry, or monitoring activities, or (e) any rules, regulations, or orders issued by the department.

(4) The department may request the prosecuting attorney to seek criminal sanctions for the violation by such persons of (a) any effluent standards and limitations or water quality standards, (b) any permit or term or condition thereof, (c) any filing requirements.

(5) The department, with the assistance of the prosecuting attorney, may seek criminal sanctions against any person who knowingly makes any false statement, representation, or certification in any form or any notice or report required by the terms and conditions of any issued permit or knowingly renders inaccurate any monitoring device or method required to be maintained by the department.

[Order DE 74-1, § 173-220-230, filed 2/15/74.]

WAC 173-220-240 Relationship of department of ecology to permits issued by the energy facility site evaluation council. (1) The energy facility site evaluation council (EFSEC) shall be the state agency to receive applications for, issue, and modify permits for energy facilities subject to chapter 80.50 RCW. Processing of such applications shall be controlled by chapter 463-38 WAC. Application for issuance and modification of permits for all other energy facilities shall be the responsibility of the department.

(2) Monitoring, recording, and reporting activities required of operators of all energy facilities by the terms of a permit issued by EFSEC shall be supervised and enforced by the department.

(3) The department shall carry on an inspection program for the periodic inspection (to be performed not less than once every year) of discharges of pollutants from energy facilities authorized by a permit issued by EFSEC. Such inspections shall determine compliance or noncompliance with issued permits and, in particular, compliance or noncompliance with specific effluent limitations and schedules of compliance in such permits.

(4) The department shall carry on a surveillance program with respect to energy facility discharges for the random sampling and analysis of the discharge for the purpose of identifying occasional and continuing violations of permit conditions and the accuracy of information submitted by permittees in reporting forms.

(5) Enforcement activities regarding the NPDES program, including the levying of civil and criminal fines pertaining to all thermal power plants, whether the permit is issued by the department or EFSEC, shall be undertaken by the department, EFSEC, the attorney general, or the prosecuting attorney, as appropriate.

(6) Nothing in this section shall authorize the department to undertake enforcement or monitoring activities in a manner not consistent with the terms and conditions of any EFSEC-issued NPDES permit.

[Statutory Authority: RCW 90.48.035 and 90.48.260. 82-24-078 (Order DE 82-39), § 173-220-240, filed 12/1/82; Order DE 74-1, § 173-220-240, filed 2/15/74.]

WASHINGTON STATE DEPARTMENT OF ECOLOGY

Wastewater Discharge Permits in Washington State

Short History of the Wastewater Discharge Permit Program

The water pollution control program in Washington state is based on both federal and state law. The state of Washington began a formal pollution program in 1945, three years before the first federal legislation dealing specifically with water pollution was enacted.

Twenty years after Washington started its pollution control program, the first federal legislation to require states to adopt water quality standards for interstate waters was enacted in the Water Quality Act of 1965. This law required state or federal authorities to show a direct link between a discharge and a specific water quality problem before they could require controls on the discharge of pollutants. Thus, the Water Quality Act of 1965 was very difficult to enforce.

In 1971, Washington enacted the Pollution Disclosure Act, which required dischargers to use "all known, available and reasonable methods of treatment (of waste water), prior to discharge, regardless of the quality of water ... to which the wastes are discharged." This law signaled a change in state philosophy to emphasize technology-based control of pollutants. Washington state agencies no longer had to demonstrate a direct link between water pollution problems and an individual discharger to control pollution. Instead, all dischargers were required to meet treatment standards, regardless of the quality of receiving waters.

The federal Water Pollution Control Act Amendments of 1972 adopted the philosophy of technology-based control that Washington law had outlined the previous year. When amended in 1977, the Act became popularly known as the Clean Water Act (CWA). This act, in conjunction with our state laws, serves as the basis and framework for Washington state's present water quality regulatory program.

The Clean Water Act set a national goal to "restore and maintain the chemical, physical, and biological integrity of the Nation's waters" and to "eliminate the discharge of pollutants" into navigable waters by 1985. In the interim, regulations were written to "provide for the protection and propagation of fish, shellfish, and wildlife and provide for recreation in and on the water." Toward those ends, the Clean Water Act prohibited the discharge of pollutants in toxic amounts.

The Water Pollution Control Act of 1972 and subsequent amendments also created the National Pollution Discharge Elimination System (NPDES). NPDES is a system for issuing permits for wastewater discharges to surface waters. The purpose of the permits is to control pollutants as a means to achieving the goals of the Clean Water Act.

In 1973, Washington became one of the first states to be delegated by the U.S. Environmental Protection Agency the authority to administer NPDES permits in addition to its state permit program.

What is a Wastewater Discharge Permit?

A wastewater discharge permit is a legal document issued by the Department of Ecology to control the discharge of wastewater to surface or ground waters and to publicly owned sewage systems.

Permits place limits on the quantity and concentrations of contaminants that may be discharged. When necessary, permits require treatment of wastewater or impose other operating conditions on dischargers to ensure that permit limits are met.

Permits may also set other conditions, including monitoring and reporting requirements, spill prevention planning, and other regulatory activities.

Permits are written by engineers and environmental scientists in Ecology. Most permits have a five-year life span.

Who Needs a Permit?

Washington administers both state wastewater discharge permits and federal National Pollutant Discharge Elimination System, or NPDES, permits.

State wastewater discharge permits are required for anyone who discharges waste materials from a commercial or industrial operation to ground or to a publicly owned treatment plant and for municipalities who discharge to ground.

NPDES permits are required for anyone who discharges wastewater to, or has a significant potential to impact, surface waters of the state.

Kinds of Permits

The State of Washington issues two types of wastewater discharge permits:

❖ Individual permits cover single, specific facilities or activities like factories.

❖ General permits cover a category of similar dischargers. Boatyards and upland fin fish hatcheries are examples of industries which have similar discharges and are covered under a general permit.

Individual and general permits may be issued either as a state permit or an NPDES permit. When discharges are to surface waters and to ground or a treatment plant, the discharges are covered by a combined state/NPDES permit.

What is a Permit Fact Sheet?

Fact sheets are companion documents to permits. Their primary purpose is to provide a record of how the requirements in the permit were derived.

Fact sheets explain the nature of the proposed discharge, Ecology's decisions on limiting the pollutants in the wastewater, and the regulatory and technical basis for those decisions.

Fact sheets also document the history of the permit through reissuances and amendments, summarize the administrative record of the permit issuance, and serve as an informational document for the public.

Fact sheets and some of their contents are required by federal and state law.

Principles of the Permit Program

Washington's goal is to maintain the highest purity of public waters by limiting pollutant discharges to the greatest extent possible. Four principles drive the Washington wastewater discharge permit program toward that goal:

❖ The discharge of pollutants is *not* a right. A permit is *required* to use the waters of the state, a public resource, for purposes of wastewater discharge.

❖ Permits limit the amount of pollutants to be discharged.

❖ Wastewater must be treated with all known available and reasonable technology before it is discharged—regardless of the quality of the water into which it is discharged.

❖ Effluent limits are set using technology-based *and* water quality-based standards. The more stringent of the two limits is always applied.

How to Read a Fact Sheet

Fact sheets detail the principal technical and scientific facts and the significant legal and policy decisions that were made when setting the terms and conditions of the permit. The fact sheet should, therefore, be used as a reference document when evaluating the terms and conditions of a permit. Certain elements of the fact sheet are of particular interest when reviewing a permit.

> **FACT SHEET**
>
> This fact sheet is a companion document to the draft National Discharge Elimination System (NPDES) Permit No. WA-XXXXXX-X. The Department of Ecology (the Department) is proposing to issue this permit, which will allow discharge of wastewater to waters of the State of Washington.
>
> This fact sheet explains the nature of the proposed discharge, the Department's decisions on limiting the pollutants in the wastewater, and the regulatory and technical basis for those decisions. Public involvement information is contained in Appendix A. Definitions are included in Appendix B.
>
> **GENERAL INFORMATION**
>
> Applicant: HOMETOWN ENTERPRISES, INC.
>
> Facility Name and Address: FINISHING OPERATIONS PLANT
1 FINISHING WAY
HOMETOWN, WA
>
> Type of Facility: ELECTROPLATING
>
> Discharge Location: HOMETOWN BAY, PUGET SOUND
>
> The Hometown Finishing Operations Plant discharges directly into Hometown Bay via a discharge pipe. The end of the disharge pipe is located 300 feet into Hometown Bay, approximately 1 mile east of Purdy Point and 550 yards west of the mouth of Purdy Creek.
>
> Latitude: 47° 30′ 05″ N.
Longitude: 122° 30′ W.
>
> Water Body ID Number: WA-01-0000

Where to look for key information in a fact sheet:

Facility Description - Each fact sheet has a cover sheet which provides the applicant's name and address, the location of the discharge in narrative form and as a latitude and longitude (when available), and a brief description of the type of operation and expected discharge.

Background Information - The background information section of the fact sheet describes the applicant's operations and wastewater discharge in greater detail. The official state classification of the receiving water (the water discharged into) is cited and common uses of the receiving water are described. The background section also summarizes the past performance, or compliance history, of a permit renewal applicant and outlines permit limitations from the previous permit. These are valuable for comparison to new or modified permit limitations in the proposed permit.

Permit Limitations and Conditions - Waste discharge permits must contain conditions that ensure a discharge will meet established water quality standards. Water quality standards are designed to protect the beneficial uses of the waters of the state.

❖ *Effluent limitations* are specific restrictions on the volume and concentration of certain pollutants that can be discharged. Permit conditions specify how a facility must operate to remain within the effluent limits. This section of the fact sheet describes both the scientific and legal basis on which the limits and conditions in the permit were derived. For permit renewal, this section of the fact sheet also presents comparisons of proposed limitations and conditions with those in the previous permit.

Federal and state regulations require that effluent limitations in a permit must be either *technology-based* or *water quality-based*. The more stringent of these two types of limits must be chosen for each pollutant of concern.

Technology-based limitations are performance standards established under federal and state regulations. *For example:* For a kraft (unbleached) pulp mill the technology based standard is 2.8 lbs. of Biochemical Oxygen Demand (oxygen consuming pollutant) per 1000 pounds of pulp production.

How to Read a Fact Sheet (cont.)

Water quality-based limitations are based upon compliance with the state water quality standards. *For example:* If the technology based standard above is not strict enough to protect the water quality standard of >7.0 mg/L dissolved oxygen a limit of less than 2.8 lbs of Biochemical Oxygen Demand per 1000 pounds of production would be required.

Technology-based effluent limits for the discharge are derived first. Washington state requires dischargers to use all known and available reasonable technology (AKART) to control pollutants in their effluent.

If technology-based controls fail to cause a discharge to meet state water quality standards, the permit will impose additional conditions so the discharge meets water quality standards. These are water quality-based effluent limits.

Water quality-based limits consider the variability of the pollutant concentrations in both the effluent and the receiving water. Water quality-based limits are determined for the water body's critical condition. The critical condition is the combination of receiving water and waste discharge conditions which has the highest potential to harm aquatic biota or existing uses of the receiving waters.

❖ *Monitoring and Reporting* - Effluent monitoring, recording, and reporting are required in most permits to verify that treatment or control processes are functioning correctly and that effluent limitations are being achieved. The monitoring and testing schedule is detailed in the permit under Condition S.2.

Specified monitoring frequencies take into account the quantity and variability of discharge, the treatment method, past compliance, significance of pollutants, and cost of monitoring. The frequency of monitoring is the minimum frequency needed to document compliance.

Other Permit Conditions - The fact sheet also describes specific activities that are required of the discharger. Requirements for preparation of pollution prevention plans, spill control plans, and other operating conditions are in this section.

Appendices - *Appendix A* contains information about how the permit development process has been advertised. Opportunities for public involvement in the development of the final permit are also included here.

Appendix B is a glossary of terms intended to help interpret complex permit language.

Major Elements of Washington Water Quality Standards

Numerical Criteria

Numerical water quality criteria are values for specific pollutants or parameters listed in Washington's Water Quality Standards. The standards are used to specify the the level of protection in a receiving water for specific pollutants or other parameters. For example: *The water quality standards for Class A waters set the numeric criteria for the pollutant copper at 2.5 µg/L in marine water and for the parameter dissolved oxygen at 7.0 mg/L in Class A waters. Numerical criteria are used to derive the water quality-based effluent limits in a discharge permit.*

Narrative Criteria

Narrative criteria describe the specific beneficial uses of all fresh and marine waters in Washington. Narrative water quality criteria are used in addition to numerical criteria to set limits for toxicity, radioactivity, and other harmful impacts of pollutants. Narrative criteria are also used to prohibit impairment of the aesthetic value of the waters of the state. An example of narrative criteria in the water quality standards is: *"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."*

Antidegradation Policy

Washington's antidegradation policy states that discharges into a receiving water can not degrade the existing water quality of the water body. The natural conditions of a receiving water constitute the water quality criteria, whether the natural conditions are of higher or lower quality than the criteria assigned. Antidegradation is currently addressed through the use of water quality-based effluent limitations.

Mixing Zones

The water quality standards allow Ecology to authorize mixing zones around a discharge point when establishing water quality-based effluent limits. Mixing zones are areas in which effluent has an opportunity to mix with receiving waters. The size of mixing zones is determined by the amount of dilution of effluent in receiving waters that is needed to meet criteria. Acute and chronic mixing zones may be set for potentially toxic pollutants. Mixing zones can be authorized only after all known, available, and reasonable methods of pollution prevention and control technology (AKART) have been applied.

The Individual Permit Process and Opportunities for Public Involvement

Ecology uses the same basic procedures to develop each individual wastewater discharge permit. However, public involvement opportunities may vary, depending on the significance of the discharge and public concern. Those stages in the process which offer the best opportunities for public involvement are labeled to coincide with the numbers in the flow chart.

Dischargers must file a *permit application* with Ecology. Permit applications are often complex and may be accompanied by detailed engineering or environmental reports. Applications must include results of analyses of pollutants in the effluents, effluent toxicity data, and other technical information about a facility and its operating procedures.

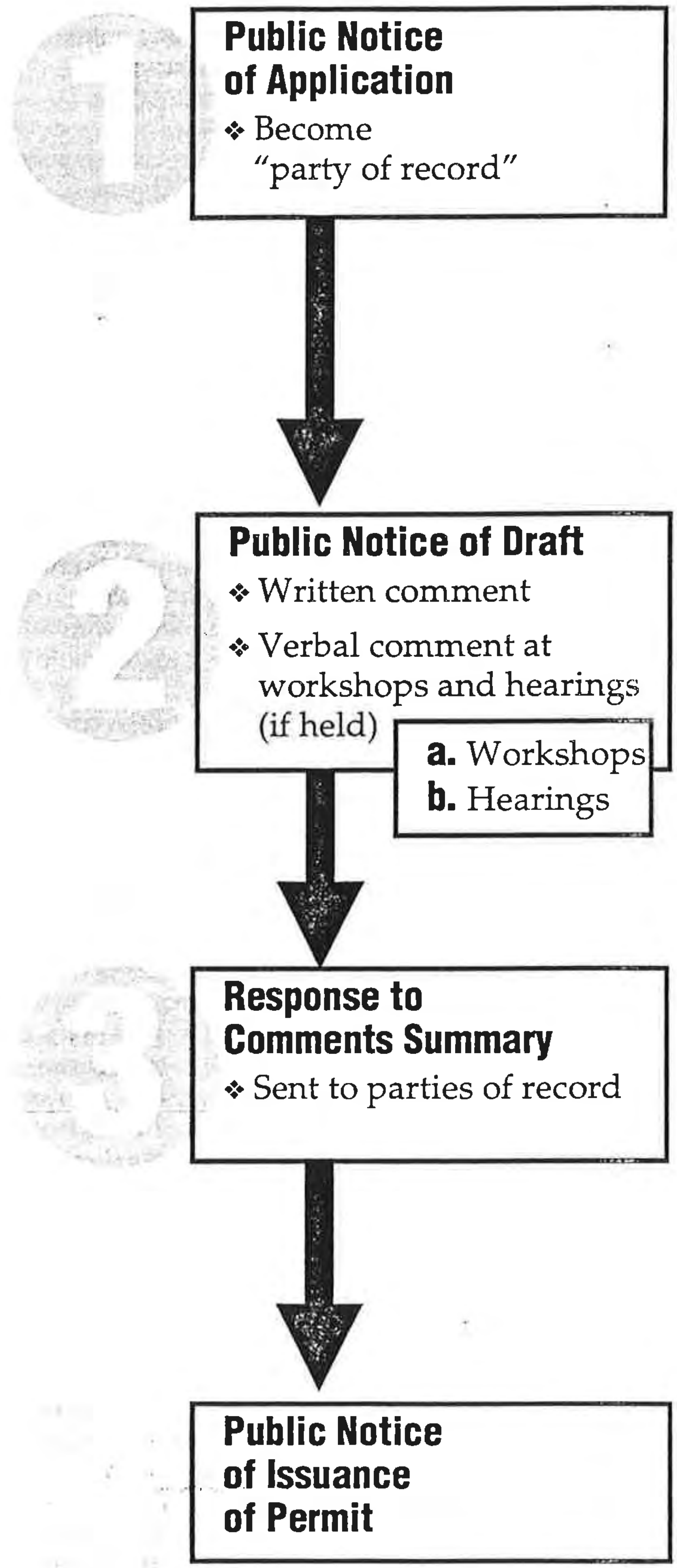
Ecology reviews each application for completeness and accuracy. Ecology may require applicants to conduct studies to gather more information about their processes and discharges before an application is accepted. Ensuring that the application is thorough and complete may require site visits as well as extensive consultation and technical assistance from Ecology.

When the permit application is accepted, Ecology releases a *Public Notice of Application* (PNOA). PNOAs may be published as legal classified advertisements or display advertisements in the geographical areas effected by the permit. PNOAs may also be mailed to persons on the water quality permits "interested parties" mailing list. Persons on this list have expressed an interest in all permit issuance activities. Procedures to get on the mailing list are specified on Page 7 of this document.

The PNOA informs the interested public that an application has been accepted and that Ecology has tentatively decided to develop a permit for the applicant. The Notice of Application invites the public to make its interest in the permit known.

All persons who respond to the PNOA, and all subsequent notices, are placed on a permit-specific mailing list as "parties of record." Parties of record will receive all further notices regarding that permit. The parties of record list is maintained through the lifetime of the permit and revised upon renewal.

The permit writer drafts a permit and fact sheet using data supplied by the discharger in the application, from information gathered during



The Individual Permit Process *(continued)*

personal inspections of the facilities, and from extensive research into operations and technologies of the industry being considered for a permit. The *application, fact sheet, and permit* make up a permit package. All three parts of the permit package are available for public review and comment upon request.

When the draft permit is complete, a *Public Notice of Draft Permit* (PNOD) is published in the legal classified section of major newspapers in the geographic area of the discharge. Parties of record will also receive a PNOD by mail. Other forms of public notice may also be used to advertise that a draft permit is available.

The PNOD invites the public to review the draft permit and to make their views on the proposed permit action known to Ecology. All PNODs explain how to obtain copies of the permit and fact sheet and list those Ecology offices that offer information and assistance to interested persons.

The normal comment period for a draft permit is 30 days after publication of the PNOD; however, the comment period can be extended by Ecology to increase opportunity for public input. The comment period is often extended when Ecology holds public hearings on the permit.

Ecology often conducts informal public meetings during the comment period for significant permits. Meetings are held to inform interested persons about the conditions of a proposed permit and to learn of public interests and concerns about the permit. Meetings or workshops are held at Ecology's discretion unless a formal hearing is planned on the permit. Informational meetings are required before hearings.

Public Notices of Meetings may appear as display advertisements, legal advertisements, via mail, or in news releases which detail the time and location of each session and the subject matter to be discussed. Parties of record will be notified of meetings by mail. Notice of upcoming meetings will often be included in Notices of Hearings.

Hearings are formal sessions which offer individuals or groups an opportunity to publicly voice their opinions on the terms and conditions of a proposed permit. Statements made in hearings are regarded as formal testimony and become part of the permit record.

Anyone may request that Ecology hold a hearing, but Ecology has the authority to decide whether a hearing is warranted. Hearings are held any time that Ecology feels that there is sufficient public interest and a likelihood of meaningful public comment on a permit.

Public Notices of Hearing appear as display advertisements in major newspapers in the geographical area of the proposed discharge. Notices of Hearings are also mailed to parties of record. Other forms of advertising may also be used to announce hearings. Hearing notices are published at least 30 days prior to the date of the hearing.

Comments may be submitted to Ecology on the terms and conditions of a proposed permit throughout the permit development process, beginning with the Notice of Application stage. Notices of Draft Permit, Meetings, and Hearings will clearly state the comment deadline date.

After the close of the comment period, Ecology reviews and evaluates all comments and information obtained regarding the proposed permit. Ecology then writes a *Responsiveness Summary* to address those comments and suggestions. The responsiveness summary details significant changes made to the permit as a result of public comments.

The responsiveness summary is mailed to parties of record and upon request.

Major changes made in the terms and conditions of the proposed permit following public review may require that Ecology re-advertise the permit to obtain public comment on the permit. Major revisions may reopen the permit process for written public comment and may initiate another series of public meetings and hearings.

When public review and comment does not result in major revisions in the terms and conditions of the draft permit, the permit may be issued.

A permit becomes effective when it is signed by the Water Quality program manager or a designee. Ecology mails a *Notice of Issuance* to parties of record upon issuance.

The conditions of a permit can be appealed after the permit has been issued. An appeal may result in changes in the final permit.

The Individual Permit Process

A permit may also be **modified** during its term. Ecology may, if necessary, modify a permit to impose numerical limitations to meet water quality standards, sediment quality standards, or based on new information obtained from sources such as inspections, effluent monitoring, outfall studies, and effluent mixing studies. Ecology may also modify a permit as a result of new or amended state or federal regulations. Permit modifications may also be required when a facility's operational changes result in changes in effluent volumes or character.

Parties of record will be notified by mail of appeals, resolution of appeals, and suspensions, modifications, or revocations of a permit throughout its lifetime.

Permits must be renewed or administratively extended every five years. Ecology will issue a *Public Notice of Application* for a renewal as a legal classified advertisement and will notify all persons on the permit-specific Parties of Record list. All respondents to that Notice will be placed on a new mailing list for that permit and all non-respondents dropped from the list. All subsequent procedures are the same as those for a new permit.

For Information About Permits or for Assistance to Participate in the Permit Process:

Statewide:
Water Quality Permit Program staff are the primary source for general information about wastewater discharge permits and the wastewater discharge permit program statewide. Public outreach staff also offers advice and assistance to groups or individuals who wish to participate in the permit process.

Public outreach staff will, upon request, also place your name on the Water Quality Program mailing list to receive wastewater permit information.

Contact:
Ray Hennekey
Water Quality Program Public Outreach Coordinator
PO Box 47600
Olympia, Washington
98504-7696
(206) 407-6428
Toll Free:
1-800-633-6193.

Ecology Regional Offices:

Water Quality permit coordinators in each of the regional offices are the primary contacts for information about specific permits that are being developed or administered in their region. Permit coordinators can also place your name on a mailing list to receive notices of regional permit actions.

Northwest Regional Office
Carla Skog
(206) 649-7201
3190 160th Avenue SE
Bellevue, Washington
98008-5452
For: *King, Whatcom, Skagit, Snohomish, San Juan, Kitsap, and Island counties.*

Southwest Regional Office
Holly Francis
(206) 407-6280
P.O. Box 47775
Olympia, Washington
98504-7775
For: *Thurston, Clallam, Jefferson, Grays Harbor, Mason, Pierce, Lewis, Skamania, Wahkiakum, Cowlitz, Clark, and Pacific counties.*

Central Regional Office
Steve Huber
(509) 575-2680
106 South 6th Avenue
Yakima, Washington
98902-3387
For: *Yakima, Benton, Klickitat,Chelan, Douglas, Kittitas*, and *Okanogan* counties.

Eastern Regional Office
Mike Huffman
(509) 456-2874
N 4601 Monroe,
Suite 100
Spokane, Washington
99205-1295
For: *Spokane, Grant, Adams, Whitman, Franklin, Ferry, Stevens, Pend Oreille*, and *Lincoln* counties.

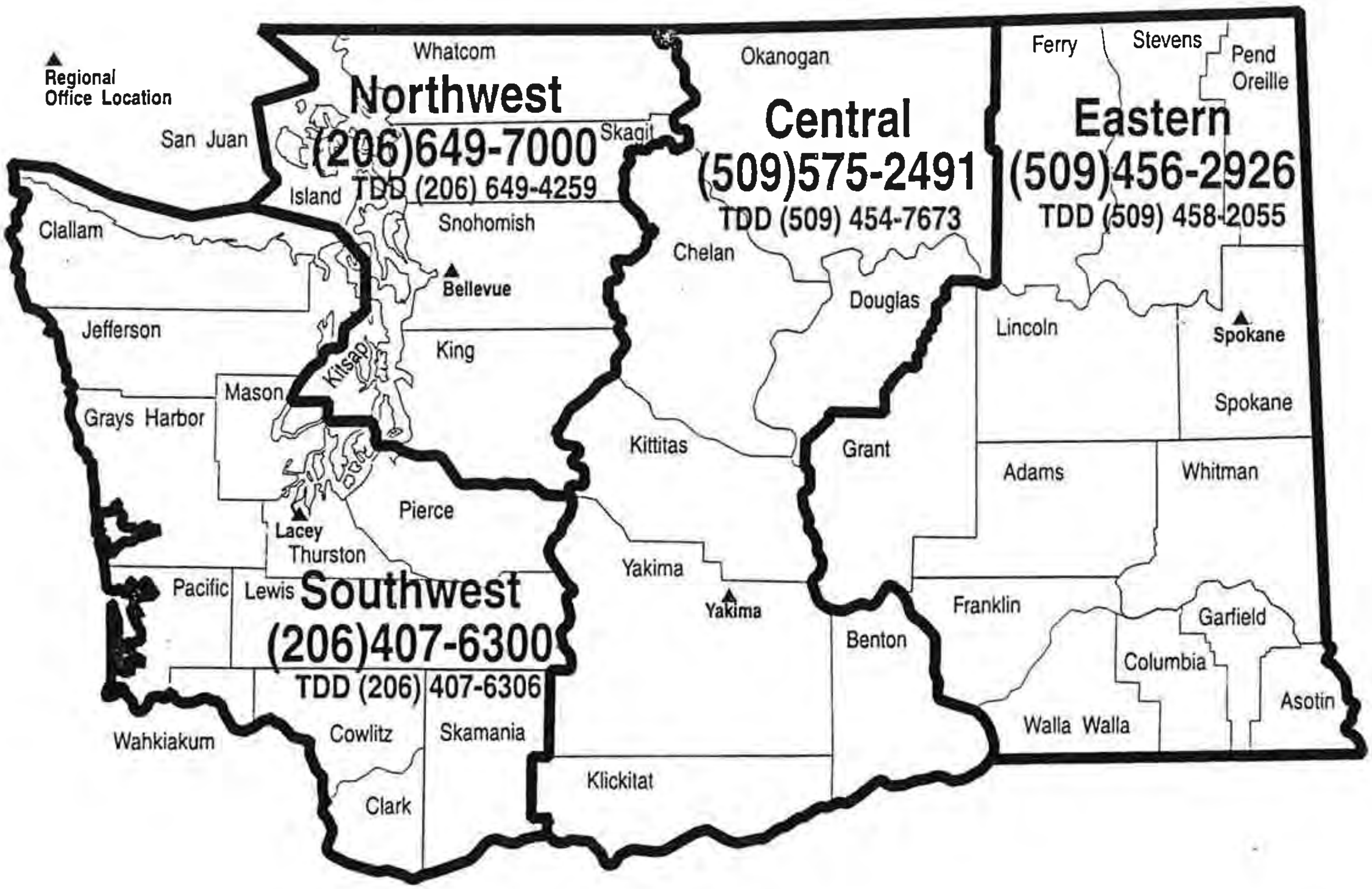
Industrial Permits Section
Arlene Army
(206) 586-1074
PO Box 47706
Olympia, Washington
98504-7706
For: *Major industrial facilities such as pulp mills, oil refineries, or aluminum plants statewide.*

The Department of Ecology is an Equal opportunity and Affirmative Action employer and shall not discriminate on the basis of race, creed, color, national origin, sex, marital status, sexual orientation, age religion, or disability as defined by applicable state and/or federal regulations or statutes.

If you have special accommodation needs, please contact Ray Hennekey Water Quality Program Public Outreach Coordinator. Phone (206) 407-6428. Ecology's telecommunications device for the deaf (TDD) number is (206) 407-6006. Regional TDD numbers are:

SWRO (206) 664-8785
NWRO (206) 649-4259
CRO (509) 454-7673
ERO (509) 458-2055

Ecology's Regional Offices



Washington State Department of Ecology
Water Quality Public Outreach
P.O. Box 47600
Olympia, Washington 98504-7600

United States
Environmental Protection
Agency

Office of
Enforcement
Washington, DC 20460

EPA Form 3510-1
Revised August 1990

Permits Division

EPA

Application Form 1 - General Information

Consolidated Permits Program

This form must be completed by all persons applying for a permit under EPA's Consolidated Permits Program. See the general instructions to Form 1 to determine which other application forms you will need.

Printed on Recycled Paper

Paperwork Reduction Act Notice

The public reporting burden for this collection of information is estimated to average 3 hours per response. This estimate includes time for reviewing instructions, searching existing data sources, gathering and maintaining the needed data, and completing and reviewing the collection of information. Send comments regarding the burden estimate or any other aspect of this collection of information to the Chief, Information Policy Branch (PM-223), US Environmental Protection Agency, 401 M Street, SW, Washington, DC 20460, and to the Office of Information and Regulatory Affairs, Office of Management and Budget, Washington, DC 20503, marked **Attention:** Desk Officer for EPA.

DESCRIPTION OF CONSOLIDATED PERMIT APPLICATION FORMS

The Consolidated Permit Application Forms are:

Form 1 — General Information *(included in this part)*;

Form 2 — Discharges to Surface Water *(NPDES Permits)*:

2A. Publicly Owned Treatment Works *(Reserved — not included in this package)*,

2B. Concentrated Animal Feeding Operations and Aquatic Animal Production Facilities *(not included in this package)*,

2C. Existing Manufacturing, Commercial, Mining, and Silvicultural Operations *(not included in this package)*, and

2D. New Manufacturing, Commercial, Mining, and Silvicultural Operations *(Reserved — not included in this package)*;

Form 3 — Hazardous Waste Application Form *(RCRA Permits — not included in this package)*;

Form 4 — Underground Injection of Fluids *(UIC Permits — Reserved — not included in this package)*; and

Form 5 — Air Emissions in Attainment Areas *(PSD Permits — Reserved — not included in this package)*.

FORM 1 PACKAGE TABLE OF CONTENTS

SECTION A — GENERAL INSTRUCTIONS

Who Must Apply

With the exceptions described in Section C of these instructions, Federal laws prohibit you from conducting any of the following activities without a permit.

NPDES *(National Pollutant Discharge Elimination System Under the Clean Water Act, 33 U.S.C. 1251)*. Discharge of pollutants into the waters of the United States.

RCRA *(Resource Conservation and Recovery Act, 42 U.S.C. 6901)*. Treatment, storage, or disposal of hazardous wastes.

UIC *(Underground Injection Control Under the Safe Drinking Water Act, 42 U.S.C. 300f)*. Injection of fluids underground by gravity flow or pumping.

PSD *(Prevention of Significant Deterioration Under the Clean Air Act, 72 U.S.C. 7401)*. Emission of an air pollutant by a new or modified facility in or near an area which has attained the National Ambient Air Quality Standards for that pollutant.

Each of the above permit programs is operated in any particular State by either the United States Environmental Protection Agency *(EPA)* or by an approved State agency. You must use this application form to apply for a permit for those programs administered by EPA. For those programs administered by approved States, contact the State environmental agency for the proper forms.

If you have any questions about whether you need a permit under any of the above programs, or if you need information as to whether a particular program is administered by EPA or a State agency, or if you need to obtain application forms, contact your EPA Regional office *(listed in Table 1)*.

Upon your request, and based upon information supplied by you, EPA will determine whether you are required to obtain a permit for a particular facility. Be sure to contact EPA if you have a question, because Federal laws provide that **you may be heavily penalized if you do not apply for a permit when a permit is required.**

Form 1 of the EPA consolidated application forms collects general information applying to all programs. You must fill out Form 1 regardless of which permit you are applying for. In addition, you must fill out one of the supplementary forms *(Forms 2 — 5)* for each permit needed under each of the above programs. Item II of Form 1 will guide you to the appropriate supplementary forms.

You should note that there are certain exclusions to the permit requirements listed above. The exclusions are described in detail in Section C of these instructions. If your activities are excluded from permit requirements then you do not need to complete and return any forms.

NOTE: Certain activities not listed above also are subject to EPA administered environmental permit requirements. These include permits for ocean dumping, dredged or fill material discharging, and certain types of air emissions. Contact your EPA Regional office for further information.

Table 1. Addresses of EPA Regional Contacts and States Within the Regional Office Jurisdictions

REGION I

Permit Contact, Environmental and Economic Impact Office, U.S. Environmental Protection Agency, John F. Kennedy Building, Boston, Massachusetts 02203, (617) 223–4635, FTS 223–4635.
Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, and Vermont.

REGION II

Permit Contact, Permits Administration Branch, Room 432, U.S. Environmental Protection Agency, 26 Federal Plaza, New York, New York 10007, (212) 264–9880, FTS 264–9880.
New Jersey, New York, Virgin Islands, and Puerto Rico.

REGION III

Permit Contact *(3 EN 23)*, U.S. Environmental Protection Agency, 6th & Walnut Streets, Philadelphia, Pennsylvania 19106, (215) 597–8816, FTS 597–8816.
Delaware, District of Columbia, Maryland, Pennsylvania, Virginia, and West Virginia.

REGION IV

Permit Contact, Permits Section, U.S. Environmental Protection Agency, 345 Courtland Street, N.E., Atlanta, Georgia 30365, (404) 881–2017, FTS 257–2017.
Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, and Tennessee.

REGION V

Permit Contact *(5EP)*, U.S. Environmental Protection Agency, 230 South Dearborn Street, Chicago, Illinois 60604, (312) 353–2105, FTS 353–2105.
Illinois, Indiana, Michigan, Minnesota, Ohio, and Wisconsin.

Table 1 *(continued)*

REGION VI

Permit Contact *(6AEP)*, U.S. Environmental Protection Agency, First International Building, 1201 Elm Street, Dallas, Texas 75270, (214) 767–2765, FTS 729–2765.
Arkansas, Louisiana, New Mexico, Oklahoma, and Texas.

REGION VII

Permit Contact, Permits Branch, U.S. Environmental Protection Agency, 324 East 11th Street, Kansas City, Missouri 64106, (816) 758–5955, FTS 758–5955.
Iowa, Kansas, Missouri, and Nebraska.

REGION VIII

Permit Contact *(8E–WE)*, Suite 103, U.S. Environmental Protection Agency, 1860 Lincoln Street, Denver, Colorado 80295, (303) 837–4901, FTS 327–4901.
Colorado, Montana, North Dakota, South Dakota, Utah, and Wyoming.

REGION IX

Permit Contact, Permits Branch *(E–4)*, U.S. Environmental Protection Agency, 215 Fremont Street, San Francisco, California 94105, (415) 556–3450, FTS 556–3450.
Arizona, California, Hawaii, Nevada, Guam, American Samoa, and Trust Territories.

REGION X

Permit Contact *(M/S 521)*, U.S. Environmental Protection Agency, 1200 6th Avenue, Seattle, Washington 98101, (206) 442–7176, FTS 399–7176.
Alaska, Idaho, Oregon, and Washington.

Where to File

The application forms should be mailed to the EPA Regional office whose Region includes the State in which the facility is located *(see Table 1)*.

If the State in which the facility is located administers a Federal permit program under which you need a permit, you should contact the appropriate State agency for the correct forms. Your EPA Regional office *(Table 1)* can tell you to whom to apply and can provide the appropriate address and phone number.

When to File

Because of statutory requirements, the deadlines for filing applications vary according to the type of facility you operate and the type of permit you need. These deadlines are as follows:[1]

Table 2. Filing Dates for Permits

FORM *(permit)*	WHEN TO FILE
2A *(NPDES)*	180 days before your present NPDES permit expires.
2B *(NPDES)*	180 days before your present NPDES permit expires[2], or 180 days prior to startup if you are a new facility.
2C *(NPDES)*	180 days before your present NPDES permit expires[2].
2D *(NPDES)*	180 days prior to startup.
3 *(Hazardous Waste)*	Existing facility: Six months following publication of regulations listing hazardous wastes. New facility: 180 days before commencing physical construction.
4 *(UIC)*	A reasonable time prior to construction for new wells; as directed by the Director for existing wells.
5 *(PSD)*	Prior to commencement of construction.

[1] Please note that some of these forms are not yet available for use and are listed as "Reserved" at the beginning of these instructions. Contact your EPA Regional office for information on current application requirements and forms.

[2] If your present permit expires on or before November 30, 1980, the filing date is the date on which your permit expires. If your permit expires during the period December 1, 1980 – May 31, 1981, the filing date is 90 days before your permit expires.

Federal regulations provide that you may not begin to construct a new source in the NPDES program, a new hazardous waste management facility, a new injection well, or a facility covered by the PSD program before the issuance of a permit under the applicable program. Please note that if you are required to obtain a permit before beginning construction, as described above, you may need to submit your permit application well in advance of an applicable deadline listed in Table 2.

Fees

The U.S. EPA does not require a fee for applying for any permit under the consolidated permit programs. *(However, some States which administer one or more of these programs require fees for the permits which they issue.)*

Availability of Information to Public

Information contained in these application forms will, upon request, be made available to the public for inspection and copying. However, you may request confidential treatment for certain information which you submit on certain supplementary forms. The specific instructions for each supplementary form state what information on the form, if any, may be claimed as confidential and what procedures govern the claim. No information on Forms 1 and 2A through 2D may be claimed as confidential.

Completion of Forms

Unless otherwise specified in instructions to the forms, each item in each form must be answered. To indicate that each item has been considered, enter "NA," for not applicable, if a particular item does not fit the circumstances or characteristics of your facility or activity.

If you have previously submitted information to EPA or to an approved State agency which answers a question, you may either repeat the information in the space provided or attach a copy of the previous submission. Some items in the form require narrative explanation. If more space is necessary to answer a question, attach a separate sheet entitled "Additional Information."

Financial Assistance for Pollution Control

There are a number of direct loans, loan guarantees, and grants available to firms and communities for pollution control expenditures. These are provided by the Small Business Administration, the Economic Development Administration, the Farmers Home Administration, and the Department of Housing and Urban Development. Each EPA Regional office *(Table 1)* has an economic assistance coordinator who can provide you with additional information.

EPA's construction grants program under Title II of the Clean Water Act is an additional source of assistance to publicly owned treatment works. Contact your EPA Regional office for details.

SECTION B – FORM 1 LINE-BY-LINE INSTRUCTIONS

This form must be completed by all applicants.

Completing This Form

Please type or print in the unshaded areas only. Some items have small graduation marks in the fill–in spaces. These marks indicate the number of characters that may be entered into our data system. The marks are spaced at 1/6" intervals which accommodate elite type *(12 characters per inch)*. If you use another type you may ignore the marks. If you print, place each character between the marks. Abbreviate if necessary to stay within the number of characters allowed for each item. Use one space for breaks between words, but not for punctuation marks unless they are needed to clarify your response.

Item I

Space is provided at the upper right hand corner of Form 1 for insertion of your EPA Identification Number. If you have an existing facility, enter your Identification Number. If you don't know your EPA Identification Number, please contact your EPA Regional office *(Table 1)*, which will provide you with your number. If your facility is new *(not yet constructed)*, leave this item blank.

Item II

Answer each question to determine which supplementary forms you need to fill out. Be sure to check the glossary in Section D of these instructions for the legal definitions of the **bold faced words**. Check Section C of these instructions to determine whether your activity is excluded from permit requirements.

If you answer "no" to every question, then you do not need a permit, and you do not need to complete and return any of these forms.

If you answer "yes" to any question, then you must complete and file the supplementary form by the deadline listed in Table 2 along with this form. *(The applicable form number follows each question and is enclosed in parentheses.)* You need not submit a supplementary form if you already have a permit under the appropriate Federal program, unless your permit is due to expire and you wish to renew your permit.

Questions (I) and (J) of Item II refer to major new or modified sources subject to Prevention of Significant Deterioration *(PSD)* requirements under the Clean Air Act. For the purpose of the PSD program, major sources are defined as: (A) Sources listed in Table 3 which have the potential to emit 100 tons or more per year emissions; and (B) All other sources with the potential to emit 250 tons or more per year. See Section C of these instructions for discussion of exclusions of certain modified sources.

Table 3. 28 Industrial Categories Listed in Section 169(1) of the Clean Air Act of 1977

Fossil fuel–fired steam generators of more than 250 million BTU per hour heat input;
Coal cleaning plants *(with thermal dryers)*;
Kraft pulp mills;
Portland cement plants;
Primary zinc smelters;
Iron and steel mill plants;
Primary aluminum ore reduction plants;
Primary copper smelters;
Municipal incinerators capable of charging more than 250 tons of refuse per day;
Hydrofluoric acid plants;
Nitric acid plants;
Sulfuric acid plants;
Petroleum refineries;
Lime plants;
Phosphate rock processing plants;
Coke oven batteries;
Sulfur recovery plants;
Carbon black plants *(furnace process)*;
Primary lead smelters;
Fuel conversion plants;
Sintering plants;
Secondary metal production plants;
Chemical process plants;
Fossil fuel boilers *(or combination thereof)* totaling more than 250 million BTU per hour heat input;

Table 3 *(continued)*

Petroleum storage and transfer units with a total storage capacity exceeding 300,000 barrels;
Taconite ore processing plants;
Glass fiber processing plants; and
Charcoal production plants.

Item III

Enter the facility's official or legal name. Do not use a colloquial name.

Item IV

Give the name, title, and work telephone number of a person who is thoroughly familiar with the operation of the facility and with the facts reported in this application and who can be contacted by reviewing offices if necessary.

Item V

Give the complete mailing address of the office where correspondence should be sent. This often is not the address used to designate the location of the facility or activity.

Item VI

Give the address or location of the facility identified in Item III of this form. If the facility lacks a street name or route number, give the most accurate alternative geographic information *(e.g., section number or quarter section number from county records or at intersection of Rts. 425 and 22)*.

Item VII

List, in descending order of significance, the four 4–digit standard industrial classification *(SIC)* codes which best describe your facility in terms of the principal products or services you produce or provide. Also, specify each classification in words. These classifications may differ from the SIC codes describing the operation generating the discharge, air emissions, or hazardous wastes.

SIC code numbers are descriptions which may be found in the "Standard Industrial Classification Manual" prepared by the Executive Office of the President, Office of Management and Budget, which is available from the Government Printing Office, Washington, D.C. Use the current edition of the manual. If you have any questions concerning the appropriate SIC code for your facility, contact your EPA Regional office *(see Table 1)*.

Item VIII–A

Give the name, as it is legally referred to, of the person, firm, public organization, or any other entity which operates the facility described in this application. This may or may not be the same name as the facility. The operator of the facility is the legal entity which controls the facility's operation rather than the plant or site manager. Do not use a colloquial name.

Item VIII–B

Indicate whether the entity which operates the facility also owns it by marking the appropriate box.

Item VIII–C

Enter the appropriate letter to indicate the legal status of the operator of the facility. Indicate "public" for a facility solely owned by local government*(s)* such as a city, town, county, parish, etc.

Items VIII–D – H

Enter the telephone number and address of the operator identified in Item VIII–A.

Item IX

Indicate whether the facility is located on Indian Lands.

Item X

Give the number of each presently effective permit issued to the facility for each program or, if you have previously filed an application but have not yet received a permit, give the number of the application, if any. Fill in the unshaded area only. If you have more than one currently effective permit for your facility under a particular permit program, you may list additional permit numbers on a separate sheet of paper. List any relevant environmental Federal *(e.g., permits under the Ocean Dumping Act, Section 404 of the Clean Water Act or the Surface Mining Control and Reclamation Act)*, State *(e.g., State permits for new air emission sources in nonattainment areas under Part D of the Clean Air Act or State permits under Section 404 of the Clean Water Act)*, or local permits or applications under "other."

Item XI

Provide a topographic map or maps of the area extending at least to one mile beyond the property boundaries of the facility which clearly show the following:

The legal boundaries of the facility;

The location and serial number of each of your existing and proposed intake and discharge structures;

All hazardous waste management facilities;

Each well where you inject fluids underground; and

All springs and surface water bodies in the area, plus all drinking water wells within 1/4 mile of the facility which are identified in the public record or otherwise known to you.

If an intake or discharge structure, hazardous waste disposal site, or injection well associated with the facility is located more than one mile from the plant, include it on the map, if possible. If not, attach additional sheets describing the location of the structure, disposal site, or well, and identify the U.S. Geological Survey *(or other)* map corresponding to the location.

On each map, include the map scale, a meridian arrow showing north, and latitude and longitude at the nearest whole second. On all maps of rivers, show the direction of the current, and in tidal waters, show the directions of the ebb and flow tides. Use a 7-1/2 minute series map published by the U.S. Geological Survey, which may be obtained through the U.S. Geological Survey Offices listed below. If a 7-1/2 minute series map has not been published for your facility site, then you may use a 15 minute series map from the U.S. Geological Survey. If neither a 7-1/2 nor 15 minute series map has been published for your facility site, use a plat map or other appropriate map, including all the requested information; in this case, briefly describe land uses in the map area *(e.g., residential, commercial)*.

You may trace your map from a geological survey chart, or other map meeting the above specifications. If you do, your map should bear a note showing the number or title of the map or chart it was traced from. Include the names of nearby towns, water bodies, and other prominent points. An example of an acceptable location map is shown in Figure 1–1 of these instructions. *(NOTE: Figure 1–1 is provided for purposes of illustration only, and does not represent any actual facility.)*

Item XI *(continued)*

U.S.G.S. OFFICES	AREA SERVED
Eastern Mapping Center National Cartographic Information Center U.S.G.S. 536 National Center Reston, Va. 22092 Phone No. (703) 860–6336	Ala., Conn., Del., D.C., Fla., Ga., Ind., Ky., Maine, Md., Mass., N.H., N.J., N.Y., N.C., S.C., Ohio, Pa., Puerto Rico, R.I., Tenn., Vt., Va., W. Va., and Virgin Islands.
Mid Continent Mapping Center National Cartographic Information Center U.S.G.S. 1400 Independance Road Rolla, Mo. 65401 Phone No. (314) 341–0851	Ark., Ill., Iowa, Kans., La., Mich., Minn., Miss., Mo., N. Dak., Nebr., Okla., S. Dak., and Wis.
Rocky Mountain Mapping Center National Cartographic Infomation Center U.S.G.S. Stop 504, Box 25046 Federal Center Denver, Co. 80225 Phone No. (303) 234–2326	Alaska, Colo., Mont., N. Mex., Tex., Utah, and Wyo.
Western Mapping Center National Cartographic Information Center U.S.G.S. 345 Middlefield Road Menlo Park, Ca. 94025 Phone No. (415) 323–8111	Ariz., Calif., Hawaii, Idaho, Nev., Oreg., Wash., American Samoa, Guam, and Trust Territories

Item XII

Briefly describe the nature of your business *(e.g., products produced or services provided)*.

Item XIII

Federal statues provide for severe penalties for submitting false information on this application form.

18 U.S.C. Section 1001 provides that "Whoever, in any matter within the jurisdiction of any department or agency of the United States knowingly and willfully falsifies, conceals or covers up by any trick, scheme, or device a material fact, or makes or uses any false writing or document knowing same to contain any false, fictitious or fraudulent statement or entry, shall be fined not more than $10,000 or imprisoned not more than five years, or both."

Section 309(c)(2) of the Clean Water Act and Section 113(c)(2) of the Clean Air Act each provide that "Any person who knowingly makes any false statement, representation, or certification in any application, . . . shall upon conviction, be punished by a fine of no more than $10,000 or by imprisonment for not more than six months, or both."

In addition, Section 3008(d)(3) of the Resource Conservation and Recovery Act provides for a fine up to $25,000 per day or imprisonment up to one year, or both, for a first conviction for making a false statement in any application under the Act, and for double these penalties upon subsequent convictions.

FEDERAL REGULATIONS REQUIRE THIS APPLICATION TO BE SIGNED AS FOLLOWS:

A. For a corporation, by a principal executive officer of at least the level of vice president. However, if the only activity in Item II which is marked "yes" is Question G, the officer may authorize a person having responsibility for the overall operations of the well or well field to sign the certification. In that case, the authorization must be written and submitted to the permitting authority.

B. For partnership or sole proprietorship, by a general partner or the proprietor, respectively; or

C. For a municipality, State, Federal, or other public facility, by either a principal executive officer or ranking elected official.

SECTION C – ACTIVITIES WHICH DO NOT REQUIRE PERMITS

I. National Pollutant Discharge Elimination System Permits Under the Clean Water Act. You are not required to obtain an NPDES permit if your discharge is in one of the following categories, as provided by the Clean Water Act *(CWA)* and by the NPDES regulations *(40 CFR Parts 122–125)*. However, under Section 510 of CWA a discharge exempted from the federal NPDES requirements may still be regulated by a State authority; contact your State environmental agency to determine whether you need a State permit.

A. DISCHARGES FROM VESSELS. Discharges of sewage from vessels, effluent from properly functioning marine engines, laundry, shower, and galley sink wastes, and any other discharge incidental to the normal operation of a vessel do not require NPDES permits. However, discharges of rubbish, trash, garbage, or other such materials discharged overboard require permits, and so do other discharges when the vessel is operating in a capacity other than as a means of transportation, such as when the vessel is being used as an energy or mining facility, a storage facility, or a seafood processing facility, or is secured to the bed of the ocean, contiguous zone, or waters of the United States for the purpose of mineral or oil exploration or development.

B. DREDGED OR FILL MATERIAL. Discharges of dredged or fill material into waters of the United States do not need NPDES permits if the dredging or filling is authorized by a permit issued by the U.S. Army Corps of Engineers or an EPA approved State under Section 404 of CWA.

C. DISCHARGES INTO PUBLICLY OWNED TREATMENT WORKS *(POTW)*. The introduction of sewage, industrial wastes, or other pollutants into a POTW does not need an NPDES permit. You must comply with all applicable pretreatment standards promulgated under Section 307(b) of CWA, which may be included in the permit issued to the POTW. If you have a plan or an agreement to switch to a POTW in the future, this does not relieve you of the obligation to apply for and receive an NPDES permit until you have stopped discharging pollutants into waters of the United States.

(NOTE: Dischargers into privately owned treatment works do not have to apply for or obtain NPDES permits except as otherwise required by the EPA Regional Administrator. The owner or operator of the treatment works itself, however, must apply for a permit and identify all users in its application. Users so identified will receive public notice of actions taken on the permit for the treatment works.)

D. DISCHARGES FROM AGRICULTURAL AND SILVICULTURAL ACTIVITIES. Most discharges from agricultural and silvicultural activities to waters of the United States do not require NPDES permits. These include runoff from orchards, cultivated crops, pastures, range lands, and forest lands. However, the discharges listed below do require NPDES permits. Definitions of the terms listed below are contained in the Glossary section of these instructions.

1. Discharges from Concentrated Animal Feeding Operations. *(See Glossary for definitions of "animal feeding operations" and "concentrated animal feeding operations." Only the latter require permits.)*

2. Discharges from Concentrated Aquatic Animal Production Facilities. *(See Glossary for size cutoffs.)*

3. Discharges associated with approved Aquaculture Projects.

4. Discharges from Silvicultural Point Sources. *(See Glossary for the definition of "silvicultural point source.")* Nonpoint source silvicultural activities are excluded from NPDES permit requirements. However, some of these activities, such as stream crossings for roads, may involve point source discharges of dredged or fill material which may require a Section 404 permit. See 33 CFR 209.120.

E. DISCHARGES IN COMPLIANCE WITH AN ON–SCENE COORDINATOR'S INSTRUCTIONS.

II. Hazardous Waste Permits Under the Resource Conservation and Recovery Act. You may be excluded from the requirement to obtain a permit under this program if you fall into one of the following categories:

Generators who accumulate their own hazardous waste on–site for less than 90 days as provided in 40 CFR 262.34;

Farmers who dispose of hazardous waste pesticide from their own use as provided in 40 CFR 262.51;

Certain persons treating, storing, or disposing of small quantities of hazardous waste as provided in 40 CFR 261.4 or 261.5; and

Owners and operators of totally enclosed treatment facilities as defined in 40 CFR 260.10.

Check with your Regional office for details. Please note that even if you are excluded from permit requirements, you may be required by Federal regulations to handle your waste in a particular manner.

III. Underground Injection Control Permits Under the Safe Drinking Water Act. You are not required to obtain a permit under this program if you:

Inject into existing wells used to enhance recovery of oil and gas or to store hydrocarbons *(note, however, that these underground injections are regulated by Federal rules)*; or

Inject into or above a stratum which contains, within 1/4 mile of the well bore, an underground source of drinking water *(unless your injection is the type identified in Item II-H, for which you do need a permit)*. However, you must notify EPA of your injection and submit certain required information on forms supplied by the Agency, and your operation may be phased out if you are a generator of hazardous wastes or a hazardous waste management facility which uses wells or septic tanks to dispose of hazardous waste.

IV. Prevention of Significant Deterioration Permits Under the Clean Air Act. The PSD program applies to newly constructed or modified facilities *(both of which are referred to as "new sources")* which increase air emissions. The Clean Air Act Amendments of 1977 exclude small new sources of air emissions from the PSD review program. Any new source in an industrial category listed in Table 3 of these instructions whose potential to emit is less than 100 tons per year is not required to get a PSD permit. In addition, any new source in an industrial category not listed in Table 3 whose potential to emit is less than 250 tons per year is exempted from the PSD requirements.

Modified sources which increase their net emissions *(the difference between the total emission increases and total emission decreases at the source)* less than the significant amount set forth in EPA regulations are also exempt from PSD requirements. Contact your EPA Regional office *(Table 1)* for further information.

SECTION D – GLOSSARY

NOTE: This Glossary includes terms used in the instructions and in Forms 1, 2B, 2C, and 3. Additional terms will be included in the future when other forms are developed to reflect the requirements of other parts of the Consolidated Permits Program. If you have any questions concerning the meaning of any of these terms, please contact your EPA Regional office *(Table 1)*.

ALIQUOT means a sample of specified volume used to make up a total composite sample.

ANIMAL FEEDING OPERATION means a lot or facility *(other than an aquatic animal production facility)* where the following conditions are met:

A. Animals *(other than aquatic animals)* have been, are, or will be stabled or confined and fed or maintained for a total of 45 days or more in any 12 month period; and

B. Crops, vegetation, forage growth, or post—harvest residues are not sustained in the normal growing season over any portion of the lot or facility.

Two or more animal feeding operations under common ownership are a single animal feeding operation if they adjoin each other or if they use a common area or system for the disposal of wastes.

ANIMAL UNIT means a unit of measurement for any animal feeding operation calculated by adding the following numbers: The number of slaughter and feeder cattle multiplied by 1.0; Plus the number of mature dairy cattle multiplied by 1.4; Plus the number of swine weighing over 25 kilograms *(approximately 55 pounds)* multiplied by 0.4; Plus the number of sheep multiplied by 0.1; Plus the number of horses multiplied by 2.0.

APPLICATION means the EPA standard national forms for applying for a permit, including any additions, revisions, or modifications to the forms; or forms approved by EPA for use in approved States, including any approved modifications or revisions. For RCRA, "application" also means "Application, Part B."

APPLICATION, PART A means that part of the Consolidated Permit Application forms which a RCRA permit applicant must complete to qualify for interim status under Section 3005(e) of RCRA and for consideration for a permit. Part A consists of Form 1 *(General Information)* and Form 3 *(Hazardous Waste Application Form)*.

APPLICATION, PART B means that part of the application which a RCRA permit applicant must complete to be issued a permit. *(NOTE: EPA is not developing a specific form for Part B of the permit application, but an instruction booklet explaining what information must be supplied is available from the EPA Regional office.)*

APPROVED PROGRAM or APPROVED STATE means a State program which has been approved or authorized by EPA under 40 CFR Part 123.

AQUACULTURE PROJECT means a defined managed water area which uses discharges of pollutants into that designated area for the maintenance or production of harvestable freshwater, estuarine, or marine plants or animals. "Designated area" means the portions of the waters of the United States within which the applicant plans to confine the cultivated species, using a method of plan or operation *(including, but not limited to, physical confinement)* which, on the basis of reliable scientific evidence, is expected to ensure the specific individual organisms comprising an aquaculture crop will enjoy increased growth attributable to the discharge of pollutants and be harvested within a defined geographic area.

AQUIFER means a geological formation, group of formations, or part of a formation that is capable of yielding a significant amount of water to a well or spring.

AREA OF REVIEW means the area surrounding an injection well which is described according to the criteria set forth in 40 CFR Section 146.06.

AREA PERMIT means a UIC permit applicable to all or certain wells within a geographic area, rather than to a specified well, under 40 CFR Section 122.37.

ATTAINMENT AREA means, for any air pollutant, an area which has been designated under Section 107 of the Clean Air Act as having ambient air quality levels better than any national primary or secondary ambient air quality standard for that pollutant. Standards have been set for sulfur oxides, particulate matter, nitrogen dioxide, carbon monoxide, ozone, lead, and hydrocarbons. For purposes of the Glossary, "attainment area" also refers to "unclassifiable area," which means, for any pollutants, an area designated under Section 107 as unclassifiable with respect to that pollutant due to insufficient information.

BEST MANAGEMENT PRACTICES *(BMP)* means schedules of activities, prohibitions of practices, maintenance procedures, and other management practices to prevent or reduce the pollution of waters of the United States. BMP's include treatment requirements, operation procedures, and practices to control plant site runoff, spillage or leaks, sludge or waste disposal, or drainage from raw material storage.

BIOLOGICAL MONITORING TEST means any test which includes the use of aquatic algal, invertebrate, or vertebrate species to measure acute or chronic toxicity, and any biological or chemical measure of bioaccumulation.

BYPASS means the intentional diversion of wastes from any any portion of a treatment facility.

CONCENTRATED ANIMAL FEEDING OPERATION means an animal feeding operation which meets the criteria set forth in either (A) or (B) below or which the Director designates as such on a case—by—case basis:

A. More than the numbers of animals specified in any of the following categories are confined:

1. 1,000 slaughter or feeder cattle,
2. 700 mature dairy cattle *(whether milked or dry cows)*,
3. 2,500 swine each weighing over 25 kilograms *(approximately 55 pounds)*,
4. 500 horses,
5. 10,000 sheep or lambs,
6. 55,000 turkeys,
7. 100,000 laying hens or broilers *(if the facility has a continuous overflow watering)*,
8. 30,000 laying hens or broilers *(if the facility has a liquid manure handling system)*,
9. 5,000 ducks, or
10. 1,000 animal units; or

B. More than the following numbers and types of animals are confined:

1. 300 slaughter or feeder cattle,
2. 200 mature dairy cattle *(whether milked or dry cows)*,
3. 750 swine each weighing over 25 kilograms *(approximately 55 pounds)*,
4. 150 horses,

CONCENTRATED ANIMAL FEEDING OPERATION *(continued)*

5. 3,000 sheep or lambs,

6. 16,500 turkeys,

7. 30,000 laying hens or broilers *(if the facility has continuous overflow watering)*,

8. 9,000 laying hens or broilers *(if the facility has a liquid manure handling system)*,

9. 1,500 ducks, or

10. 300 animal units; AND

Either one of the following conditions are met: Pollutants are discharged into waters of the United States through a manmade ditch, flushing system or other similar manmade device *("manmade" means constructed by man and used for the purpose of transporting wastes)*; or Pollutants are discharged directly into waters of the Unites States which originate outside of and pass over, across, or through the facility or otherwise come into direct contact with the animals confined in the operation.

Provided, however, that no animal feeding operation is a concentrated animal feeding operation as defined above if such animal feeding operation discharges only in the event of a 25 year, 24 hour storm event.

CONCENTRATED AQUATIC ANIMAL PRODUCTION FACILITY means a hatchery, fish farm, or other facility which contains, grows or holds aquatic animals in either of the following categories, or which the Director designates as such on a case—by—case basis:

A. Cold water fish species or other cold water aquatic animals including, but not limited to, the Salmonidae family of fish *(e.g., trout and salmon)* in ponds, raceways or other similar structures which discharge at least 30 days per year but does not include:

1. Facilities which produce less than 9,090 harvest weight kilograms *(approximately 20,000 pounds)* of aquatic animals per year; and

2. Facilities which feed less than 2,272 kilograms *(approximately 5,000 pounds)* of food during the calendar month of maximum feeding.

B. Warm water fish species or other warm water aquatic animals including, but not limited to, the Ameiuridae, Cetrarchidae, and Cyprinidae families of fish *(e.g., respectively, catfish, sunfish, and minnows)* in ponds, raceways, or other similar structures which discharge at least 30 days per year, but does not include:

1. Closed ponds which discharge only during periods of excess runoff; or

2. Facilities which produce less than 45,454 harvest weight kilograms *(approximately 100,000 pounds)* of aquatic animals per year.

CONTACT COOLING WATER means water used to reduce temperature which comes into contact with a raw material, intermediate product, waste product other than heat, or finished product.

CONTAINER means any portable device in which a material is stored, transported, treated, disposed of, or otherwise handled.

CONTIGUOUS ZONE means the entire zone established by the United States under article 24 of the convention of the Territorial Sea and the Contiguous Zone.

CWA means the Clean Water Act *(formerly referred to the Federal Water Pollution Control Act)* Pub. L. 92–500, as amended by Pub. L. 95–217 and Pub. L. 95–576, 33 U.S.C. 1251 *et seq.*

DIKE means any embankment or ridge of either natural or manmade materials used to prevent the movement of liquids, sludges, solids, or other materials.

DIRECT DISCHARGE means the discharge of a pollutant as defined below.

DIRECTOR means the EPA Regional Administrator or the State Director as the context requires.

DISCHARGE *(OF A POLLUTANT)* means:

A. Any addition of any pollutant or combination of pollutants to waters of the United States from any point source; or

B. Any addition of any pollutant or combination of pollutants to the waters of the contiguous zone or the ocean from any point source other than a vessel or other floating craft which is being used as a means of transportation.

This definition includes discharges into waters of the United States from: Surface runoff which is collected or channelled by man; Discharges through pipes, sewers, or other conveyances owned by a State, municipality, or other person which do not lead to POTW's; and Discharges through pipes, sewers, or other conveyances, leading into privately owned treatment works. This term does not include an addition of pollutants by any indirect discharger.

DISPOSAL *(in the RCRA program)* means the discharge, deposit, injection, dumping, spilling, leaking, or placing of any hazardous waste into or on any land or water so that the hazardous waste or any constituent of it may enter the environment or be emitted into the air or discharged into any waters, including ground water.

DISPOSAL FACILITY means a facility or part of a facility at which hazardous waste is intentionally placed into or on land or water, and at which hazardous waste will remain after closure.

EFFLUENT LIMITATION means any restriction imposed by the Director on quantities, discharge rates, and concentrations of pollutants which are discharged from point sources into waters of the United States, the waters of the continguous zone, or the ocean.

EFFLUENT LIMITATION GUIDELINE means a regulation published by the Administrator under Section 304(b) of the Clean Water Act to adopt or revise effluent limitations.

ENVIRONMENTAL PROTECTION AGENCY *(EPA)* means the United States Environmental Protection Agency.

EPA IDENTIFICATION NUMBER means the number assigned by EPA to each generator, transporter, and facility.

EXEMPTED AQUIFER means an aquifer or its portion that meets the criteria in the definition of USDW, but which has been exempted according to the procedures in 40 CFR Section 122.35(b).

EXISTING HWM FACILITY means a Hazardous Waste Management facility which was in operation, or for which construction had commenced, on or before October 21, 1976. Construction had commenced if (A) the owner or operator had obtained all necessary Federal, State, and local preconstruction approvals or permits, and either (B1) a continuous on–site, physical construction program had begun, or (B2) the owner or operator had entered into contractual obligations, which could not be cancelled or modified without substantial loss, for construction of the facility to be completed within a reasonable time.

(NOTE: This definition reflects the literal language of the statute. However, EPA believes that amendments to RCRA now in conference will shortly be enacted and will change the date for determining when a facility is an "existing facility" to one no earlier than May of 1980; indications are the conferees are considering October 30, 1980. Accordingly, EPA encourages every owner or operator of a facility which was built or under construction as of the promulgation date of the RCRA program regulations to file Part A of its permit application so that it can be quickly processed for interim status when the change in the law takes effect. When those amendments are enacted, EPA will amend this definition.)

EXISTING SOURCE or EXISTING DISCHARGER *(in the NPDES program)* means any source which is not a new source or a new discharger.

EXISTING INJECTION WELL means an injection well other than a new injection well.

FACILITY means any HWM facility, UIC underground injection well, NPDES point source, PSD stationary source, or any other facility or activity *(including land or appurtenances thereto)* that is subject to regulation under the RCRA, UIC, NPDES, or PSD programs.

FLUID means material or substance which flows or moves whether in a semisolid, liquid, sludge, gas, or any other form or state.

GENERATOR means any person by site, whose act or process produces hazardous waste identified or listed in 40 CFR Part 261.

GROUNDWATER means water below the land surface in a zone of saturation.

HAZARDOUS SUBSTANCE means any of the substances designated under 40 CFR Part 116 pursuant to Section 311 of CWA. *(NOTE: These substances are listed in Table 2c—4 of the instructions to Form 2C.)*

HAZARDOUS WASTE means a hazardous waste as defined in 40 CFR Section 261.3 published May 19, 1980.

HAZARDOUS WASTE MANAGEMENT FACILITY *(HWM facility)* means all contiguous land, structures, appurtenances, and improvements on the land, used for treating, storing, or disposing of hazardous wastes. A facility may consist of several treatment, storage, or disposal operational units *(for example, one or more landfills, surface impoundments, or combinations of them)*.

IN OPERATION means a facility which is treating, storing, or disposing of hazardous waste.

INCINERATOR *(in the RCRA program)* means an enclosed device using controlled flame combustion, the primary purpose of which is to thermally break down hazardous waste. Examples of incinerators are rotary kiln, fluidized bed, and liquid injection incinerators.

INDIRECT DISCHARGER means a nondomestic discharger introducing pollutants to a publicly owned treatment works.

INJECTION WELL means a well into which fluids are being injected.

INTERIM AUTHORIZATION means approval by EPA of a State hazardous waste program which has met the requirements of Section 3006(c) of RCRA and applicable requirements of 40 CFR Part 123, Subparts A, B, and F.

LANDFILL means a disposal facility or part of a facility where hazardous waste is placed in or on land and which is not a land treatment facility, a surface impoundment, or an injection well.

LAND TREATMENT FACILITY *(in the RCRA program)* means a facility or part of a facility at which hazardous waste is applied onto or incorporated into the soil surface; such facilities are disposal facilities if the waste will remain after closure.

LISTED STATE means a State listed by the Administrator under Section 1422 of SDWA as needing a State UIC program.

MGD means millions of gallons per day.

MUNICIPALITY means a city, village, town, borough, county, parish, district, association, or other public body created by or under State law and having jurisdiction over disposal of sewage, industrial wastes, or other wastes, or an Indian tribe or an authorized Indian tribal organization, or a designated and approved management agency under Section 208 of CWA.

NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM *(NPDES)* means the national program for issuing modifying, revoking and reissuing, terminating, monitoring, and enforcing permits and imposing and enforcing pretreatment requirements, under Sections 307, 318, 402, and 405 of CWA. The term includes an approved program.

NEW DISCHARGER means any building, structure, facility, or installation: (A) From which there is or may be a new or additional discharge of pollutants at a site at which on October 18, 1972, it had never discharged pollutants; (B) Which has never received a finally effective NPDES permit for discharges at that site; and (C) Which is not a "new source." This definition includes an indirect discharger which commences discharging into waters of the United States. It also includes any existing mobile point source, such as an offshore oil drilling rig, seafood processing vessel, or aggregate plant that begins discharging at a location for which it does not have an existing permit.

NEW HWM FACILITY means a Hazardous Waste Management facility which began operation or for which construction commenced after October 21, 1976.

NEW INJECTION WELL means a well which begins injection after a UIC program for the State in which the well is located is approved.

NEW SOURCE *(in the NPDES program)* means any building, structure, facility, or installation from which there is or may be a discharge of pollutants, the construction of which commenced:

A. After promulgation of standards of performance under Section 306 of CWA which are applicable to such source; or

B. After proposal of standards of performance in accordance with Section 306 of CWA which are applicable to such source, but only if the standards are promulgated in accordance with Section 306 within 120 days of their proposal.

NON—CONTACT COOLING WATER means water used to reduce temperature which does not come into direct contact with any raw material, intermediate product, waste product *(other than heat)*, or finished product.

OFF—SITE means any site which is not "on—site."

ON—SITE means on the same or geographically contiguous property which may be divided by public or private right*(s)*—of—way, provided the entrance and exit between the properties is at a cross—roads intersection, and access is by crossing as opposed to going along, the right*(s)*—of—way. Non—contiguous properties owned by the same person, but connected by a right—of—way which the person controls and to which the public does not have access, is also considered on—site property.

OPEN BURNING means the combustion of any material without the following characteristics:

A. Control of combustion air to maintain adequate temperature for efficient combustion;

B. Containment of the combustion—reaction in an enclosed device to provide sufficient residence time and mixing for complete combustion; and

C. Control of emission of the gaseous combustion products.

(See also "incinerator" and "thermal treatment").

OPERATOR means the person responsible for the overall operation of a facility.

OUTFALL means a point source.

OWNER means the person who owns a facility or part of a facility.

PERMIT means an authorization, license, or equivalent control document issued by EPA or an approved State to implement the requirements of 40 CFR Parts 122, 123, and 124.

PHYSICAL CONSTRUCTION *(In the RCRA program)* means excavation, movement of earth, erection of forms or structures, or similar activity to prepare a HWM facility to accept hazardous waste.

PILE means any noncontainerized accumulation of solid, nonflowing hazardous waste that is used for treatment or storage.

POINT SOURCE means any discernible, confined, and discrete conveyance, including but not limited to any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock, concentrated animal feeding operation, vessel or other floating craft from which pollutants are or may be discharged. This term does not include return flows from irrigated agriculture.

POLLUTANT means dredged spoil, solid waste, incinerator residue, filter backwash, sewage, garbage, sewage sludge, munitions, chemical waste, biological materials, radioactive materials *(except those regulated under the Atomic Energy Act of 1954, as amended [42 U.S.C. Section 2011 et seq.])*, heat, wrecked or discarded equipment, rocks, sand, cellar dirt and industrial, municipal, and agriculture waste discharged into water. It does not mean:

A. Sewage from vessels; or

B. Water, gas, or other material which is injected into a well to facilitate production of oil or gas, or water derived in association with oil and gas production and disposed of in a well, if the well used either to facilitate production or for disposal purposes is approved by authority of the State in which the well is located, and if the State determines that the injection or disposal will not result in the degradation of ground or surface water resources.

(NOTE: Radioactive materials covered by the Atomic Energy Act are those encompassed in its definition of source, byproduct, or special nuclear materials. Examples of materials not covered include radium and accelerator produced isotopes. See Train v. Colorado Public Interest Research Group, Inc., 426 U.S. 1 [1976].)

PREVENTION OF SIGNIFICANT DETERIORATION *(PSD)* means the national permitting program under 40 CFR 52.21 to prevent emissions of certain pollutants regulated under the Clean Air Act from significantly deteriorating air quality in attainment areas.

PRIMARY INDUSTRY CATEGORY means any industry category listed in the NRDC Settlement Agreement *(Natural Resources Defense Council v. Train, 8 ERC 2120 [D.D.C. 1976], modified 12 ERC 1833 [D.D.C. 1979])*.

PRIVATELY OWNED TREATMENT WORKS means any device or system which is: (A) Used to treat wastes from any facility whose operator is not the operator of the treatment works; and (B) Not a POTW.

PROCESS WASTEWATER means any water which, during manufacturing or processing, comes into direct contact with or results from the production or use of any raw material, intermediate product, finished product, byproduct, or waste product.

PUBLICLY OWNED TREATMENT WORKS or POTW means any device or system used in the treatment *(including recycling and reclamation)* of municipal sewage or industrial wastes of a liquid nature which is owned by a State or municipality. This definition includes any sewers, pipes, or other conveyances only if they convey wastewater to a POTW providing treatment.

RENT means use of another's property in return for regular payment.

RCRA means the Solid Waste Disposal Act as amended by the Resource Conservation and Recovery Act of 1976 *(Pub. L. 94—580, as amended by Pub. L. 95—609, 42 U.S.C. Section 6901 et seq.)*.

ROCK CRUSHING AND GRAVEL WASHING FACILITIES are facilities which process crushed and broken stone, gravel, and riprap *(see 40 CFR Part 436, Subpart B, and the effluent limitations guidelines for these facilities)*.

SDWA means the Safe Drinking Water Act *(Pub. L. 95—523, as amended by Pub. L. 95—1900, 42 U.S.C. Section 300[f] et seq.)*.

SECONDARY INDUSTRY CATEGORY means any industry category which is not a primary industry category.

SEWAGE FROM VESSELS means human body wastes and the wastes from tiolets and other receptacles intended to receive or retain body wastes that are discharged from vessels and regulated under Section 312 of CWA, except that with respect to commercial vessels on the Great Lakes this term includes graywater. For the purposes of this definition, "graywater" means galley, bath, and shower water.

SEWAGE SLUDGE means the solids, residues, and precipitate separated from or created in sewage by the unit processes of a POTW. "Sewage" as used in this definition means any wastes, including wastes from humans, households, commercial establishments, industries, and storm water runoff, that are discharged to or otherwise enter a publicly owned treatment works.

SILVICULTURAL POINT SOURCE means any discernable, confined, and discrete conveyance related to rock crushing, gravel washing, log sorting, or log storage facilities which are operated in connection with silvicultural activities and from which pollutants are discharged into waters of the United States. This term does not include nonpoint source silvicultural activities such as nursery operations, site preparation, reforestation and subsequent cultural treatment, thinning, prescribed burning, pest and fire control, harvesting operations, surface drainage, or road construction and maintenance from which there is natural runoff. However, some of these activities *(such as stream crossing for roads)* may involve point source discharges of dredged or fill material which may require a CWA Section 404 permit. "Log sorting and log storage facilities" are facilities whose discharges result from the holding of unprocessed wood, e.g., logs or roundwood with bark or after removal of bark in self—contained bodies of water *(mill ponds or log ponds)* or stored on land where water is applied intentionally on the logs *(wet decking)*. *(See 40 CFR Part 429, Subpart J, and the effluent limitations guidelines for these facilities.)*

STATE means any of the 50 States, the District of Columbia, Guam, the Commonwealth of Puerto Rico, the Virgin Islands, American Samoa, the Trust Territory of the Pacific Islands *(except in the case of RCRA)*, and the Commonwealth of the Northern Mariana Islands *(except in the case of CWA)*.

STATIONARY SOURCE *(in the PSD program)* means any building, structure, facility, or installation which emits or may emit any air pollutant regulated under the Clean Air Act. "Building, structure, facility, or installation" means any grouping of pollutant—emitting activities which are located on one or more contiguous or adjacent properties and which are owned or operated by the same person *(or by persons under common control)*.

STORAGE *(in the RCRA program)* means the holding of hazardous waste for a temporary period at the end of which the hazardous waste is treated, disposed, or stored elsewhere.

STORM WATER RUNOFF means water discharged as a result of rain, snow, or other precipitation.

SURFACE IMPOUNDMENT or IMPOUNDMENT means a facility or part of a facility which is a natural topographic depression, manmade excavation, or diked area formed primarily of earthen materials *(although it may be lined with manmade materials)*, which is designed to hold an accumulation of liquid wastes or wastes containing free liquids, and which is not an injection well. Examples of surface impoundments are holding, storage, settling, and aeration pits, ponds, and lagoons.

TANK *(in the RCRA program)* means a stationary device, designed to contain an accumulation of hazardous waste which is constructed primarily of non—earthen materials *(e.g., wood, concrete, steel, plastic)* which provide structural support.

THERMAL TREATMENT *(in the RCRA program)* means the treatment of hazardous waste in a device which uses elevated temperature as the primary means to change the chemical, physical, or biological character or composition of the hazardous waste. Examples of thermal treatment processes are incineration, molten salt, pyrolysis, calcination, wet air oxidation, and microwave discharge. *(See also "incinerator" and "open burning").*

TOTALLY ENCLOSED TREATMENT FACILITY *(in the RCRA program)* means a facility for the treatment of hazardous waste which is directly connected to an industrial production process and which is constructed and operated in a manner which prevents the release of any hazardous waste or any constituent thereof into the environment during treatment. An example is a pipe in which waste acid is neutralized.

TOXIC POLLUTANT means any pollutant listed as toxic under Section 307(a)(1) of CWA.

TRANSPORTER *(in the RCRA program)* means a person engaged in the off–site transportation of hazardous waste by air, rail, highway, or water.

TREATMENT *(in the RCRA program)* means any method, technique, or process, including neutralization, designed to change the physical, chemical, or biological character or composition of any hazardous waste so as to neutralize such waste, or so as to recover energy or material resources from the waste, or so as to render such waste non–hazardous, or less hazardous; safer to transport, store, or dispose of; or amenable for recovery, amenable for storage, or reduced in volume.

UNDERGROUND INJECTION means well injection.

UNDERGROUND SOURCE OF DRINKING WATER or USDW means an aquifer or its portion which is not an exempted aquifer and:

A. Which supplies drinking water for human consumption; or

B. In which the ground water contains fewer than 10,000 mg/l total dissolved solids.

UPSET means an exceptional incident in which there is unintentional and temporary noncompliance with technology–based permit effluent limitations because of factors beyond the reasonable control of the permittee. An upset does not include noncompliance to the extent caused by operational error, improperly designed treatment facilities, inadequate treatment facilities, lack of preventive maintenance, or careless or improper operation.

WATERS OF THE UNITED STATES means:

A. All waters which are currently used, were used in the past, or may be susceptible to use in interstate or foreign commerce, including all waters which are subject to the ebb and flow of the tide;

B. All interstate waters, including interstate wetlands;

C. All other waters such as intrastate lakes, rivers, streams *(including intermittent streams)*, mudflats, sandflats, wetlands, sloughs, prairie potholes, wet meadows, playa lakes, and natural ponds, the use, degradation, or destruction of which would or could affect interstate or foreign commerce including any such waters:

1. Which are or could be used by interstate or foreign travelers for recreational or other purposes,

2. From which fish or shellfish are or could be taken and sold in interstate or foreign commerce,

3. Which are used or could be used for industrial purposes by industries in interstate commerce;

D. All impoundments of waters otherwise defined as waters of the United States under this definition;

E. Tributaries of waters identified in paragraphs (A) — (D) above;

F. The territorial sea; and

G. Wetlands adjacent to waters *(other than waters that are themselves wetlands)* identified in paragraphs (A) — (F) of this definition.

Waste treatment systems, including treatment ponds or lagoons designed to meet requirement of CWA *(other than cooling ponds as defined in 40 CFR Section 423.11(m) which also meet the criteria of this definition)* are not waters of the United States. This exclusion applies only to manmade bodies of water which neither were originally created in waters of the United States *(such as a disposal area in wetlands)* nor resulted from the impoundments of waters of the United States.

WELL INJECTION or UNDERGROUND INJECTION means the subsurface emplacement of fluids through a bored, drilled, or driven well; or through a dug well, where the depth of the dug well is greater than the largest surface dimension.

WETLANDS means those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas.

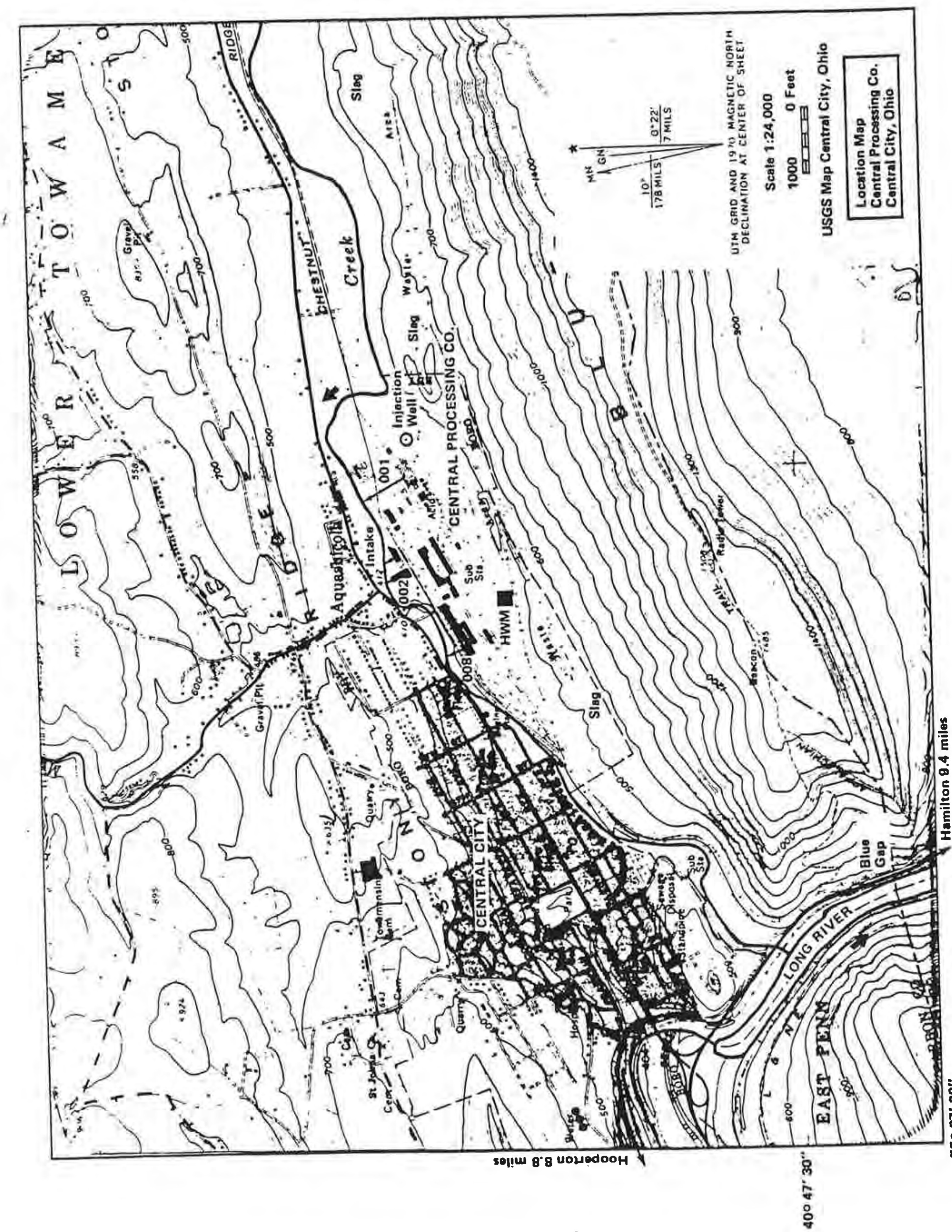

Location Map
Central Processing Co.
Central City, Ohio
USGS Map Central City, Ohio
Scale 1:24,000
1000 0 Feet
UTM GRID AND 1970 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET
CENTRAL PROCESSING CO.
CENTRAL CITY
LONG RIVER
Chestnut Ridge
Creek
Injection Well
Intake
Aqueduct
HWM
Slag
Waste
Blue Gap
EAST PENN
LOWER TOWAMENSING
Hamilton 9.4 miles
Hooperton 8.8 miles
40° 47' 30"
75° 37' 30"

FIGURE 1-1

Please print or type in the unshaded areas only (fill—in areas are spaced for elite type, i.e., 12 characters/inch).

Form Approved. OMB No. 2040-0086. Approval expires 5-31-92.

FORM 1 GENERAL — EPA

U.S. ENVIRONMENTAL PROTECTION AGENCY

GENERAL INFORMATION

Consolidated Permits Program

(Read the "General Instructions" before starting.)

I. EPA I.D. NUMBER

F | | D (T/A C)

LABEL ITEMS

I. EPA I.D. NUMBER

III. FACILITY NAME

V. FACILITY MAILING ADDRESS

VI. FACILITY LOCATION

PLEASE PLACE LABEL IN THIS SPACE

GENERAL INSTRUCTIONS

If a preprinted label has been provided, affix it in the designated space. Review the information carefully; if any of it is incorrect, cross through it and enter the correct data in the appropriate fill—in area below. Also, if any of the preprinted data is absent *(the area to the left of the label space lists the information that should appear)*, please provide it in the proper fill—in area(s) below. If the label is complete and correct, you need not complete Items I, III, V, and VI *(except VI-B which must be completed regardless)*. Complete all items if no label has been provided. Refer to the instructions for detailed item descriptions and for the legal authorizations under which this data is collected.

II. POLLUTANT CHARACTERISTICS

INSTRUCTIONS: Complete A through J to determine whether you need to submit any permit application forms to the EPA. If you answer "yes" to any questions, you must submit this form and the supplemental form listed in the parenthesis following the question. Mark "X" in the box in the third column if the supplemental form is attached. If you answer "no" to each question, you need not submit any of these forms. You may answer "no" if your activity is excluded from permit requirements; see Section C of the instructions. See also, Section D of the instructions for definitions of **bold—faced terms**.

SPECIFIC QUESTIONS	MARK 'X' YES	NO	FORM ATTACHED	SPECIFIC QUESTIONS	MARK 'X' YES	NO	FORM ATTACHED
A. Is this facility a **publicly owned treatment works** which results in a **discharge** to **waters of the U.S.**? (FORM 2A)	16	17	18	B. Does or will this facility *(either existing or proposed)* include a **concentrated animal feeding operation** or **aquatic animal production facility** which results in a **discharge to waters of the U.S.**? (FORM 2B)	19	20	21
C. Is this a facility which currently results in **discharges** to **waters of the U.S.** other than those described in A or B above? (FORM 2C)	22	23	24	D. Is this a proposed facility *(other than those described in A or B above)* which will result in a **discharge** to **waters of the U.S.**? (FORM 2D)	25	26	27
E. Does or will this facility treat, store, or dispose of **hazardous wastes**? (FORM 3)	28	29	30	F. Do you or will you inject at this facility industrial or municipal effluent below the lowermost stratum containing, within one quarter mile of the well bore, **underground sources of drinking water**? (FORM 4)	31	32	33
G. Do you or will you inject at this facility any produced water or other fluids which are brought to the surface in connection with conventional oil or natural gas production, inject fluids used for enhanced recovery of oil or natural gas, or inject fluids for storage of liquid hydrocarbons? (FORM 4)	34	35	36	H. Do you or will you inject at this facility fluids for special processes such as mining of sulfur by the Frasch process, solution mining of minerals, in situ combustion of fossil fuel, or recovery of geothermal energy? (FORM 4)	37	38	39
I. Is this facility a proposed **stationary source** which is one of the 28 industrial categories listed in the instructions and which will potentially emit 100 tons per year of any air pollutant regulated under the Clean Air Act and may affect or be located in an attainment area? (FORM 5)	40	41	42	J. Is this facility a proposed **stationary source** which is NOT one of the 28 industrial categories listed in the instructions and which will potentially emit 250 tons per year of any air pollutant regulated under the Clean Air Act and may affect or be located in an **attainment area**? (FORM 5)	43	44	45

III. NAME OF FACILITY

C 1 SKIP (15 16-29 30 ... 69)

IV. FACILITY CONTACT

A. NAME & TITLE *(last, first, & title)* — B. PHONE *(area code & no.)*

C 2 (15 16 ... 45 | 46-48 | 49-51 | 52-55)

V. FACILITY MAILING ADDRESS

A. STREET OR P.O. BOX

C 3 (15 16 ... 45)

B. CITY OR TOWN — C. STATE — D. ZIP CODE

C 4 (15 16 ... 40 | 41 42 | 47-51)

VI. FACILITY LOCATION

A. STREET, ROUTE NO. OR OTHER SPECIFIC IDENTIFIER

C 5 (15 16 ... 45)

B. COUNTY NAME

(46 ... 70)

C. CITY OR TOWN — D. STATE — E. ZIP CODE — F. COUNTY CODE *(if known)*

C 6 (15 16 ... 40 | 41 42 | 47-51 | 52-54)

CONTINUE ON REVERSE

CONTINUED FROM THE FRONT

VII. SIC CODES *(4-digit, in order of priority)*

A. FIRST		B. SECOND	
C 7	*(specify)*	C 7	*(specify)*
C. THIRD		**D. FOURTH**	
C 7	*(specify)*	C 7	*(specify)*

VIII. OPERATOR INFORMATION

A. NAME

C 8

B. Is the name listed in Item VIII-A also the owner?

☐ YES ☐ NO

C. STATUS OF OPERATOR *(Enter the appropriate letter into the answer box; if "Other", specify.)*

F = FEDERAL
S = STATE
P = PRIVATE
M = PUBLIC *(other than federal or state)*
O = OTHER *(specify)*

(specify)

D. PHONE *(area code & no.)*

C A

E. STREET OR P.O. BOX

F. CITY OR TOWN | **G. STATE** | **H. ZIP CODE**

C B

IX. INDIAN LAND

Is the facility located on Indian lands?

☐ YES ☐ NO

X. EXISTING ENVIRONMENTAL PERMITS

A. NPDES *(Discharges to Surface Water)*	D. PSD *(Air Emissions from Proposed Sources)*	
C T I: 9 N	C T I: 9 P	
B. UIC *(Underground Injection of Fluids)*	**E. OTHER** *(specify)*	
C T I: 9 U	C T I: 9	*(specify)*
C. RCRA *(Hazardous Wastes)*	**E. OTHER** *(specify)*	
C T I: 9 R	C T I: 9	*(specify)*

XI. MAP

Attach to this application a topographic map of the area extending to at least one mile beyond property bounderies. The map must show the outline of the facility, the location of each of its existing and proposed intake and discharge structures, each of its hazardous waste treatment, storage, or disposal facilities, and each well where it injects fluids underground. Include all springs, rivers and other surface water bodies in the map area. See instructions for precise requirements.

XII. NATURE OF BUSINESS *(provide a brief description)*

XIII. CERTIFICATION *(see instructions)*

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this application and all attachments and that, based on my inquiry of those persons immediately responsible for obtaining the information contained in the application, I believe that the information is true, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

A. NAME & OFFICIAL TITLE *(type or print)*	B. SIGNATURE	C. DATE SIGNED

COMMENTS FOR OFFICIAL USE ONLY

C C

Please print or type in the unshaded areas only
(fill—in areas are spaced for elite type, i.e., 12 characters/inch).

Form Approved. OMB No. 2040-0086. Approval expires 5-31-92.

FORM 1 GENERAL — EPA

U.S. ENVIRONMENTAL PROTECTION AGENCY

GENERAL INFORMATION

Consolidated Permits Program

(Read the "General Instructions" before starting.)

I. EPA I.D. NUMBER

F | | D

LABEL ITEMS

I. EPA I.D. NUMBER

III. FACILITY NAME

V. FACILITY MAILING ADDRESS

VI. FACILITY LOCATION

PLEASE PLACE LABEL IN THIS SPACE

GENERAL INSTRUCTIONS

If a preprinted label has been provided, affix it in the designated space. Review the information carefully; if any of it is incorrect, cross through it and enter the correct data in the appropriate fill—in area below. Also, if any of the preprinted data is absent *(the area to the left of the label space lists the information that should appear)*, please provide it in the proper fill—in area(s) below. If the label is complete and correct, you need not complete Items I, III, V, and VI *(except VI-B which must be completed regardless)*. Complete all items if no label has been provided. Refer to the instructions for detailed item descriptions and for the legal authorizations under which this data is collected.

II. POLLUTANT CHARACTERISTICS

INSTRUCTIONS: Complete A through J to determine whether you need to submit any permit application forms to the EPA. If you answer "yes" to any questions, you must submit this form and the supplemental form listed in the parenthesis following the question. Mark "X" in the box in the third column if the supplemental form is attached. If you answer "no" to each question, you need not submit any of these forms. You may answer "no" if your activity is excluded from permit requirements; see Section C of the instructions. See also, Section D of the instructions for definitions of bold—faced terms.

SPECIFIC QUESTIONS	MARK 'X' YES	NO	FORM ATTACHED	SPECIFIC QUESTIONS	MARK 'X' YES	NO	FORM ATTACHED
A. Is this facility a **publicly owned treatment works** which results in a **discharge** to **waters of the U.S.**? (FORM 2A)	16	17	18	B. Does or will this facility *(either existing or proposed)* include a **concentrated animal feeding operation** or **aquatic animal production facility** which results in a **discharge** to **waters of the U.S.**? (FORM 2B)	19	20	21
C. Is this a facility which currently results in **discharges** to **waters of the U.S.** other than those described in A or B above? (FORM 2C)	22	23	24	D. Is this a proposed facility *(other than those described in A or B above)* which will result in a **discharge** to **waters of the U.S.**? (FORM 2D)	25	26	27
E. Does or will this facility treat, store, or dispose of **hazardous wastes**? (FORM 3)	28	29	30	F. Do you or will you inject at this facility industrial or municipal effluent below the lowermost stratum containing, within one quarter mile of the well bore, underground sources of drinking water? (FORM 4)	31	32	33
G. Do you or will you inject at this facility any produced water or other fluids which are brought to the surface in connection with conventional oil or natural gas production, inject fluids used for enhanced recovery of oil or natural gas, or inject fluids for storage of liquid hydrocarbons? (FORM 4)	34	35	36	H. Do you or will you inject at this facility fluids for special processes such as mining of sulfur by the Frasch process, solution mining of minerals, in situ combustion of fossil fuel, or recovery of geothermal energy? (FORM 4)	37	38	39
I. Is this facility a proposed **stationary source** which is one of the 28 industrial categories listed in the instructions and which will potentially emit 100 tons per year of any air pollutant regulated under the Clean Air Act and may affect or be located in an attainment area? (FORM 5)	40	41	42	J. Is this facility a proposed **stationary source** which is NOT one of the 28 industrial categories listed in the instructions and which will potentially emit 250 tons per year of any air pollutant regulated under the Clean Air Act and may affect or be located in an **attainment area**? (FORM 5)	43	44	45

III. NAME OF FACILITY

C 1 SKIP

15 16 - 29 30 69

IV. FACILITY CONTACT

A. NAME & TITLE *(last, first, & title)* — B. PHONE *(area code & no.)*

C 2

15 16 45 46 - 48 49 - 51 52 - 55

V. FACILITY MAILING ADDRESS

A. STREET OR P.O. BOX

C 3

15 16 45

B. CITY OR TOWN — C. STATE — D. ZIP CODE

C 4

15 16 40 41 42 47 51

VI. FACILITY LOCATION

A. STREET, ROUTE NO. OR OTHER SPECIFIC IDENTIFIER

C 5

15 16 45

B. COUNTY NAME

46 70

C. CITY OR TOWN — D. STATE — E. ZIP CODE — F. COUNTY CODE *(if known)*

C 6

15 16 40 41 42 47 51 52 54

CONTINUED FROM THE FRONT

VII. SIC CODES (4-digit, in order of priority)

A. FIRST		B. SECOND	
C 7	(specify)	C 7	(specify)
C. THIRD		**D. FOURTH**	
C 7	(specify)	C 7	(specify)

VIII. OPERATOR INFORMATION

A. NAME

C 8

B. Is the name listed in Item VIII-A also the owner?

☐ YES ☐ NO

C. STATUS OF OPERATOR (Enter the appropriate letter into the answer box; if "Other", specify.)

F = FEDERAL
S = STATE
P = PRIVATE
M = PUBLIC (other than federal or state)
O = OTHER (specify)

(specify)

D. PHONE (area code & no.)

C A

E. STREET OR P.O. BOX

F. CITY OR TOWN

C B

G. STATE

H. ZIP CODE

IX. INDIAN LAND

Is the facility located on Indian lands?

☐ YES ☐ NO

X. EXISTING ENVIRONMENTAL PERMITS

A. NPDES (Discharges to Surface Water)	D. PSD (Air Emissions from Proposed Sources)	
C T I 9 N	C T I 9 P	
B. UIC (Underground Injection of Fluids)	**E. OTHER (specify)**	
C T I 9 U	C T I 9	(specify)
C. RCRA (Hazardous Wastes)	**E. OTHER (specify)**	
C T I 9 R	C T I 9	(specify)

XI. MAP

Attach to this application a topographic map of the area extending to at least one mile beyond property bounderies. The map must show the outline of the facility, the location of each of its existing and proposed intake and discharge structures, each of its hazardous waste treatment, storage, or disposal facilities, and each well where it injects fluids underground. Include all springs, rivers and other surface water bodies in the map area. See instructions for precise requirements.

XII. NATURE OF BUSINESS (provide a brief description)

XIII. CERTIFICATION (see instructions)

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this application and all attachments and that, based on my inquiry of those persons immediately responsible for obtaining the information contained in the application, I believe that the information is true, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

A. NAME & OFFICIAL TITLE (type or print)	B. SIGNATURE	C. DATE SIGNED

COMMENTS FOR OFFICIAL USE ONLY

C C

NATIONAL POLLUTANT
DISCHARGE ELIMINATION
SYSTEM (NPDES)

Application for Permit to Discharge Wastewater

Supplementary Instructions for STANDARD FORM A — MUNICIPAL

STANDARD FORM A – MUNICIPAL
SUPPLEMENTARY INSTRUCTIONS

TABLE OF CONTENTS

NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM
APPLICATION FOR PERMIT TO DISCHARGE
GENERAL INSTRUCTIONS
STANDARD FORMS

The Federal Water Pollution Control Act, as amended by Public Law 92-500 enacted October 18, 1972, prohibits any person from discharging pollutants into a waterway from a point source unless his discharge is authorized by a permit issued either by the U.S. Environmental Protection Agency or by an approved State agency. Regulations for the operation of this program are published in the FEDERAL REGISTER as 40 CFR part 125 (38 F.R. 13528, May 22, 1973), available from the Government Printing Office, Washington, D.C. 20402. Applicants wishing detailed information regarding this form or the permit should refer to this publication. It is expected, however, that for most applicants, the attached cover letter and the general instructions below will provide the information necessary to complete the form.

Who must apply.—The owner and operator of any activity or wastewater system, publicly or privately owned, which discharges wastes from one or more point sources into a waterway, must obtain a permit for such discharge(s). Where the system is owned by one person but leased to another person for operation, it is the responsibility of the operator to obtain the permit. A separate application is to be submitted for each facility discharging separately which is owned and/or operated by the applicant. Federal departments, agencies, and instrumentalities are also subject to these requirements. Discharges into publicly owned treatment works are not subject to permit requirements. However, discharges to publicly owned collection systems not connected to a treatment works are subject to these requirements. For a municipality, a facility is defined as a distinct activity or installation, including connected wastewater transport systems, which operates under the control or jurisdiction of a single responsible organization and discharges pollutants from one or more discharge points.

Application form to be used.—There are two sets of National Pollutant Discharge Elimination System (NPDES) Forms which are to be used, short forms (A-D) and standard forms (A and C). These instructions are for the standard forms A and C. The standard form requires specific information on the activity or wastewater facility and on each discharge. Depending on the adequacy of the data submitted for determining the issuance of a permit, additional information and analyses may be required from an applicant. Standard forms are designed for different sources of discharge as follows:

Form A—Municipal Wastewater Systems.

Form C—Manufacturing and Commercial (including mining and vessel discharges).

If the discharge is from a Federal facility's treatment plant receiving more than 50 percent domestic waste (based on the dry weather flow rate), complete standard form A. All other dischargers (including dischargers of domestic waste), with the exception of municipalities, municipal-type activities (e.g., subdivisions, shopping centers, etc.) and Federal facilities described above, must complete standard form C.

Signature on application.—The person who signs the application form will often be the applicant himself; when another person signs on behalf of the applicant, his title or relationship to the applicant should be shown in the space provided. In all cases the person signing the form should be authorized to do so by the applicant. An application submitted by a corporation must be signed by a principal executive officer of at least the level of vice president or his duly authorized representative, if such representative is responsible for the overall operation of the facility from which the discharge(s) described in the form originate. In the case of a partnership or a sole proprietorship, the application must be signed by a general partner or the proprietor, respectively. In the case of a municipal, State, Federal, or other public facility, the application must be signed by either a principal executive officer, ranking elected official or other duly authorized employee.

Attachments and supplemental information.—Some items in this form may require narrative explanation; for this purpose, use the item labeled "Additional Information" at the end of sections I and II, or attach a separate sheet entitled "Additional Information." Where a separate sheet is used, be sure it is identified by the name of the applicant, the activity, and the discharge number to which it applies. Also, identify each separate remark by the item number and section of the form to which it refers.

Drawings required in section I should be attached to this application and identified by the name of the applicant and the activity. All other papers and attachments to the application must be similarly identified.

Use of information.—Except as specified below, all information contained in this application will, upon request, be made available to the public for inspection and copying. A separate sheet entitled "Confidential Answers" must be used to set out information which the applicant believes if disclosed to the general public would divulge methods and processes entitled to protection as trade secrets. The information must clearly indicate the item number to which it applies. Confidential treatment can be considered only for the information for which a specific written request for confidential treatment has been made on the attached sheet. However, in no event will identification of the contents, volume, and frequency of a discharge be recognized as confidential or privileged information.

Completion of forms.—Unless otherwise specified in the detailed instructions, each item in the forms must be answered. To indicate that each item has been considered, enter "NA," for not applicable, where a particular item does not fit the circumstances or characteristics of your operation or activity.

Assistance and advice regarding requirements for filing permit applications can be obtained through contact with your EPA Regional Office or approved State agency.

Addresses of EPA Regional Offices and States Within Their Jurisdiction

Region	Address and Phone	State
I	Regional Administrator, Region I, Environmental Protection Agency, John F. Kennedy Federal Bldg., room 2303, Boston, Mass. 02203; attention: Permits Branch. 617-223-7210.	Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont.
II	Regional Administrator, Region II, Environmental Protection Agency, 26 Federal Plaza, room 908, New York, N.Y. 10007; attention: Permits Branch. 212-264-9895.	New Jersey, New York, Virgin Islands, Puerto Rico.
III	Regional Administrator, Region III, Environmental Protection Agency, Curtis Bldg., Sixth and Walnut Sts., Philadelphia, Pa. 19106; attention: Permits Branch. 215-597-9966.	Delaware, District of Columbia, Maryland, Pennsylvania, Virginia, West Virginia.
IV	Regional Administrator, Region IV, Environmental Protection Agency, 1421 Peachtree St. NE., Atlanta, Ga. 30309; attention: Permits Branch. 404-526-3971.	Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, Tennessee.
V	Regional Administrator, Region V, Environmental Protection Agency, 1 North Wacker Dr., Chicago, Ill. 60606; attention: Permits Branch. 312-353-1472.	Illinois, Indiana, Michigan, Minnesota, Ohio, Wisconsin.
VI	Regional Administrator, Region VI, Environmental Protection Agency, 1600 Patterson St., suite 1100, Dallas, Tex. 75201; attention: Permits Branch. 214-749-1983.	Arkansas, Louisiana, New Mexico, Oklahoma, Texas.
VII	Regional Administrator, Region VII, Environmental Protection Agency, 1735 Baltimore Ave., Kansas City, Mo. 64108; attention: Permits Branch. 816-374-5955.	Iowa, Kansas, Missouri, Nebraska.
VIII	Regional Administrator, Region VIII, Environmental Protection Agency, 1860 Lincoln St., suite 900, Denver, Colo. 80203; attention: Permits Branch. 303-837-4901.	Colorado, Montana, North Dakota, South Dakota, Utah, Wyoming.
IX	Regional Administrator, Region IX, Environmental Protection Agency, 100 California St., San Francisco, Calif. 94111; attention: Permits Branch. 415-556-3450.	Arizona, California, Hawaii, Nevada, Guam, American Samoa, Trust Territories.
X	Regional Administrator, Region X, Environmental Protection Agency, 1200 Sixth Ave., Seattle, Wash. 98101, attention: Permits Branch. 206-442-1213.	Alaska, Idaho, Oregon, Washington.

SECTION I. APPLICANT AND FACILITY DESCRIPTION: MUNICIPAL

1. *Legal name of applicant.*—This term applies to the person, agency, firm, or other entity which owns or is responsible for any waste treatment works, interceptor systems, or any facility/activity conducting operations that result or may result in a discharge of pollutants to a waterway. This may or may not be the same name as the facility or activity producing the discharge. Enter the name of the applicant as it is officially or legally referred to, e.g., Doddsonville Department of Public Works; Metropolitan Sanitary Commission. Do not use colloquial names as a substitute for the official name.

2. *Mailing address of applicant.*—Use the complete mailing address of the applicant's main office. This often will not be the same address as is used to designate the location of the work or activity (see item 5).

3. *Applicant's authorized agent.*—Give the name of person who is thoroughly familiar with the facts reported on the forms and who can be contacted by the Environmental Protection Agency, State offices, and other agencies involved in permit application processing and review.

The person named, although not necessarily the same as the signing official, is also subject to the provisions of law quoted below the signature line on the first page of this form.

5. *Discharge facility/activity.*—A facility is a distinct activity or installation, including connected transport systems, which operates under the control or jurisdiction of a single responsible organization and discharges pollutants from one or more discharge points. Name the facility/activity as it is officially or legally referred to in order to distinguish it from similar entities, if any, in the same geographical area. Do not use colloquial names as a substitute for the official name. Enter the address where the facility is located.

6.b. *Responsible organization receiving discharge.*—If part of your discharge is into a municipal waste transport system under a responsible organization other than the one responsible for your facility, give the name and mailing address of that responsible organization. If you discharge to more than one other system, provide the appropriate data of items 6b, 6c, and 6d on additional sheets. If exact flows to these other systems are not known, provide best estimates.

c. *Facility which receives discharge.*—Give the name of the waste treatment facility that ultimately treats the discharged waste from your facility.

7. *Facility discharges number and facility discharge volume.*—If the discharge is directly to land, use category "Surface impoundment with no effluent," "Underground percolation," or if to a surface which drains into a waterway, "Surface water."

A "continuous" discharge is one which occurs without interruption throughout the operation hours of the facility. An "intermittent" discharge is one which occurs and ceases at regular or irregular intervals either during or outside of the operating hours of the facility.

Surface water.—Water other than subterranean water, e.g., streams, estuaries, lakes, oceans, rivers.

Surface impoundment with no effluent.—A manmade holding pond or basin large enough to contain all wastes discharged which allows evaporation with no or an insignificant amount of percolation into the ground and has no overflow.

Underground percolation.—The movement or flow of water through the interstices or the pores of soil or other porous medium.

Well injection.—This code is to be used for injection of wastes into a well.

8.a. *Facility bypass points.*—A bypass is an arrangement of pipes, conduits, gates, and valves whereby all or a portion of the flow is diverted and results in a discharge.

Indicate the number of bypass points that result in point discharges. A section II must be completed for each bypass point.

b. *Overflow.*—An overflow occurs when the volume of water exceeds the capacity of a transport system causing the extra water to be spilled or forced out of the system into a waterway. A section II must be completed for each overflow point.

9. *Collection system type.*—

Separate storm.—A separate collection system of pipes that carries only runoff from buildings and land caused by precipitation.

Separate sanitary.—A separate collection of pipes that carries:

(1) Domestic wastewater with storm and surface water excluded.

(2) Wastewater discharged from the sanitary conveniences of dwellings (including apartment houses and hotels), office buildings, industrial plants, or institutions.

(3) The water supply of a community after it has been used and discharged into a sewer.

Combined sanitary and storm.—A system of pipes which carries a mixture of storm water runoff, surface water runoff and other wastewater such as domestic or industrial wastewater.

10. *Municipalities or areas served.*—Enter the names of the municipalities or areas served by this facility and for each enter the best estimate of actual population served at the time of this application. If there is another sewer authority discharging into this facility, give the name of that authority and the actual population it serves. Do not include communities served by that sewer authority.

12. *Permits, licenses and applications.*—List all existing permits and licenses or permit and license applications granted, denied or requested from Federal, interstate, State or local agencies associated with any discharge described in this application. Example: A permit to discharge issued by a State water control office.

13. *Required maps and drawings.*—A "schematic of water flow" and a "location map" are required with this application. All maps and drawings should be either on paper or other material suitable for reproduction. If possible, all sheets should be approximately letter size with margins suitable for filing and binding. As few sheets should be used as necessary to show clearly what is involved. All discharge points should be identified with the discharge serial numbers used in section II of this application. All

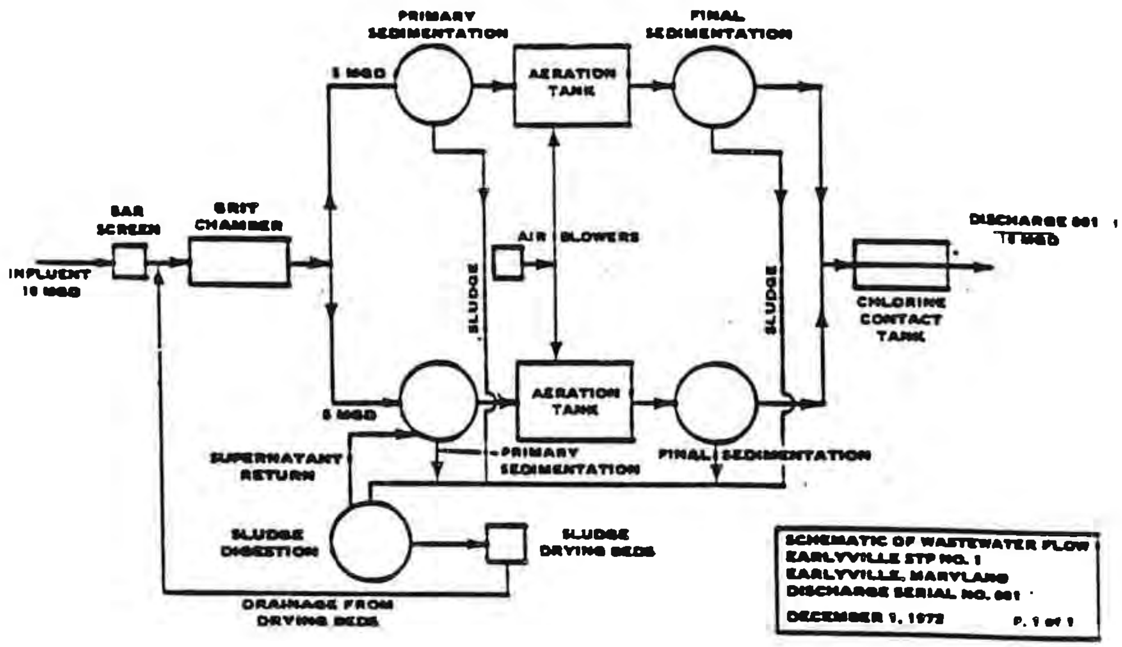


FIGURE A

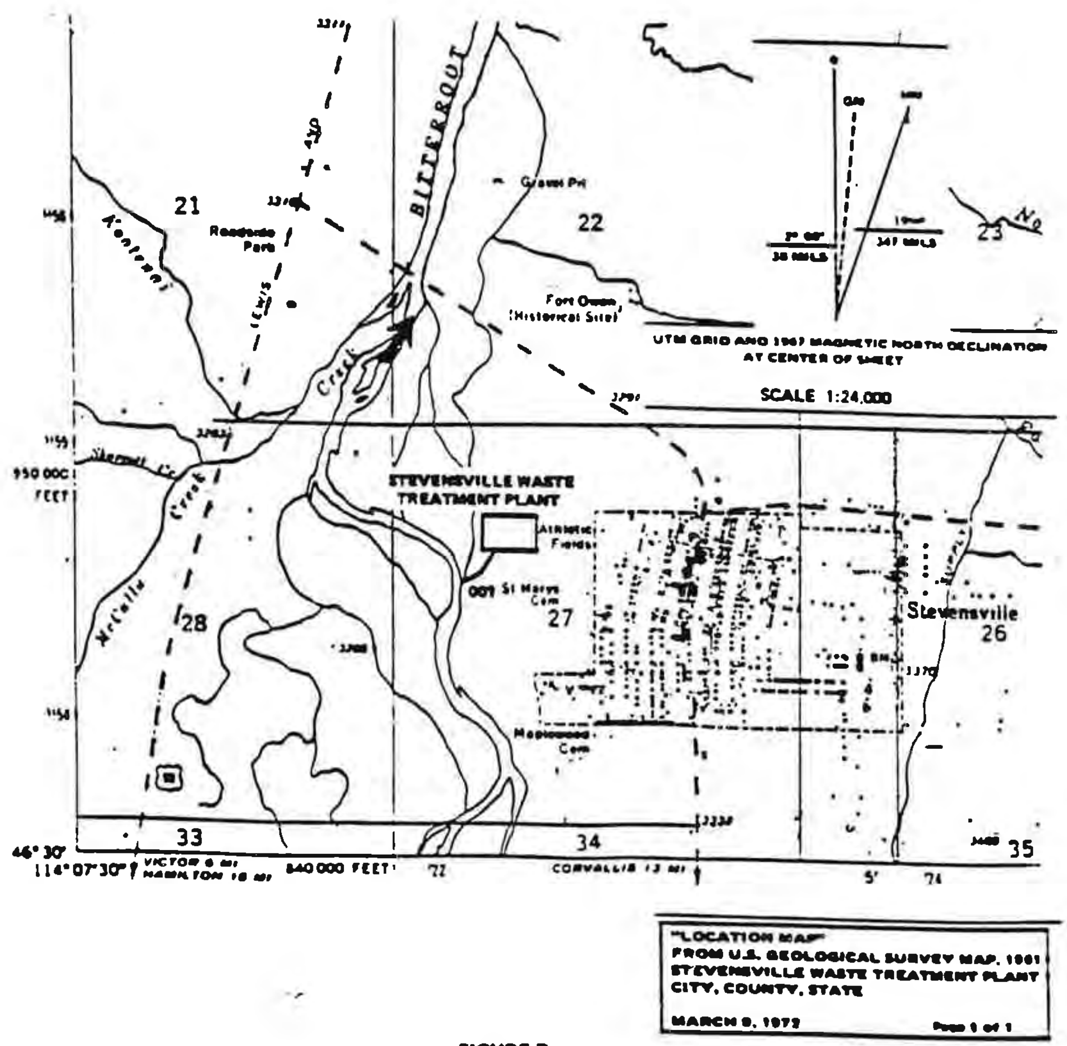


FIGURE B

sheets should include a title which includes applicant's name, facility location, date of drawing and designation of number of sheets of each diagram type as "page— of —."

(a) *Schematic of wastewater flow.*– A line drawing of wastewater flow through the facility producing discharges must be attached to this application. Average flow rates should be shown for various wastewaters if possible. Specific treatment processes are to be indicated. The title is to be headed by the statement "Schematic of Wastewater Flow." An example of the drawing required is shown in figure A.

(b) *Location map.*- A map showing the location of each discharge structure, including any and all outfall devices, dispersive devices, and nonstructural points of discharge, must be attached to this application. The usual meridian arrow showing north as well as the map scale must be shown. On all maps of rivers, the direction of the current is to be indicated by an arrow. In tidal waters, the directions of the ebb and flow tides are to be shown. Maps may be traced from a coast survey, lake survey or geological survey chart, road map, or other general map and must bear a note showing the number of title of such map or chart (e.g., "Traced from U.S. Coast Survey Chart 272"). The name of the waterway and the names of the towns and prominent points are to be placed on this map and identified. The location of each existing and proposed discharge structure must be clearly identified using the discharge serial number specified in section II of this application. The title is to be headed by the statement "Location Map." An example of the application map is shown in figure B.

SEC. II–BASIC DISCHARGE DESCRIPTION: MUNICIPAL

A separate section II must be submitted for each unique discharge, including overflow and bypass points. A unique discharge is defined as having a specific location and a specific activity or process causing the discharge.

1. *Discharge serial number.* - a. Assign a three-digit number beginning with 001 for the point of discharge covered by the first description. Discharge serial numbers must be consecutive for each additional discharge described; hence, the second serial number would be 002, the third 003, etc. Enter this number at the top of each page of section II in the space provided.

b. *Discharge point name.*–Give the name of the discharge point which distinguishes this discharge point from all other discharge points from the facility, e.g., Ursus Creek Discharge; Varga STP Outfall No. 2. Do not use colloquial terms.

c. *Previous discharge serial number.* - If application for a national or Federal permit was made previously for this discharge (see item 4, sec. I), supply the serial number assigned for this discharge.

4. *Discharge point description.* - See instructions for section I, item 7.

5. *Discharge point · latitude/longitude.* · State the precise location where the effluent from the discharge reaches the waterway. If the discharge is an overflow point, give the point where the overflow occurs. If the discharge is to a dry waterway, give the point where the discharge hits the waterway.

6. *Discharge receiving water name.* · Use the name of the waterway by which it is usually designated on published maps of the area. If possible, refer to one of the map series published by the U.S. Geological Survey. If the discharge is to an unnamed tributary, please so state; and give the name of the first body of water fed by that tributary which is named on the map, e.g., Unnamed ditch to Vaughan Creek, Unnamed arroyo to Serpent River, where Serpent River is the first waterway that is named on the map and is reached by the discharge.

8. *Bypass.* - See definition in instructions for section I, item 8.

9. *Overflow.* - See definition in instructions for section I, item 8.

11. *Discharge treatment.*–

a. *Discharge treatment description.*–Provide in this space a brief narrative description of the waste abatement practices currently in use which affect this discharge. Example: Treatment consists of primary sedimentation using clarifiers, followed by biological treatment using activated sludge, followed by secondary clarification and chlorination. Sludge is treated by digestion and vacuum filtration. Final sludge disposal is by incineration. If no treatment is provided, such as for overflows or bypasses, enter "None."

b. *Discharge treatment codes.*–Describe the wastewater abatement procedures for this discharge using the lettered codes for abatement practices which are listed in table I. As much as possible list the codes in the sequence in which the wastewater abatement procedures are applied at this facility for this discharge.

13. *Plant design data.*– a. *Plant design flow.*–Enter the average flow in millions of gallons per day (mgd), to three decimal places, for which this facility was designed, e.g., 3.120 translates to three million one hundred twenty thousand gallons per day.

b. *Plant design BOD removal (percent).*–Enter as a percentage the 5-day BOD which the plant is designed to remove from the wastewater.

c. *Plant design N removal (percent).*–Enter as a percentage the nitrogen which the plant is designed to remove from the wastewater.

d. *Plant design P removal (percent).*–Enter as a percentage the phosphorus which the plant is designed to remove from the wastewater.

e. *Plant design SS removal (percent).*–Enter as a percentage the suspended solids which the plant is designed to remove from the wastewater.

14. *Description of influent and effluent.*–For each of the parameters listed, enter in the appropriate box the value or code letter answer required. Values must be representative of the discharge during the twelve preceding months of operation or represent best engineering estimates for proposed discharges. For facilities that have not been in operation for one year, data reported should represent the existing period of record with a note to that effect. Detailed instructions for completing particular columns are provided

below. Please report in the units specified. Values do not need to be supplied for boxes that have been crossed out.

Where it is indicated that parameter values are to be provided if available, this information shall be supplied if a sampling and analysis program on these parameters has been initiated or, in the case of new facilities, where an engineering determination has been made.

Column 1–influent, annual average value.–Supply the average of all daily values during the year for the influent before treatment.

Column 2–annual average value.–Supply the average of all daily values during the year when discharge actually is, or is expected to be operating (if a new discharge). If a discharge occurs irregularly, the value supplied in this column should represent an average for the days the discharge actually occurs.

Column 3–lowest monthly average value.–Supply the lowest of the 12 monthly average values for the preceding year. The monthly average value is the arithmetic mean of the daily values in a one month period.

Column 4–highest monthly average value.–Supply the highest of the 12 monthly average values for the preceding year. The monthly average value, except for bacteria, is the arithmetic mean of the daily values in a one month period. The monthly average value of bacteria is the geometric mean of the daily values in a one month period.

Column 5–frequency of analysis.–Specify the frequency of analysis for each parameter as number of analyses per number of days (e.g., "3/7" is equivalent to three analyses performed every 7 days). If continuous, enter "CONT." When analyses are conducted on more than one individual grab sample which are collected during the same day, the analysis frequency should reflect one analysis whose value is the average of the individual grab sample measurements.

Column 6–number of analyses.–Specify the number of analyses performed during the previous 12 months of operation at the average frequency specified in column 5 up to 365.

Column 7–sample type.–Specify sample type as follows:

G For grab sample (individual sample collected in less than 15 minutes).

For composite sample "#" is to be replaced by the average number of hours over which the composite sample was collected. Composite samples are combinations of individual samples obtained at intervals over a time period. Either the volume of each individual sample is directly proportional to discharge flow rates or the sampling interval (for constant-volume samples) is inversely proportional to the flow rates over the time period used to produce the composite.

NA If "CONT" was entered in column 6.

Analytical methods.–Appendix A contains all parameters with their reporting levels, test descriptions and references. The parameter values can be determined either by use of one of the standard analytical methods as described in table A or by methods previously approved by the EPA Regional Administrator or Director of a federally approved State program (or their authorized representatives) which has jurisdiction over the State in which the discharge occurs. If the test used is not one shown in table A, the test procedure should be referenced in item 17 or on a separate sheet. If values are determined to be less than the detectable limit (as determined by referenced standard analytical techniques and/or instrument manufacturer's literature), specify "LT (value of detectable limit)" in the appropriate space. For example, if the detectable limit is .005 mg/l and quantities of less than this are determined, specify "LT.005." Do not enter descriptors such as "NIL," "TRACE," "NEG," etc., for this purpose.

In order for values reported to be representative, it is recommended that they be based on daily composite samples (if applicable) taken over at least one week during period of maximum flow, if possible. If samples are taken at periods of less than maximum flow, state in item 17 the percent of maximum flow that was obtained during the sampling period.

15. *Additional wastewater characteristics.*–Indicate by an "X" in the appropriate box those chemical constituents known to be present in the effluent based on any previous analyses that have been performed on this discharge. Those constituents for which no previous analyses have been performed need not be indicated.

SECTION III–SCHEDULED IMPROVEMENTS AND SCHEDULES OF IMPLEMENTATION

1. b *Improvements–authority imposing requirement.*–

Locally developed plan.–A schedule developed at the county or municipal or Federal facility level.

Areawide plan.–A schedule developed by a metropolitan authority or other agency formed by local or municipal governments, e.g., Greater Washington area.

Basin plan.–A schedule developed by a river basin commission, or other body having authority over a watershed area, e.g., Delaware River Basin, Potomac River Basin.

State approved implementation schedule.–A plan imposed to achieve compliance with State water quality standards for intrastate waters or by a permit or equivalent document issued by a State water pollution control agency.

Federal approved water quality standards implementation plan.–A schedule imposed to achieve compliance with water quality standards approved by the Environmental Protection Agency or by its predecessors, the Federal Water Quality Administration, and the Federal Water Pollution Control Administration.

Federal enforcement procedures or actions.–A schedule imposed by an enforcement conference held under section 10(a) of the Federal Water Pollution Control Act prior to the date of enactment of the FWPCA amendments of 1972.

State court order.–A schedule imposed in an order or settlement issued or approved by a State court of law.

Federal court order.–A schedule imposed in an order or settlement issued or approved by a court of the United States.

2. *Implementation schedule and actual completion dates.*–Supply the following dates as they are applicable to the implementation schedule (plan) being described:

(a) *Preliminary plan complete.*—The date the preliminary engineering plans are complete.

(b) *Final plan complete.*—The date the final engineering plans are complete.

(c) *Financing complete.*—The date all financing arrangements are to be completed.

(d) *Site acquired.*—The date the land to be used for the treatment works is to be acquired.

(e) *Begin construction.* — The date the construction is scheduled to begin.

(f) *End construction.*—The date the construction is scheduled to be completed.

(g) *Begin discharge.*—The date the discharge is scheduled to start operating after the implemented action has been completed.

(h) *Operational level attained.*—The date the effluent level is scheduled to meet the conditions imposed by the implementation plan.

3. *Actual completion.*—Supply actual completion dates for those steps of the implementation schedule which have been completed.

SECTION IV—INDUSTRIAL WASTE CONTRIBUTION TO MUNICIPAL SYSTEM

Each municipal facility is required to complete a separate section IV for each major industrial facility discharging wastes into the municipal system. This includes industrial wastes which are discharged into another collection system that is served by the collection and/or treatment system for which this permit application is being filed. It is the responsibility of the applicant to obtain the required information on any major industrial contributors to his facility, including those contributing via another system. Actual data should be provided if available. If actual data is not immediately available, section IV should be marked "interim" and a best estimate should be provided with a statement indicating the amount of time required to provide the actual information. Filing the permit application should not be delayed beyond the filing deadline for completion of section IV. However, any missing information is to be submitted when available. If certain of the requested information does not apply, it should be marked "NA."

A major contributing industry is considered to be one that has or could have significant impact on the municipal wastewater treatment facility receiving the waste or upon the quality of effluent from that treatment facility. Specifically, a major contributing industry is defined as one that (1) has a flow of 50,000 gallons or more per average work day; (2) has a flow greater than 5 percent of the total flow carried by the municipal system receiving the waste, or (3) has a toxic material in its discharge. It may be necessary to alter these administrative criteria in certain cases, such as an instance where two or more contributing industries in combination can produce an undesirable effect on either the municipal facility or the quality of its effluent.

1. *Major contributing facility.*—Give the name and the address that designates the location of the facility.

2. *Primary standard industrial classification code.*—Using four digit standard industrial classification (SIC) codes, indicate the type of industrial facility described in this section IV that is discharging into the municipal system covered by this application.

Standard industrial classification (SIC) code numbers and descriptions may be found in the 1972 edition of the "Standard Industrial Classification Manual" prepared by the Executive Office of the President, Office of Management and Budget, which is available from the Government Printing Office, Washington, D.C. Do not use previous editions of the manual. Copies are also available for examination at your State water pollution control office, Regional Offices of the Environmental Protection Agency, and at most public libraries.

3. *Principal product or raw material.*—Specify either the principal product or the principal raw material and the maximum quantity per day produced or consumed. Quantities are to be reported in the units of measurement given in table III for the particular SIC categories that are listed. Enter the letter-number code from the "Code" column in table III for the units selected under "Units." Other SIC categories should use the units of measurement normally used by that industry.

6. *Characteristics of wastewater.*—Indicate the characteristics of the wastewater from the contributing industry in terms of parameters that will adequately identify the waste such as BOD, COD, Cr, Zn, pH units, degrees Fahrenheit, etc. The characteristics should be indicative of the waste stream after any pretreatment is provided by the industrial facility but prior to entering the municipal system. In addition to parameter names, give the five-digit parameter numbers specified in appendix A. Report values in units specified in appendix A.

Table I – Waste Treatment Codes—Municipal

The treatment operations shown in this table are, in general, arranged in the order in which they normally occur during a sewage disposal cycle. Select those which apply to the system being reported and enter the codes in Section II, item 11 (b) in the sequence in which they occur. Where parallel or alternate operations are involved, list the codes one after the other, but enclose all of them in slashes. Example: Where plant influent is initially screened and then routed through two primary settling tanks emptying into a single trickling filter and single sludge bed, the treatment processes would be coded as follows: S/C, C/FT, B.

In most instances each major operation is designated by a single letter. To allow more specific definition of complex operations, one or two letters have been added to the basic codes showing variations in processes or techniques. For example, the basic code for filtering operations is "F;" to show that it is a sand filter, an "S" is added to make the code "FS." It is further defined to show an intermittent sand filter as "FSI." Record the codes which most clearly define your plant operations.

J—Equalization.
JS—Surge Tank.
S—Screens.
SC—Comminutor (grinding of sewage stream).
M—Metering.
G—Grit chamber.
GA—Aerated grit chambers.
O—Grease removal and skimming tanks not incidental to settling tanks.
OA—Aerated tank (diffused air).
E—Pretreatment.
EA—By aeration.
EG—By chlorine gas.
EH—By hypochlorite.
EZ—By ozonation.
ET—By temperature control.
EO—By other.
C—Primary settling tanks and holding tanks.
R—Intermediate settling tanks (include only if designated for use as part of other than additional treatment processes).
AS—Activated sludge treatment.
ASN—Conventional (approximately 4 to 8 hours of aeration with approximately 25 percent sludge return).
ASA—High rate aeration (less than 4 hours aeration).
AST—Tapered aeration (variable aeration along length of tank).
ASS—Step aeration.
ASP—Plug flow.
ASR—Completely mixed step aeration and sludge return.
ASG—Stage aeration including intermediate settling.
ASC—Contact stabilization (provides aeration period less than 2 hours in contact tank).
ASE—Extended aeration (greater than 24 hours).
ASO—Pure oxygen used (80 percent +).
AP—Treatment by plain aeration.
APC—Contact aeration (fixed media, i.e., contact plates or frames).
APP—Plain aeration (no sludge return).
APO—Oxidation ditch.
F—Filters.
FC—Contact beds including dosing siphons.
FS—Sand.
FSI—Intermittent sand filters.
FSR—Rapid sand filters or other sand straining including subsurface.
FO—Roughing filters.
FT—Trickling filters.
FTH—High rate.
FTL—Low rate.
K—Intermediate treatment (include only if designed for use as part of an other than additional treatment process).
KG—Coagulation.
KF—Flocculation.
N—Final settling tanks.
P—Disinfection.
PG—By chlorine gas.
PH—By hypochlorite.
PO—By ozone.
I—Application of wastewater treatment facility effluents to land.
IC—Cultivated soils used to produce crops for consumption by animals or man.
IA—Sprays used.
IS—Subsurface application.
L—Lagoons or ponds.
LE—Evaporation (no discharge).
LS—Seepage (no discharge).
LP—Settling.
LH—Holding or detention.
LT—Emergency storage only.
LO—Stabilization.
LA—Aeration provided.
D—Digester, separate sludge.
DN—Anaerobic.
DA—Mechanical aeration provided (aerobic digestion).
DD—Diffused aeration provided (aerobic digestion).
B—Sludge drying beds.
H—Sludge storage tanks (not second stage digestion units).
T—Sludge thickener.
TA—Air flotation
V—Mechanical sludge dewatering.
VC—Centrifuge.

Table I – Waste Treatment Codes–Municipal (Continued)

VV–Rotary vacuum filter.
VP–Press.
VH–Heat treatment.
Z–Sludge conditioning.
ZY–Elutriation.
W–Additional treatment.
WH–Heavy metals removal.
WP–Phosphorus removal.
WS–Suspended solids removal.
WA–Carbon adsorption.
WB–Breakpoint chlorination.
WC–Chemical coagulation and sedimentation.
WD–Distillation.
WE–Electrical processes.
WEC–Electrochemical.
WED–Electrodialysis.
WG–Evaporation.
WF–Filtration.
WK–Foaming.
WI–Ion exchange.
WJ–Dissolved air floatation.
WL–Lagoons–polishing only.
WM–Microscreening.
WN–Nitrogen removal.
WNS–Ammonia stripping.
WNA–Biological nitrification 1 stage.
WNB–Biological nitrification 2 stage.
WND–Denitrification by anaerobic digestion and suspended growth chamber.
WNC–Denitrification by anaerobic digestion and packed columns.
WX–Chemical oxidation.
WU–Neutralization.
WR–Reverse osmosis.
WV–Solvent extraction.
X–Sludge disposal.
XB–Barged to sea.
XD–Used for fertilizer.
XF–Burned for fuel.
XI–Incinerated.
XN–Used for landfill.
XR–Land reclamation.
XO–Wet air oxidation.

Table II – Facility Requirement Codes

	Key word
General action description:	
New facility	NEW
Modification (no increase in capacity or treatment)	MOD
Increase in capacity	INC
Increase in treatment level	INT
Both increase in treatment level and capacity	ICT
Specific action description:	
Primary	PRI
Secondary	SEC
Tertiary	TER
Polishing lagoon	PLA
Phosphorus removal	PHO
Nitrogen removal	NIT
Organic removal	ROR
Disinfection	DIS
Sludge processing	SLP
Sludge disposal	SLD
Outfall	OUT
Sanitary intercepting sewer	SIN
Sanitary collector sewer	CSE
Pumping station	IPU
Force main	FUM
Infiltration/correction	INI
Combined sewer correction	CSC

Table III – Units of Measurement by SIC Code (Industry)
(To be Used for Item 3, Section IV)

SIC Code(s)	Code	Units of measurement	Industry
201; 2077	A-1	Pound live weight killed (meatpacking in slaughterhouse or packinghouse; poultry processing).	Meat products.
	A-2	Pound product (slaughtering & rendering; processing).	
	A-3	Pound raw material (rendering in offsite plant).	
202; 5143	B-1	1,000 lb milk equivalent	Dairy products.
2033; 2034; 2037; 2038.	C-1	Ton raw material	Canned and preserved fruits and vegetables.
204	D-1	1,000 bu processed	Grain mill products.
2061	E-1	Ton sugar cane processed	Raw cane sugar.
2062	E-2	Ton raw sugar processed	Cane sugar refining.
2063	E-3	Ton beets sliced	Beet sugar.
2077		See SIC 201	
2084	F-1	Ton grapes pressed	Wines, brandy, and brandy spirits.
	F-2	1,000 gal wine (table wine, for process season only).	
2085	F-3	1,000 bu grain processed	Distilled liquor, except brandy.
2086	F-4	1,000 standard cases	Bottled and canned soft drinks.
2091; 2092	G-1	Ton raw material	Seafoods.
22	H-1	1,000 lb raw material	Textile mill products.
	H-2	*or* 1,000 lb product	
2421	I-1	1,000 fbm	Sawmills and planing mills.
2435; 2436	I-2	1,000 ft^2 on three-eighths inch basis	Veneer and plywood.
2491	I-3	1,000 ft^3 treated	Wood preserving.
2492	I-4	1,000 ft^2 on a three-fourths inch basis	Particle board.
26	J-1	Ton product	Paper and allied products.
2812; 2816; 2819	K-1	Ton product	Inorganic chemicals.
2821; 2823; 2824; 2891; 3079.	L-1	1,000 lb product	Plastic materials and synthetics industry.
2822	M-1	1,000 lb rubber produced	Synthetic rubber (vulcanizable elastomers).
283	N-1	1,000 lb raw material	Drugs and pharmaceuticals.
2841	O-1	1,000 lb product	Soap and detergents.
	O-2	*or* 1,000 gal product	
2865; 2869	P-1	1,000 lb product	Organic chemicals.
2873; 2874; 2875	Q-1	1,000 ton product	Fertilizer industry.
2879	R-1	1,000 lb product	Agricultural chemicals and pesticides.
2891		See SIC 2821	
2911	S-1	1,000 bbl crude or partially refined feed stock (stream day).	Petroleum refining.
3011; 3021; 3031; 3041; 3069.	T-1	1,000 lb raw material	Rubber products.
3111	U-1	1,000 lb green salted hides or pickled skins.	Leather tanning and finishing.
3211; 3231	V-1	1,000 ton product	Flat glass and glass products made from purchased glass.
	V-2	*or* 1,000 ft^2 mirrored surface (for mirrored glass only).	
3241	V-3	1,000 bbl product	Hydraulic cement.
327	V-4	1,000 ton product	Concrete, gypsum, and plaster products.

Table III – Units of Measurement by SIC Code (Industry)
(To be Used for Item 3, Section IV)
(Continued)

SIC Code(s)	Code	Units of measurement	Industry
3292	V-5	1,000 ton asbestos used	Asbestos products.
331	W-1	Ton dry coal	Coke making.
	W-2	Ton hot metal	Blast furnaces.
	W-3	Ton liquid steel	Steelworks.
	W-4	Ton hot formed steel	Hot forming.
	W-5	Ton processed steel	Rolling and finishing mills.
332	W-6	Ton metal cast	Iron and steel foundries.
333	X-1	1,000 lb metal product	Primary smelting and refining of nonferrous metals.
334	X-2	1,000 lb metal product	Secondary smelting and refining of nonferrous metals.
335	X-3	1,000 lb metal processed	Rolling, drawing, and extruding of nonferrous metals.
336	X-4	1,000 lb metal cast	Nonferrous foundries.
3465, 3711; 3714	Y-1	Unit production	Automobile manufacturing.
	Y-2	*or* square feet	
4911; 4931	Z-1	1,000 MWd generated	Electric power services.
4961	Z-2	1 million lb steam produced	Steam supply.

APPENDIX A–STANDARD ANALYTICAL METHODS (INTERIM)

(To be used with item 14, section II)

The following tables are to be used as a guide in reporting the data concerning each parameter. The first column of each table, "PARAMETER & UNITS," indicates the preferred units for reporting data for a given parameter. The second column, "METHOD," lists the preferred analytical method (if any) for determining the required parameter values. The next three columns, "REFERENCES," give the page numbers in standard reference works where a detailed description of the recommended analytical technique given under "METHOD" can be found. These standard references are:

1. Standard Methods for the Examination of Water and Wastewaters, 13th Edition, 1971, American Public Health Association, New York, N.Y. 10019.

2. A.S.T.M. Standards, Part 23, Water; Atmospheric Analysis, 1972 American Society for Testing and Materials, Philadelphia, Pa. 19103.

3. EPA Methods for Chemical Analysis of Water and Wastes, April 1971, Environmental Protection Agency, Water Quality Office, Analytical Quality Control Laboratory, NERC, Cincinnati, Ohio 45268.

Copies of the publications are available from the above sources, or for review in the Regional Offices of the Environmental Protection Agency or the State Water Control Board.

Data must be reported with an accuracy of *at least* two significant digits, i.e., values less than 1 must be reported *at least* to the nearest .01, values between 1 and 10 to the nearest 0.1, values between 10 and 100 to the nearest 1.0, and so forth.

TABLE A

Chemical Parameters				
Parameter & Units	Method	References		
		Standard Methods 13th Ed. 1971	A.S.T.M. Standards Pt. 23 1972	EPA Methods 1971
Alkalinity (as $CaCO_3$) 00410	Titration-Electrometric or Automated Method-Methyl Orange End Point	p. 370	p. 143	p. 6 p. 8
BOD 5 Day mg/liter 00310	Modified Winkler or Probe Method	p. 489	p. 618	p. 15
Chemical Oxygen Demand (COD) mg/liter 00340	Dichromate Reflux	p. 495	p. 219	p. 17
Total Solids mg/liter 00500	Gravimetric, 105°C.	p. 535	–	p. 280
Total Dissolved (Filterable) Solids mg/liter 70300	Glass Fiber Filtration 180°C.	–	–	p. 275
Total Suspended (Non-Filterable) Solids mg/liter 00530	Glass Fiber Filtration 103-105°C.	p. 537	–	p. 278
Total Volatile Solids mg/liter 00505	Gravimetric Method 550°C.	p. 536	–	p. 282
Settleable Matter (Residue) ml/liter 00545	Imhoff Cone, by Volume	p. 539	–	–
Ammonia (as N) mg/liter 00610	Distillation-Nesslerization or Automated Phenolate	–	–	p. 134 p. 141
Kjeldahl Nitrogen (as N) mg/liter 00625	Digestion-Distillation or Automated-Digestion and Phenolate	p. 469	–	p. 149 p. 157
Nitrate (as N) mg/liter 00620	Brucine Sulfate or Automated-Hydrazine or Cadmium Reduction	p. 461	p. 124	p. 185 p. 170 p. 175
Total Phosphorus (as P) mg/liter 00665	Persulfate Digestion and Single Reagent or Manual Digestion and Automated Single Reagent or Stannous Chloride	p. 526	–	p. 246 p. 235 p. 259
Acidity (as $CaCO_3$) mg/liter 00435	Volumetric-color or Electrometric End Point	p. 370	p. 143	p. 5
Total Organic Carbon (TOC) mg/liter 00680	Combustion-Infrared Method	p. 257	p. 702	p. 221
Hardness-Total (as $CaCO_3$) mg/liter 00900	EDTA Titration-Automated Colorimetric, or Atomic Absorption Spectrophotometer	p. 179	p. 169	p. 76 p. 78
Nitrite (as N) mg/liter 00615	Diazotization-Manual or Automated Colorimetric	p. 468	p. 228	p. 195

TABLE A (Continued)

Total Metal Content				
Parameter & Units	Method	References		
		Standard Methods 13th Ed. 1971	A.S.T.M. Standards Pt. 23 1972	EPA Methods 1971
Aluminum-Total** mg/liter 01105	Atomic Absorption Spectrophotometer	p. 57	–	p. 98
Antimony-Total** mg/liter 01097	Atomic Absorption Spectrophotometer	–	–	p. 83
Arsenic-Total** mg/liter 01002	Silver Diethyldithiocarbamate or Atomic Absorption Spectrophotometer	p. 62	–	p. 13 p. 99
Barium-Total** mg/liter 01007	Atomic Absorption Spectrophotometer	p. 66	–	p. 83
Beryllium-Total** mg/liter 01012	Aluminon or Atomic Absorption Spectrophotometer	p. 67	–	p. 83
Boron-Total** mg/liter 01022	Curcumin, Carmine or Potentiometric	p. 69	–	p. 83
Cadmium-Total** mg/liter 01027	Atomic Absorption Spectrophotometer or Colorimetric	p. 422	p. 692	p. 101
Calcium-Total** mg/liter 00916	EDTA Titration or Atomic Absorption Spectrophotometer or Colorimetric	p. 84	p. 692	p. 102
Chromium-Total** mg/liter 01034	Atomic Absorption Spectrophotometer or Colorimetric	p. 426	p. 692	p. 104
Cobalt-Total** mg/liter 01037	Atomic Absorption Spectrophotometer	–	p. 692	p. 83
Copper-Total** mg/liter 01042	Atomic Absorption Spectrophotometer or Colorimetric	p. 430	p. 692	p. 106
Iron-Total** mg/liter 01045	Atomic Absorption Spectrophotometer or Colorimetric	p. 433	p. 692	p. 108
Lead-Total** mg/liter 01051	Atomic Absorption Spectrophotometer or Colorimetric	p. 436	p. 692	p. 110
Magnesium-Total** mg/liter 00927	Atomic Absorption Spectrophotometer or Colorimetric	p. 416	p. 692	p. 112
Manganese-Total** mg/liter 01055	Atomic Absorption Spectrophotometer	–	p. 692	p. 114

**See Note 2 at end of table.

TABLE A (Continued)

Total Metal Content				
Parameter & Units	Method	References		
		Standard Methods 13th Ed. 1971	A.S.T.M. Standards Pt. 23 1972	EPA Methods 1971
Mercury-Total** mg/liter 71900	Flameless Atomic Absorption Procedure. For updated method, see JAWWA, 64, No. 1, pp. 20-25 (Jan. 1972)	–	–	p. 121
Molybdenum-Total** mg/liter 01062	Atomic Absorption Spectrophotometer	–	–	p. 83
Nickel-Total** mg/liter 01067	Absorption or Atomic Spectrophotometer	p. 443	p. 692	p. 83
Potassium-Total** mg/liter 00937	Colorimetric, Flame Photometric or Atomic Absorption Spectrophotometer	p. 285 p. 283	p. 326	p. 115
Selenium-Total** mg/liter 01147	Colorimetric-Diaminobenzidine	p. 296	–	p. 271
Silver-Total** mg/liter 01077	Atomic Absorption Spectrophotometer	p. 309	–	p. 117
Sodium-Total** mg/liter 00929	Flame Photometric or Atomic Absorption Spectrophotometer	p. 317	p. 326	p. 118
Thallium-Total** mg/liter 01059	Atomic Absorption Spectrophotometer	–	–	p. 83
Tin-Total** mg/liter 01102	Atomic Absorption Spectrophotometer	–	–	p. 83
Titanium-Total** mg/liter 01152	Atomic Absorption Spectrophotometer	–	–	p. 83
Zinc-Total** mg/liter 01092	Colorimetric, or Atomic Absorption Spectrophotometer	p. 444 p. 211	p. 692	p. 120

**See Note 2 at end of table.

TABLE A (Continued)

Chemical Parameters				
		References		
Parameter & Units	Method	Standard Methods 13th Ed. 1971	A.S.T.M. Standards Pt. 23 1972	EPA Methods 1971
Organic Nitrogen (as N) mg/liter 00605	Kjeldahl Nitrogen Minus Ammonia (N)	p. 468	–	p. 149
Ortho-Phosphate (as P) mg/liter 70507	Direct Single Reagent, Automated Colorimetric-Single Reagent or Stannous Chloride	p. 532	p. 42	p. 235 p. 246 p. 259
Sulfate (as SO_4) mg/liter 00945	Turbidimetric or Automated Colorimetric-Barium Chloranilate	p. 334	p. 52	p. 286 p. 288
Sulfide (as S) mg/liter 00745	Titrimetric-Iodide, Methylene Blue Color Matching or Methylene Blue Colorimetric	p. 551	–	p. 294
Sulfite (as SO_3) mg/liter 00740	Iodide-Iodate Titration	p. 337	p. 261	–
Bromide mg/liter 71870	Colorimetric	p. 75	p. 214	–
Chloride mg/liter 00940	Mercuric Nitrate or Automated Colorimetric-Ferric Thiocyanate	p. 97	p. 21	p. 29 p. 31
Cyanide mg/liter 00720	Distillation-Silver Nitrate Titration or Pyridine Pyrazolone Colorimetric	p. 404	p. 556	p. 41
Fluoride mg/liter 00951	Distillation-Spadns Automated Complexone or Electrode	p. 171	p. 191	p. 64 p. 66 p. 72
Chlorine-Total Residual mg/liter 50060	Amperometric or Colorimetric	p. 107	–	–
Oil and Grease mg/liter 00550	Liquid-Liquid Extraction	p. 254	–	–
Phenols mg/liter 32730	Colorimetric, 4-AAP	p. 502	p. 445	p. 232
Surfactants mg/liter 38260	Methylene Blue Procedure	p. 559	p. 619	p. 131
Algicides* mg/liter 74051	Specify Method Used in "Remarks"	–	–	–
Chlorinated Organic Compounds* (Except Pesticides) 74052	Specify Method Used in "Remarks"	–	–	–
Pesticides* mg/liter 74053	Specify Method Used in "Remarks"	–	–	–

*See Note 1 at end of table.

TABLE A (Continued)

Physical and Biological Parameters				
		References		
Parameter & Units	Method	Standard Methods 13th Ed. 1971	A.S.T.M. Standards Pt. 23 1972	EPA Methods 1971
Color Pt-Co units 00080	Platinum-Cobalt Visual	p. 160	–	p. 38
Specific Conductance micromhos/cm at 25°C 00095	Wheatstone Bridge	p. 323	p. 163	p. 284
Turbidity Jackson units 00070	Turbidimeter	p. 577	p. 467	p. 308
Fecal Streptococci Bacteria number/100 ml 74054	Specify Method Used in "Remarks"	p. 688	–	–
Coliform Bacteria, Fecal number/100 ml 74055	Specify Method Used in "Remarks"	p. 669 p. 684	–	–
Coliform Bacteria, Total number/100 ml 74056	Specify Method Used in "Remarks"	p. 664 p. 679	–	–

TABLE A (Continued)

Radioactive Parameters		
	References	
Type of Radiation	Standard Methods 13th Ed. 1971	A.S.T.M. Standards Pt. 23 1972
Alpha-Total picocurie/liter 01501	p. 598	p. 509
Alpha Counting Error picocurie/liter 01502	p. 598	p. 512
Beta-Total picocurie/liter 03501	p. 598	p. 473
Beta Counting Error picocurie/liter 03502	p. 598	p. 478

Note 1.—*Interim procedures for algicides, chlorinated organic compounds, and pesticides can be obtained from the Analytical Quality Control Laboratory, National Environmental Research Center, Cincinnati, Ohio 45268, or from the Regional Offices of the Environmental Protection Agency.

Note 2.—**For the determination of total metals the sample is not filtered before processing. Choose a volume of sample appropriate for the expected level of metals. If much suspended material is present, as little as 50–100 ml of well-mixed sample will most probably be sufficient. (The sample volume required may also vary proportionally with the number of metals to be determined.)

Transfer a representative aliquot of the well-mixed sample to a Griffin beaker and add 3 ml of concentrated distilled HNO_3. Place the beaker on a hotplate and evaporate to dryness making certain that the sample does not boil. Cool the beaker and add another 3 ml portion of distilled concentrated HNO_3. Cover the beaker with a watch glass and return to the hotplate. Increase the temperature of the hotplate so that a gentle reflux action occurs. Continue heating, adding additional acid as necessary until the digestion is complete, generally indicated by a light-colored residue. Add sufficient distilled 1 : 1 HCl and again warm the beaker to dissolve the residue. Wash down the beaker walls and watch glass with distilled water and filter the sample to remove silicates and other insoluble material that could clog the atomizer. Adjust the volume to some predetermined value based on the expected metal concentrations. The sample is now ready for analysis. Concentrations so determined shall be reported as "total." STORET parameter numbers for reporting this type of data have been assigned and are given for each metal.

* U.S. GOVERNMENT PRINTING OFFICE: 1974—723-335/6152

FORM APPRCVED
OMB No. 158– 1100

FOR AGENCY USE

NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM
APPLICATION FOR PERMIT TO DISCHARGE WASTEWATER

STANDARD FORM A – MUNICIPAL

SECTION I. APPLICANT AND FACILITY DESCRIPTION

Unless otherwise specified on this form all items are to be completed. If an item is not applicable indicate 'NA.'

ADDITIONAL INSTRUCTIONS FOR SELECTED ITEMS APPEAR IN SEPARATE INSTRUCTION BOOKLET AS INDICATED. REFER TO BOOKLET BEFORE FILLING OUT THESE ITEMS.

Please Print or Type

1. Legal Name of Applicant (see instructions) — 101 ____________

2. Mailing Address of Applicant (see instructions)
   - Number & Street — 102a ____________
   - City — 102b ____________
   - State — 102c ____________
   - Zip Code — 102d ______

3. Applicant's Authorized Agent (see instructions)
   - Name and Title — 103a ____________
   - Number & Street — 103b ____________
   - City — 103c ____________
   - State — 103d ____________
   - Zip Code — 103e ______
   - Telephone — 103f ____ Area Code ______ Number

4. Previous Application
   If a previous application for a permit under the National Pollutant Discharge Elimination System has been made, give the date of application. — 104 ___ YR ___ MO ___ DAY

I certify that I am familiar with the information contained in this application and that to the best of my knowledge and belief such information is true, complete, and accurate.

______________________ Printed Name of Person Signing — 102e ______________________ Title

______________________ Signature of Applicant or Authorized Agent — 102f ___ YR ___ MO ___ DAY Date Application Signed

18 U.S.C. Section 1001 provides that:

Whoever, in any matter within the jurisdiction of any department or agency of the United States knowingly and wilfully falsifies, conceals or covers up by any trick, scheme, or device a material fact, or makes any false, fictitious or fraudulent statement or representation, or makes or uses any false writing or document knowing same to contain any false, fictitious or fraudulent statement or entry, shall be fined not more than $10,000 or imprisoned not more than five years, or both.

FOR AGENCY USE

Received ___ YR ___ MO ___ DAY

OFFICE: ____ EPA Region Number
____ State

FOR AGENCY USE

5. Facility (see instructions)
Give the name, ownership, and physical location of the plant or other operating facility where discharge(s) presently occur(s) or will occur.

Name 105a ____________________

Ownership (Public, Private or Both Public and Private). 105b ☐ PUB ☐ PRV ☐ BPP

Check block if a Federal facility 105c ☐ FED

and give GSA Inventory Control Number 105d ________

Location:

Number & Street 105e ____________________

City 105f ____________________

County 105g ____________________

State 105h ____________________

6. Discharge to Another Municipal Facility (see instructions)

a. Indicate if part of your discharge is into a municipal waste transport system under another responsible organization. If yes, complete the rest of this item and continue with item 7. If no, go directly to item 7. 106a ☐ Yes ☐ No

b. Responsible Organization Receiving Discharge

Name 106b ____________________

Number & Street 106c ____________________

City 106d ____________________

State 106e ____________________

Zip Code 106f ________

c. Facility Which Receives Discharge
Give the name of the facility (waste treatment plant) which receives and is ultimately responsible for treatment of the discharge from your facility. 106g ____________________

d. Average Daily Flow to Facility (mgd) Give your average daily flow into the receiving facility. 106h ________ mgd

7. Facility Discharges, Number and Discharge Volume (see instructions)
Specify the number of discharges described in this application and the volume of water discharged or lost to each of the categories below. Estimate average volume per day in million gallons per day. Do not include intermittent or noncontinuous overflows, bypasses or seasonal discharges from lagoons, holding

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		Number of Discharge Points		Total Volume Discharged, Million Gallons Per Day
To: Surface Water	107a1	______	107a2	______
Surface Impoundment with no Effluent	107b1	______	107b2	______
Underground Percolation	107c1	______	107c2	______
Well (Injection)	107d1	______	107d2	______
Other	107e1	______	107e2	______
Total Item 7	107f1	______	107f2	______

If 'other' is specified, describe 107g1 ________________________________

If any of the discharges from this facility are intermittent, such as from overflow or bypass points, or are seasonal or periodic from lagoons, holding ponds, etc., complete item 8.

8. Intermittent Discharges

a. Facility bypass points
Indicate the number of bypass points for the facility that are discharge points.(see instructions) 108a ______

b. Facility Overflow Points
Indicate the number of overflow points to a surface water for the facility (see instructions). 108b ______

c. Seasonal or Periodic Discharge Points Indicate the number of points where seasonal discharges occur from holding ponds, lagoons, etc. 108c ______

9. Collection System Type
Indicate the type and length (in miles) of the collection system used by this facility. (see instructions) 109a

Separate Storm ☐ SST

Separate Sanitary ☐ SAN

Combined Sanitary and Storm ☐ CSS

Both Separate Sanitary and Combined Sewer Systems ☐ BSC

Both Separate Storm and Combined Sewer Systems 109b ☐ SSC

Length ____________ miles

10. Municipalities or Areas Served (see instructions)

	Name		Actual Population Served
110a	______	110b	______
110a	______	110b	______
110a	______	110b	______
110a	______	110b	______
110a	______	110b	______
Total Population Served		110c	______

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11. **Average Daily Industrial Flow**
Total estimated average daily waste flow from all industrial sources. 111 ________ mgd

Note: All major industries (as defined in Section IV) discharging to the municipal system must be listed in Section IV.

12. **Permits, Licenses and Applications**
List all existing, pending or denied permits, licenses and applications related to discharges from this facility. (see instructions)

	Issuing Agency	For Agency Use	Type of Permit or License	ID Number	Date Filed YR/MO/DA	Date Issued YR/MO/DA	Date Denied YR/MO/DA	Expiration Date YR/MO/DA
112	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)
1.								
2.								
3.								

13. **Maps and Drawings**
Attach all required maps and drawings to the back of this application. (see instructions)

14. **Additional Information**

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SECTION II. BASIC DISCHARGE DESCRIPTION

Complete this section for **each** present or proposed discharge indicated in Section I, Items 7 and 8, that is to surface waters. **This includes** discharges to other municipal sewerage systems in which the waste water does not go through a treatment works prior to being discharged to surface waters. Discharges to wells must be described where there are also discharges to surface waters from this facility. **Separate descriptions of each discharge are required even if several discharges originate in the same facility.** All values for an existing discharge should be representative of the twelve previous months of operation. If this is a proposed discharge, values should reflect best engineering estimates.

ADDITIONAL INSTRUCTIONS FOR SELECTED ITEMS APPEAR IN SEPARATE INSTRUCTION BOOKLET AS INDICATED. REFER TO BOOKLET BEFORE FILLING OUT THESE ITEMS.

1. **Discharge Serial No. and Name**
   a. **Discharge Serial No.** (see instructions) — **201a** ______
   b. **Discharge Name** Give name of discharge, if any (see instructions) — **201b** ______
   c. **Previous Discharge Serial No** If a previous NPDES permit application was made for this discharge (Item 4, Section I) provide previous discharge serial number. — **201c** ______

2. **Discharge Operating Dates**
   a. **Discharge to Begin Date** If the discharge has never occurred but is planned for some future date, give the date the discharge will begin. — **202a** ____ ____ YR MO
   b. **Discharge to End Date** If the discharge is scheduled to be discontinued within the next 5 years, give the date (within best estimate) the discharge will end. Give reason for discontinuing this discharge in Item 17. — **202b** ____ ____ YR MO

3. **Discharge Location** Name the political boundaries within which the point of discharge is located:

				Agency Use
State	**203a**	______	**203d**	______
County	**203b**	______	**203e**	______
(if applicable) City or Town	**203c**	______	**203f**	______

4. **Discharge Point Description** (see instructions) Discharge is into (check one)

Stream (includes ditches, arroyos, and other watercourses)	**204a**	☐ STR
Estuary		☐ EST
Lake		☐ LKE
Ocean		☐ OCE
Well (Injection)		☐ WEL
Other		☐ OTH
If 'other' is checked, specify type	**204b**	______

5. **Discharge Point — Lat/Long.** State the precise location of the point of discharge to the nearest second. (see instructions)

Latitude	**205a**	____ DEG. ____ MIN. ____ SEC
Longitude	**205b**	____ DEG. ____ MIN. ____ SEC

DISCHARGE SERIAL NUMBER

______

FOR AGENCY USE

6. **Discharge Receiving Water Name** Name the waterway at the point of discharge.(see instructions) — 206a ______________________

____

For Agency Use

Major	Minor	Sub

206c — For Agency Use 303e

If the discharge is through an outfall that extends beyond the shoreline or is below the mean low water line, complete Item 7. — 206b

7. **Offshore Discharge**

   a. **Discharge Distance from Shore** — 207a ________feet

   b. **Discharge Depth Below Water Surface** — 207b ________feet

If discharge is from a bypass or an overflow point or is a seasonal discharge from a lagoon, holding pond, etc., complete items 8, 9 or 10, as applicable, and continue with item 11.

8. **Bypass Discharge** (see instructions)

   a. **Bypass Occurrence** Check when bypass occurs

      Wet weather — 208a1 ☐ Yes ☐ No

      Dry weather — 208a2 ☐ Yes ☐ No

   b. **Bypass Frequency** Give the actual or approximate number of bypass incidents per year.

      Wet Weather — 208b1 ______times per year

      Dry weather — 208b2 ______times per year

   c. **Bypass Duration** Give the average bypass duration in hours.

      Wet weather — 208c1 ______hours

      Dry weather — 208c2 ______hours

   d. **Bypass Volume** Give the average volume per bypass incident, in thousand gallons.

      Wet weather — 208d1 ________thousand gallons per incident

      Dry weather — 208d2 ________thousand gallons per incident

   e. **Bypass Reasons** Give reasons why bypass occurs. — 208e ______________________

____

____

   Proceed to Item 11.

9. **Overflow Discharge** (see instructions)

   a. **Overflow Occurrence** Check when overflow occurs.

      Wet weather — 209a1 ☐ Yes ☐ No

      Dry weather — 209a2 ☐ Yes ☐ No

   b. **Overflow Frequency** Give the actual or approximate incidents per year.

      Wet weather — 209b1 ______times per year

      Dry weather — 209b2 ______times per year

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DISCHARGE SERIAL NUMBER

____

c. **Overflow Duration** Give the average overflow duration in hours.

Wet weather — 209c1 — ______hours

Dry weather — 209c2 — ______Hours

d. **Overflow Volume** Give the average volume per overflow incident in thousand gallons.

Wet weather — 209d1 — __________thousand gallons per incident

Dry weather — 209d2 — __________thousand gallons per incident

Proceed to Item 11

10. Seasonal/Periodic Discharges

a. **Seasonal/Periodic Discharge Frequency** If discharge is intermittent from a holding pond, lagoon, etc., give the actual or approximate number of times this discharge occurs per year. — 210a — ______times per year

b. **Seasonal/Periodic Discharge Volume** Give the average volume per discharge occurrence in thousand gallons. — 210b — __________thousand gallons per discharge occurrence

c. **Seasonal/Periodic Discharge Duration** Give the average duration of each discharge occurrence in days. — 210c — ______days

d. **Seasonal/Periodic Discharge Occurrence—Months** Check the months during the year when the discharge normally occurs. — 210d

☐ JAN ☐ FEB ☐ MAR
☐ APR ☐ MAY ☐ JUN
☐ JUL ☐ AUG ☐ SEP
☐ OCT ☐ NOV ☐ DEC

11. Discharge Treatment

a. **Discharge Treatment Description** Describe waste abatement practices used on this discharge with a brief narrative. (See instructions) — 211a

____

DISCHARGE SERIAL NUMBER

____

FOR AGENCY USE

b. Discharge Treatment Codes
Using the codes listed in Table I of the Instruction Booklet, describe the waste abatement processes applied to this discharge in the order in which they occur, if possible.
Separate all codes with commas except where slashes are used to designate parallel operations.

211b _______________

If this discharge is from a municipal waste treatment plant (not an overflow or bypass), complete Items 12 and 13

12. Plant Design and Operation Manuals
Check which of the following are currently available

a. Engineering Design Report	212a	☐
b. Operation and Maintenance Manual	212b	☐

13. Plant Design Data (see instructions)

a. Plant Design Flow (mgd)	213a	_______ mgd
b. Plant Design BOD Removal (%)	213b	_______ %
c. Plant Design N Removal (%)	213c	_______ %
d. Plant Design P Removal (%)	213d	_______ %
e. Plant Design SS Removal (%)	213e	_______ %
f. Plant Began Operation (year)	213f	_______
g. Plant Last Major Revision (year)	213g	_______

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DISCHARGE SERIAL NUMBER

______

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14. Description of Influent and Effluent (see instructions)

Parameter and Code 214	Influent	Effluent					
	Annual Average Value (1)	Annual Average Value (2)	Lowest Monthly Average Value (3)	Highest Monthly Average Value (4)	Frequency of Analysis (5)	Number of Analyses (6)	Sample Type (7)
Flow Million gallons per day 50050							
pH Units 00400	X	X					
Temperature (winter) ° F 74028							
Temperature (summer) ° F 74027							
Fecal Streptococci Bacteria Number/100 ml 74054 (Provide if available)	X	X	X				
Fecal Coliform Bacteria Number/100 ml 74055 (Provide if available)	X	X	X				
Total Coliform Bacteria Number/100 ml 74056 (Provide if available)	X	X	X				
BOD 5-day mg/l 00310							
Chemical Oxygen Demand (COD) mg/l 00340 (Provide if available)							
OR							
Total Organic Carbon (TOC) mg/l 00680 (Provide if available) (Either analysis is acceptable)							
Chlorine–Total Residual mg/l 50060							

DISCHARGE SERIAL NUMBER

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14. Description of Influent and Effluent (see instructions) (Continued)

Parameter and Code 214	Influent	Effluent					
	Annual Average Value (1)	Annual Average Value (2)	Lowest Monthly Average Value (3)	Highest Monthly Average Value (4)	Frequency of Analysis (5)	Number of Analyses (6)	Sample Type (7)
Total Solids mg/l 00500							
Total Dissolved Solids mg/l 70300							
Total Suspended Solids mg/l 00530							
Settleable Matter (Residue) ml/l 00545							
Ammonia (as N) mg/l 00610 (Provide if available)							
Kjeldahl Nitrogen mg/l 00625 (Provide if available)							
Nitrate (as N) mg/l 00620 (Provide if available)							
Nitrite (as N) mg/l 00615 (Provide if available)							
Phosphorus Total (as P) mg/l 00665 (Provide if available)							
Dissolved Oxygen (DO) mg/l 00300	X						

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15. Additional Wastewater Characteristics
Check the box next to each parameter if it is present in the effluent. (see instructions)

Parameter (215)	Present	Parameter (215)	Present	Parameter (215)	Present
Bromide 71870		Cobalt 01037		Thallium 01059	
Chloride 00940		Chromium 01034		Titanium 01152	
Cyanide 00720		Copper 01042		Tin 01102	
Fluoride 00951		Iron 01045		Zinc 01092	
Sulfide 00745		Lead 01051		Algicides* 74051	
Aluminum 01105		Manganese 01055		Chlorinated organic compounds* 74052	
Antimony 01097		Mercury 71900		Oil and grease 00550	
Arsenic 01002		Molybdenum 01062		Pesticides* 74053	
Beryllium 01012		Nickel 01067		Phenols 32730	
Barium 01007		Selenium 01147		Surfactants 38260	
Boron 01022		Silver 01077		Radioactivity* 74050	
Cadmium 01027					

*Provide specific compound and/or element in Item 17, if known.

Pesticides (Insecticides, fungicides, and rodenticides) must be reported in terms of the acceptable common names specified in *Acceptable Common Names and Chemical Names for the Ingredient Statement on Pesticide Labels*, 2nd Edition, Environmental Protection Agency, Washington, D.C. 20250, June 1972, as required by Subsection 162.7(b) of the Regulations for the Enforcement of the Federal Insecticide, Fungicide, and Rodenticide Act.

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16. Plant Controls Check if the following plant controls are available for this discharge

216

Alternate power source for major pumping facility including those for collection system lift stations ☐ APS

Alarm for power or equipment failure ☐ ALM

17. Additional Information

217

Item Number	Information

FOR AGENCY USE

STANDARD FORM A–MUNICIPAL

SECTION III. SCHEDULED IMPROVEMENTS AND SCHEDULES OF IMPLEMENTATION

This section requires information on any uncompleted implementation schedule which has been imposed for construction of waste treatment facilities. Requirement schedules may have been established by local, State, or Federal agencies or by court action. IF YOU ARE SUBJECT TO SEVERAL DIFFERENT IMPLEMENTATION SCHEDULES, EITHER BECAUSE OF DIFFERENT LEVELS OF AUTHORITY IMPOSING DIFFERENT SCHEDULES (ITEM 1b) AND/OR STAGED CONSTRUCTION OF SEPARATE OPERATIONAL UNITS (ITEM 1c), SUBMIT A SEPARATE SECTION III FOR EACH ONE.

FOR AGENCY USE
Sched. No. ______

1. **Improvements Required**

a. **Discharge Serial Numbers Affected** List the discharge serial numbers, assigned in Section II, that are covered by this implementation schedule — **300**

b. **Authority Imposing Requirement** Check the appropriate item indicating the authority for the implementation schedule If the identical implementation schedule has been ordered by more than one authority, check the appropriate items. (see instructions) — **301a** ____ , ____ , ____ , ____ , ____

Locally developed plan	301b	☐ LOC
Areawide Plan		☐ ARE
Basin Plan		☐ BAS
State approved implementation schedule		☐ SQS
Federal approved water quality standards implementation plan		☐ WQS
Federal enforcement procedure or action		☐ ENF
State court order		☐ CRT
Federal court order		☐ FED

c. **Improvement Description** Specify the 3-character code for the General Action Description in Table II that best describes the improvements required by the implementation schedule. If more than one schedule applies to the facility because of a staged construction schedule, state the stage of construction being described here with the appropriate general action code. submit a separate Section III for each stage of construction planned. Also, list all the 3-character (Specific Action) codes which describe in more detail the pollution abatement practices that the implementation schedule requires.

3-character general action description	301c	______
3-character specific action descriptions	301d	____/____/____/____/

2. **Implementation Schedule and 3. Actual Completion Dates**

Provide dates imposed by schedule and any actual dates of completion for implementation steps listed below. Indicate dates as accurately as possible. (see instructions)

Implementation Steps		2. Schedule (Yr /Mo /Day)		3. Actual Completion (Yr /Mo /Day)
a. Preliminary plan complete	302a	___/___/___	303a	___/___/___
b. Final plan complete	302b	___/___/___	303b	___/___/___
c. Financing complete & contract awarded	302c	___/___/___	303c	___/___/___
d. Site acquired	302d	___/___/___	303d	___/___/___
e. Begin construction	302e	___/___/___	303e	___/___/___
f. End construction	302f	___/___/___	303f	___/___/___
g. Begin Discharge	302g	___/___/___	303g	___/___/___
h. Operational level attained	302h	___/___/___	303h	___/___/___

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STANDARD FORM A–MUNICIPAL

SECTION IV. INDUSTRIAL WASTE CONTRIBUTION TO MUNICIPAL SYSTEM

Submit a description of each major industrial facility discharging to the municipal system, using a separate Section IV for each facility description. Indicate the 4 digit Standard Industrial Classification (SIC) Code for the industry, the major product or raw material, the flow (in thousand gallons per day), and the characteristics of the wastewater discharged from the industrial facility into the municipal system. Consult Table III for standard measures of products or raw materials. (see instructions)

1. **Major Contributing Facility** (see instructions)
   - Name — 401a ____________
   - Number& Street — 401b ____________
   - City — 401c ____________
   - County — 401d ____________
   - State — 401e ____________
   - Zip Code — 401f ______

2. **Primary Standard Industrial Classification Code** (see instructions) — 402 ______

3. **Principal Product or Raw Material** (see instructions)

			Quantity		Units (See Table III)
Product	403a ____________	403c	______	403e	______
Raw Material	403b ____________	403d	______	403f	______

4. **Flow** Indicate the volume of water discharged into the municipal system in thousand gallons per day and whether this discharge is intermittent or continuous.
   - 404a ______ thousand gallons per day
   - 404b ☐ Intermittent (int) ☐ Continuous (con)

5. **Pretreatment Provided** Indicate if pretreatment is provided prior to entering the municipal system — 405 ☐ Yes ☐ No

6. **Characteristics of Wastewater** (see instructions)

	Parameter Name							
406a	Parameter Number							
406b	Value							

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

Permit No. WA-002935-1

Issuance Date: JUN 3 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)

Waterway Segment Number:

03-07-13

Receiving Water:

South Fork of Snoqualmie River

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

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	Daily	
	Final Effluent	Daily	
*Total Available (Residual) Chlorine	Final Effluent	Daily	
Dissolved Oxygen	Raw Sewage	Daily	
	Aeration Basin	Daily	
	Final Effluent	Daily	
BOD_5	Raw Sewage	Weekly	24 hr. Composite
	Final Effluent	Weekly	24 hr. Composite
Settleable Solids	Raw Sewage	Daily	
	Final Effluent	Daily	
Total Suspended Solids	Raw Sewage	Weekly	24 hr. Composite
	Aeration Basin	Weekly	
	Final Effluent	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. <u>Discharge Violations:</u>

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. <u>Proper Operation and Maintenance:</u>

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. <u>Reduced Production for Compliance:</u>

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. <u>Non-Compliance Notification:</u>

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:

East Bank of the Snoqualmie River
½ Mile North of the Snoqualmie
City Limits

Receiving Water: Snoqualmie River

Discharge Location: 47° 32' 39" N
121° 49' 02" W

Waterway Segment Number: 03-07-13

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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/1	265 lbs/day	30 mg/1	176 lbs/day	85%
Total Suspended Solids	45 mg/1	265 lbs/day	30 mg/1	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″

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

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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.

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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.

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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. 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.

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 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.

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 informatic 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 <u>Short-Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms</u> (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 Environmental Technology, Volume 11.04 Biological Effects and Environmental Fate.

D. Quality Assurance/Quality Control Procedures

The Permittee shall follow the quality assurance procedures discussed in 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.