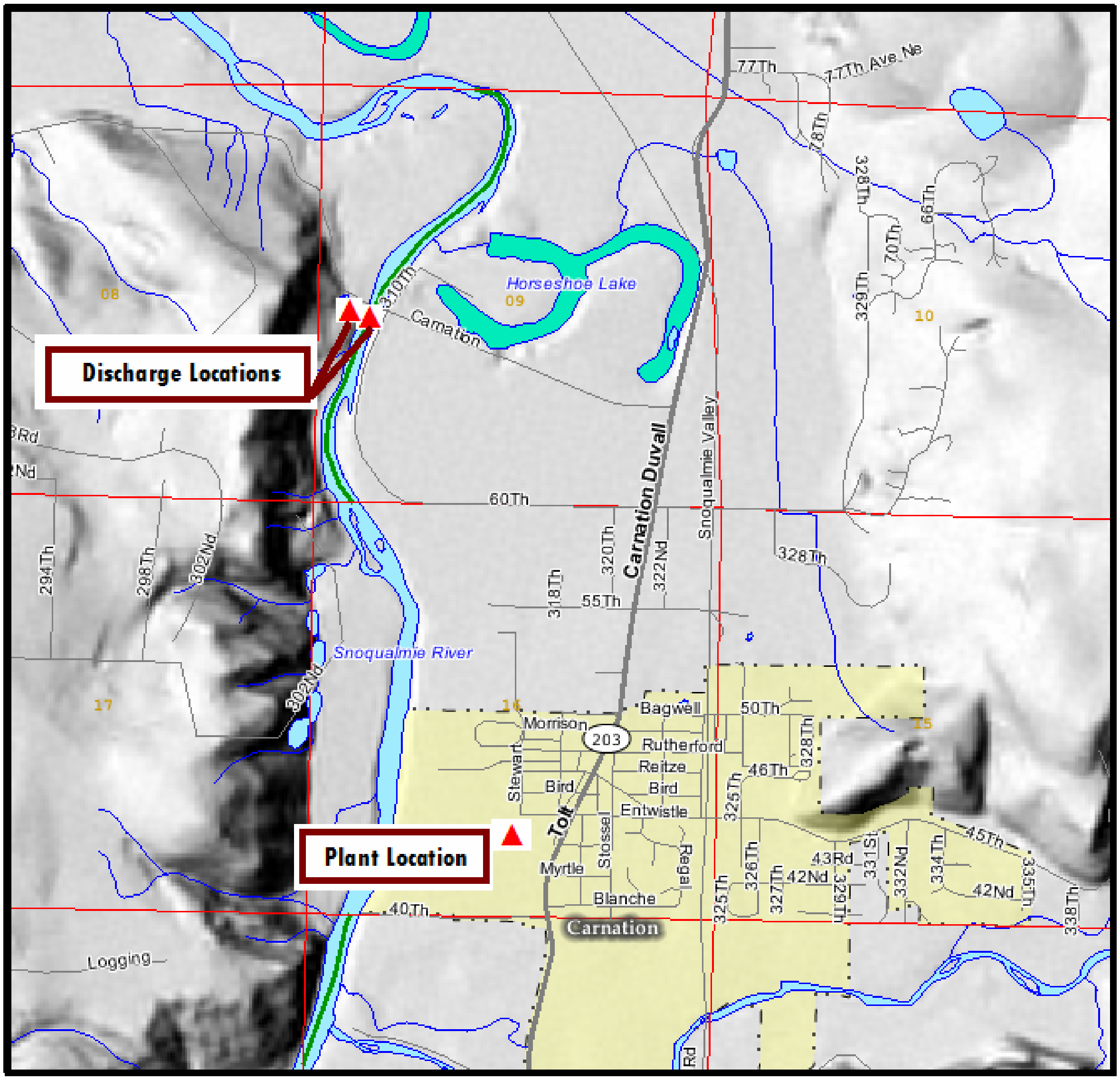
FACT SHEET FOR NPDES PERMIT WA-003218-2
Carnation Wastewater Treatment Facility



PURPOSE OF THIS FACT SHEET

This fact sheet explains and documents the decisions Ecology made in drafting the proposed National Pollutant Discharge Elimination System (NPDES) permit for the Carnation Wastewater Treatment Facility. This fact sheet complies with Section 173-220-060 of the Washington Administrative Code (WAC), which requires Ecology to prepare a draft permit and accompanying fact sheet for public evaluation before issuing an NPDES permit.

Ecology makes the draft permit and fact sheet available for public review and comment at least thirty (30) days before we issue the final permit. Copies of the fact sheet and draft permit for the Carnation Wastewater Treatment Facility, NPDES permit WA-003218-2, are available for public review and comment from March 12, 2008 until April 11, 2008. For more details on preparing and filing comments about these documents, please see *Appendix A - Public Involvement*.

King County reviewed the draft permit and fact sheet for factual accuracy. Ecology corrected any errors or omissions regarding the facility's location, history, discharges or receiving water.

After the public comment period closes, Ecology will summarize substantive comments and provide responses to them. Ecology will include the summary and responses to comments in this Fact Sheet as *Appendix G - Response to Comments*.

SUMMARY

The City of Carnation is located in rural King County, twenty miles east of Bellevue. Carnation is bounded on the west by the Snoqualmie River and on the south by the Tolt River. The new Carnation wastewater treatment facility will be owned and operated by King County; the collection system will be owned and operated by the City of Carnation. This membrane biological reactor (MBR) facility will begin operating in Spring of 2008. The facility has five MBR units and a design maximum month flow of 0.48 MGD.

This permit allows discharge to the Snoqualmie River at the Carnation Farm Road Bridge. Technology-based limits have been proposed during the high flow months (November through July). The *Snoqualmie River Total Maximum Daily Load Study*, dated May 1994 (approved by EPA on July 3, 1996), was used to set TMDL-based limits for the low flow months (August through October).

King County plans to eventually use the effluent from this facility to augment a Category II wetlands located near the Carnation Farm Road Bridge (see figure on page 1). This reclaimed water discharge will be permitted in a separate reclaimed water permit.

General Information	
Applicant	King County, Department of Natural Resources and Parks- Wastewater Treatment Division
Facility Name and Address	Carnation Wastewater Treatment Facility 4405 Larson Avenue Carnation, WA
Mailing Address	1200 Monster Road. SW Mail Stop RTP NR 0100 Renton WA 99057-2962
Type of Treatment	Membrane Bio-Reactor
Discharge Location	Snoqualmie River Longitude: -121º 55 30" W Latitude: 47º 39' 57" N
Water Body ID Number	1218442475506 WA-07-1100 http://ecydevasp/website/wbid%5Ffinder/

TABLE OF CONTENTS

I. INTRODUCTION

The Federal Clean Water Act (FCWA, 1972, and later amendments in 1977, 1981, and 1987) established water quality goals for the navigable (surface) waters of the United States. One mechanism for achieving the goals of the Clean Water Act is the National Pollutant Discharge Elimination System (NPDES), administered by the federal Environmental Protection Agency (EPA). The EPA authorized the State of Washington to manage the NPDES permit program in our state. Our state legislature accepted the delegation and assigned the power and duty for conducting NPDES permitting and enforcement to Ecology. The legislature defined Ecology's authority and obligations for the wastewater discharge permit program in 90.48 RCW (Revised Code of Washington).

The following regulations apply to municipal NPDES permits:

- Procedures Ecology follows for issuing NPDES permits (chapter 173-220 WAC),
- Technical criteria for discharges from municipal wastewater treatment facilities (chapter 173-221 WAC)
- Water quality criteria for surface waters (chapter 173-201A WAC) and for ground waters (chapter 173-200 WAC)
- Sediment management standards (chapter 173-204 WAC).

These rules require any treatment facility operator to obtain an NPDES permit before discharging wastewater to state waters. They also define the basis for limits on each discharge and for other requirements imposed by the permit.

Under the NPDES permit program Ecology must prepare a draft permit and accompanying fact sheet and make them available for public review. Ecology must also publish an announcement (public notice) telling people where they can read the draft permit, and where to send their comments on the draft permit, during a period of thirty days (WAC 173-220-050). (See *Appendix A--Public Involvement* for more detail about the Public Notice and Comment procedures). After the Public Comment Period ends, Ecology may make changes to the draft NPDES permit. Ecology will summarize the responses to comments and any changes to the permit in *Appendix G--Response to Comments*.

II. BACKGROUND INFORMATION

A. Facility Description

History

King County, Department of Natural Resources & Parks-Wastewater Treatment Division, owns the treatment facility currently under construction located east of the Snoqualmie River in the City of Carnation. King County plans to begin operation in Spring of 2008. This WWTP treats wastewater from the City of Carnation.

City of Carnation residents currently use individual septic systems to treat their domestic wastewater. Providing disposal for business in the commercial district, and many of the homes on smaller lots, particularly west of Tolt Avenue, has become more problematic over the years. Many of these businesses and homesites are unable to meet the current Seattle and King County Department of Health standard for septic treatment and disposal because of lack of disposal area. The Washington Department of Health issued a Severe Public Health Hazard advisory because of concern for contamination of the City's potable water well in the center of the town.

The facility now under construction will have a capacity of 0.48 MGD maximum month average daily flow, for a design population of 3871. The plant uses membrane bio-reactor technology with UV disinfection to treat wastewater to secondary standards.

Collection System Status

The City of Carnation collects domestic wastewater from residential and commercial users in the city and urban growth area and delivers it to the King County-owned wastewater treatment facility. The City of Carnation constructed the collection system in 2007 and will maintain and operate the system. The collection system consists of 15,500 feet of 10-inch vacuum sewer pipeline, 8,900 linear feet of 8-inch vacuum sewer pipeline, 9,100 linear feet of 6-inch vacuum sewer pipeline, and 23,400 linear feet of 4-inch vacuum sewer pipeline. The City will collect wastewater at a central vacuum station with standby power, and will pump sewage by force-main to the adjacent King County Carnation WWTP.

Treatment Processes

The Carnation WWTP treats up to 0.48 MGD of wastewater using membrane bio-reactor (MBR) technology. This facility is designed to meet secondary treatment standards. The treatment train includes influent and effluent measurement, 2-mm rotary drum screens for influent screening, grit removal, two aeration basins in parallel (each with four aeration zones), five Zenon ZeeWeed 500 ultrafiltration MBR units in parallel, two UV disinfection units in parallel, and two solids holding basins. A back-up power supply is included to meet Class II reliability standards.

Discharge Outfall

King County will discharge the secondary-treated and disinfected effluent into the Snoqualmie River. Effluent flows through approximately 8780 linear feet of buried 12-inch diameter HDPE pipeline from the WWTP to the Carnation Farm Road Bridge (see Figure 1). The pipeline is attached to the underside of the bridge roadway structure as it crosses from the East side of the Snoqualmie River towards the West side of the River. The pipeline turns downward from the roadway deck and is attached to the downstream side of the western bridge abutment. The wastewater discharges into the Snoqualmie River water two feet above the riverbed through a Proco® duckbill diffuser check valve. The County will operate a selector valve to divert flow from the river diffuser to the reclaimed water outfall as called for (reclaimed water permit will be issued separately from the NPDES permit). The discharge pipeline and outfall is part of the treatment system owned by King County.

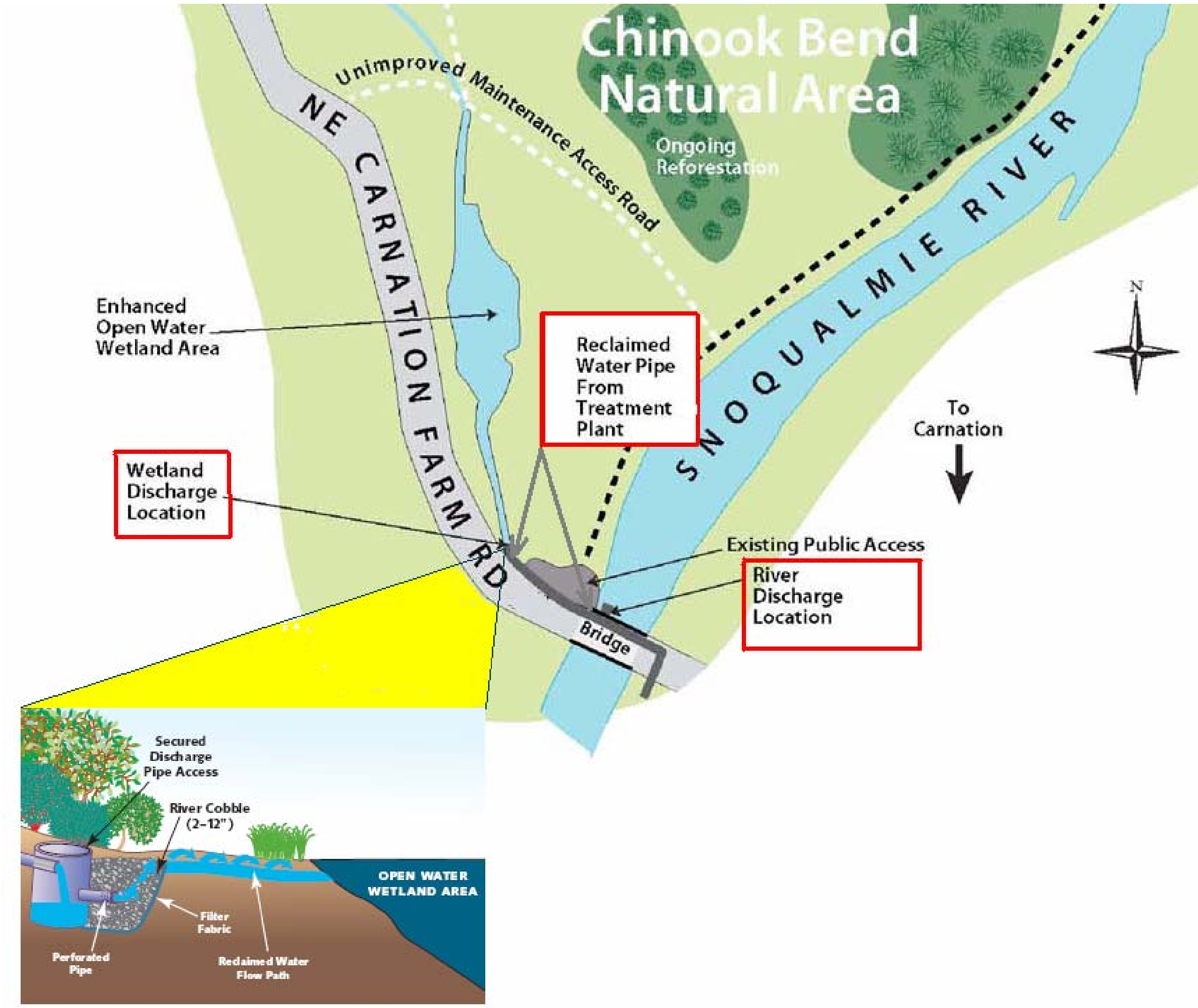


Figure 1. Outfall location.

Residual Solids

The treatment facility removes solids at the headworks (grit and screenings) with a 2 mm rotary drum screen. The County will clean, dewater, compact and transport headworks screenings and grit removed at the influent screens to a local landfill for disposal. Operators will use the solids holding basins to collect and store residual solids generated during the treatment of the wastewater, including waste activated sludge (WAS) wasted from the membrane reactor, and scum from the aeration basin scum launders. Thickened solids will be transported to a King County regional plant, either South Plant or Brightwater WWTP (when operational), for further stabilization, dewatering, and disposal in their solid stream process.

B. Permit Status

This is a new facility with no previous permit or discharge. King County, Department of Natural Resources and Parks-Wastewater Treatment Division submitted an application for a permit on May 3, 2007. Ecology accepted it as complete on January 14, 2008.

C. Summary of Compliance with Previous Permit Issued

There is no previous permit.

D. Wastewater Characterization

There is no history of wastewater discharge to characterize.

E. SEPA Compliance

King County has completed the SEPA process for construction of the new Carnation wastewater treatment facility. Documentation can be found in the *Final Wastewater Facilities Plan for the Carnation Wastewater Treatment Facility*, dated October 2005.

III. PROPOSED PERMIT LIMITS

Federal and State regulations require that effluent limits in an NPDES permit must be either technology- or water quality-based.

- Technology-based limits are based upon the treatment methods available to treat specific pollutants. Technology-based limits are set by the EPA and published as a regulation, or Ecology develops the limit on a case-by-case basis (40 CFR 125.3, and chapter 173-220 WAC).

- Water quality-based limits are calculated so that the effluent will comply with the Surface Water Quality Standards (chapter 173-201A WAC), Ground Water Standards (chapter 173-200 WAC), Sediment Quality Standards (chapter 173-204 WAC) or the National Toxics Rule (40 CFR 131.36). TMDL limits are derived from the Surface Water Quality Standards.

- Ecology must apply the most stringent of these limits to each parameter of concern. These limits are described below.

The limits in this permit reflect information received in the application. Ecology evaluated the permit application and determined the limits needed to comply with the rules adopted by the State of Washington. Ecology does not develop effluent limits for all reported pollutants**.** Some pollutants are not treatable at the concentrations reported, are not controllable at the source, are not listed in regulation, or do not have a reasonable potential to cause a water quality violation.

Ecology does not usually develop limits for pollutants that were not reported in the permit application but that may be present in the discharge. The permit does not authorize discharge of the non-reported pollutants. If significant changes occur in any constituent of the effluent discharge, the Permittee is required to notify Ecology (40 CFR 122.42(a)). The Permittee may be in violation of the permit until the permit is modified to reflect additional discharge of pollutants.

A. Design Criteria

Under WAC 173-220-150 (1)(g), flows and waste loadings must not exceed approved design criteria. The design criteria approved by Ecology for this treatment plant were included in the *Carnation Wastewater Treatment Facility Plans & Specifications* prepared by Carollo Engineers, Inc. These values are shown in Table 1.

Table 1. Design Criteria for Carnation Wastewater Treatment Facility.

Parameter	Design Quantity
Average Day Flow (mgd-maximum month)	0.48
Peak Hour (mgd)	1.40
BOD_5 influent loading (at max month flow)	1,669 lb/day
TSS influent loading (at max month flow)	1,669 lb/day

B. Technology-Based Effluent Limits

Federal and state regulations define technology-based effluent limits for municipal wastewater treatment plants. These effluent limits are given in 40 CFR Part 133 (federal) and in chapter 173-221 WAC (state). These regulations are performance standards that constitute all known, available, and reasonable methods of prevention, control, and treatment (AKART) for municipal wastewater.

Table 2 lists the technology-based limits for pH, fecal coliform, BOD_5, TSS, and chlorine. These values were obtained from Chapter 173-221 WAC.

Table 2. Technology-based Limits.

Parameter	Limit
pH	shall be within the range of 6 to 9 standard units.
Fecal Coliform Bacteria	Monthly Geometric Mean = 200 organisms/100 mL Weekly Geometric Mean = 400 organisms/100 mL
BOD_5 (concentration)	Average Monthly Limit is the most stringent of the following: - 30 mg/L - may not exceed fifteen percent (15%) of the average influent concentration Average Weekly Limit = 45 mg/L
TSS (concentration)	Average Monthly Limit is the most stringent of the following: - 30 mg/L - may not exceed fifteen percent (15%) of the average influent concentration Average Weekly Limit = 45 mg/L
Chlorine	Average Monthly Limit = 0.5 mg/L Average Weekly Limit = 0.75 mg/L

The Carnation WWTP uses UV for disinfection; however, chlorine will be onsite for in-situ membrane cleaning and disinfection of the outfall line and may be used for back-up disinfection of the effluent. The technology-based monthly average limit for chlorine is derived from standard operating practices. The Water Pollution Control Federation's *Chlorination of Wastewater* (1976) states that a properly designed and maintained wastewater treatment plant can achieve adequate disinfection if a 0.5 mg/L chlorine residual is maintained after fifteen minutes of contact time. See also Metcalf and Eddy, *Wastewater Engineering, Treatment, Disposal and Reuse*, *Third Edition*, 1991. A treatment plant that provides adequate chlorination contact time can meet the 0.5 mg/L chlorine limit on a monthly average basis. According to WAC 173-221-030(11)(b), the corresponding weekly average is 0.75 mg/L. A water quality-based limit was also calculated (see table C-9 in Appendix C). Since the water quality-based limit is less stringent than the technology-based limit, the technology-based limit was used in the proposed permit.

Proposed limits for TSS, BOD_5, fecal coliform, and chlorine for the high-flow months (November through July) are technology-based, as shown in Table 2. During the low-flow months (August through October), these technology-based limits will still apply, however, Ecology proposes additional TMDL-based limits for BOD_5, fecal coliform, and ammonia based on the Total Maximum Daily Load (TMDL) study completed by Ecology in 1994.

The following technology-based *mass* limits for BOD and TSS are based on WAC 173-220-130(3)(b) and 173-221-030(11)(b):

> Monthly effluent mass loadings (lbs/day) were calculated as the maximum monthly design flow (0.48 MGD) x Concentration limit (30 mg/L) x 8.34 (conversion factor) = mass limit 120 lb/day.
>
> The weekly average effluent mass loading is calculated as 1.5 x monthly loading = 180 lb/day.

C. Surface Water Quality-Based Effluent Limits

The Washington State Surface Water Quality Standards (chapter 173-201A WAC) are designed to protect existing water quality and preserve the beneficial uses of Washington's surface waters. Waste discharge permits must include conditions that ensure the discharge will meet the surface water quality standards (WAC 173-201A-510). Water quality-based effluent limits may be based on an individual waste load allocation or on a waste load allocation developed during a basin wide total maximum daily load study (TMDL).

On July 3, 1996, the Environmental Protection Agency (EPA) approved the Snoqualmie River TMDL completed by Ecology in 1994. The TMDL study addresses the critical condition, which in this case occurs during the summer low flow period of August through October. This TMDL limits ammonia, nitrogen, fecal coliform bacteria, and BOD_5 in the South Fork of the Snoqualmie River in the vicinity of the North Bend WWTP and downstream through the mainstem Snoqualmie to its confluence with the Skykomish River. The TMDL contained an evaluation of two options, one for the three existing municipal WWTPs, and one for five municipal WWTPs, which included the two potential discharges of Fall City and Carnation. Ecology based the proposed limits on the five plant discharge option, assuming non-point sources in the vicinity have not been controlled. Table C-2 in Appendix C summarizes the allocations resulting from the TMDL study.

Numerical Criteria for the Protection of Aquatic Life and Recreation

Numerical water quality criteria are listed in the water quality standards for surface waters (chapter 173-201A WAC). They specify the maximum levels of pollutants allowed in receiving water to protect aquatic life and recreation in and on the water. Ecology uses numerical criteria along with chemical and physical data for the wastewater and receiving water to derive the effluent limits in the discharge permit. When surface water quality-based limits are more stringent or potentially more stringent than technology-based limits, the discharge must meet the water quality-based limits.

Numerical Criteria for the Protection of Human Health

The U.S. EPA has published 91 numeric water quality criteria for the protection of human health that are applicable to dischargers in Washington State (EPA 1992). These criteria are designed to protect humans from exposure to pollutants linked to cancer and other diseases, based on consuming fish and shellfish and drinking contaminated surface waters. The Water Quality Standards also include radionuclide criteria to protect humans from the effects of radioactive substances.

Narrative Criteria

Narrative water quality criteria (WAC 173-201A) limit concentrations of toxic, radioactive, or deleterious material. Levels are set below those which have the potential to adversely affect characteristic water uses, cause acute or chronic toxicity to biota, impair aesthetic values, or adversely affect human health. Narrative criteria protect the specific beneficial uses of all fresh and marine surface waters in the state of Washington.

Antidegradation

The purpose of Washington's Antidegradation Policy (WAC 173-201A-300-330; 2006) is to:

- Restore and maintain the highest possible quality of the surface waters of Washington.
- Describe situations under which water quality may be lowered from its current condition.
- Apply to human activities that are likely to have an impact on the water quality of surface water.
- Ensure that all human activities likely to contribute to a lowering of water quality, at a minimum, apply all known, available, and reasonable methods of prevention, control, and treatment (AKART).
- Apply three Tiers of protection (described below) for surface waters of the state.

Tier I ensures existing and designated uses are maintained and protected and applies to all waters and all sources of pollutions. Tier II ensures that waters of a higher quality than the criteria assigned are not degraded unless such lowering of water quality is necessary and in the overriding public interest. Tier II applies only to a specific list of polluting activities. Tier III prevents the degradation of waters formally listed as "outstanding resource waters," and applies to all sources of pollution.

A facility must prepare a Tier II analysis when all three of the following conditions are met:

- The facility is planning a new or expanded action.
- Ecology regulates or authorizes the action.
- The action has the potential to cause measurable degradation to existing water quality at the edge of a chronic mixing zone.

This facility must meet Tier I requirements:

- Existing and designated uses must be maintained and protected. No degradation may be allowed that would interfere with, or become injurious to, existing or designated uses, except as provided for in chapter 173-201A WAC.
- For waters that do not meet assigned criteria, or protect existing or designated uses, Ecology will take appropriate and definitive steps to bring the water quality back into compliance with the water quality standards.

Ecology's analysis described in this fact sheet demonstrates that the existing and designated uses of the receiving water will be protected under the conditions of the proposed permit.

Ecology determined that a Tier II analysis was not required because this facility will not cause measurable degradation to existing water quality at the edge of the chronic mixing zone. Table 3 summarizes the definition of "measurable change" for each parameter of concern. This table also shows the calculated change expected at the edge of the chronic mixing zone for each of the parameters. Using a chronic dilution factor of 150 and the technology-based limits, the calculated change is much lower than that considered to be measurable for all parameters except fecal coliform. Calculations show fecal coliform concentrations at the edge of the mixing zone to be 2 cfu/100 ml higher than ambient concentrations when an effluent concentration of 400 cfu/100 ml is assumed. However, since this facility treats wastewater with MBRs and UV, fecal coliform levels of 0 to 5 cfu/100mL are expected. As long as this facility meets permit limits, it will not cause measurable degradation to existing water quality at the edge of the chronic mixing zone.

Table 3. Demonstration of 'No Measurable Change' at edge of chronic mixing zone

Parameter	Definition of 'Measurable Change' from ambient conditions*	Estimated Change at Edge of Chronic Mixing Zone
Temperature	increase of 0.3°C or greater	0.05°C (App. C, Table C-8)
Dissolved oxygen	decrease of 0.2 mg/L or greater	0.006 mg/L (App. C, Table C-4)
Bacteria level (fecal coliform)	increase of 2 cfu/100 mL or greater	2 cfu/100 mL (App. C, Table C-5)
pH	change of 0.1 units or greater	0.04 std. units (App. C, Table C-8)
Turbidity	increase of 0.5 NTU or greater	No increase expected
Toxic or radioactive substances	Any detectable increase	No increase expected

* as defined by Ecology, 2005: *Supplementary Guidance*, *Implementing the Tier II Antidegradation Rules*, page 6.
Concentrations at Chronic Mixing Zone

Mixing Zones

A mixing zone is the defined area in the receiving water surrounding the discharge port(s) where wastewater mixes with receiving water. Within mixing zones the pollutant concentrations may exceed water quality numeric standards, as long as the diluting wastewater doesn't interfere with designated uses of the receiving water body (e.g., recreation, aquatic life and wildlife habitat, etc.) The pollutant concentrations outside of the mixing zones must meet water quality numeric standards.

State and federal rules allow mixing zones because the concentrations and effects of most pollutants diminish rapidly after discharge, due to dilution. Ecology defines mixing zone sizes to limit the amount of time any exposure to the end-of-pipe discharge could harm water quality, plants, or fish.

The state's water quality standards allow Ecology to authorize mixing zones for the facility's permitted wastewater discharges only if those discharges already receive all known, available, and reasonable methods of prevention, control and treatment (AKART). Mixing zones typically require compliance with water quality criteria within 200 to 300 feet from the point of discharge; and use no more than 25% of the available width of the water body for dilution. We use modeling to estimate the amount of mixing within the mixing zone. Through modeling we determine the potential for violating the water quality standards at the edge of the mixing zone and derive any necessary effluent limits. Steady-state models are the most frequently used tools for conducting mixing zone analyses. Ecology chooses values for each effluent and for receiving water variables that correspond to the time period when the most critical condition is likely to occur (see Ecology's Permit Writer's Manual). Each critical condition parameter, by itself, has a low probability of occurrence and the resulting dilution factor is conservative. The term "reasonable worst-case" applies to these values.

The mixing zone analysis produces a numerical value called a dilution factor (DF). A dilution factor represents the amount of mixing of effluent and receiving water that occurs at the boundary of the mixing zone. For example, a dilution factor of 10 means the effluent is 10% and the receiving water is 90% of the total volume of water at the boundary of the mixing zone. We use dilution factors with the water quality criteria to calculate reasonable potentials and effluent limits. Water quality standards include both aquatic life-based criteria and human health-based criteria. The former are applied at both the acute and chronic mixing zone boundaries; the latter are applied only at the chronic boundary. The concentration of pollutants at the boundaries of any of these mixing zones may not exceed the numerical criteria for that zone.

Each aquatic life *acute* criterion is based on the assumption that organisms are not exposed to that concentration for more than one hour and more often than one exposure in three years. Each aquatic life *chronic* criterion is based on the assumption that organisms are not exposed to that concentration for more than four consecutive days and more often than once in three years.

The two types of human health-based water quality criteria distinguish between those pollutants linked to non-cancer effects (non-carcinogenic) and those linked to cancer effects (carcinogenic). The human health-based water quality criteria incorporate several exposure and risk assumptions. These assumptions include:

- A 70-year lifetime of daily exposures.
- An ingestion rate for fish or shellfish measured in kg/day.
- An ingestion rate of two liters/day for drinking water
- A one-in-one-million cancer risk for carcinogenic chemicals.

This permit authorizes a small acute mixing zone, surrounded by a chronic mixing zone around the point of discharge (WAC 173-201A-400). The water quality standards impose certain conditions before allowing the discharger a mixing zone:

1. *Ecology must specify both the allowed size and location in a permit* - The proposed permit specifies the size and location of the allowed mixing zone based on estimates of discharge quality.

2. *The facility must fully apply "all known available and reasonable methods of prevention, control and treatment" (AKART) to its discharge* - Ecology has determined that the treatment provided at the Carnation Wastewater Treatment Facility meets and exceeds the requirements of AKART (see "Technology based Limits").

3. *Ecology must consider critical discharge conditions* - Surface water quality-based limits are derived for the water body's critical condition (the receiving water and waste discharge condition with the highest potential for adverse impact on the aquatic biota, human health, and existing or designated water body uses). The critical discharge condition is often pollutant-specific or water body-specific.

   Critical discharge conditions are those conditions that result in reduced dilution or increased effect of the pollutant. Factors affecting dilution include the depth of water, the density stratification in the water column, the currents and the rate of discharge. Ecology's Permit Writer's Manual describes additional guidance on criteria/design conditions for determining dilution factors. The Manual can be obtained from Ecology's website at: http://www.ecy.wa.gov/biblio/92109.html.

   Ecology used the following critical conditions to model the discharge:

   - The seven day average low river flow with a recurrence interval of ten years (7Q10) = 446 cfs.
   - River depth of 5.4 feet at the 7Q10 period.
   - River velocity of 0.6 ft per second.
   - Slope = 0.00097 ft/ft.
   - Channel width of 200 feet.
   - Maximum average monthly effluent flow of 0.48 MGD for chronic and human health non-carcinogen.
   - Maximum daily flow of 0.77 million gallons per day (MGD) for acute mixing zone.

   Ambient data at critical conditions in the vicinity of the outfall was taken from a preliminary mixing study based on effluent assumptions. The study is contained in *Technical Memorandum No.12: Outfall Evaluation*, by Carollo Engineers P.C. and Cosmopolitan Engineering Group Inc., dated May 2003.

4. *Supporting information must clearly indicate the mixing zone would not*:

   - *Have a reasonable potential to cause the loss of sensitive or important habitat,*
   - *Substantially interfere with the existing or characteristic uses,*
   - *Result in damage to the ecosystem, or*
   - *Adversely affect public health.*

   Ecology established Washington State water quality criteria for toxic chemicals using EPA criteria. EPA developed the criteria using toxicity tests with numerous organisms, and set the criteria to generally protect 95% of the species tested and to fully protect all commercially and recreationally important species.

   EPA sets acute criteria for toxic chemicals assuming organisms are exposed to the pollutant at the criteria concentration for one hour. They set chronic standards assuming organisms are exposed to the pollutant at the criteria concentration for 4 days. Dilution modeling under critical conditions generally shows that both acute and chronic criteria concentrations are reached within minutes of being discharged.

   The discharge plume does not impact drifting and non-strong swimming organisms because they cannot stay in the plume close to the outfall long enough to be affected. Strong swimming fish could maintain a position within the plume, but they can also avoid the discharge by swimming away. Mixing zones generally do not affect benthic organisms (bottom dwellers) because the buoyant plume rises in the water column. Ecology has additionally determined that the effluent will not exceed 33 degrees C for more than 2 seconds after discharge; and that the temperature of the water will not create lethal conditions or blockages to fish migration.

   Ecology reviewed the above information, the specific information on the characteristics of the discharge, the receiving water characteristics and the discharge location. Based on this review we conclude that the discharge does not have a reasonable potential to cause the loss of sensitive or important habitat, substantially interfere with existing or characteristics uses, result in damage to the ecosystem or adversely affect public health.

5. *The discharge/receiving water mixture must not exceed water quality criteria outside the boundary of a mixing zone* - Ecology conducted a reasonable potential analysis, using procedures established by the EPA and by Ecology, for each pollutant of concern. We concluded the discharge/receiving water mixture will not likely violate water quality criteria outside the boundary of the mixing zone, unless the receiving water is already impaired for a given parameter. For parameters in which the receiving water is already impaired, Ecology proposed TMDL allocations that are mass-limited and not subject to mixing zones.

6. *Maximum size of mixing zone* - The authorized mixing zone does not exceed the maximum size restriction.

7. *Acute Mixing Zone -*
   - *The discharge/receiving water mixture must comply with acute criteria as near to the point of discharge as practicably attainable.* We determined the acute criteria will be met at 10% of the chronic mixing zone at the ten year low flow.
   - *The pollutant concentration, duration and frequency of exposure to the discharge, will not create a barrier to migration or translocation of indigenous organisms to a degree that has the potential to cause damage to the ecosystem.*
     As described above the toxicity of any pollutant depends upon the exposure, the pollutant concentration and the time the organism is exposed to that concentration. Authorizing a limited acute mixing zone for this discharge assures that it will not create a barrier to migration. The effluent from this discharge will rise as it enters the receiving water, assuring that the rising effluent will not cause translocation of indigenous organisms near the point of discharge (below the rising effluent).
   - *Comply with size restrictions* - The mixing zone authorized for this discharge complies with the size restrictions published in chapter 173-201A WAC.
8. *Overlap of Mixing Zones* - This mixing zone does not overlap another mixing zone.

D. Description of the Receiving Water

The Carnation Wastewater Treatment Facility discharges to the Snoqualmie River which is designated as a Core Summer Habitat in the vicinity of the outfall. Table 4 summarizes ambient background data in this area. This data was found online at the Department of Ecology's River and Stream Water Quality Monitoring website: http://www.ecy.wa.gov/programs/eap/fw_riv/rv_main.html. The monitoring station (#07D070) is located in the Snoqualmie River at the Carnation Farm Road Bridge. This is the same bridge in which the outfall is located. Data from 1970 to 1996 is available for temperature, DO, ammonia, phosphorus, and coliform. These values have been tabulated and plotted in *Appendix D.* Ecology used the 7Q10 flow data available in the *Outfall Evaluation* (Cosmopolitan, 2004).

Table 4. Ambient Background Data (at Carnation Farm Road Bridge, station #07D070)

Parameter	Value used
Flow – 7Q10 Low Flow	443 cfs
Temperature (90% Confidence level)	16.04^{o} C
pH (high - 90% Confidence level)	7.5
pH (low - 10% Confidence level)	6.8
Dissolved Oxygen (90% Confidence level)	13.0 mg/L
Total Ammonia-N (90% Confidence level)	0.06 mg/L
Fecal Coliform (90% Confidence level)	80/100 mL

The following paragraphs, pulled from the *2004 QAPP, Snoqualmie River TMDL Effectiveness Evaluation* (http://www.ecy.wa.gov/pubs/0403201.pdf), summarize the ambient conditions for dissolved oxygen, fecal coliform, and ammonia:

Dissolved Oxygen - High water temperatures and minimum DO concentrations occurred in the months of July and August (EarthInfo 1992, STORET 1993). Naturally, these high water temperatures can create lower DO concentrations due to lesser gas solubility. On the other hand, algal primary productivity also increases in summer. Photosynthetic activity can create DO supersaturation during daylight hours, and respiration processes can cause depressed DO concentrations at night in some reaches. Similarly, reaction rates affecting oxygen demanding substances also increase with temperature, thereby affecting the DO levels. Furthermore, critical conditions for DO can occur when velocities and re-aeration rates are reduced in pool areas at lower flows. According to Joy (1994), instream temperatures and DO levels in several areas of the river basin do not meet Class A or Class AA criteria.

Fecal Coliform Bacteria- Fecal coliform bacteria counts exceeding Class A and AA standards occur at various times of the year in the Snoqualmie basin. There is less dilution during dry periods (July through September); hence direct discharges of fecal wastes to the water column can lead to violations. On the other hand, fecal wastes can be washed into water courses directly from land surfaces or through the soils during extended rainstorms or flood conditions. Joy et al. (1991) found both non-point and point sources contributing to the bacterial problems in the mainstem Snoqualmie River. Fecal coliform-water quality limited tributaries are Ames Creek, Cherry Creek, Kimball Creek, Patterson Creek, and Raging River. Although Das (1992) reported significant improvements in effluent disinfection at the three main sewage treatment plants, other non-point sources were still creating localized bacterial contamination problems (Patterson and Dickes, 1993).

Ammonia Toxicity - Critical conditions for ammonia toxicity occur near wastewater sources. According to Joy et al. (1991) and Das (1992), the highest ammonia concentrations were reported from Duvall WWTP effluent samples. These critical conditions occur during low-flow months when high pH (usually related to biomass productivity), elevated background ammonia concentrations (from the WWTP), low dilution, and high temperatures are present. Also, elevated ammonia concentrations were observed at Ames Creek in comparison to characteristically low concentrations throughout most of the Snoqualmie River system.

Other point source outfalls on the Snoqualmie River near the Carnation outfall include the City of Duvall WWTP, the City of Snoqualmie WWTP, Weyerhaeuser Snoqualmie Mill, the City of North Bend WWTP and the Tokul Creek Hatchery. Significant nearby non-point sources of pollutants include silvicultural and agricultural activities.

Water quality of this Core Summer Habitat class shall meet or exceed the requirements for all or substantially all uses.

E. Snoqualmie River Total Maximum Daily Load

On July 3, 1996, the Environmental Protection Agency approved the Snoqualmie River Total Maximum Daily Load (TMDL) Study prepared by Ecology in 1994. This TMDL sets limits for ammonia, BOD_5 and fecal coliform bacteria discharged in the Snoqualmie River. Ecology evaluated options in the TMDL study that included discharges from the existing North Bend, Snoqualmie, and Duvall WWTPs as well as future Fall City and Carnation WWTPs. The study can be found online at: http://www.ecy.wa.gov/biblio/9471.html. Ecology based this permit on the 5-plant scenario. (Refer to Appendix C, Table C-2, TMDL Allocation for 5-plant scenario.) The

City of Carnation TMDL allocations are as follows: 25 lb/day for BOD_5, 8.4 lb/day for ammonia, and 3.1E+09 cfu/day for fecal coliform.

The Snoqualmie River is listed as a Category 5 (impaired) water as part of Ecology's Water Quality Assessment Process (also know as the 303(d) list) due to high temperatures. For this reason, Ecology is developing a temperature TMDL for the Snoqualmie. A Quality Assurance Project Plan (QAPP) that describes the technical investigation used to evaluate stream temperature in the Snoqualmie River from its confluence with the Skykomish River to the Mt. Baker-Snoqualmie National Forest can be found online at: http://www.ecy.wa.gov/biblio/0603106.html. Field work for the temperature TMDL was completed in 2006 and TMDL development and approval is expected to be completed in early 2009.

F. Designated Uses and Surface Water Quality Criteria

Applicable designated uses and surface water quality criteria are defined in chapter 173-201A WAC. Water quality criteria are based on Aquatic Life Uses, Recreational Uses, Water Supply Uses, and Misc. Uses. In addition, the U.S. EPA set human health criteria for toxic pollutants (EPA 1992).

Aquatic Life Uses are designated based on the presence of, or the intent to provide protection for, the key uses. All indigenous fish and non-fish aquatic species must be protected in waters of the state in addition to the key species. The Aquatic Life Use for this receiving water is identified in Table 5.

Table 5. Aquatic Life Use & Associated Criteria

Core Summer Salmonid Habitat	
Temperature Criteria – Highest 7DAD MAX	16°C (60.8°F)
Dissolved Oxygen Criteria	9.5 mg/L
Turbidity Criteria	• 5 NTU over background when the background is 50 NTU or less; or • A 10 percent increase in turbidity when the background turbidity is more than 50 NTU
Total Dissolved Gas Criteria	Total dissolved gas shall not exceed 110 percent of saturation at any point of sample collection
pH Criteria	pH shall be within the range of 6.5 to 8.5, with a human-caused variation within the above range of less than 0.2 units

The Washington State water quality standards include three levels of *Recreational Uses:* extraordinary primary contact recreation, primary contact recreation, and secondary contact recreation. The recreational use for this receiving water is primary contact recreation; the criterion for this use is summarized in Table 6.

The *Water Supply Uses* for this facility include domestic, agricultural, industrial, and stock watering. The *Miscellaneous Fresh Water Uses* include wildlife habitat, harvesting, commerce and navigation, boating, and aesthetics.

Table 6. Recreational Uses & Associated Criteria

Recreational use	Criteria
Primary Contact Recreation	Fecal coliform organism levels must not exceed a geometric mean value of 100 colonies /100 mL, with not more than 10 percent of all samples (or any single sample when less than ten sample points exist) obtained for calculating the geometric mean value exceeding 200 colonies /100 mL

G. Evaluation of Surface Water Quality-Based Effluent Limits for Numeric Criteria

Pollutants in an effluent may affect the aquatic environment near the point of discharge (near field) or at a considerable distance from the point of discharge (far field). Toxic pollutants, for example, are near-field pollutants--their adverse effects diminish rapidly with mixing in the receiving water. Conversely, a pollutant such as biological oxygen demand (BOD) is a far-field pollutant whose adverse effect occurs away from the discharge even after dilution has occurred. Thus, the method of calculating surface water quality-based effluent limits varies with the point at which the pollutant has its maximum effect.

With technology-based controls (AKART), predicted pollutant concentrations in the discharge exceed water quality criteria. Ecology therefore authorizes a mixing zone in accordance with the geometric configuration, flow restriction, and other restrictions imposed on mixing zones by chapter 173-201A WAC.

The outfall for this facility drops from a west piling of the Carnation Farm Road Bridge into the Snoqualmie River. The mixing port is a duckbill valve that discharges at 1.9 feet above the river bed. Ecology obtained this information from the Preliminary Mixing Zone Study dated May 2003, and submitted by Cosmopolitan Engineering Group Inc. as a technical memo; this memo was reviewed with the Facilities Plan.

Chronic Mixing Zone

WAC 173-201A-400(7)(a) specifies that mixing zones must not extend in a downstream direction from the discharge ports for a distance greater than 300 feet plus the depth of water over the discharge ports or extend upstream for a distance of over 100 feet, not utilize greater than 25% of the flow, and not occupy greater than 25% of the width of the water body. The flow volume restriction resulted in a smaller chronic dilution factor than the distance downstream; therefore Ecology used the volume restriction approach to determine the dilution factor shown below.

Acute Mixing Zone

WAC 173-201A-400(8)(a) specifies that in rivers and streams a zone where acute toxics criteria may be exceeded must not extend beyond 10% of the distance towards the upstream and downstream boundaries of the chronic zone, not use greater than 2.5% of the flow and not occupy greater than 25% of the width of the water body. The flow volume restriction resulted in a smaller acute dilution factor than the distance downstream; therefore Ecology used the volume restriction approach to determine the dilution factor shown below.

Dilution Factors were originally determined in a study conducted by Carollo Engineers P.C. and Cosmopolitan Engineering Group Inc. Results are summarized in a report called *Technical Memorandum No.12: Outfall Evaluation*, dated May 2003. The study performed was somewhat preliminary in that the final flow design for the facility had not yet been determined. Ecology used the RIVPLUM5 spreadsheet to re-calculate the dilution factors with the updated flowrates (see *Appendix C*). Table 7 reflects these new dilution factors. Similar to the Cosmopolitan study, the dilution factors determined by percentage of river flow are more restrictive than the dilution factors calculated using RIVPLUM5. Therefore, Ecology used the most restrictive dilution factors, based on percent of river flow, in this permit.

Table 7. Dilution Factors (DF)

Criteria	Acute	Chronic
Aquatic Life	10.3	150
Human Health, Carcinogen		150
Human Health, Non-carcinogen		150

Ecology determined the impacts of dissolved oxygen deficiency, fecal coliform, ammonia , phosphorus, temperature, pH, and toxics as described below, using the dilution factors in the above table. The derivation of surface water quality-based limits also takes into account the variability of pollutant concentrations in both the effluent and the receiving water.

Nutrients, bacteria, and BOD_5 limits for the summer low flow period of August through October are all addressed in the Snoqualmie River TMDL. The TMDL limits ammonia, nitrogen, phosphorus, fecal coliform bacteria, and BOD_5 in the South Fork of the Snoqualmie River in the vicinity of the North Bend WWTP and downstream through the mainstem Snoqualmie to its confluence with the Skykomish River. The TMDL contained an evaluation of two options, one for the three existing municipal WWTPs, and one for five municipal WWTPs, which included the two potential discharges of Fall City and Carnation. The TMDL water quality-based limits are based on the five plant discharge, assuming non-point sources in the vicinity have not been controlled.

In accordance with NPDES regulations at 40 CFR 122.45(d), all permit limits must be expressed, unless impracticable, as both average monthly (AML) and maximum daily (MDL) values. Both Ecology guidance (Permit Writer’s Manual p. VI-26) and EPA Guidance (Technical Support Document for Water Quality-based Toxic Control p. 99) provide the basis for calculating an average monthly limit (AML) from waste load allocation or maximum daily limit (MDL) based on the inherent variability of the data set and the number of samples expected per month. Since effluent data is not yet available for the Carnation Treatment Plant, Ecology followed the steady state procedure recommended by the EPA. This approach calculates the AML to be ½ of the MDL. Refer to Table C-3 in *Appendix C* for calculations.

BOD_5— For the low-flow season (August – October), the TMDL allocates a maximum daily BOD_5 limit of 25 lbs/day for the Carnation plant. Ecology used the maximum daily limit to calculate an average monthly limit of 12.5 lbs/day (see Table C-3 in *Appendix C*).

Ecology modeled the impact of BOD on the receiving water during the high-flow season using the Streeter-Phelps analysis at critical condition and with the technology-based effluent limitation for BOD_5 described under *Technology-Based Effluent Limits* above. Calculations show that when the effluent is well mixed with the river water, the resulting DO will be 9.9 mg/L. This is greater than the 9.5 mg/L criteria; therefore the technology-based limits are protective of the water quality standards. The calculations to determine dissolved oxygen impacts are shown in Table C-4 in *Appendix C*.

Fecal coliform— For the low-flow season (August – October), the TMDL allocates a maximum daily fecal coliform limit of 3.1E+09 cfu/day, and an average monthly value of 1.55E+09 cfu/day (see Table C-3 in *Appendix C*).

For the high-flow season (November – July), Ecology calculated the numbers of fecal coliform by simple mixing analysis using the technology-based limit of 400 organisms per 100 ml and a dilution factor of 150. Under these conditions, the calculation predicts no violation of the water quality criterion for fecal coliform (Table C-5 in *Appendix C*). Therefore, the proposed permit includes the technology-based effluent limitation for fecal coliform bacteria during these months.

Ammonia— For the low-flow season (August – October), the TMDL allocates a maximum daily ammonia limit of 8.4 lb/day, and an average monthly value of 4.2 lb/day (see Table C-3 in *Appendix C*).

For the high-flow season (November – July), Ecology calculated the numbers of ammonia by simple mixing analysis using an assumed ammonia discharge of 40 mg/L as N (conservative assumption since no data is available) and a dilution factor of 150 (see Table C-7). The ammonia standard for this fresh water receiving water was calculated as being 2.0 mg/L using the spreadsheet shown in Table C-6. Under these conditions, the calculation predicts no violation of the water quality criterion for ammonia. Therefore, the proposed permit includes no limit for ammonia during these high-flow months.

Phosphorus— The TMDL recommends a maximum daily soluble reactive phosphorus (SRP) limit of 3 lb/day, however since there is no water quality standard for Phosphorus this is not an enforceable limit. The permit requires phosphorus monitoring.

Temperature—The state temperature standards include multiple criteria, each with different durations of exposure and points of application. Ecology evaluates each criterion independently to determine reasonable potential and permit limits. For this permitted discharge, there was not sufficient information on temperature of the effluent or the receiving water to determine compliance with water quality criteria for temperature. The permit requires the Permittee to monitor effluent and receiving water temperature and report the results to Ecology. A temperature TMDL study is in progress and a TMDL may be instated by the time the next permit is issued.

pH— Ecology modeled the impact of the effluent pH on the receiving water using the technology-based limits, the calculations from EPA, 1988, and the chronic dilution factor of 150. The receiving water input variables used are listed above in Table 4 and the calculations are shown in Table C-8 in *Appendix C*. Ecology predicts no violation of the pH criteria under critical conditions. Therefore, the proposed permit includes technology-based effluent limits for pH.

Toxic Pollutants--Federal regulations (40 CFR 122.44) require Ecology to place limits in NPDES permits on toxic chemicals in an effluent whenever there is a reasonable potential for those chemicals to exceed the surface water quality criteria. Ecology does not exempt facilities with technology-based effluent limits from meeting the surface water quality standards.

The following toxic pollutants will likely be present in the discharge: chlorine and ammonia. Ammonia limits were addressed in the TMDL study and are included in the permit. Chlorine will be used at this facility in small quantities for in-situ membrane cleaning. Technology-based limits have been instated for chlorine. Ecology will conduct a reasonable potential analysis for ammonia and other toxics at the drafting of the next permit when effluent data is available.

H. Whole Effluent Toxicity

The water quality standards for surface waters forbid discharge of effluent that causes toxic effects in the receiving waters. Many toxic pollutants cannot be measured by commonly available detection methods. However, laboratory tests can measure toxicity directly by exposing living organisms to the wastewater and measuring their responses. These tests measure the aggregate toxicity of the whole effluent, so this approach is called whole effluent toxicity (WET) testing. Some WET tests measure acute toxicity and other WET tests measure chronic toxicity.

- *Acute toxicity tests measure mortality as the significant response* to the toxicity of the effluent. Dischargers who monitor their wastewater using acute toxicity tests find early indications of any potential lethal effect of the effluent on organisms in the receiving water.

- *Chronic toxicity tests measure various sublethal toxic responses,* such as retarded growth or reduced reproduction. Chronic toxicity tests often involve either a complete life cycle test on an organism with an extremely short life cycle, or a partial life cycle test during a critical stage of a test organism's life. Some chronic toxicity tests also measure organism survival.

Because King County has a Pretreatment Program it is required to conduct toxicity testing. The proposed permit contains WET testing requirements as authorized by RCW 90.48.520 and 40 CFR 122.44, using procedures from chapter 173-205 WAC. The proposed permit requires the facility to conduct WET testing annually for a total of 4 times throughout the permit term, to characterize both the acute and chronic toxicity of the effluent.

If the year of WET testing shows acute or chronic toxicity levels that have a reasonable potential to cause receiving water toxicity, then the proposed permit will:

- Set a limit on acute or chronic toxicity.

- Require this facility operator to conduct WET testing to monitor compliance with an acute toxicity limit, a chronic toxicity limit, or both.

- Specify the procedures the facility operator must use to come back into compliance if toxicity exceeds the limits.

Ecology-accredited WET testing laboratories use the proper WET testing protocols, fulfill the data requirements, and submit results in the correct reporting format. Accredited laboratory staff knows how to calculate an NOEC, LC_{50}, EC_{50}, IC_{25}, etc. Ecology gives all accredited labs the most recent version of Ecology Publication No. WQ-R-95-80, *Laboratory Guidance and Whole Effluent Toxicity Test Review Criteria* (http://www.ecy.wa.gov/biblio/9580.html), which is referenced in the permit. Ecology recommends that each regulated facility send a copy of the acute or chronic toxicity sections(s) of its NPDES permit to the laboratory.

I. Human Health

Washington's water quality standards include 91 numeric human health-based criteria that Ecology must consider when writing NPDES permits. These criteria were established in 1992 by the U.S. EPA in its National Toxics Rule (40 CFR 131.36). The National Toxics Rule allows states to use mixing zones to evaluate whether discharges comply with human health criteria.

Ecology determined the effluent may contain chemicals of concern for human health. Ecology can not evaluate the discharge's potential to violate the water quality standards as required by 40 CFR 122.44(d) until effluent data is available. Ecology will perform a reasonable potential evaluation when additional effluent data is available.

J. Sediment Quality

The aquatic sediment standards (chapter 173-204 WAC) protect aquatic biota and human health. Under these standards Ecology may require a facility to evaluate the potential for its discharge to cause a violation of sediment standards (WAC 173-204-400).

Through a review of the discharger characteristics and of the effluent characteristics, Ecology determined that this discharge has no reasonable potential to violate the Sediment Management Standards.

K. Ground Water Quality Limits

The Ground Water Quality Standards (chapter 173-200 WAC) protect beneficial uses of ground water. Permits issued by Ecology must not allow violations of those standards (WAC 173-200-100). This NPDES permit does not allow the Carnation WWTP to discharge wastewater to the ground. Therefore no permit limits are required to protect ground water.

L. Comparison of Effluent Limits with the Previous Permit

This is a new permit and discharge; there were no previous effluent limits.

IV. MONITORING REQUIREMENTS

Ecology requires monitoring, recording, and reporting (WAC 173-220-210 and 40 CFR 122.41) to verify that the treatment process is functioning correctly and that the discharge complies with the permit's effluent limits.

The monitoring schedule is detailed in the proposed permit under Condition S.2. Specified monitoring frequencies take into account the quantity and variability of the discharge, the treatment method, past compliance, significance of pollutants, and cost of monitoring. The required monitoring frequency is consistent with agency guidance given in the current version of Ecology's *Permit Writer's Manual* (July 2004) for activated sludge plant with less that 2.0 MGD average design flow.

Monitoring of sludge quantity and quality is necessary to determine the appropriate uses of the sludge. Sludge monitoring is required by the current state and local solid waste management program and also by EPA under 40 CFR 503.

Lab Accreditation

Ecology requires that all monitoring data (with the exception of certain parameters) be prepared by a laboratory registered or accredited under the provisions of chapter 173-50 WAC, *Accreditation of Environmental Laboratories.* This facility plans to obtain accreditation for Biological Oxygen Demand (BOD_5), Total Suspended Solids (TSS), fecal coliform, total coliform, residual chlorine, and pH. King County will send samples to their South Plant facility and the King County Environmental Laboratory until accreditation has been obtained. The South Plant laboratory is accredited for the parameters listed in Table 8.

Table 8. South Plant Lab Accreditation Parameters.

Parameter Name	Method	Parameter Name	Method
Alkalinity, Total	2320 B(4a)	Orthophosphate	4500-P E
Ammonia	4500-NH3 F	pH	4500-H
Biochemical Oxygen Demand, BOD/CBOD	5210 B	Phosphorus, Total Persulfate	4500-P E
Chemical Oxygen Demand (COD)	5220 D	Solids, Total	2540 B
Chloride	4500-Cl- C	Solids, Total Dissolved	2540 C
Chlorine Residual, Total	4500-Cl G	Solids, Total Suspended	2540 D
Dissolved Oxygen	4500-O C	Solids, Total Volatile	2540 E
Hardness, Total (as CaCO3)	2340 C	Specific Conductance	2510 B
Magnesium	3500-Mg D	Sulfate	4500-SO4 E
Nitrate	4500-NO3 E	Turbidity	2130 B
Nitrate + Nitrite	4500-NO3 E	Fecal Coliform - count	9222 D
Nitrite	4500-NO2 B	Total Coli - count MF	9222 B2,5,6
Nitrogen, Total Kjeldahl	4500-Norg B		

V. OTHER PERMIT CONDITIONS

A. Reporting and Recordkeeping

Ecology based permit condition S3 on our authority to specify any appropriate reporting and recordkeeping requirements to prevent and control waste discharges (WAC 173-220-210).

B. Prevention of Facility Overloading

Overloading of the treatment plant is a violation of the terms and conditions of the permit. To prevent this from occurring, RCW 90.48.110 and WAC 173-220-150 require the Permittee to take the actions detailed in proposed permit requirement S.4. to plan expansions or modifications before existing capacity is reached and to report and correct conditions that could result in new or increased discharges of pollutants. Condition S.4. restricts the amount of flow.

C. Operation and Maintenance (O&M)

The proposed permit contains condition S.5 as authorized under RCW 90.48.110, WAC 173-220-150, Chapter 173-230 WAC, and WAC 173-240-080. It is included to ensure proper operation and regular maintenance of equipment, and to ensure that adequate safeguards are taken so that constructed facilities are used to their optimum potential in terms of pollutant capture and treatment. The proposed permit requires submission of an O&M manual for the treatment facility, and not the collection system since the collection system is owned and operated by the City of Carnation.

D. Pretreatment

To provide more direct and effective control of pollutants, Ecology has delegated permitting, monitoring and enforcement authority to King County for industrial users discharging to their treatment system. Ecology oversees the delegated Industrial Pretreatment Program to assure compliance with federal pretreatment regulations (40 CFR Part 403) and categorical standards and state regulations (Chapter 90.48 RCW and Chapter 173-216 WAC).

E. Residual Solids Handling

To prevent water quality problems the Permittee is required in permit condition S7. to store and handle all residual solids (grit, screenings, scum, sludge, and other solid waste) in accordance with the requirements of RCW 90.48.080 and State Water Quality Standards.

The final use and disposal of sewage sludge from this facility is regulated by U.S. EPA under 40 CFR 503, and by Ecology under Chapter 70.95J RCW, Chapter 173-308 WAC “Biosolids Management”, and Chapter 173-350 WAC “Solid Waste Handling Standards”. The disposal of other solid waste is under the jurisdiction of the King County Health Department.

H. Outfall Evaluation

The proposed permit requires King County to conduct an outfall inspection and submit a report detailing the findings of that inspection (Condition S12). The inspection must evaluate the physical condition of the discharge pipe.

I. General Conditions

Ecology bases the standardized General Conditions on state and federal law and regulations. They are included in all individual municipal NPDES permits issued by Ecology.

VI. PERMIT ISSUANCE PROCEDURES

A. Permit Modifications

Ecology may modify this permit to impose numerical limits, if necessary to comply with water quality standards for surface waters, with sediment quality standards, or with water quality standards for ground waters, based on new information from sources such as inspections, effluent monitoring, outfall studies, and effluent mixing studies.

Ecology may also modify this permit to comply with new or amended state or federal regulations.

B. Proposed Permit Issuance

This proposed permit meets all statutory requirements for Ecology to authorize a wastewater discharge. The permit includes limits and conditions to protect human health and aquatic life, and the beneficial uses of waters of the State of Washington. Ecology proposes to issue this permit for a term of five years.

VII. REFERENCES FOR TEXT AND APPENDICES

Carollo Engineers P.C. and Cosmopolitan Engineering Group Inc.

2003, May. *Technical Memorandum No.12: Outfall Evaluation for the Carnation WWTP.*

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1992. *National Toxics Rule.* Federal Register, V. 57, No. 246, Tuesday, December 22, 1992.
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May 2004. *Draft Recovery Plan for the Coastal-Puget Sound Distinct Population Segment of Bull Trout* (http://www.fws.gov/pacific/bulltrout/jcs/vol_I.html)

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1994, *Snoqualmie River Total Maximum Daily Load Study (*http://www.ecy.wa.gov/biblio/9471.html*)*
2004, *QAPP, Snoqualmie River TMDL Effectiveness Evaluation* (http://www.ecy.wa.gov/pubs/0403201.pdf)
2005, *Supplementary Guidance, Implementing the Tier II Antidegradation Rules*, WAC 173-201A-320, Developed by the Department of Ecology Water Quality Program (http://www.ecy.wa.gov/programs/wq/swqs/antideg-tier2-guidance.pdf)
2006. *Permit Writer's Manual*. Publication Number 92-109 (http://www.ecy.wa.gov/biblio/92109.html)
Laws and Regulations (http://www.ecy.wa.gov/laws-rules/index.html)
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1979. *In-stream De-oxygenation Rate Prediction*. Journal Environmental Engineering Division, ASCE. 105(EE2). (Cited in EPA 1985 op.cit.)

APPENDIX A--PUBLIC INVOLVEMENT INFORMATION

Ecology proposes to issue a permit to the applicant listed on page one of this fact sheet. The permit includes wastewater discharge limits and other conditions. This fact sheet describes the facility and Ecology's reasons for requiring permit conditions.

Ecology placed a Public Notice of Application on December 5, 2007 and December 12, 2007 in *The Snoqualmie Valley Record* to inform the public about the submitted application and to invite comment on the issuance of this permit.

Ecology will place a Public Notice of Draft on (date) in *The Snoqualmie Valley Record* to inform the public and to invite comment on the proposed draft National Pollutant Discharge Elimination System permit and fact sheet.

The Notice –

- tells where copies of the draft Permit and Fact Sheet are available for public evaluation
- (a local public library, the closest Regional or Field Office, posted on our website.).
- offers to provide the documents in an alternate format to accommodate special needs.
- asks people to tell us how well the proposed permit would protect the receiving water.
- invites people to suggest fairer conditions, limits, and requirements for the permit.
- invites comments on Ecology's determination of compliance with antidegradation rules.
- urges people to submit their comments, in writing, before the end of the Comment Period
- tells how to request a public hearing of comments about the proposed NPDES Permit.
- explains the next step(s) in the permitting process.

Ecology has published a document entitled *Frequently Asked Questions about Effective Public Commenting* which is available on our website at http://www.ecy.wa.gov/biblio/0307023.html.

You may obtain further information from Ecology by telephone, 425-649-7000, or by writing to the address listed below.

Water Quality Permit Coordinator
Department of Ecology
Northwest Regional Office
3190 160th Avenue SE
Bellevue, WA 98008

APPENDIX B--GLOSSARY

Acute Toxicity--The lethal effect of a compound on an organism that occurs in a short period of time, usually 48 to 96 hours.

AKART-- An acronym for "all known, available, and reasonable methods of prevention, control and treatment".

Ambient Water Quality--The existing environmental condition of the water in a receiving water body.

Ammonia--Ammonia is produced by the breakdown of nitrogenous materials in wastewater. Ammonia is toxic to aquatic organisms, exerts an oxygen demand, and contributes to eutrophication. It also increases the amount of chlorine needed to disinfect wastewater.

Average Monthly Discharge Limitation --The average of the measured values obtained over a calendar month's time.

Best Management Practices (BMPs)--Schedules of activities, prohibitions of practices, maintenance procedures, and other physical, structural and/or managerial practices to prevent or reduce the pollution of waters of the State. BMPs include treatment systems, operating procedures, and practices to control: plant site runoff, spillage or leaks, sludge or waste disposal, or drainage from raw material storage. BMPs may be further categorized as operational, source control, erosion and sediment control, and treatment BMPs.

BOD_5--Determining the Biochemical Oxygen Demand of an effluent is an indirect way of measuring the quantity of organic material present in an effluent that is utilized by bacteria. The BOD_5 is used in modeling to measure the reduction of dissolved oxygen in receiving waters after effluent is discharged. Stress caused by reduced dissolved oxygen levels makes organisms less competitive and less able to sustain their species in the aquatic environment. Although BOD is not a specific compound, it is defined as a conventional pollutant under the federal Clean Water Act.

Bypass--The intentional diversion of waste streams from any portion of a treatment facility.

Chlorine--Chlorine is used to disinfect wastewaters of pathogens harmful to human health. It is also extremely toxic to aquatic life.

Chronic Toxicity--The effect of a compound on an organism over a relatively long time, often 1/10 of an organism's lifespan or more. Chronic toxicity can measure survival, reproduction or growth rates, or other parameters to measure the toxic effects of a compound or combination of compounds.

Clean Water Act (CWA)--The Federal Water Pollution Control Act enacted by Public Law 92-500, as amended by Public Laws 95-217, 95-576, 96-483, 97-117; USC 1251 et seq.

Compliance Inspection - Without Sampling--A site visit for the purpose of determining the compliance of a facility with the terms and conditions of its permit or with applicable statutes and regulations.

Compliance Inspection - With Sampling--A site visit to accomplish the purpose of a Compliance Inspection - Without Sampling and as a minimum, sampling and analysis for all parameters with limits in the permit to ascertain compliance with those limits; and, for municipal facilities, sampling of influent to ascertain compliance with the 85 percent removal requirement. Additional sampling may be conducted.

Composite Sample--A mixture of grab samples collected at the same sampling point at different times, formed either by continuous sampling or by mixing discrete samples. May be "time-composite"(collected at constant time intervals) or "flow-proportional" (collected either as a constant sample volume at time intervals proportional to stream flow, or collected by increasing the volume of each aliquot as the flow increased while maintaining a constant time interval between the aliquots.

Construction Activity--Clearing, grading, excavation and any other activity which disturbs the surface of the land. Such activities may include road building, construction of residential houses, office buildings, or industrial buildings, and demolition activity.

Continuous Monitoring –Uninterrupted, unless otherwise noted in the permit.

Critical Condition--The time during which the combination of receiving water and waste discharge conditions have the highest potential for causing toxicity in the receiving water environment. This situation usually occurs when the flow within a water body is low, thus, its ability to dilute effluent is reduced.

Dilution Factor (DF)--A measure of the amount of mixing of effluent and receiving water that occurs at the boundary of the mixing zone. Expressed as the inverse of the percent effluent fraction e.g., a dilution factor of 10 means the effluent comprises 10% by volume and the receiving water 90%.

Engineering Report--A document which thoroughly examines the engineering and administrative aspects of a particular domestic or industrial wastewater facility. The report must contain the appropriate information required in WAC 173-240-060 or 173-240-130.

Fecal Coliform Bacteria--Fecal coliform bacteria are used as indicators of pathogenic bacteria in the effluent that are harmful to humans. Pathogenic bacteria in wastewater discharges are controlled by disinfecting the wastewater. The presence of high numbers of fecal coliform bacteria in a water body can indicate the recent release of untreated wastewater and/or the presence of animal feces.

Grab Sample--A single sample or measurement taken at a specific time or over as short a period of time as is feasible.

Industrial Wastewater--Water or liquid-carried waste from industrial or commercial processes, as distinct from domestic wastewater. These wastes may result from any process or activity of industry, manufacture, trade or business, from the development of any natural resource, or from animal operations such as feed lots, poultry houses, or dairies. The term includes contaminated storm water and, also, leachate from solid waste facilities.

Major Facility--A facility discharging to surface water with an EPA rating score of > 80 points based on such factors as flow volume, toxic pollutant potential, and public health impact.

Maximum Daily Discharge Limitation--The highest allowable daily discharge of a pollutant measured during a calendar day or any 24-hour period that reasonably represents the calendar day for purposes of sampling. The daily discharge is calculated as the average measurement of the pollutant over the day.

Method Detection Level (MDL)--The minimum concentration of a substance that can be measured and reported with 99% confidence that the pollutant concentration is above zero and is determined from analysis of a sample in a given matrix containing the pollutant.

Minor Facility--A facility discharging to surface water with an EPA rating score of < 80 points based on such factors as flow volume, toxic pollutant potential, and public health impact.

Mixing Zone--An area that surrounds an effluent discharge within which water quality criteria may be exceeded. The area of the authorized mixing zone is specified in a facility's permit and follows procedures outlined in state regulations (chapter 173-201A WAC).

National Pollutant Discharge Elimination System (NPDES)--The NPDES (Section 402 of the Clean Water Act) is the Federal wastewater permitting system for discharges to navigable waters of the United States. Many states, including the State of Washington, have been delegated the authority to issue these permits. NPDES permits issued by Washington State permit writers are joint NPDES/State permits issued under both State and Federal laws.

pH--The pH of a liquid measures its acidity or alkalinity. A pH of 7 is defined as neutral, and large variations above or below this value are considered harmful to most aquatic life.

Quantitation Level (QL)-- A calculated value five times the MDL (method detection level).

Responsible Corporate Officer-- A president, secretary, treasurer, or vice-president of the corporation in charge of a principal business function, or any other person who performs similar policy- or decision-making functions for the corporation, or the manager of one or more manufacturing, production, or operating facilities employing more than 250 persons or have gross annual sales or expenditures exceeding $25 million (in second quarter 1980 dollars), if authority to sign documents has been assigned or delegated to the manager in accordance with corporate procedures (40 CFR 122.22).

Technology-based Effluent Limit--A permit limit that is based on the ability of a treatment method to reduce the pollutant.

Total Suspended Solids (TSS)--Total suspended solids is the particulate material in an effluent. Large quantities of TSS discharged to receiving waters may result in solids accumulation. Apart from any toxic effects attributable to substances leached out by water, suspended solids may kill fish, shellfish, and other aquatic organisms by causing abrasive injuries and by clogging the gills and respiratory passages of various aquatic fauna. Indirectly, suspended solids can screen out light and can promote and maintain the development of noxious conditions through oxygen depletion.

State Waters--Lakes, rivers, ponds, streams, inland waters, underground waters, salt waters, and all other surface waters and watercourses within the jurisdiction of the state of Washington.

Stormwater--That portion of precipitation that does not naturally percolate into the ground or evaporate, but flows via overland flow, interflow, pipes, and other features of a storm water drainage system into a defined surface water body, or a constructed infiltration facility.

Upset--An exceptional incident in which there is unintentional and temporary noncompliance with technology-based permit effluent limits 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, lack of preventative maintenance, or careless or improper operation.

Water Quality-based Effluent Limit--A limit on the concentration of an effluent parameter that is intended to prevent the concentration of that parameter from exceeding its water quality criterion after it is discharged into receiving waters.

APPENDIX C—TECHNICAL CALCULATIONS

Several of the Excel® spreadsheet tools used to evaluate a discharger's ability to meet Washington State water quality standards can be found on the Department's homepage at (http://www.ecy.wa.gov/programs/wq/wastewater/index.html

Table C-1. Dilution Analysis

Spread of a plume from a point source in a river with boundary effects from the shoreline based on the method of Fischer *et al.* (1979) with correction for the effective origin of effluent. Revised 22-Feb-96

Carnation Wastewater Treatment Facility
Run Date: 11/29/2007

INPUT	Cosmopolitan Mixing Study Chronic	Cosmopolitan Mixing Study Acute	Revised Flows Chronic	Revised Flows Acute
1. Effluent Discharge Rate (mgd):	0.62	0.93	0.48	0.77
Effluent Discharge Rate (cfs):	0.96	1.44	0.74	1.19
2. Receiving Water Characteristics Downstream From Waste Input				
Stream Depth (ft):	5.40	5.40	5.40	5.40
7Q10 Stream Flow (cfs)	443	443	443	443
Stream Velocity (fps):	0.61	0.61	0.61	0.61
Channel Width (ft):	200.00	200.00	200.00	200.00
Stream Slope (ft/ft) or Manning roughness "n":	0.00097	0.00097	0.00097	0.00097
0 if slope or 1 if Manning "n" in previous cell:	0	0	0	0
3. Discharge Distance From Nearest Shoreline (ft):	15.00	15.00	15.00	15.00
4. Location of Point of Interest to Estimate Dilution				
Distance Downstream to Point of Interest (ft):	305.00	30.50	305.00	30.50
Distance From Nearest Shoreline (ft):	0.00	0.00	0.00	0.00
5. Transverse Mixing Coefficient Constant (usually 0.6):	0.6	0.6	0.6	0.6
6. Original Fischer Method (enter 0) or *Effective Origin* Modification (enter	0	0	0	0
OUTPUT				
1. Source Conservative Mass Input Rate				
Concentration of Conservative Substance (%):	100.00	100.00	100.00	100.00
Source Conservative Mass Input Rate (cfs*%):	95.93	143.90	74.27	119.14
2. Shear Velocity				
Shear Velocity based on slope (ft/sec):	0.411	0.411	0.411	0.411
Shear Velocity based on Manning "n":				
using Prasuhn equations 8-26 and 8-54 assuming hydraulic radius				
equals depth for wide channel Darcy-Weisbach friction factor "f":	#N/A	#N/A	#N/A	#N/A
Shear Velocity from Darcy-Weisbach "f" (ft/sec):	#N/A	#N/A	#N/A	#N/A
Selected Shear Velocity for next step (ft/sec):	0.411	0.411	0.411	0.411
3. Transverse Mixing Coefficient (ft2/sec):	1.331	1.331	1.331	1.331
4. Plume Characteristics Accounting for Shoreline Effect (Fischer *et al.*, 1979)				
Co	1.46E-01	2.18E-01	1.13E-01	1.81E-01
x'	3.23E-03	3.23E-03	1.66E-02	1.66E-03
y'o	7.50E-02	7.50E-02	7.50E-02	7.50E-02
y' at point of interest	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Solution using superposition equation (Fischer eqn 5.9)				
Term for n= -2	0.00E+00	0.00E+00	2.74E-101	0.00E+00
Term for n= -1	2.75E-125	2.75E-125	6.47E-25	1.28E-242
Term for n= 0	1.29E+00	1.29E+00	1.84E+00	8.59E-01
Term for n= 1	2.75E-125	2.75E-125	6.47E-25	1.28E-242
Term for n= 2	0.00E+00	0.00E+00	2.74E-101	0.00E+00
Upstream Distance from Outfall to Effective Origin of Effluent Source (ft)	#N/A	#N/A	#N/A	#N/A
Effective Distance Downstream from Effluent to Point of Interest (ft)	305.00	30.50	305.00	30.50
x' Adjusted for Effective Origin	1.66E-02	1.66E-03	1.66E-02	1.66E-03
C/Co (dimensionless)	2.83E+00	8.95E+00	4.02E+00	5.94E+00
Concentration at Point of Interest (Fischer Eqn 5.9)	4.12E-01	1.96E+00	4.53E-01	1.07E+00
Unbounded Plume Width at Point of Interest (ft)	145.91	46.14	145.91	46.14
Unbounded Plume half-width (ft)	72.96	23.07	72.96	23.07
Distance from near shore to discharge point (ft)	15.00	15.00	15.00	15.00
Distance from far shore to discharge point (ft)	185.00	185.00	185.00	185.00
Plume width bounded by shoreline (ft)	87.96	38.07	87.96	38.07
Approximate Downstream Distance to Complete Mix (ft):	6276	6276	6276	6276
Theoretical Dilution Factor at Complete Mix:	687	458	887	553
Calculated Flux-Average Dilution Factor Across Entire Plume Width:	302	87	390	105
Calculated Dilution Factor at Point of Interest:	**243**	**51**	**221**	**93**
Regulatory Max (effluent well-mixed with 25% of 7Q10 flow) :	**116**	**8.7**	**150**	**10.3**

Table C-2. TMDL Allocation for 5-Plant Scenario

(The following table is an excerpt from the Department of Ecology's Snoqualmie River Total Maximum Daily Load Study, May 1994, p. 31.)

Waste Load Allocations used to calculate AML and MDL for BOD_5, SRP, fecal coliform, and Ammonia.

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: Flow (cfs)	Concentrations: BOD5 (mg/L)	Concentrations: NH3-N (mg/L)	Concentrations: SRP (mg/L)	Concentrations: Fecal* Coliform	Loads: BOD5 (lbs/d)	Loads: NH3-N (lbs/d)	Loads: SRP (lbs/d)	Loads: 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: Flow (cfs)	Concentrations: BOD5 (mg/L)	Concentrations: NH3-N (mg/L)	Concentrations: SRP (mg/L)	Concentrations: Fecal* Coliform	Loads: BOD5 (lbs/d)	Loads: NH3-N (lbs/d)	Loads: SRP (lbs/d)	Loads: 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

Table C-3. Calculation of AML for BOD5, Ammonia, SRP, and Fecal Coliform

Calculating Permit Limits Based on Wasteload Allocation
Source: EPA Technical Support Document for Water Quality-based Toxics Control

Input	**Definition**	**Formula**	**BOD, lb/day**	**Ammonia, lb/day**	**Fecal Coliform, cfu/day**
MDL	Maximum Daily Limit	= Daily WLA	25	8.4	3.10E+09
AML*	Average Monthly Limit	= Daily WLA/2	12.50	4.20	1.55E+09

* Ecology used the steady-state approach because no effluent data was available to do the statistical approach. The steady-state approach is more conservative; the AML values will be revised with the next permit when effluent data is available to perform the statistical approach. (Refer to *EPA Technical Support Document for Water Quality-based Toxics Control* for details.)

Table C-4. Streeter-Phelps Analysis of Critical DO Sag

Streeter-Phelps analysis of critical dissolved oxygen sag.

Based on Lotus File DOSAG2.WK1 Revised 19-Oct-93

Input				Source
1. EFFLUENT CHARACTERISTICS				
Discharge (cfs):			0.74	Max Month Design Criteria
CBOD5 (mg/L):			40	Technology-based limit weekly average
NBOD (mg/L):	2.10 mg/L NH3-N		20.64	TMDL Ammonia Limit
Dissolved Oxygen (mg/L):			6.36	Estimate using Duvall's Wastewater Treatment Plant Outfall Improvements, Parametrix, Inc., 4/00, pg B-8
Temperature (deg C):			20	Estimate using Duvall's DMR data
2. RECEIVING WATER CHARACTERISTICS				
Upstream Discharge (cfs):			443	Wastewater Treatment Plant Outfall Improvements, Parametrix, Inc., 4/00, pg. 5-2
Upstream CBOD5 (mg/L):			1.4	Estimated, TMDL report background and tributary sources pg. 31
Upstream NBOD (mg/L):	0.06 mg/L NH3-N		0.59	Snoqualmie River Data @ Carnation - Ecology's website. 90% Confidence Value used.
Upstream Dissolved Oxygen (mg/L):			9.9	Snoqualmie River Data @ Carnation - Ecology's website. 10% Confidence Value used.
Upstream Temperature (deg C):			4.5	Snoqualmie River Data @ Carnation - Ecology's website. 10% Confidence Value used.
Elevation (ft NGVD):			75	Carnation webpage est. elevation
Downstream Average Channel Slope (ft/ft):			0.0009	not applicable only used on Tsivoglou-Wallace model
Downstream Average Channel Depth (ft):			5.4	Carnation WWTP Outfall Evaluation by Cosmopolitan
Downstream Average Channel Velocity (fps):			0.61	Carnation WWTP Outfall Evaluation by Cosmopolitan
3. REAERATION RATE (Base e) AT 20 deg C (day^-1):			0.81	from below
Reference	Applic. Vel (fps)	Applic. Dep (ft)	Suggested Values	
Churchill	1.5 - 6	2 - 50	0.43	
O'Connor and Dobbins	.1 - 1.5	2 - 50	**0.81**	used based on low velocity and depth
Owens	.1 - 6	1 - 2	0.69	
Tsivoglou-Wallace	.1 - 6	.1 - 2	2.27	
4. BOD DECAY RATE (Base e) AT 20 deg C (day^-1):			0.52	use suggested value below
Reference			Suggested Value	
Wright and McDonnell, 1979			0.52	

OUTPUT		
1. INITIAL MIXED RIVER CONDITION		[assumes 100% well-mixed]
CBOD5 (mg/L):	1.5	
NBOD (mg/L):	0.6	
Dissolved Oxygen (mg/L):	9.89	
Temperature (deg C):	4.5	
2. TEMPERATURE ADJUSTED RATE CONSTANTS (Base e)		
Reaeration (day^-1):	0.56	
BOD Decay (day^-1):	0.26	
3. CALCULATED INITIAL ULTIMATE CBODU AND TOTAL BODU		
Initial Mixed CBODU (mg/L):	2.2	
Initial Mixed Total BODU (CBODU + NBOD, mg/L):	2.8	
4. INITIAL DISSOLVED OXYGEN DEFICIT		
Saturation Dissolved Oxygen (mg/L):	12.895	
Initial Deficit (mg/L):	3.00	
5. TRAVEL TIME TO CRITICAL DO CONCENTRATION (days):	0.00	
6. DISTANCE TO CRITICAL DO CONCENTRATION (miles):	0.00	
7. CRITICAL DO DEFICIT (mg/L):	3.00	
8. CRITICAL DO CONCENTRATION (mg/L):	**9.89**	
Difference between ambient and Chronic Mixing Zone	**0.006**	

Table C-5. Simple Mixing Calculations for Fecal Coliform and Ammonia

Carnation WWTP Receiving Water Calculations

Chronic Dilution Factor	150	1	
Acute Dilution Factor	10		
Facility Design Max Month Flow	0.48	mgd	
	0.74	cfs	
Fecal Coliform Dilution Calculation			
Receiving Water Fecal Coliform	80	#/100 ml	
Effluent Fecal Coliform - worst case	400	#/100 ml	
Downstream Fecal Coliform	**82**	#/100 ml	
Difference between mixed and ambient	**2**	#/100 ml	
Core Summer Habitat Surface Water Criteria	*100*	*#/100 ml*	*Current state WAC designation*

Conclusion: At design flow, discharge has small impact on receiving water fecal coliform conc.

Table C-6. Freshwater Un-ionized Ammonia Criteria Calculation

Freshwater un-ionized ammonia criteria based on Chapter 173-201A WAC
Amended November 20, 2006

INPUT		NOTES
1. Temperature (deg C):	16.0	Source: Ecology web-page monitoring station (1976-1992). 90% value used.
2. pH:	7.50	Source: Ecology web-page monitoring station (1976-1992). 90% value used.
3. Is salmonid habitat an existing or designated use?	Yes	
4. Are non-salmonid early life stages present or absent?	Present	
OUTPUT		
1. Unionized ammonia NH3 criteria (mgNH3/L)		
Acute:	0.149	
Chronic:	0.022	
2. Total ammonia nitrogen criteria (mgN/L):		
Acute:	13.283	
Chronic:	1.986	

Table C-7. Reasonable Potential Calculation for Ammonia

Facility: Carnation Wastewater Treatment Facility

Parameter	Ambient Conc. (metals as dissolved) ug/L	State Water Quality Standard Acute ug/L	State Water Quality Standard Chronic ug/L	Max concentration at edge of... Acute Mixing Zone ug/L	Max concentration at edge of... Chronic Mixing Zone ug/L	LIMIT REQ'D?	Eff. % value	Pn	Max effluent conc. Measured ug/L	Coeff Vari. CV	s	# of Samples n	Multiplier	Acute Dil'n Factor	Chronic Dil'n Factor
AMMONIA, total as N*	60.0000	13,283	1,986	5887	460	**NO**	0.95	0.82	40,000	0.60	0.55	15	1.50	10.3	150

**No actual data available (facility not yet online). 40 mg/L used as conservative high estimate.*

Table C-8. Calculation of pH mixture

Calculation of pH of a mixture of two flows. Based on the procedure in EPA's DESCON program (EPA, 1988. Technical Guidance on Supplementary Stream Design Conditions for Steady State Modeling. USEPA Office of Water, Washington D.C.)

INPUT	min pH	max pH	**NOTES**
1. DILUTION FACTOR AT MIXING ZONE BOUNDARY	150	150	
2. UPSTREAM/BACKGROUND CHARACTERISTICS			
Temperature (deg C):	**16.0**	**16.0**	Snoqualmie River Data @ Carnation - Ecology's website. 10% Confidence Value used.
pH:	**6.8**	**7.5**	Snoqualmie River Data @ Carnation - Ecology's website. 10% & 90% Confidence Values used.
Alkalinity (mg CaCO3/L):	50	50	Sensitivity Analysis indicates this value has negligible impact on result with high dilution factor.
3. EFFLUENT CHARACTERISTICS			
Temperature (deg C):	24.0	24.0	Estimate using Duvall's DMR data (90%)
pH:	6.0	9.0	Technology-based WQ Limits
Alkalinity (mg CaCO3/L):	150	150	Sensitivity Analysis indicates this value has negligible impact on result with high dilution factor.
OUTPUT			
1. IONIZATION CONSTANTS			
Upstream/Background pKa:	6.41	6.41	
Effluent pKa:	6.36	6.36	
2. IONIZATION FRACTIONS			
Upstream/Background Ionization Fraction:	0.71	0.92	
Effluent Ionization Fraction:	0.31	1.00	
3. TOTAL INORGANIC CARBON			
Upstream/Background Total Inorganic Carbon (mg CaCO3/L):	70.46	54.08	
Effluent Total Inorganic Carbon (mg CaCO3/L):	490.42	150.34	
4. CONDITIONS AT MIXING ZONE BOUNDARY			
Temperature (deg C):	16.05	16.05	
Diff. btwn upstrm temp. and Mixing Zone Boundary temp.:	0.05	0.05	
Alkalinity (mg CaCO3/L):	50.67	50.67	
Total Inorganic Carbon (mg CaCO3/L):	73.26	54.72	
pKa:	6.41	6.41	
pH at Mixing Zone Boundary:	6.8	7.5	
Diff. between upstream pH and Mixing Zone Boundary pH:	0.04	0.01	

Table C-9. Calculation Water-Quality based chlorine limit

Parameter	Acute Dil'n Factor	Chronic Dil'n Factor	Ambient Conc. *ug/L*	Water Quality Standard Acute *ug/L*	Water Quality Standard Chronic *ug/L*	Average Monthly Limit (AML) ug/L	Average Monthly Limit (AML) lbs/day	Max Daily Limit (MDL) ug/L	WLA Acute *ug/L*	WLA Chronic *ug/L*	LTA Acute *ug/L*	LTA Chronic *ug/L*	LTA Coeff. Var. (CV) *decimal*	LTA Prob'y Basis *decimal*	Limiting LTA *ug/L*	Coeff. Var. (CV) *decimal*	AML Prob'y Basis *decimal*	MDL Prob'y Basis *decimal*	# of Samples per Month *n*
				Permit Limit Calculation Summary					**Waste Load Allocation (WLA) and Long Term Average (LTA) Calculations**							**Statistical variables for permit limit calculation**			
Chlorine	10.3	150		13	7.50	**51**	**0.2**	**134**	134	1125.00	43.0	593.4	0.60	0.99	43.0	0.60	0.95	0.99	30

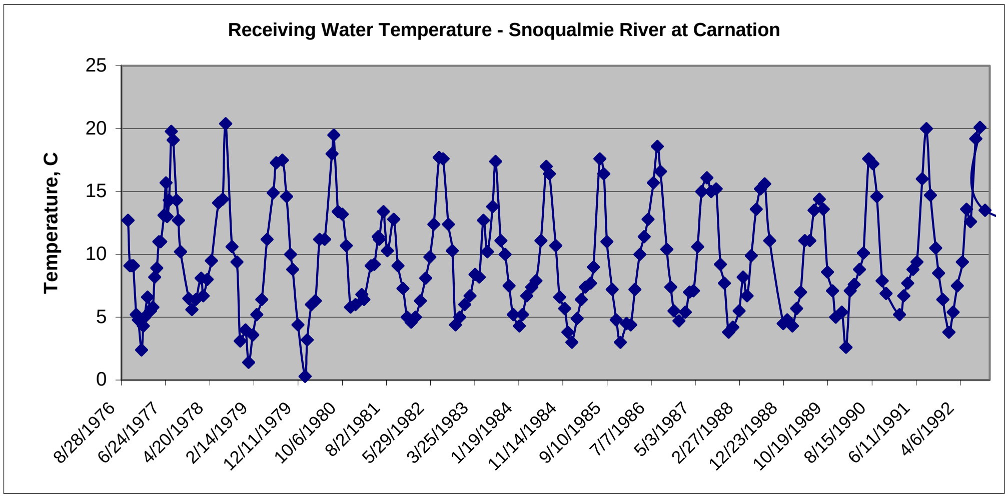
This spreadsheet calculates water quality based permit limits based on the two value steady state model using the State Water Quality standards contained in WAC 173-201A. The procedure and calculations are done per the procedure in Technical Support Document for Water Quality-based Toxics Control, U.S. EPA, March, 1991 (EPA/505/2-90-001) on page 99. Last revision date 9/98.

APPENDIX D—SNOQUALMIE RIVER DATA, 1970 - 1996

Source: Department of Ecology's River and Stream Water Quality Monitoring website: http://www.ecy.wa.gov/programs/eap/fw_riv/rv_main.html.
Monitoring station (#07D070) is located in the Snoqualmie River near Carnation.

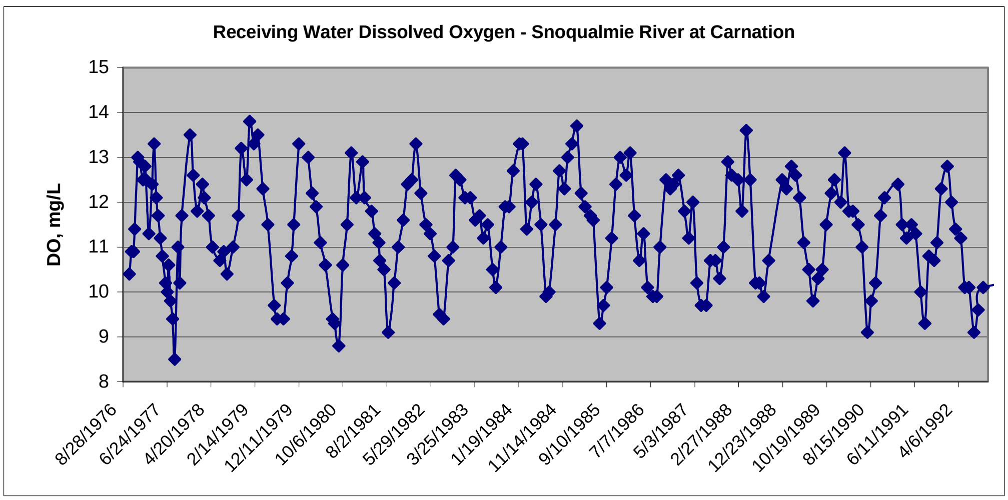
Temperature:

Ave	9.5
Max	20.4
Min	0.3
90%	**16.04**
10%	**4.5**



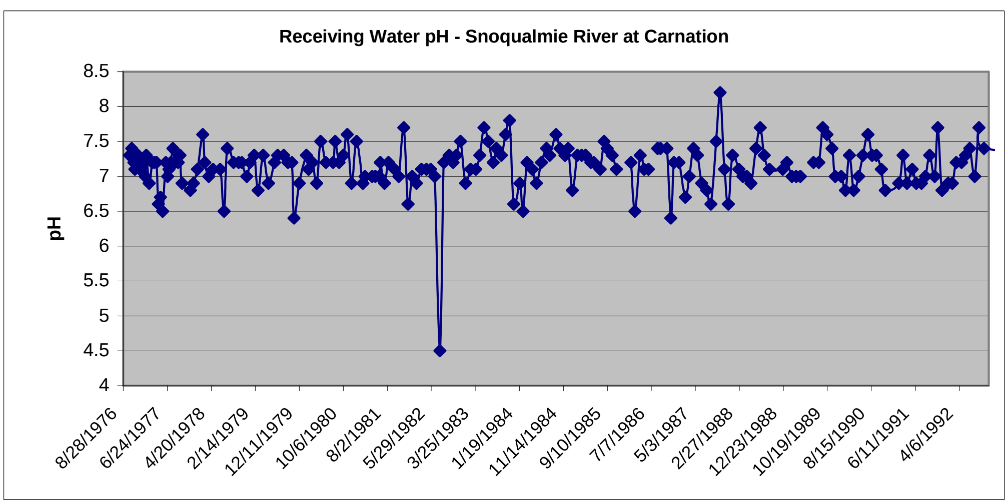
DO:

Ave	11.5
Max	15.2
Min	8.5
90%	13.0
10%	**9.9**



pH:

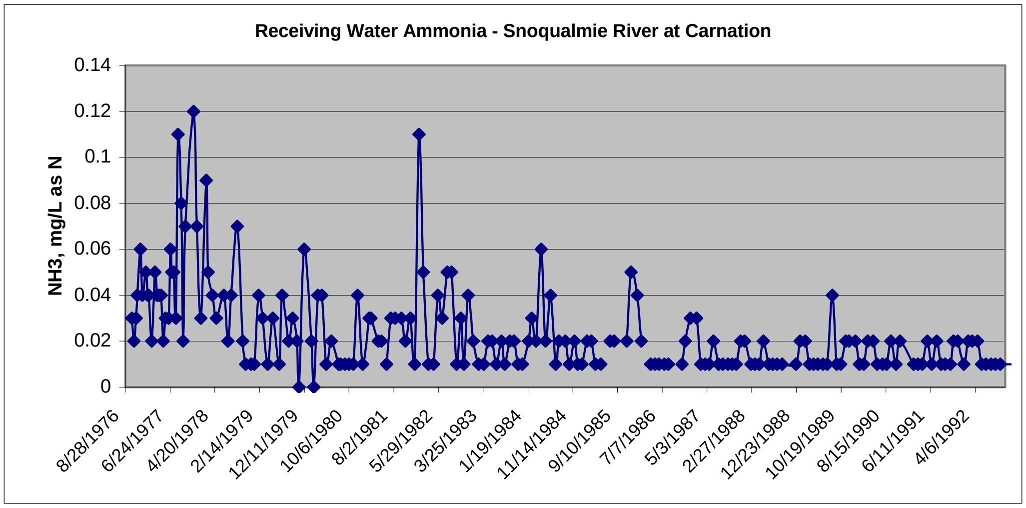
Ave	7.1
Max	8.2
Min	4.5
Min -outlier	6.4
90%	7.5
10%	**6.8**



(APPENDIX D— continued)

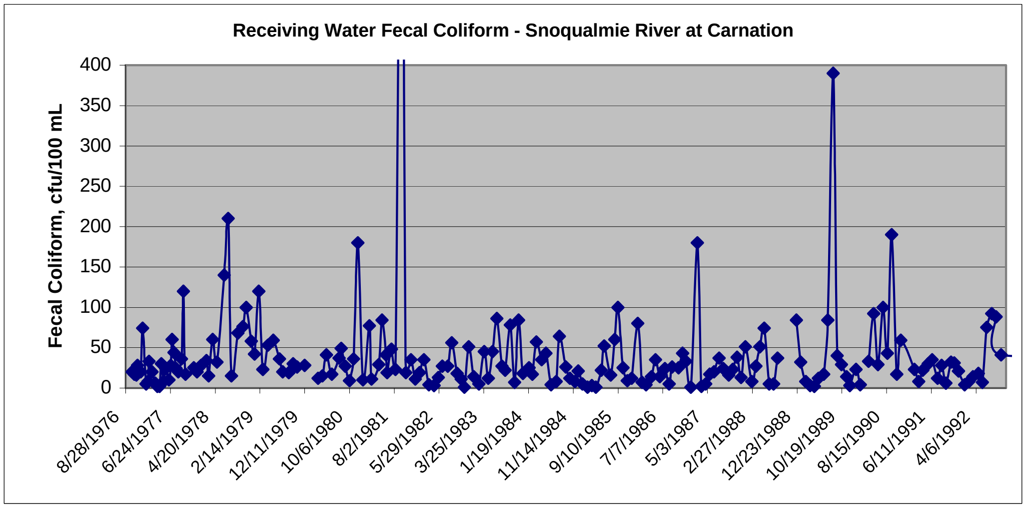
Ammonia:

Ave	0.029
Max	0.37
Min	0.01
90%	**0.06**



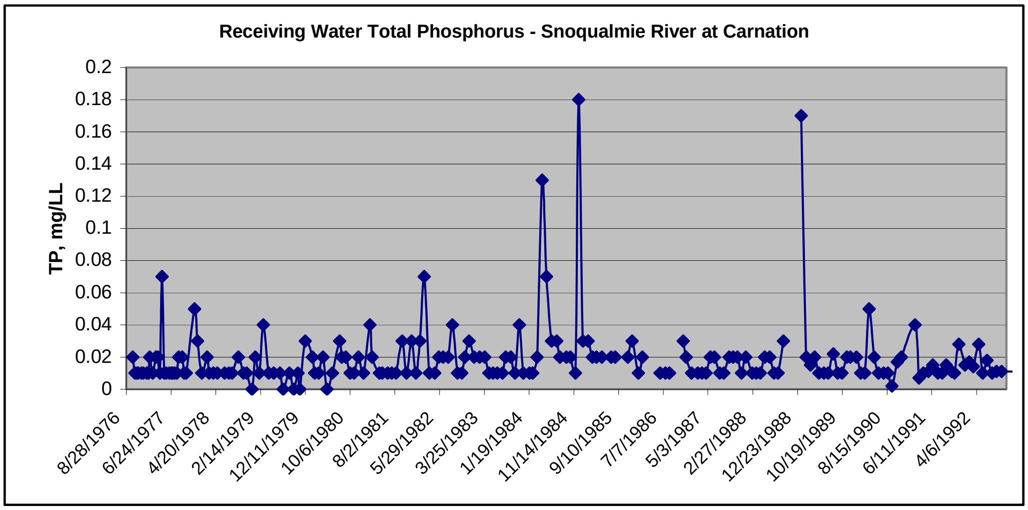
Fecal Coliform:

Ave	39
Max	790
Max - outlie	390
Min	1
90%	**80**

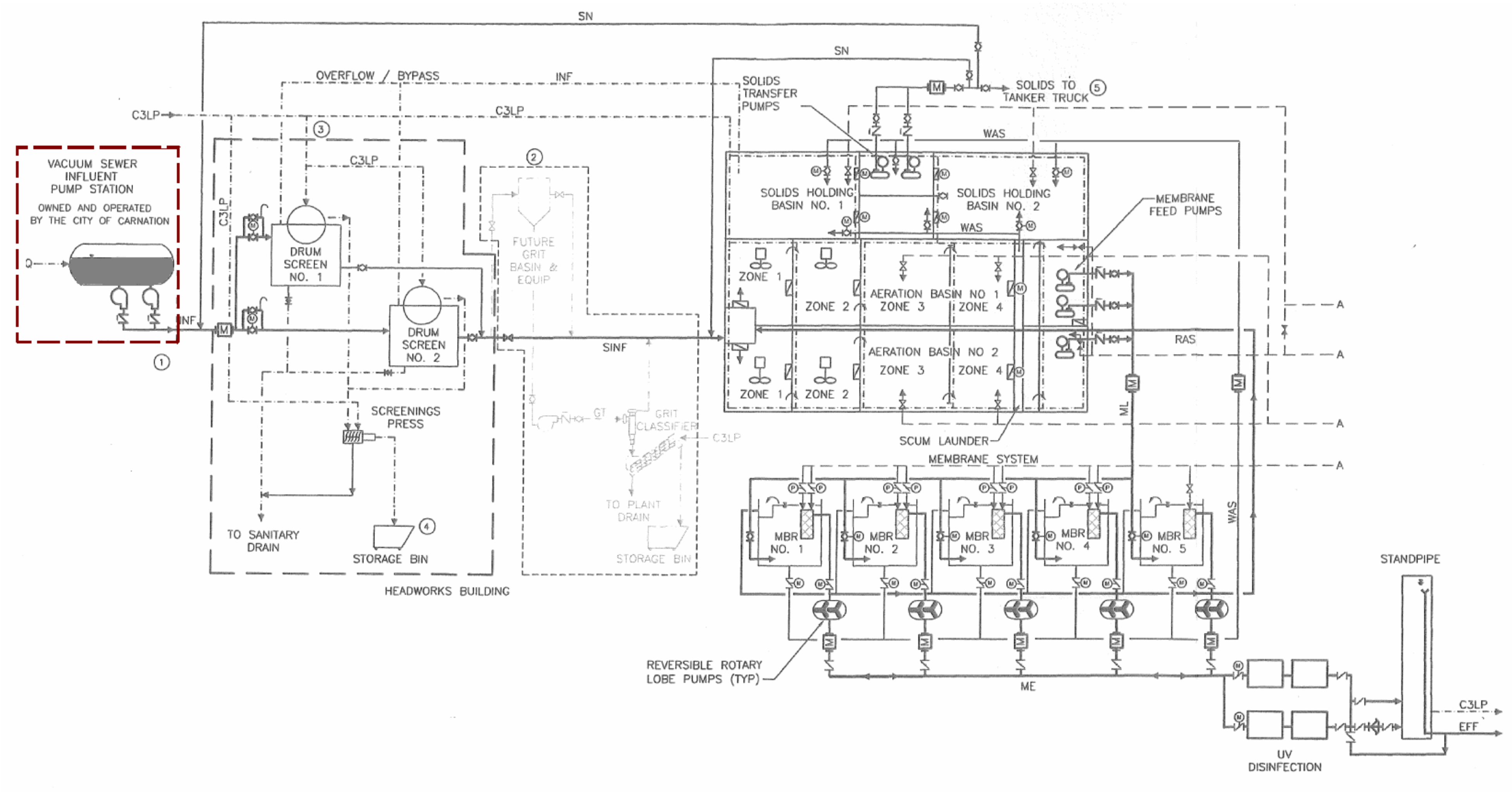


Total P:

Ave	0.019
Max	0.18
Min	0.002
90%	**0.030**



APPENDIX E—WASTE FLOW DIAGRAM AND WWTP DESIGN CRITERIA



APPENDIX F —EPA LIST OF 126 PRIORITY POLLUTANTS

EPA List of 126 Priority Pollutants

(source: 40 CFR Part 423, titled "Appendix A to Part 403 - 126 Priority Pollutants")

Chlorinated Benzenes
Chlorobenzene
1,2-dichlorobenzene
1,3-dichlorobenzene
1,4-dichlorobenzene
1,2,4-trichlorobenzene
Hexachlorobenzene

Chlorinated Ethanes
Chloroethane
1,1-dichloroethane
1,2-dichloroethane
1,1,2-trichloroethane
1,1,1-trichloroethane
1,1,2,2-tetrachloroethane
Hexachloroethane

Chlorinated Phenols
2-chlorophenol
2,4-dichlorophenol
2,4,6-trichlorophenol
Parametachlorocresol (4-chloro-3-methyl phenol)

Other Chlorinated Organics
Chloroform (trichloromethane)
Carbon tetrachloride (tetrachloromethane)
Bis(2-chloroethoxy)methane
Bis(2-chloroethyl)ether
2-chloroethyl vinyl ether (mixed)
2-chloronaphthalene
3,3'-dichlorobenzidine
1,1-dichlorethylene
1,2-trans-dichloroethylene
1,2-dichloropropane
1,2-dichloropropylene (1,3-dichloropropene)
Tetrachloroethylene
Trichloroethylene
Vinyl chloride (chloroethylene)
Hexachlorobutadiene
Hexachlorocyclopentadiene

Haloethers
4-chlorophenyl phenyl ether
2-bromophenyl phenyl ether
Bis(2-chloroisopropyl)

Halomethanes
Methylene chloride (dichloromethane)
Methyl chloride (chloromethane)
Methyl bromide (bromomethane)
Bromoform (tribromomethane)
Dichlorobromomethane
Chlorodibromomethane

Nitroamines
N-nitrosodimethylamine
N-nitrosodiphenylamine
N-nitrosodi-n-propylamine

Phenols (other than chlorinated)
2-nitrophenol
4-nitrophenol
2,4-dinitrophenol
4,6-dinitro-o-cresol (4,6-dinitro-2-methylphenol)
Pentachlorophenol
Phenol
2,4-dimethylphenol
1, 2-diphenyl hydrazine (azobenzene)
Total Phenolic Compounds

Phthalate Esters
Bis(2-ethylhexyl)phthalate
Butyl benzyl phthalate
Di-n-butyl phthalate
Di-n-octyl phthalate
Diethyl phthalate
Dimethyl phthalate

Polynuclear Aromatic Hydrocarbons (PAHs)
Acenaphthene
1,2-benzanthracene (benzo(a)anthracene)
Benzo(a)pyrene (3,4-benzo-pyrene)
3,4-benzofluoranthene (benzo(b)fluoranthene)
11,12-benzofluoranthene (benzo(k)fluoranthene)
Chrysene
Acenaphthylene
Anthracene
1,12-benzoperylene (benzo(ghi)perylene)
Fluorene
Fluoranthene
Phenanthrene
1,2,5,6-dibenzanthracene
(dibenzo(a,h)anthracene)
Indeno (1,2,3-cd) pyrene (2,3-o-phenylene pyrene)
Pyrene

Pesticides and Metabolites
Aldrin
Dieldrin
Chlordane (technical mixture and metabolites)
Alpha-endosulfan
Beta-endosulfan
Endosulfan sulfate
Endrin
Endrin aldehyde
Heptachlor
Heptachlor epoxide (BHChexachlorocyclohexane)
Alpha-BHC
Beta-BHC
Gamma-BHC (Lindane)
Delta-BHC
Toxaphene

DDT and Metabolites
4,4-DDT
4,4-DDE (p,p-DDX)
4,4-DDD (p,p-DDE)

Polychlorinated Biphenyls (PCBs)
PCB-1242 (Aroclor 1242)
PCB-1254 (Aroclor 1254)
PCB-1221 (Aroclor 1221)
PCB-1232 (Aroclor 1232)
PCB-1248 (Aroclor 1248)
PCB-1260 (Aroclor 1260)
PCB-1016 (Aroclor 1016)

Other Organics
Acrolein
Acrylonitrile
Benzene
Benzidine
2,4-dinitrotolulene
2,6-dinitrotolulene
Ethylbenzene
Isophrone
Naphthalene
Nitrobenzene
Tolulene

Inorganics
Antimony
Arsenic
Beryllium
Cadmium
Chromium, total
Copper
Cyanide, total
Cyanide, weak acid dissociable
Lead
Mercury
Nickel
Selenium
Silver
Thallium
Zinc

APPENDIX G—RESPONSE TO COMMENTS

(This section will be completed after the public comment period.)