Fact Sheet for NPDES Permit WA0029548

City of Snohomish Wastewater Treatment Plant

Effective Date: July 1, 2018

Purpose of this fact sheet

This fact sheet explains and documents the decisions the Department of Ecology (Ecology) made in drafting the proposed National Pollutant Discharge Elimination System (NPDES) permit for City of Snohomish Wastewater Treatment Plant (WWTP).

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 issuing the final permit. Copies of the fact sheet and draft permit for City of Snohomish WWTP, NPDES permit WA0029548, were available for public review and comment from April 9, 2018, until May 9, 2018. For more details on preparing and filing comments about these documents, please see *Appendix A - Public Involvement Information.*

The City of Snohomish (City) reviewed the draft permit and fact sheet for factual accuracy. Ecology corrected any errors or omissions regarding the facility's location, history, wastewater discharges, or receiving water prior to publishing this draft fact sheet for public notice.

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*, and publish it when issuing the final NPDES permit. Ecology generally will not revise the rest of the fact sheet. The full document will become part of the legal history contained in the facility's permit file.

Summary

The City operates an aerated lagoon wastewater treatment plant that discharges to the Snohomish River. Ecology issued the previous permit for this facility on October 30, 2012, and modified it on June 1, 2017. The proposed permit contains the same effluent concentration limits as the previous permit for Total Suspended Solids (TSS), Carbonaceous Biochemical Oxygen Demand ($CBOD_5$), Fecal Coliform, wet-season $CBOD_5$ mass limits, and Total Residual Chlorine. The proposed permit changes the NBOD+CBOD average monthly effluent limit from 146 lbs/day to 134 lbs/day. This change is due to effluent variability observed during the last permit cycle and the 2012 biological treatment process improvements. The minimum pH limit has changed from 6.2 to 6.4. Ecology has erroneously used average ambient pH data in the previous permit. The proposed permit includes a Total Residual Peracetic Acid (PAA) daily maximum limit.

The City also operates a partially combined collection system that occasionally discharges untreated combined wastewater and stormwater to the river at two locations. The proposed permit includes conditions related to Combined Sewer Overflows (CSOs) from the collection system. Those conditions require the City to monitor CSO discharges and report them annually to Ecology. The permit also requires the City to maintain technology-based controls to minimize pollutants discharged during CSOs and to validate that the City's CSO reduction measures comply with state Water Quality Standards.

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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 domestic wastewater 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).
- Water quality criteria for groundwaters (chapter 173-200 WAC).
- Whole effluent toxicity testing and limits (chapter 173-205 WAC).
- Sediment management standards (chapter 173-204 WAC).
- Submission of plans and reports for construction of wastewater facilities (chapter 173-240 WAC).

The following additional regulations apply to communities operating collection systems with Combined Sewer Overflows:

- Submission of plans and reports for construction and operation of combined sewer overflow reduction facilities (chapter 173-245 WAC).
- US EPA CSO control policy (59 FR 18688).

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

Under the NPDES permit program and in response to a complete and accepted permit application, Ecology must prepare a draft permit and accompanying fact sheet, and make them available for public review before final issuance. Ecology must also publish an announcement (public notice) telling people where they can read the draft permit, and where to send their comments, during a period of thirty days (WAC 173-220-050). (See *Appendix A – Public Involvement Information* 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 in response to comment(s). Ecology will summarize the responses to comments and any changes to the permit in *Appendix G*.

II. Background Information

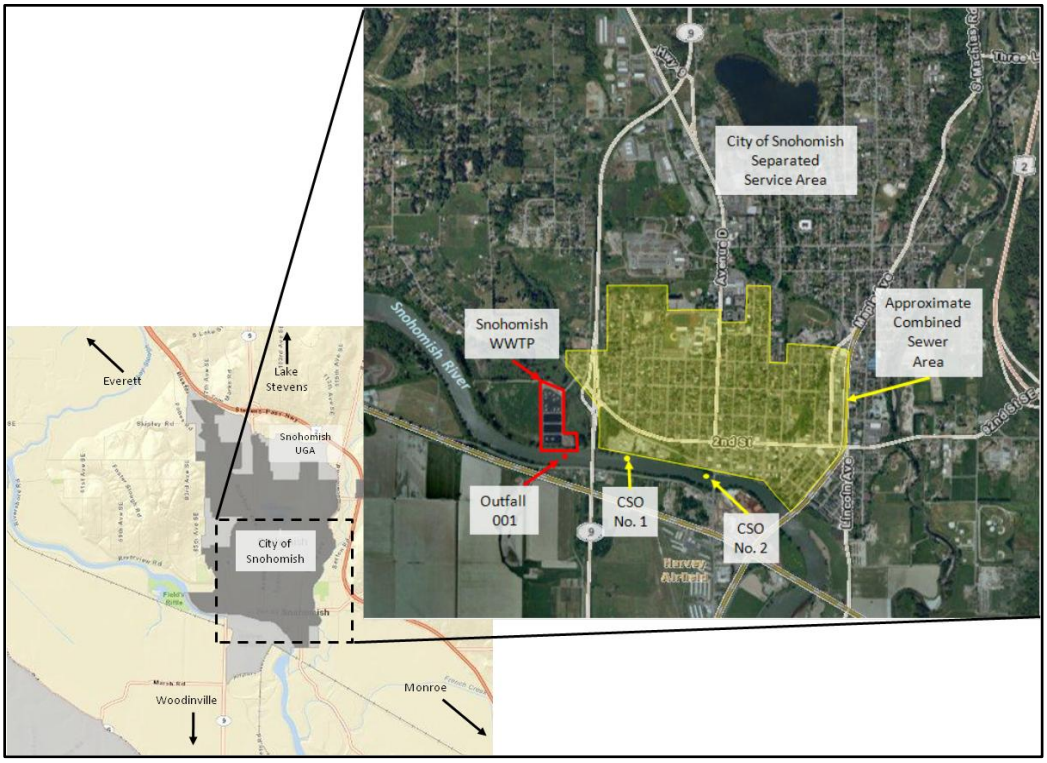
Table 1. General Facility Information

Facility Information	
Applicant	City of Snohomish 116 Union Avenue Snohomish, WA 98290
Facility Name and Address	Snohomish Wastewater Treatment Plant 2115 2nd Street Snohomish, WA 98290
Contact at Facility	Name: Duane Leach Telephone #: (360) 568-0160
Responsible Official	Name: Steve Schuller Title: City of Snohomish Administrator Address: 116 Union Avenue Snohomish, WA 98290 Telephone #: (360) 282-3194
Type of Treatment	Aerated Lagoon with Submerged Fixed-Film Media System
Facility Location (NAD83/WGS84 reference datum)	Latitude: 47.91587 Longitude: -122.11129
Discharge Waterbody Name and Location (NAD83/WGS84 reference datum)	Outfall 001, Snohomish River Latitude: 47.912552 Longitude: -122.110974
CSO Discharge Waterbody Name and Locations (NAD83/WGS84 reference datum)	CSO #1 (Outfall 002), Snohomish River Latitude: 47.912119 Longitude: -122.104180 CSO #2 (Outfall 003), Snohomish River Latitude: 47.911389 Longitude: -122.100000

Permit Status	
Issuance Date of Previous Permit	10/30/2012
Application for Permit Renewal Submittal Date	4/27/2017
Date of Ecology Acceptance of Application	5/31/2017

Inspection Status	
Date of Last Sampling Inspection	1/24/2017

Figure 1. Facility Location Map



A. Facility description

History

The City of Snohomish owns and operates a lagoon wastewater treatment system that serves the residents and businesses within the City's incorporated boundaries. The service territory encompasses approximately two square miles (1,240 acres) between the Snohomish River to the south and US Hwy 2 to the north. State Route 9 and the Pilchuck River generally border the service area to the west and east, respectively. Approximately 26% (325 acres) of the plant's service area operates as a combined sewer system.

The treatment plant is located in the southwest corner of the City on the north bank of the Snohomish River west of State Route 9. The City constructed the original treatment plant on the site in 1958. The original plant consisted of a 40-acre facultative lagoon treatment system with chlorine disinfection. In 1989, the City upgraded disinfection and disposal by adding a new chlorine contact tank, chlorine feed and mixing equipment, and a new outfall.

The City converted the facility to a dual-powered, multi-cellular aerated lagoon system in 1995. The project added a new headworks consisting of three influent screw pumps, a rotary screen, and a manually cleaned bar screen. The new lagoon system consists of four aerated lagoon cells on ten acres previously occupied by the old system. The first cell is a 10-million-gallon (MG) completely mixed aerated basin. This cell is followed by three 3.5 MG partially mixed basins. The upgrade also included an effluent filtration system and dechlorination facilities.

In 2012, the City upgraded the existing lagoon system. The final three partially mixed lagoon cells were retrofitted with 18 Submerged Fixed-Film (SFF) Media modules and integral coarse bubble diffusers near the bottom of the SFF media to enhance treatment. The SFF media modules improve biomass growth in the lagoons, which increases biological treatment capacity. The project also included upgraded screening and a supplemental alkalinity system consisting of a storage tank and chemical feed pumps.

Collection system status

The first sewage collection systems within the City were installed in the early 1900s and operated as a combined sanitary and storm sewer system with numerous outfalls to the Snohomish River. The City expanded its combined sewer system to meet the needs of population growth until the 1950s. The City began constructing separate sanitary sewer systems in new areas developed after 1950. The existing system consists of approximately 46,500 feet of sewer lines in the combined sewer area and 140,000 feet of lines in the separated areas.

The collection system includes 15 sewage pump stations, three of which pump flows from the combined sewer area. The City has installed permanent backup power generators at seven pump stations: pump stations 3, 4, 6, 7, 8 (adjacent to Blackmans Lake) and 14, and the new CSO/Stormwater pump station facility (pump station #1) at the west end of 1st Street. Pump stations 13 and 15 have gas engine powered backup systems. The remaining pump stations have the ability to connect to a portable generator during power outages.

Combined sewer overflows

The City of Snohomish's combined sewer system is confined to 325 acres of the historic downtown area. The combined system has two overflow outfalls (CSOs) that discharge untreated wastewater directly into the Snohomish River whenever rainfall causes combined sewage flow to exceed the sewer system's capacity. CSO outfall #1 discharges upstream of the State Route 9 Bridge near the Public Works Shops site and CSO outfall #2 discharges downstream of the Avenue D Bridge.

The City uses a fixed weir overflow control structure located at the intersection of 2nd Street and Avenue H to regulate discharges from CSO outfall #1. The City upgraded this structure as part of their CSO control project in 2011 and added a parallel 18-inch sewer line from the structure to the wastewater treatment plant. This improvement was designed to convey peak flows up to 7.4 MGD (approximately 5,100 gpm) without causing an overflow. The controlled flow rate is based on the estimated peak flow for a design storm with a recurrence frequency of 1.01 years.

Each of the two CSO outfalls is preceded by a hydraulic control structure to limit discharge of combined sewage. The control structure for CSO #1 is located south of the Avenue H and Second Street intersection. All flow passing through this control structure is conveyed by gravity to the WWTP and, therefore, does not contribute to CSO Pump Station flows. The control structure will be modified in the future once the tributary storm water and sanitary sewer basins are separated and all storm water is conveyed to the treatment wetland.

Level instruments in the CSO Pump Station wet well are used to control operation of the pumps. The CSO Pump Station is operated based on level in the wet well. The four centrifugal pumps are designated as lead, lag, lag-lag and standby. These designations are automatically rotated to distribute runtime of the pumps.

The City has limited flow history prior to November 2008 due to challenges with equipment reliability and vendor responsiveness. Table 2 below summarizes the recent record of CSO discharges from both outfalls from October 2012 through October 2017, as reported in Annual CSO Reports.

Table 2. Combined Sewer Overflow Summary

Monitoring Year	CSO Outfall #1		CSO Outfall #2		Total Annual Rainfall (inches)
	Number of Overflow Events	Discharge Volume (Gallons)	Number of Overflow Events	Discharge Volume (Gallons)	
Oct - Dec 2012	1	17,548	1	39	24.83
2013	1	28,560	1	351,996	39.69
2014	0	0	1	5,765	54.61
2015	0	0	0	0	43.79
2016	0	0	1	15,351	49.06
Jan - Oct 2017	1	49	1	8,306	35.21
Average	**1**	**7,693**	**1**	**63,576**	**41.2**

Treatment processes

The City of Snohomish uses a Dual-Powered, Multi-Cellular aerated lagoon system to treat domestic sewage from its service territory. Raw wastewater enters the facility through a headworks structure that consists of a Parshall Flume for flow measurement, screw pumps and a ¼-inch multi-rake bar screening system. Screened wastewater then flows by gravity from the headworks to a 10 MG completely mixed aerated lagoon before passing through a series of three 3.5 MG partially-mixed lagoon cells that contain submerged fixed-film media modules.

Treated wastewater from lagoon cell #4 flows to an effluent control structure that controls flow routing to effluent filters and the disinfection system. Operators have the option to treat a portion of the effluent flow (up to 1.1 MGD) using continuous-backwash sand filters to enhance TSS removal. All effluent flow, whether filtered or unfiltered, passes through a chlorine contact chamber for disinfection prior to discharge. The City uses chlorine gas for disinfection and sulfur dioxide gas for dechlorination.

In September 2012, the City retrofitted the final three partially-mixed lagoon cells 2, 3 and 4. Each lagoon cell is equipped with 18 Submerged Fixed-Film Media Modules to enhance CBOD and ammonia treatment. The project also added systems to provide supplemental alkalinity to support the process enhancement and upgraded the headworks screens to ¼-inch mechanically-cleaned multi-rake bar screens.

The City is interested in changing from chlorination/dechlorination to peracetic acid (PAA) for disinfection. Currently, the City is conducting full scale testing to evaluate the efficacy of PAA, to determine the appropriate PAA dosing rate and PAA dosing location, and compare different PAA formulations. The PAA system consists of two main components provided by the PAA vendor. One component is the metering pump skid and controls. The other is for PAA storage and containment.

The first step of the testing is to prove the effectiveness of PAA in meeting the permit limits for fecal coliform. The City initially used a conservative PAA dose to maintain a relatively high residual (near 1 mg/L) to ensure adequate disinfection. Results of prior bench scale testing suggests a dosage of between 1.0 mg/L and 1.5 mg/L (yielding a predicted residual between 0.3 mg/L and 0.5 mg/L) should provide adequate disinfection. The City started testing with an initial target dose of up to 2 mg/L to ensure proper disinfection with a sufficiently high residual, but not exceed a residual of 1.0 mg/L.

After successful disinfection at the initial dose rate, the City stepped down the dose over time. Throughout the testing period, the City has collected data, evaluated performance, and adjusted the PAA dose through measurements of PAA residual and effluent fecal coliform. The City established the performance goal of maintaining the monthly average fecal coliform concentration below 50 CFU/100 mL, or about one-quarter of the current average monthly permit limit, to provide buffering and factor of safety.

Once the testing is completed, a report will be prepared to assess whether the system is successful and cost effective in meeting the objectives and the application of PAA at the WWTP. If the report concludes that PAA is successful and cost effective and thereby capable of being implemented, the report will be submitted to Ecology for review and approval in accordance with the requirements for new/developmental technology. Assuming the application of PAA is deemed successful and cost-effective, and Ecology approves the report, the City would begin to prepare a design for a permanent installation.

Appendix E includes a diagram showing the existing treatment plant process flow.

You can find basic information describing wastewater treatment processes included in a booklet at the Water Environment Federation website at:
http://www.wef.org/resources/for-the-public/public-information/

Discharge outfall

Treated, disinfected, and dechlorinated effluent discharges to the Snohomish River via outfall #001. The outfall consists of a 30-inch ductile iron pipe and a 24-foot long HDPE diffuser section. The diffuser has four equally-spaced 12-inch ports; three ports facing downstream and the fourth at the pipe end facing across the river channel. The outfall and diffuser extend approximately 40 feet in to the channel and sits at a depth of 14 feet at MLLW.

An outfall inspection in 2017 found that the outfall pipe appeared to be in good working condition and structurally sound. The report noted minor surface corrosion and heavy debris build up along the base. The interior pipe also appeared to be in good condition with minor to moderate surface corrosion. Based on the findings of the outfall inspection, Ecology will not include a requirement in the proposed permit to re-inspect the outfall. Ecology will reevaluated the need of an outfall inspection in the next permit cycle.

Residual solids

Waste sludge is currently stabilized and stored in the three partially mixed lagoons. The completely mixed lagoon was designed to keep solids in suspension and not accumulate sludge. In 2014, the City completed a Biosolids Management Plan as part of the Agreed Order AO 10467. The plan included an estimated schedule for biosolids removal and disposal, proposed method for removal, and proposals for treatment and/or beneficial uses. In August 2015, 696

dry tons of biosolids were removed from the lagoon cells and hauled to Cascade Materials, a Beneficial Use Facility (BUF) located in Snohomish County. Solids removed by screens at the headworks and incidental solids removed during routine maintenance are drained and disposed of as solid waste.

B. Description of the receiving water

The Snohomish WWTP discharges to the Snohomish River at approximately river mile 12.1. Other point source discharges permitted nearby include Seattle Snohomish Mill Company and Riverside Topsoil, both with General Industrial Stormwater Permits. Ecology has issued a Phase II Municipal General Stormwater Permit to the City of Snohomish for stormwater discharges from the city and a Phase I Municipal General Stormwater Permit to Snohomish County for stormwater discharges from unincorporated areas nearby. Agricultural runoff also contributes significant nearby non-point sources of pollutants.

Ecology conducts long-term water quality monitoring of the Snohomish River at the Avenue D Bridge, located approximately one half mile upriver of outfall #001 (monitoring station #07A090). Table 3 below summarizes ambient conditions for conventional parameters measured during the critical season (July-October) between 2010 and 2017. Based on the 2016 water quality summary report, the overall water quality at this station met or exceeded expectations and is of lowest concern.

Table 3. Ambient Background Data

Parameter	Average Value	90th Percentile Value
Temperature, 7-DADMax	14.66° C	18.24° C
Dissolved Oxygen	9.81 mg/L	9.5 mg/L (10th percentile)
Suspended Solids	6.9 mg/L	10.2 mg/L
pH (min/max range: 6.83-7.49)	7.18	7.36
Fecal Coliform	49.64/100 mL	390/100 mL (Maximum Value)
Total Ammonia-N	0.017 mg/L	0.029 mg/L
Nitrate + Nitrite N	0.15 mg/L	0.218 mg/L
Total Phosphorus-P,	0.018 mg/L	0.0256 mg/L
Alkalinity	14.4 mg/L as $CaCO_3$	17 mg/L as $CaCO_3$
Hardness	17.9 mg/L as $CaCO_3$	23.4 mg/L as $CaCO_3$
Arsenic	0.66 µg/L	0.8 µg/L
Chromium	0.28 µg/L	0.35 µg/L
Copper	0.87 µg/L	1.18 µg/L
Lead	0.099 µg/L	0.191 µg/L
Mercury	0.0021 µg/L	0.0022 µg/L
Nickel	0.38 µg/L	0.54 µg/L
Zinc	3.2 µg/L	5.45 µg/L

C. Wastewater influent characterization

The Snohomish WWTP monitors influent flow and waste loading to verify actual loading does not exceed approved design capacity. Table 4 below summarizes loading to the facility from the period of November 2011 to September 2017.

Table 4. Wastewater Influent Characterization

Parameter	Units	Average of Average Monthly Value	Maximum of Average Monthly Value
Flow	MGD	1.3	2.7
Biochemical Oxygen Demand (BOD_5)	mg/L	238	401
Biochemical Oxygen Demand (BOD_5)	lbs/day	1,943	2,724
Total Suspended Solids (TSS)	mg/L	205	362
Total Suspended Solids (TSS)	lbs/day	1,717	2,613
Carbonaceous Biochemical Oxygen Demand ($CBOD_5$)	mg/L	231	394
Carbonaceous Biochemical Oxygen Demand ($CBOD_5$)	lbs/day	2,041	2,891

D. Wastewater effluent characterization

The Snohomish WWTP reported the concentration of pollutants in the discharge in the permit application and in discharge monitoring reports. Table 5 below summarizes effluent data for routinely monitored parameters as reported in monthly DMRs between November 2011 and September 2017. Table 6 summarizes expanded conventional, non-conventional and priority pollutant parameters, as reported in the application

Table 5. Wastewater Effluent Characterization

-Parameter	Units	Average of Average Monthly Value	Maximum of Average Monthly Value
Flow	MGD	1.4	3.0
Carbonaceous Biochemical Oxygen Demand ($CBOD_5$)	mg/L	4.7	7.9
Carbonaceous Biochemical Oxygen Demand ($CBOD_5$)	lbs/day	60	191
Total Suspended Solids (TSS)	mg/L	12	34
Total Suspended Solids (TSS)	lbs/day	160	539
Ammonia (as NH_3-H) (Jul – Oct)	mg/L	0.18	5.4
Ammonia (as NH_3-H) (Nov – Jun)	mg/L	6.2	19.4
Total Residual Peracitic Acid (PAA) – Pilot Testing	mg/L	0.22	0.68
Chlorine, Total Residual	μg/L	3.3	16.5

Parameter	Units	Average of Average Monthly Value	95th Percentile Value
Temperature, Summer 7-day Average of Daily Maximums	°C	20.8	26.9

Parameter	Units	Maximum Monthly Geometric Mean	Maximum Weekly Geometric Mean
Fecal Coliforms	cfu/mL	3.0	139

Parameter	Units	Minimum Value	Maximum Value
pH	standard units	6.9	7.3

Table 6. Expanded Effluent Characterization

Parameter	Units	Average Value	Maximum Value
Dissolved Oxygen	mg/L	10.74	11.64
Nitrate+Nitrite – Nitrogen	mg/L	15	30
Total Kjeldahl Nitrogen	mg/L	7	22
Total Phosphorus	mg/L	3	7
Oil and Grease	mg/L	1.1	2.7
Alkalinity (as $CaCO_3$)	mg/L	100	136
Hardness (as $CaCO_3$)	mg/L	206.6	253.6
Antimony	µg/L	0.3	0.5
Arsenic	µg/L	0.1	0.8
Cadmium	µg/L	0.03	0.03
Chromium (Tri)	µg/L	1	1
Copper	µg/L	12	12
Lead	µg/L	0.6	1
Mercury	µg/L	0.0079	0.0175
Nickel	µg/L	2	2
Selenium	µg/L	0.7	1
Silver	µg/L	0.016	0.4
Zinc	µg/L	18	30
Total Phenolic Compounds	µg/L	110	190
Chlorobidbromo-Methane	µg/L	0.98	3.9
Chloroform	µg/L	16.45	42.6
Dichlorobromomethane	µg/L	0.4	1.6
Bis(2-ethylhexyl)phthalate	µg/L	0.33	0.7

E. Summary of compliance with previous permit issued October 30, 2012

Ecology issued the previous permit for the Snohomish WWTP on October 30, 2012. That permit placed effluent limits on 5-day Carbonaceous Biochemical Oxygen Demand ($CBOD_5$), Total Suspended Solids (TSS), pH, fecal coliform bacteria, and total residual chlorine. The permit also included seasonal, TMDL-based mass limits for $CBOD_5$ and total ammonia for the summer (July-October) months.

The City of Snohomish WWTP has not consistently complied with the effluent limits and permit conditions throughout the duration of the permit issued on October 30, 2012. Ecology assessed compliance based on its review of the facility's discharge monitoring reports (DMRs) and on inspections.

The following table summarizes the violations and permit triggers that occurred during the permit term. Permit triggers are not violations but rather when triggered require the permit holder to take an action defined in the permit.

Table 7. Violations/Permit Triggers

Date	Parameter	Reported Value	Units	Limit Value	Category
11/1/2012	Total Suspended Solids Removal	83.69	Percent	85	Permit violation
12/1/2012	Daily Max Total Residual Chlorine	291	ug/L	209	Permit violation
12/1/2012	Influent Flow	2.73	MGD	2.38	Permit trigger (85% design)
12/1/2013	Average Monthly Total Suspended Solids	34.3	mg/L	30	Permit violation
12/1/2013	Total Suspended Solids	82.66	Percent	85	Permit violation
2/1/2014	Total Suspended Solids	79.01	Percent	85	Permit violation
3/1/2014	Influent Flow	2.56	MGD	2.38	Permit trigger (85% design)
12/1/2014	Total Suspended Solids Removal	78	Percent	85	Permit violation
12/1/2015	Influent Flow	2.67	MGD	2.38	Permit trigger (85% design)
1/1/2016	Total Suspended Solids Removal	83	Percent	85	Permit violation

11/2/2012	Late Submittal of DMRs		Permit violation
12/1/2012	Late Submittal of DMRs		Permit violation
7/1/2013	Biochemichal Oxygen Demand (BOD5)	Analysis not Conducted	Permit violation
7/1/2013	Biochemichal Oxygen Demand (BOD5)	Analysis not Conducted	Permit violation
11/1/2013	Carbonaceous Biochemichal Oxygen Demand (CBOD5)	Frequency of Sampling Violation	Permit violation
8/8/2017	Biochemichal Oxygen Demand (BOD5)	Analysis not Conducted	Permit violation
8/8/2017	Biochemichal Oxygen Demand (BOD5)	Analysis not Conducted	Permit violation
8/8/2017	Carbonaceous Biochemichal Oxygen Demand (CBOD5)	Analysis not Conducted	Permit violation

The City of Snohomish WWTP has also failed to comply with the requirements of section S.2.C of the NPDES permit, which required the City to conduct representative sampling of any unusual discharge or discharge conditions. The 2015 DMR records show that the samples were typically collected on days were flow was lower than the average flow for the month in question. Table 8 summarizes the sampling pattern during storm events.

Table 8. Sampling Pattern during Storm Events

Date (influent flow >20% over average)	Daily influent flow	Influent TSS sampling?	Normal sample day?
1/4/2015	3.48	N	N
1/5/2015	3.79	N	N
1/6/2015	2.1	Y	Y
1/7/2015	1.68	Y	Y
1/17/2015	3.39	N	N
1/18/2015	1.78	N	N
2/4/2015	2.25	Y	Y
2/5/2015	3.35	N	N
2/6/2015	4.14	N	N
2/7/2015	4.3	N	N
2/8/2015	2.64	N	N
2/9/2015	2.76	N	N
2/10/2015	2.12	Y	Y
3/15/2015	5.23	N	N
3/16/2015	1.99	Y	N
3/17/2015	1.49	Y	Y
4/11/2015	1.25	N	N
4/13/2015	2.28	N	N
4/14/2015	1.3	Y	Y
4/24/2015	1.29	N	N
11/7/2015	2.97	N	N
11/13/2015	3.67	N	N
11/14/2015	7.12	N	N
11/15/2015	3.91	N	N
11/16/2015	2.46	Y	N
11/17/2015	3.61	Y	Y
11/18/2015	2.58	N	Y
12/6/2015	4.33	N	N
12/7/2015	4.22	N	N
12/8/2015	8.3	N	Y
12/9/2015	4.23	N	Y
12/10/2015	4.49	N	N
12/17/2015	4.01	N	N

The Snohomish WWTP historically had a poor compliance record with numerous effluent violations. Ecology and the City entered into Agreed Orders in 2010 that contained compliance schedules developed to bring the plant back into consistent compliance with its NPDES permit. Agreed Order numbered 7973 established timelines to design and install a SFF media system that would address near-term compliance issues. Agreed Order 7974 focused on long-term compliance by designing and constructing a pump station and conveyance line that would send the City's sewage flow to the City of Everett for treatment. In 2014 Ecology and the City negotiated Agreed Order 10467, which amended the long-term order. The amendment mandated specific actions for the City to complete in order to demonstrate that the City's existing WWTP would provide reliable, long-term wastewater treatment. The City complied with the terms of each order and Ecology issued a Notice of Compliance on March 10, 2015.

F. State environmental policy act (SEPA) compliance

State law exempts the issuance, reissuance or modification of any wastewater discharge permit from the SEPA process as long as the permit contains conditions that are no less stringent than federal and state rules and regulations (RCW 43.21C.0383). The exemption applies only to existing discharges, not to new discharges.

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).
- 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 and from supporting reports (engineering, hydrogeology, etc.). 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, and do not have a reasonable potential to cause a water quality violation.

Ecology does not usually develop limits for pollutants not reported in the permit application but may be present in the discharge. The permit does not authorize discharge of the non-reported pollutants. During the five-year permit term, the facility's effluent discharge conditions may change from those conditions reported in the permit application. The facility must notify Ecology if significant changes occur in any constituent [40 CFR 122.42(a)]. Until Ecology modifies the permit to reflect additional discharge of pollutants, a permitted facility could be violating its permit.

A. Design criteria

Under WAC 173-220-150 (1)(g), flows and waste loadings must not exceed approved design criteria. Table 9 below summarizes the approved design criteria for the Snohomish WWTP. Ecology approved the design criteria in the 1996 Wastewater Treatment Plant Expansion Design Documents, prepared by Vasey Engineering. Although the 2011 design documents for the Near Term Wastewater Treatment Plant Improvement Project, prepared by Kennedy-Jenks, justify improvements in overall process efficiency at the facility, the plans retained the originally approved design parameters listed below as the basis for the upgraded facility design.

Table 9. Design Criteria for the City of Snohomish WWTP

Parameter	Design Quantity
Maximum Month Design Flow (MMDF)	2.8 MGD
BOD_5 Loading for Maximum Month	3,960 lb/day
TSS Loading for Maximum Month	4,400 lb/day

B. Technology-based effluent limits

Federal and state regulations define technology-based effluent limits for domestic 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 domestic wastewater.

The table below identifies technology-based limits for pH, fecal coliform, $CBOD_5$, and TSS, as listed in chapter 173-221 WAC. Section III.F of this fact sheet describes the potential for water quality-based limits.

Table 10. Technology-based Limits

Parameter	Average Monthly Limit	Average Weekly Limit
$CBOD_5$ (concentration)	25 mg/L	40 mg/L
$CBOD_5$ (concentration)	In addition, the $CBOD_5$ effluent concentration must not exceed fifteen percent (15%) of the average influent concentration.	
TSS (concentration)	30 mg/L	45 mg/L
TSS (concentration)	In addition, the TSS effluent concentration must not exceed fifteen percent (15%) of the average influent concentration.	

Parameter	Monthly Geometric Mean Limit	Weekly Geometric Mean Limit
Fecal Coliform Bacteria	200 organisms/100 mL	400 organisms/100 mL

Parameter	Daily Minimum	Daily Maximum
pH	6.0 standard units	9.0 standard units

Parameter	Average Monthly	Daily Maximum
Chlorine	83 µg/L	209 µg/L
PAA		1.0 mg/L

PAA

State regulations prohibit the discharge of pollutants to surface waters of the state unless authorized by a NPDES permit (WAC 173-220-020). The pilot test results in a pollutant (PAA) from the Snohomish WWTP to the Snohomish River. The existing permit does not authorize the discharge of this pollutant in any detectable quantity. The proposed permit authorizes the discharge of PAA only after Ecology's review and approval of the PAA pilot testing engineering report and design, and after the submission of written notice of the PAA system construction completion. The proposed permit establishes limits for the discharge, requires monitoring to assess the impacts of the discharge, and includes conditions for terminating the discharge if certain problems arise.

Based on the City's pilot study plan, facilities using PAA for disinfection can achieve effective levels of disinfection with a PAA residual of less than 1.0 mg/L in the effluent. The proposed permit includes a limit of 1.0 mg/L for the daily maximum effluent PAA residual. Ecology may adjust this limit in future permits based on performance testing, if the City chooses to permanently install a PAA disinfection system.

TSS removal limits for combined sewer systems

Per *Ecology Water Quality Program Permit Writer's Manual (2015)* facilities that receive flow from combined sewers during wet weather can qualify for alternative monthly percent removal limits. During such wet weather conditions, the facility may be excused from achieving any predetermined percent removal requirement or may have a percent removal limit which is lower than otherwise allowed.

During rainfall events, sewage treatment facilities which serve combined sewers can receive widely fluctuating influent flow rates and influent pollutant concentrations. These fluctuations are due to the intrusion of storm water to the sewer system. In some situations the influent concentrations are so dilute that achieving 85% or any other predetermined percent removal per Section 050(1) or (2) is not possible. The fluctuations can also cause inaccurate computation of the 85% removal requirement. In many cases, the wide fluctuations prevent the establishment of a minimum (below 85%) percent removal requirement which the treatment system would be expected to achieve regardless of any flow situation.

The statistical analysis summarized in Table 11 shows that the CSO events contribute to lower percent TSS removals during wet weather conditions. Therefore, the proposed permit includes a TSS percent removal limit of 72.2% during wet weather conditions (November – March). Since percent removal is a minimum limit, Ecology used the 5th percentile to determine the value where 95% of the data is higher than that value.

Table 11. TSS Percent Removal Analysis

TSS Percent Removals (2012 - 2017)		
	April - October	**November - March**
Minimum	68.1%	46.4%
Monthly Average	96.2%	86.8%
Maximum	99.4%	97.0%
5th Percentile	92.0%	**72.2%**

Ecology derived the technology-based monthly average limit for chlorine 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.

In developing the previous permit for the Snohomish WWTP, Ecology determined that the general technology-based chlorine limit had a reasonable potential to exceed water quality standards. Chlorine limits listed in Table 9 above are water quality-based limits in the previous permit. Through the use of a dechlorination step the facility has demonstrated a capability of meeting the water quality-based limit. By policy Ecology will retain the previous limit in the proposed permit as a technology-based limit.

Technology-based mass limits are based on WAC 173-220-130(3)(b) and 173-221-030(11)(b). Ecology calculated the monthly and weekly average mass limits for $CBOD_5$ and Total Suspended Solids as follows:

Mass Limit = CL x DF x CF

where:

CL = Technology-based concentration limits listed in the above table

DF = Maximum Monthly Average Design flow (MGD)

CF = Conversion factor of 8.34

Table 12. Technology-based Mass Limits

Parameter	Concentration Limit (mg/L)	Mass Limit (lbs/day)
$CBOD_5$ Monthly Average	25	584
$CBOD_5$ Weekly Average	40	934
TSS Monthly Average	30	701
TSS Weekly Average	45	1,051

Technology standards for combined sewer overflows

The federal CSO Control Policy (59 FR 18688) requires entities with Combined Sewer Overflows to implement "Nine Minimum Controls" as technology-based performance standards for CSO discharges. The proposed permit requires the City to continue to comply with this technology standard. Further details of the Nine Minimum Controls are included in the overall CSO discussion found in Section V of this fact sheet.

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).

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

In 1992, U.S. EPA published 91 numeric water quality criteria for the protection of human health that are applicable to dischargers in Washington State in its National Toxics Rule (40 CFR (EPA, 1992). Ecology submitted a standards revision for 192 new human health criteria for 97 pollutants to EPA on August 1, 2016. In accordance with requirements of CWA section 303(c)(2)(B), EPA finalized 143 new and revised Washington-specific human health criteria for priority pollutants, to apply to waters under Washington's jurisdiction. EPA approved 45 human health criteria as submitted by Washington. The EPA took no action on Ecology submitted criteria for arsenic, dioxin, and thallium. The existing criteria for these three pollutants as adopted in the National Toxics Rule (40 CFR 131.36) remain in effect.

These newly adopted criteria, located in WAC 173-201A-240, 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 (e.g., WAC 173-201A-240(1); 2006) limit the toxic, radioactive, or other deleterious material concentrations that the facility may discharge to levels below those which have the potential to:

- Adversely affect designated water uses.
- Cause acute or chronic toxicity to biota.
- Impair aesthetic values.
- Adversely affect human health.

Narrative criteria protect the specific designated uses of all fresh waters (WAC 173-201A-200, 2006) and of all marine waters (WAC 173-201A-210, 2006) in the state of Washington.

Antidegradation

Description--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.

Facility Specific Requirements--This facility must meet Tier I requirements.

- Dischargers must maintain and protect existing and designated uses. Ecology must not allow any degradation that will 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.
- Whenever the natural conditions of a water body are of a lower quality than the assigned criteria, the natural conditions constitute the water quality criteria. Where water quality criteria are not met because of natural conditions, human actions are not allowed to further lower the water quality, except where explicitly allowed in chapter 173-201A WAC.

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

Combined sewer overflows

Chapter 173-245 WAC requires that "All CSO sites shall achieve and at least maintain the greatest reasonable reduction, and neither cause violations of applicable water quality standards, nor restrictions to the characteristic uses of the receiving water, nor accumulation of deposits which: (a) Exceed sediment criteria or standards; or (b) have an adverse biological effect." "The greatest reasonable reduction" means control of each CSO outfall such that an average of no more than one untreated discharge may occur per year. Ecology includes specific conditions in the proposed permit to ensure that City of Snohomish WWTP demonstrates and maintains compliance with water quality goals for each CSO outfall in its system. Section V of this fact sheet contains more detailed information on these CSO requirements.

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, so long as the discharge doesn't interfere with designated uses of the receiving water body (for example, recreation, water supply, and 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 a specified distance from the point of discharge and must not use more than 25% of the available width of the water body for dilution [WAC 173-201A-400 (7)(a)(ii-iii) or WAC 173-201A-400(7)(b)(ii-iii)].

Ecology uses modeling to estimate the amount of mixing within the mixing zone. Through modeling Ecology determines the potential for violating the water quality standards at the edge of the mixing zone and derives 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 4 means the effluent is 25% and the receiving water is 75% of the total volume of water at the boundary of the mixing zone. Ecology uses 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.

Most aquatic life *acute* criteria are 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. Most aquatic life *chronic* criteria are 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 and four tenths (2.4) liters/day for drinking water (increased from two liters/day in the 2016 Water Quality Standards update).
- 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 (as specified below).

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 City of Snohomish WWTP meets 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 waterbody uses). The critical discharge condition is often pollutant-specific or waterbody-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. Density stratification is determined by the salinity and temperature of the receiving water. Temperatures are warmer in the surface waters in summer. Therefore, density stratification is generally greatest during the summer months. Density stratification affects how far up in the water column a freshwater plume may rise. The rate of mixing is greatest when an effluent is rising. The effluent stops rising when the mixed effluent is the same density as the surrounding water. After the effluent stops rising, the rate of mixing is much more gradual. Water depth can affect dilution when a plume might rise to the surface when there is little or no stratification. Ecology uses the water depth at mean lower low water (MLLW) for marine waters. 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: https://fortress.wa.gov/ecy/publications/summarypages/92109.html.

   The following paragraphs explain facts Ecology used to determine the appropriate mixing zone constraints for the Snohomish WWTP outfall.

   Outfall 001 is equipped with a 24-foot long diffuser section consisting of four 12-inch diameter ports spaced 8 feet apart. Based on flow characteristics of the Snohomish River in the vicinity of the discharge, Ecology considers the waterbody as an "Estuary" due to significant tidal variations and tidally-influenced flow reversal.

Cosmopolitan Engineering evaluated the outfall and used modeling to predict dilution for the outfall with a 4-port diffuser. Table 12 summarizes critical conditions used in the modeling. The project used the UM3 subroutine of EPA's Plumes dilution model to predict acute mixing and used rivplume5 to predict chronic mixing. The modeling used the seven-day-average low river flow with a recurrence interval of twenty years (7Q20) for consistency with flows used in the Snohomish Estuary TMDL study.

Table 13. Critical Conditions Used to Model the Discharge

Critical Condition	Value
7Q20 River Flow	1,051 cfs
River depth at the 7Q20, Mean Lower Low Water (MLLW) period	14 feet
10th percentile river velocity (used for acute mixing)	0.05 fps
90th percentile river velocity (used for acute mixing)	0.63 fps
Median river velocity (used for chronic mixing)	0.25 fps
Manning roughness coefficient	0.03
Channel width	360 feet
Acute reflux factor	1.31%
Chronic reflux factor	0.56%
Salinity	0 part per thousand
Design maximum daily flow for acute mixing zone	6.55 MGD
Design maximum average monthly effluent flow for chronic and human health non-carcinogen	2.8 MGD
Ambient temperature	18° C
Effluent temperature	20.8° C
Source: City of Snohomish Amended Effluent Mixing Zone Study, Cosmopolitan Engineering, December 2000	

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.
- 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 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 four days. Dilution modeling under critical conditions generally shows that both acute and chronic criteria concentrations are reached within minutes of discharge.

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 two seconds after discharge; and that the temperature of the water will not create lethal conditions or blockages to fish migration.

Ecology evaluates the cumulative toxicity of an effluent by testing the discharge with whole effluent toxicity (WET) testing.

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, Ecology concluded 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 if the permit limits are met.

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 and concluded the discharge/receiving water mixture will not violate water quality criteria outside the boundary of the mixing zone if permit limits are met.

6. **The size of the mixing zone and the concentrations of the pollutants must be minimized.**

   At any given time, the effluent plume uses only a portion of the acute and chronic mixing zone, which minimizes the volume of water involved in mixing. Because tidal currents change direction, the plume orientation within the mixing zone changes. The plume mixes as it rises through the water column therefore much of the receiving water volume at lower depths in the mixing zone is not mixed with discharge. Similarly, because the discharge may stop rising at some depth due to density stratification, waters above that depth will not mix with the discharge. Ecology determined it is impractical to specify in the permit the actual, much more limited volume in which the dilution occurs as the plume rises and moves with the current.

   Ecology minimizes the size of mixing zones by requiring dischargers to install diffusers when they are appropriate to the discharge and the specific receiving waterbody. When a diffuser is installed, the discharge is more completely mixed with the receiving water in a shorter time. Ecology also minimizes the size of the mixing zone (in the form of the dilution factor) using design criteria with a low probability of occurrence. For example, Ecology uses the expected 95th percentile pollutant concentration, the 90th percentile background concentration, the centerline dilution factor, and the lowest flow occurring once in every ten years to perform the reasonable potential analysis.

   Because of the above reasons, Ecology has effectively minimized the size of the mixing zone authorized in the proposed permit.

7. **Maximum size of mixing zone.**

   The authorized mixing zone does not exceed the maximum size restriction.

8. Acute mixing zone.

- **The discharge/receiving water mixture must comply with acute criteria as near to the point of discharge as practicably attainable.**

  Ecology determined the acute criteria will be met at 10% of the distance of the chronic mixing zone.

- **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.

9. Overlap of mixing zones.

This mixing zone does not overlap another mixing zone.

D. Designated uses and surface water quality criteria

- Applicable designated uses and surface water quality criteria are defined in chapter 173-201A WAC. In 1992, U.S. EPA published 91 numeric water quality criteria for the protection of human health that are applicable to dischargers in Washington State in its National Toxics Rule (40 CFR (EPA, 1992). Ecology submitted a standards revision for 192 new human health criteria for 97 pollutants to EPA on August 1, 2016. In accordance with requirements of CWA section 303(c)(2)(B), EPA finalized 144 new and revised Washington-specific human health criteria for priority pollutants, to apply to waters under Washington's jurisdiction. EPA approved 45 human health criteria as submitted by Washington. The tables included below summarize the criteria applicable to the receiving water's designated uses.
- 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 Uses for this receiving water are identified in Table 13.

Table 14. Freshwater Aquatic Life Uses and Associated Criteria

Salmonid Spawning, Rearing, and Migration	
Temperature Criteria – Highest 7-DAD MAX	17.5°C (63.5°F)
Dissolved Oxygen Criteria – Lowest 1-Day Minimum	8.0 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 must not exceed 110 percent of saturation at any point of sample collection.
pH Criteria	The pH must measure within the range of 6.5 to 8.5 with a human-caused variation within the above range of less than 0.5 units.

- The *recreational uses* for this receiving water are identified below.

Table 15. Recreational Uses and 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.

- The *water supply uses* are domestic, agricultural, industrial, and stock watering.
- The *miscellaneous freshwater uses* are wildlife habitat, harvesting, commerce and navigation, boating, and aesthetics.

E. Water quality impairments

Ecology developed a TMDL for the Snohomish River Estuary in 1999 to address dissolved oxygen impairments in the basin. This TMDL, which EPA approved in 2002, placed waste load allocations on $CBOD_5$ and ammonia from several point sources, including the Snohomish WWTP's outfall. The proposed permit incorporates these waste load allocations as water quality based limits for $CBOD_5$ and ammonia-nitrogen in the form of a combined parameter NBOD+CBOD.

The Snohomish River in the vicinity of the discharge is listed as impaired for temperature (303(d) listing # 7312). Ecology has not completed a TMDL specific to this impairment. A TMDL has been approved for fecal coliform bacteria in tributaries to this river segment, and the Snohomish River is now meeting water quality standards for bacteria. Compliance with technology-based limits for fecal coliform bacteria and continued compliance with CSO discharge limits will ensure that the Snohomish WWTP does not contribute to further fecal coliform impairments. This river segment is also listed as a "water of concern" for pH.

F. Evaluation of surface water quality-based effluent limits for narrative criteria

Ecology must consider the narrative criteria described in WAC 173-201A-160 when it determines permit limits and conditions. Narrative water quality criteria limit the toxic, radioactive, or other deleterious material concentrations that the facility may discharge which have the potential to adversely affect designated uses, cause acute or chronic toxicity to biota, impair aesthetic values, or adversely affect human health.

Ecology considers narrative criteria when it evaluates the characteristics of the wastewater and when it implements all known, available, and reasonable methods of treatment and prevention (AKART) as described above in the technology-based limits section. When Ecology determines if a facility is meeting AKART it considers the pollutants in the wastewater and the adequacy of the treatment to prevent the violation of narrative criteria.

In addition, Ecology considers the toxicity of the wastewater discharge by requiring whole effluent toxicity (WET) testing when there is a reasonable potential for the discharge to contain toxics. Ecology's analysis of the need for WET testing for this discharge is described later in the fact sheet.

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 biochemical oxygen demand (BOD_5) 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 consists of a 30-inch ductile iron pipe and a 24-foot long HDPE diffuser section. The diffuser has four equally spaced 12-inch ports; three ports facing downstream and the fourth at the pipe end facing across the river channel. The outfall and diffuser extend approximately 40 feet in to the channel and sits at a depth of 14 feet at MLLW.

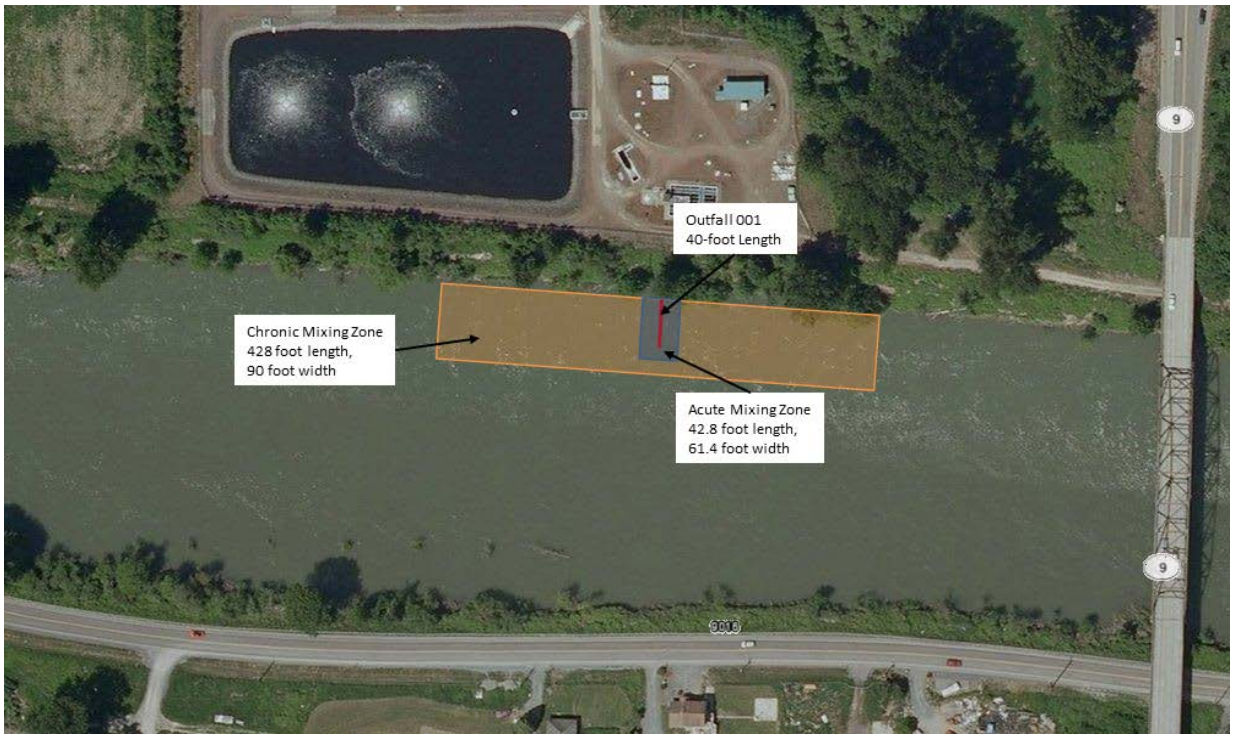
Chronic Mixing Zone--WAC 173-201A-400(7)(b) specifies that mixing zones must not extend in any horizontal direction from the discharge ports for a distance greater than 200 feet plus the depth of water over the discharge ports and may not occupy more than 25% of the width of the water body as measured during MLLW. The proposed permit authorizes a chronic mixing zone for outfall 001 based on a 7Q20/MLLW depth of 14 feet and the river width of 360 feet. The mixing zone extends 214 feet upstream and downstream for the centerline of the outfall and 90 feet across the river channel from the north bank. The mixing zone extends from the top of the discharge ports to the water surface.

Acute Mixing Zone--WAC 173-201A-400(8)(b) specifies that in estuarine waters a zone where acute criteria may be exceeded must not extend beyond 10% of the distance established for the chronic zone, as measured independently from each port. Using this

restriction the proposed permit authorizes an acute mixing zone that extends 21.4 feet upstream and downstream from the centerline of the outfall. Given the overall outfall and diffuser length of 40 feet and the diffuser design with one port discharging transversely across the channel, the authorized acute mixing zone extends 61.4 feet across the river channel from the north bank.

The following image illustrates the approximate size and location of the authorized mixing zones.

Figure 2. Mixing Zone Location



The proposed permit authorizes dilution factors for the authorized mixing zones, as shown in Table 16 below. Ecology used dilution values derived from modeling by Cosmopolitan Engineering, completed in December 2000.

Table 16. Dilution Factors (DF)

Criteria	Acute	Chronic
Aquatic Life	11	28
Human Health, Carcinogen		28
Human Health, Non-carcinogen		28

Ecology determined the impacts of dissolved oxygen deficiency, nutrients, pH, fecal coliform, chlorine, ammonia, metals, other toxics, and temperature 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.

Dissolved Oxygen--BOD_5 and Ammonia Effects--Natural decomposition of organic material in wastewater effluent impacts dissolved oxygen in the receiving water at distances far outside of the regulated mixing zone. The 5-day Biochemical Oxygen Demand (BOD_5) of an effluent sample indicates the amount of biodegradable material in the wastewater and estimates the magnitude of oxygen consumption the wastewater will generate in the receiving water. The amount of ammonia-based nitrogen in the wastewater also provides an indication of oxygen demand potential in the receiving water.

The 1999 *Snohomish River Estuary Dissolved Oxygen TMDL* established waste load allocations (WLAs) for carbonaceous biochemical oxygen demand ($CBOD_5$) and ammonia for discharges occurring during the July-October critical season. Waste load allocations for the Snohomish WWTP are:

- 93 lbs/day $CBOD_5$
- 99 lbs/day Ammonia (N)

The previous permit included a combined "NBOD+CBOD" effluent limit based on the WLAs for each parameter. Because the combination of $CBOD_5$ and ammonia determine the effluent's total oxygen demand, different combinations of the two parameters can meet the TMDL allocation goal. Ecology established a WLA exchange rate for Snohomish Estuary Dischargers of 2.1 pounds of $CBOD_5$ for each pound of ammonia (*Lake Stevens WWTP, WA0020893*). Based on this exchange, the total WLA can be expressed as a combined parameter, which Ecology calls "NBOD + CBOD", which is calculated as follows:

NBOD + CBOD lbs/day = (2.1*ammonia lbs/day) + $CBOD_5$ lbs/day

WLA = (2.1 * 99) + 93 = 301 lbs/day NBOD+CBOD

The WLA is the maximum daily limit (MDL). According to federal NPDES regulations, all permit limits must be expressed as both average monthly and maximum daily limits. The average monthly limit (AML) is calculated according to the method in EPA's Technical Support Document for Water Quality-based Toxics Control (1991). See Appendix D for detailed calculations. The AML calculation is affected by effluent variability and number of samples per month. Ecology calculated the average monthly limit based on 8 sampling events per month (2 per week) and a calculated coefficient of variation (CV) of 0.6. Average monthly and daily maximum limits for the proposed permit are:

MDL = WLA = 301 lbs/day NBOD + CBOD

AML = 134 lbs/day NBOD + CBOD

The proposed permit will continue to enforce technology-based limits for $CBOD_5$ concentration during the critical season. The TMDL allocation, the daily maximum, and the method of calculating the monthly average limit are the same as in the previous permit. The change in the monthly average limit is due to an increase in the effluent variability in the last 5 years, and the 2012 biological treatment process upgrades that provide improved ammonia and $CBOD_5$ removals. The variability was computed using "coefficient of variation" or CV.

pH--Ecology modeled the impact of the effluent pH on the receiving water using the calculations from EPA, 1988, and the chronic dilution factor in Table 15. Modeling evaluates pH based on the following two points of criteria: final pH at the edge of the mixing zone and amount of change for ambient condition. The analysis assumes discharges at each end of the technology-based limit of 6.0 and 9.0 and the 90 percentile ambient pH of 7.36.

As shown in the detailed model results in *Appendix D*, modeling predicts that discharges at a pH of 6.0 will violate the pH criteria for the receiving water by causing a change from background of more than 0.5 standard units. Modeling does not predict violations when effluent pH is 9.0. Therefore, the proposed permit includes water quality-based effluent limits for pH of 6.4 to 9.0.

Fecal Coliform-- Ecology modeled the numbers of fecal coliform by simple mixing analysis using the technology-based limit of 400 organisms per 100 ml, an ambient concentration of 49.6 organisms per 100 ml and a dilution factor of 28.

Under critical conditions, modeling predicts no violation of the water quality criterion for fecal coliform. Therefore, the proposed permit includes the technology-based effluent limit for fecal coliform bacteria.

Turbidity--Ecology evaluated the impact of turbidity based on the range of total suspended solids in the effluent and turbidity of the receiving water. Ecology expects no violations of the turbidity criteria outside the designated mixing zone provided the facility meets its technology-based total suspended solids permit limits.

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 are present in the discharge: chlorine, ammonia, antimony, arsenic, cadmium, chromium, copper, lead, mercury, nickel, selenium, silver, zinc, phenols, chlorobidbromomethane, chloroform, dichlorobromomethane and bis(2-ethylhexyl)phthalate. Ecology conducted a reasonable potential analysis (*See Appendix D*) on these parameters to determine whether it would require effluent limits in this permit.

Ammonia's toxicity depends on that portion which is available in the unionized form. The amount of unionized ammonia depends on the temperature and pH in the receiving freshwater. To evaluate ammonia toxicity, Ecology used the available receiving water information for ambient station # 070A090 and Ecology spreadsheet tools.

Valid ambient background data were available for ammonia, arsenic, chromium, copper, lead, mercury, nickel and zinc. Ecology used all applicable data to evaluate reasonable potential for this discharge to cause a violation of water quality standards. No valid ambient background data were available for the other pollutants listed above. Ecology used zero for background.

Ecology determined that pollutants listed above pose no reasonable potential to exceed the water quality criteria at the critical condition using procedures given in EPA, 1991 (*Appendix D*) and as described above. Ecology's determination assumes that this facility meets the other effluent limits of this permit.

The Snohomish WWTP has demonstrated the ability of meeting the previous water quality-based limit for chlorine and therefore, Ecology has retained that limit in the proposed permit as a performance-based technology standard for the facility. That limit remains sufficiently protective of water quality in the receiving water.

Temperature--The state temperature standards [WAC 173-201A-200-210 and 600-612] include multiple elements:

- Annual summer maximum threshold criteria (June 15 to September 15)
- Supplemental spawning and rearing season criteria (September 15 to June 15)
- Incremental warming restrictions
- Protections against acute effects

Ecology evaluates each criterion independently to determine reasonable potential and derive permit limits.

- Annual summer maximum and supplementary spawning/rearing criteria

  Each water body has an annual maximum temperature criterion [WAC 173-201A-200(1)(c), 210(1)(c), and Table 602]. These threshold criteria (e.g., 12, 16, 17.5, 20°C) protect specific categories of aquatic life by controlling the effect of human actions on summer temperatures.

  Some waters have an additional threshold criterion to protect the spawning and incubation of salmonids (9°C for char and 13°C for salmon and trout) [WAC 173-201A-602, Table 602]. These criteria apply during specific date-windows.

  The threshold criteria apply at the edge of the chronic mixing zone. Criteria for most fresh waters are expressed as the highest 7-Day average of daily maximum temperature (7-DADMax). The 7-DADMax temperature is the arithmetic average of seven consecutive measures of daily maximum temperatures. Criteria for marine waters and some fresh waters are expressed as the highest 1-Day annual maximum temperature (1-DMax).

- Incremental warming criteria

  The water quality standards limit the amount of warming human sources can cause under specific situations [WAC 173-201A-200(1)(c)(i)-(ii), 210(1)(c)(i)-(ii)]. The incremental warming criteria apply at the edge of the chronic mixing zone.

  At locations and times when background temperatures are cooler than the assigned threshold criterion, point sources are permitted to warm the water by only a defined increment. These increments are permitted only to the extent doing so does not cause temperatures to exceed either the annual maximum or supplemental spawning criteria.

  At locations and times when a threshold criterion is being exceeded due to natural conditions, all human sources, considered cumulatively, must not warm the water more than 0.3°C above the naturally warm condition.

  When Ecology has not yet completed a TMDL, our policy allows each point source to warm water at the edge of the chronic mixing zone by 0.3°C. This is true regardless of the background temperature and even if doing so would cause the temperature at the edge of a standard mixing zone to exceed the numeric threshold criteria. Allowing a 0.3°C warming for each point source is reasonable and protective where the dilution factor is based on 25% or less of the critical flow. This is because the fully mixed effect on temperature will only be a fraction of the 0.3°C cumulative allowance (0.075°C or less) for all human sources combined.

- Protections for temperature acute effects

  Instantaneous lethality to passing fish: The upper 99th percentile daily maximum effluent temperature must not exceed 33°C, unless a dilution analysis indicates ambient temperatures will not exceed 33°C two seconds after discharge.

  General lethality and migration blockage: Measurable (0.3°C) increases in temperature at the edge of a chronic mixing zone are not allowed when the receiving water temperature exceeds either a 1DMax of 23°C or a 7DADMax of 22°C.

  Lethality to incubating fish: Human actions must not cause a measurable (0.3°C) warming above 17.5°C at locations where eggs are incubating.

Reasonable Potential Analysis

Annual summer maximum and incremental warming criteria: Ecology evaluated the reasonable potential for the discharge to exceed the annual summer maximum, and the incremental warming criteria at the edge of the chronic mixing zone during critical summer season. State Water Quality Standards do not include Supplemental Spawning Criteria for the Snohomish River in the vicinity of the discharge. The evaluation used the calculated 95th percentile of summer 7-Day Average of Daily Maximum (7DADMax) effluent temperature listed in Table 4. Continuous ambient temperature monitoring was unavailable to calculate ambient 7DADMax. This analysis assumes the 90th percentile of 1-day maximum ambient temperature of 18.2°C is consistent with the ambient 7DADMax. As shown in Appendix D, no reasonable potential exists to exceed the temperature criterion and the incremental increase for this discharge is within the allowable amount. Therefore, the proposed permit does not include a temperature limit.

H. Human health

Washington's water quality standards include numeric human health-based criteria for 97 priority pollutants that Ecology must consider when writing NPDES permits.

Washington's water quality standards include numeric human health-based criteria that Ecology must consider when writing NPDES permits. In accordance with the requirements of CWA section 303(c)(2)(B), EPA has finalized 144 new and revised Washington-specific human health criteria for priority toxic pollutants, to apply to waters under Washington's jurisdiction, and has approved 45 new human health criteria submitted by Washington. For arsenic, dioxin, and thallium, the existing criteria from the National Toxics Rule (40 CFR 131.36) remain in effect.

Ecology determined the effluent contains chemicals of concern for human health, based on data or information reported in priority pollutant testing that indicate regulated chemicals occur in the discharge. Pollutants of concern for human health detected in the effluent includes antimony, arsenic, copper, chloroform, dichlorobromethane, mercury, nickel, zinc, selenium, bis(2-ethylhexyl) phthalate, and phenols.

Ecology evaluated the discharge's potential to violate the water quality standards as required by 40 CFR 122.44(d) by following the procedures published in the *Technical Support Document for Water Quality-Based Toxics Control* (EPA/505/2-90-001) and Ecology's *Permit Writer's Manual* to make a reasonable potential determination. The evaluation

showed that the discharge has no reasonable potential to cause a violation of water quality standards for antimony, arsenic, cadmium, chloroform, chromium, copper, mercury, nickel, zinc, selenium, phenol, methylene chloride, and thallium. Effluent limits are not needed for the pollutants listed above. Ecology will reevaluate this discharge for impacts to human health at the next permit reissuance.

The 2016 update to Washington's water quality standards significantly lowered the criteria for bis(2-ethylhexyl) phthalate (DEHP) compared to the previously adopted standard. DEHP, a known carcinogen, is frequently detected in wastewater effluent. Phthalates are plasticizers that are commonly used in hundreds of common consumer and building products. The ubiquitous chemical has also been identified as a common sampling and laboratory contaminate. Although the concentrations detected in the City's effluent do not result in the need for a human health-based limit, minor increases in concentrations could result in a limit in the future. To ensure future permit decisions are made based on appropriate monitoring data, the City must use clean sampling techniques for future priority pollutant monitoring.

The permittee should work with an accredited laboratory on specific clean sampling requirements. At a minimum, samples should be collected in clean glass bottles with polytetrafluoroethylene (PFTE or Teflon™) lids. Standard practice may also include an equipment rinse with a non-polar solvent to remove possible organics. Accidental sample contamination from safety equipment (e.g. gloves) is also possible. All samples must be kept from directly contacting plastics of any kind.

To help assess the sample contamination potential, permittees may opt to collect a field blank for comparison with the effluent sample so that field collection contamination may be quantified. It is the laboratory's responsibility to analyze method blanks and laboratory control samples when analyzing batches consisting of 20 or less discrete samples. These laboratory QA results must be submitted with the laboratory report.

I. 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). You can obtain additional information about sediments at the Aquatic Lands Cleanup Unit website. https://www.ecy.wa.gov/Spills-Cleanup/Contamination-cleanup/Sediment-cleanups

Ecology has promulgated aquatic sediment standards (Chapter 173-204 WAC) to protect aquatic biota and human health. These standards state that the department may require Permittees to evaluate the potential for the discharge to cause a violation of applicable 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.

J. Whole effluent toxicity

The water quality standards for surface waters forbid discharge of effluent that has the potential to cause 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 with 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 reduced growth or 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.

Laboratories accredited by Ecology for WET testing know how to use the proper WET testing protocols, fulfill the data requirements, and submit results in the correct reporting format. Accredited laboratory staff know about WET testing and how to calculate an NOEC, LC50, EC50, IC25, 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* (https://fortress.wa.gov/ecy/publications/documents/9580.pdf), which is referenced in the permit. Ecology recommends that Permittees send a copy of the acute or chronic toxicity sections(s) of its NPDES permit to the laboratory.

WET testing conducted during effluent characterization showed no reasonable potential for effluent discharges to cause receiving water acute or chronic toxicity. The proposed permit will not include an acute or chronic WET limit. The Snohomish WWTP must retest the effluent before submitting an application for permit renewal.

- If this facility makes process or material changes which, in Ecology's opinion, increase the potential for effluent toxicity, then Ecology may (in a regulatory order, by permit modification, or in the permit renewal) require the facility to conduct additional effluent characterization. The City of Snohomish may demonstrate to Ecology that effluent toxicity has not increased by performing additional WET testing and/or chemical analyses after the process or material changes have been made. Ecology recommends that the Permittee check with it first to make sure that Ecology will consider the demonstration adequate to support a decision to not require an additional effluent characterization.
- If WET testing conducted for submittal with a permit application fails to meet the performance standards in WAC 173-205-020, Ecology will assume that effluent toxicity has increased.

K. Groundwater quality limits

The groundwater quality standards (chapter 173-200 WAC) protect beneficial uses of groundwater. Permits issued by Ecology must not allow violations of those standards (WAC 173-200-100). Under the terms of Agreed Order 10467, the City hired a contractor in July 2014 to conduct leak testing of the plant's lagoon liners. The testing did not reveal any leaks. The City of Snohomish WWTP does not discharge treated wastewater to the ground and has demonstrated that the lagoon liners are protective of groundwater. The proposed permit does not contain limits to protect ground water, nor does it authorize discharges to groundwater.

L. Comparison of effluent limits with the previous permit issued on October 30, 2012

Table 17. Comparison of Previous and Proposed Effluent Limits

	Previous Effluent Limits: Outfall # 001		Proposed Effluent Limits: Outfall # 001	
Parameter	**Average Monthly**	**Average Weekly**	**Average Monthly**	**Average Weekly**
Carbonaceous Biochemical Oxygen Demand (5-day) Concentration Limits	25 mg/L 85% Removal	40 mg/L	25 mg/L 85% Removal	40 mg/L
$CBOD_5$ Mass Limits *Effective Nov.-June Only*	584 lbs/day	934 lbs/day	584 lbs/day	934 lbs/day
Total Suspended Solids (*April through October*)	30 mg/L 701 lbs/day 85% Removal	45 mg/L 1,051 lbs/day	30 mg/L 701 lbs/day 85% Removal	45 mg/L 1,051 lbs/day
Total Suspended Solids (*November through March*)	30 mg/L 701 lbs/day 85% Removal	45 mg/L 1,051 lbs/day	30 mg/L 701 lbs/day 72.2% Removal	45 mg/L 1,051 lbs/day

Parameter	**Monthly Geometric Mean Limit**	**Weekly Geometric Mean Limit**	**Monthly Geometric Mean Limit**	**Weekly Geometric Mean Limit**
Fecal Coliform Bacteria	200/100 ml	400/100 ml	200/100 ml	400/100 ml

Parameter	**Limit**	**Limit**
pH	Daily minimum is equal to or greater than 6.2 and the daily maximum is less than or equal to 9.0.	Daily minimum is equal to or greater than 6.4 and the daily maximum is less than or equal to 9.0.

Parameter	**Average Monthly**	**Maximum Daily**	**Average Monthly**	**Maximum Daily**
Total Residual Chlorine	83 μg/L	209 μg/L	83 μg/L	209 μg/L
Total Residual Peracetic Acid (PAA)	N/A	1 mg/L	N/A	1 mg/L
NBOD+CBOD Seasonal Mass Limit *Effective July-Oct. Only*	146 lbs/day	301 lbs/day	134 lbs/day	301 lbs/day

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.

If a facility uses a contract laboratory to monitor wastewater, it must ensure that the laboratory uses the methods and meets or exceeds the method detection levels required by the permit. The permit describes when facilities may use alternative methods. It also describes what to do in certain situations when the laboratory encounters matrix effects. When a facility uses an alternative method as allowed by the permit, it must report the test method, detection level (DL), and quantitation level (QL) on the discharge monitoring report or in the required report.

A. Wastewater monitoring

The monitoring schedule is detailed in the proposed permit under Special 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* (Publication Number 92-109) for anaerated lagoon with design flow greater than 0.5 MGD.

During the past permit term Ecology advised plant staff during site visits, in inspection reports and in emails that the City's monitoring practices did not fully comply with the requirements of special condition S.2.C of their NPDES permit. That condition requires the City to conduct representative sampling of any unusual discharge or discharge conditions. This includes ensuring representative sampling of influent on days when influent flows are high due to rainfall. DMR records show that the samples were typically collected on days were flow was lower than the average flow for the month in question. Specifically, DMR reports show that sampling did not occur on the highest flow days of the year unless those high flow days were on a normal sampling day of Tuesday or Wednesday. Of the 30 days of 2015 where flows were more than 20% over the average for the month in question, 10 days had influent TSS sampling done; only 2 of those were on days other than Tuesday or Wednesday. The records also show that sampling was not done on the highest flow day of the year (12/8/15 with 8.3 MGD) despite it being a normal sampling day (Tuesday).

Ecology has a concern that the sampling has not accurately shown the variability of TSS concentration entering the plant during the wet weather conditions. The data may be more skewed towards higher concentrations and not representative of low concentrations when the system has more stormwater entering to the plant. By not sampling the highest flow days when TSS influent concentration is likely low, the average TSS concentrations for these wet weather months are likely higher than they actually were. This raises questions about whether the TSS percent removal calculations for these months are accurate or if the actual percent removal was lower than what was reported. Therefore, the proposed permit requires 4/week minimum sampling frequency for influent TSS monitoring during wet weather conditions (November – March). The wet weather months were determine based on an statistical analysis of the TSS percent removals reported in the last 5 years (Table 11).

Ecology has included some additional monitoring of nutrients in the proposed permit to establish a baseline for this discharger. It will use this data in the future as it develops TMDLs for dissolved oxygen and establishes WLAs for nutrients.

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

B. Lab accreditation

Ecology requires facilities to use a laboratory registered or accredited under the provisions of chapter 173-50 WAC, Accreditation of Environmental Laboratories, to prepare all monitoring data (with the exception of certain parameters). The laboratory at the Snohomish WWTP holds an accreditation (#M509-11) for the following parameters:

Table 18. Accredited Parameters

Parameter Name	Category	Method Name	Matrix Description
Biochemical Oxygen Demand	General Chemistry	SM 5210 B-01	Non-potable water
Total Suspended Solids	General Chemistry	SM 2540 D-97	Non-potable water
Alkalinity as $CaCO_3$	General Chemistry	SM 2320 B	Non-potable water
Ammonia as N	General Chemistry	SM 19/20 4500-NH3 D97	Non-potable water
pH	General Chemistry	SM 4500-H^+ B-00	Non-potable water
Total Residual Chlorine	General Chemistry	SM 4500-Cl G-00	Non-potable water
Fecal coliform	Microbiology	SM 9222 D (m-FC)-97	Non-potable water

V. Other Permit Conditions

A. Reporting and record keeping

Ecology based Special Condition S3 on its authority to specify any appropriate reporting and record keeping 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 City of Snohomish WWTP to:

- Take the actions detailed in proposed permit Special Condition S.4.
- Design and construct expansions or modifications before the treatment plant reaches existing capacity.
- Report and correct conditions that could result in new or increased discharges of pollutants.

C. Operation and maintenance

The proposed permit contains Special Condition S.5 as authorized under RCW 90.48.110, WAC 173-220-150, chapter 173-230 WAC, and WAC 173-240-080. Ecology included it to ensure proper operation and regular maintenance of equipment, and to ensure that the City of Snohomish WWTP takes adequate safeguards so that it uses constructed facilities to their optimum potential in terms of pollutant capture and treatment.

Special Condition S.5.G requires the City of Snohomish to update the wastewater treatment plant's operation and maintenance manual to incorporate new systems installed as part of the Peracetic Acid Pilot Study. The revised manual must fulfill the requirements of WAC 173-240-080 and RCW 90.48.110. Section G1-4.4 of the 2008 Edition of the *Criteria for Sewage Works Design* (Orange Book, Ecology Publication #98-37 WQ) provides extensive guidance on recommended contents and formats for a functional O&M manual. Ecology has an electronic version of the most recent update available at the following web address: http://www.ecy.wa.gov/biblio/9837.html.

Inflow & Infiltration

The City of Snohomish WWTP has not conducted an I/I evaluation in the last years. Per written communication between the City and Ecology, the City is currently working on a General Sewer Plan that will include an updated I/I evaluation. Therefore, the proposed permit requires the City to conduct an inflow and infiltration evaluation and submit a report summarizing the results of the evaluation and any recommendations for corrective actions.

D. Pretreatment

Duty to enforce discharge prohibitions

This provision prohibits the publicly owned treatment works (POTW) from authorizing or permitting an industrial discharger to discharge certain types of waste into the sanitary sewer.

- The first section of the pretreatment requirements prohibits the POTW from accepting pollutants which causes "pass-through" or "interference". This general prohibition is from 40 CFR §403.5(a). *Appendix C* of this fact sheet defines these terms.
- The second section reinforces a number of specific state and federal pretreatment prohibitions found in WAC 173-216-060 and 40 CFR §403.5(b). These reinforce that the POTW may not accept certain wastes, which:
  a. Are prohibited due to dangerous waste rules.
  b. Are explosive or flammable.
  c. Have too high or low of a pH (too corrosive, acidic or basic).
  d. May cause a blockage such as grease, sand, rocks, or viscous materials.
  e. Are hot enough to cause a problem.
  f. Are of sufficient strength or volume to interfere with treatment.
  g. Contain too much petroleum-based oils, mineral oil, or cutting fluid.
  h. Create noxious or toxic gases at any point.

40 CFR Part 403 contains the regulatory basis for these prohibitions, with the exception of the pH provisions which are based on WAC 173-216-060.

- The third section of pretreatment conditions reflects state prohibitions on the POTW accepting certain types of discharges unless the discharge has received prior written authorization from Ecology. These discharges include:
  a. Cooling water in significant volumes.
  b. Stormwater and other direct inflow sources.
  c. Wastewaters significantly affecting system hydraulic loading, which do not require treatment.

Federal and state pretreatment program requirements

Ecology administers the Pretreatment Program under the terms of the addendum to the "Memorandum of Understanding between Washington Department of Ecology and the United States Environmental Protection Agency, Region 10" (1986) and 40 CFR, part 403. Under this delegation of authority, Ecology issues wastewater discharge permits for significant industrial users (SIUs) discharging to POTWs which have not been delegated authority to issue wastewater discharge permits. Ecology must approve, condition, or deny new discharges or a significant increase in the discharge for existing significant industrial users (SIUs) [40 CFR 403.8 (f)(1)(i) and(iii)].

Industrial dischargers must obtain a permit from Ecology before discharging waste to the City of Snohomish WWTP [WAC 173-216-110(5)]. Industries discharging wastewater that is similar in character to domestic wastewater do not require a permit.

Routine identification and reporting of industrial users

The permit requires non-delegated POTWs to take "continuous, routine measures to identify all existing, new, and proposed significant industrial users (SIUs) and potential significant industrial users (PSIUs)" discharging to their sewer system. Examples of such routine measures include regular review of water and sewer billing records, business license and building permit applications, advertisements, and personal reconnaissance. System maintenance personnel should be trained on what to look for so they can identify and report new industrial dischargers in the course of performing their jobs. The POTW may not allow SIUs to discharge prior to receiving a permit, and must notify all industrial dischargers (significant or not) in writing of their responsibility to apply for a State Waste Discharge Permit. The POTW must send a copy of this notification to Ecology.

Requirements for performing an industrial user survey

This POTW has the potential to serve significant industrial or commercial users and must conduct an industrial user (IU) survey. The purpose of the IU Survey is to identify all facilities that may be subject to pretreatment standards or requirements so that Ecology can take appropriate measures to control these discharges. The POTW should identify each such user, and require them to apply for a permit before allowing their discharge to the POTW to commence. For SIUs, the POTW must require they actually are issued a permit prior to accepting their discharge. The steps the POTW must document in their IU Survey submittal include:

1. The POTW must develop a master list of businesses that may be subject to pretreatment standards and requirements and show their disposition. This list must be based on several sources of information including business licenses, and water and sewer billing records.
2. The POTW must canvas all the potential sources, having them either complete a survey form or ruling them out by confirming they only generate domestic wastewater.
3. The POTW must develop a list of the SIUs and potential SIUs in all areas served by the POTW. The list must contain sufficient information on each to allow Ecology to decide which discharges merit further controls such as a state waste discharge permit.

Ecology describes the information needed in IU Survey submittals to allow Ecology to make permitting decision in the manual "Performing an Industrial User Survey". Properly completing an Industrial User Survey helps Ecology control discharges that may otherwise harm the POTW including its collection system, processes, and receiving waters. Where surveys are incomplete, Ecology may take such enforcement as appropriate and/or require the POTW to develop a fully delegated pretreatment program.

The proposed permit requires the City of Snohomish WWTP to conduct an industrial user survey to determine the extent of compliance of all industrial users of the sanitary sewer and wastewater treatment facility with federal pretreatment regulations [40 CFR Part 403 and Sections 307(b) and 308 of the Clean Water Act)], with state regulations (chapter 90.48 RCW and chapter 173-216 WAC), and with local ordinances.

E. Solid wastes

To prevent water quality problems the facility is required in permit Special 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 Snohomish Health District.

Requirements for monitoring sewage sludge and record keeping are included in this permit. Ecology will use this information, required under 40 CFR 503, to develop or update local limits.

F. Effluent mixing study

Ecology used the mixing zone study prepared by Cosmopolitan Engineering (2000) to estimate the amount of mixing of the discharge with receiving water and the potential for the mixture to violate the water quality standards for surface waters at the edge of the mixing zone (chapter 173-201A WAC). The proposed permit requires the permittee to more accurately determine the mixing characteristics of the discharge (Permit Condition S.9). The effluent mixing study must measure or model the characteristics of the discharge under conditions specified in the permit to assess whether the receiving water quality is protected outside the mixing zone boundary. The study should include the determination of new dilution factors for use with the evaluation of Human Health criteria. See Permit Condition S.9 for details.

G. Combined sewer overflows

Combined sewer systems are sewers that are designed to collect rainwater runoff, domestic sewage, and industrial wastewater in the same piping system. Most of the time, combined sewer systems transport all wastewater to a sewage treatment plant, where it is treated and then discharged to a water body. During periods of heavy rainfall or snowmelt, however, the wastewater volume in a combined sewer system can exceed the capacity of the combined sewer system or treatment plant. For this reason, combined sewer systems are designed to overflow occasionally and discharge excess wastewater directly to nearby streams, rivers, or other water bodies. Chapter 173-245 WAC and EPA's CSO control policy (59 FR 18688) identify the required measures for control of overflows from combined sewer systems.

CSO reduction plan/long-term control plan and CSO reduction plan amendments

Ecology requires municipalities to initially develop combined sewer overflow (CSO) reduction plans per chapter 173-245 WAC requirements. These plans are substantially equivalent to the long-term control plan (LTCP) as defined by EPA in its CSO control policy. Chapter 173-245 WAC requires that "All CSO sites shall achieve and at least maintain the greatest reasonable reduction, and neither cause violations of applicable water quality standards, nor restrictions to the characteristic uses of the receiving water, nor accumulation of deposits which: (a) Exceed sediment criteria or standards; or (b) have an adverse biological effect." "The greatest reasonable reduction" means control of each CSO outfall such that an average of no more than one untreated discharge may occur per year.

Under EPA's CSO Control Policy's presumption approach, CSO controls are presumed to attain WQS if certain performance criteria are met. Ecology presumes that a program that meets the criteria specified in WAC 173-245 and EPA's CSO control policy provides an adequate level of control to meet the water quality-based requirements of the Clean Water Act. This presumption must be verified via a post-construction monitoring program by characterization, monitoring, and modeling of the system, including consideration of sensitive areas. Ecology approved the City's Post Construction Monitoring Plan in 2015.

Nine minimum controls

Municipalities with combined sewer overflow outfalls must implement nine minimum controls as technology-based standards for CSO discharges. The nine minimum controls are largely programmatic policies and practices designed to minimize the impacts untreated CSOs have on human health and the environment. It is not possible with current knowledge and technology to calculate numeric water quality-based effluent limits for CSOs. Ecology may include numeric water quality-based effluent limits in the future permits only after the long-term control plan is in place and after collection of sufficient water quality data.

The nine minimum controls include:

1. Use proper operations and maintenance practices within the combined collection system to reduce the magnitude, frequency and duration of CSOs.
2. Implement procedures that maximize storage capacity of the combined collection system.
3. Minimize pollution from non-domestic wastewater sources through close management of a pretreatment program.
4. Maximize treatable flow to the wastewater treatment plant during wet weather.

5. Prevent CSO discharges during dry weather and properly report any dry weather CSO discharges immediately to Ecology.
6. Implement procedures to control solid and floatable materials in CSOs.
7. Implement and maintain a pollution prevention program designed to keep pollutants from entering the combined sewer system.
8. Establish a process to notify the public when and where CSOs occur.
9. Monitor CSO outfalls to characterize CSO impacts and the efficacy of CSO controls, including event-based monitoring of all CSO flow quantity, frequency and duration.

It is not possible with current knowledge and technology to calculate numeric water quality-based effluent limits for CSOs. Ecology may include numeric or narrative water quality-based effluent limits in future permits if post construction monitoring shows that the controlled CSO discharge has a reasonable potential to cause a loss of sensitive or important habitat; interfere with designated uses; result in damage to the ecosystem; or adversely affect public health.

CSO monitoring

The proposed permit requires the City of Snohomish to monitor the volume and duration of each CSO discharge event at each CSO outfall identified in Table 1 and the amount of precipitation associated with each event.

Annual CSO report

The City of Snohomish must submit annual reports according to the requirements of WAC 173-245-090(1). This report: (a) details the past year's frequency and volume of combined sewage discharge from each CSO site, (b) explains the previous year's CSO reduction accomplishments, and (c) lists the projects planned for the next year. The report must indicate whether a CSO site has increased over the baseline annual condition. If an increase has occurred, the Permittee must propose a project and/or schedule to reduce that site below its baseline conditions. The report must document implementation of the nine minimum controls, and wet weather operation at the treatment plant.

The City of Snohomish must also assess in its annual reports whether identified outfalls continue to meet the state standard of one untreated discharge per year per CSO. Assessment must be based on a long-term average which is currently defined as 5 years. It must also include results of post construction monitoring completed according to the approved 2015 Post Construction Monitoring Plan.

Post-construction monitoring program

The federal CSO control policy (59 FR 18688) requires post-construction monitoring to verify implemented CSO control strategies comply with water quality standards. Post-construction monitoring applies to any CSO outfall that is controlled to meet the "greatest reasonable reduction" of combined sewer overflows, as defined in chapter 173-245 WAC. Implementation requires development of a monitoring plan and completion of a data report that documents compliance.

The City of Snohomish fulfilled all the requirements of 2015 Post Construction Monitoring Plan. The plan validates that the CSO reduction project completed in 2011 meets the intended performance standard along with demonstrating compliance with state water quality standards.

H. Compliance schedule

In 2017 the City began a full-scale pilot test of peracetic acid (PAA) in order to establish whether it is a viable alternative to using chlorine-based disinfection. Ecology considers PAA a "new and developmental technology" for wastewater treatment, which requires pilot testing before a facility can permanently install the alternative technology. Ecology accepted the City's pilot study plan in October 2016 and modified its NPDES permit to authorize the discharge of PAA during the pilot study. The City is continuing to perform the pilot testing.

As part of the pilot study plan, the City committed to submitting a summary report to Ecology that documents the results of the test and assesses whether the test met the study objectives. If the test proves successful and PAA is determined to be cost effective, the City plans to permanently modify the treatment plant to use PAA. The proposed permit includes a compliance schedule for the City to submit the test summary report and, if permanent installation is desired, engineering documents for upgrading the disinfection system.

I. General conditions

Ecology bases the standardized General Conditions on state and federal law and regulations. They are included in all individual domestic wastewater 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 groundwaters, 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 5 years.

VII. References for Text and Appendices

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2011. *Operations and Maintenance Manual, City of Snohomish CSO Pump Station.*

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Laws and Regulations (http://www.ecy.wa.gov/laws-rules/index.html)

Permit and Wastewater Related Information (http://www.ecy.wa.gov/programs/wq/permits/guidance.html)

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Appendix A--Public Involvement Information

Ecology proposes to reissue a permit to the City of Snohomish Wastewater Treatment Plant. 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 Draft on April 9, 2018, in the *Everett Herald* to inform the public and to invite comment on the proposed draft National Pollutant Discharge Elimination System permit and fact sheet.

The notice:

- Told where copies of the draft permit and fact sheet were available for public evaluation (a local public library, the closest regional or field office, posted on our website).
- Offered to provide the documents in an alternate format to accommodate special needs.
- Asked people to tell us how well the proposed permit would protect the receiving water.
- Invited people to suggest fairer conditions, limits, and requirements for the permit.
- Invited comments on Ecology's determination of compliance with antidegradation rules.
- Urged people to submit their comments, in writing, before the end of the comment period.
- Told how to request a public hearing about the proposed NPDES permit.
- Explained 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 https://fortress.wa.gov/ecy/publications/SummaryPages/0307023.html.

You may obtain further information from Ecology by telephone, (425) 649-7027, or by writing to the address listed below.

Water Quality Permit Coordinator
Department of Ecology
Northwest Regional Office
3190 160th Avenue SE
Bellevue, WA 98008-5452

The primary author of this permit and fact sheet is Lazaro Eleuterio.

Appendix B--Your Right to Appeal

You have a right to appeal this permit to the Pollution Control Hearing Board (PCHB) within 30 days of the date of receipt of the final permit. The appeal process is governed by chapter 43.21B RCW and chapter 371-08 WAC. "Date of receipt" is defined in RCW 43.21B.001(2) (see glossary).

To appeal you must do the following within 30 days of the date of receipt of this permit:

- File your appeal and a copy of this permit with the PCHB (see addresses below). Filing means actual receipt by the PCHB during regular business hours.
- Serve a copy of your appeal and this permit on Ecology in paper form - by mail or in person. (See addresses below.) E-mail is not accepted.

You must also comply with other applicable requirements in chapter 43.21B RCW and chapter 371-08 WAC.

ADDRESS AND LOCATION INFORMATION

Street Addresses	Mailing Addresses
Department of Ecology Attn: Appeals Processing Desk 300 Desmond Drive SE Lacey, WA 98503	**Department of Ecology** Attn: Appeals Processing Desk PO Box 47608 Olympia, WA 98504-7608
Pollution Control Hearings Board 1111 Israel RD SW STE 301 Tumwater, WA 98501	**Pollution Control Hearings Board** PO Box 40903 Olympia, WA 98504-0903

Appendix C--Glossary

1-DMax or 1-day maximum temperature -- The highest water temperature reached on any given day. This measure can be obtained using calibrated maximum/minimum thermometers or continuous monitoring probes having sampling intervals of thirty minutes or less.

7-DADMax or 7-day average of the daily maximum temperatures -- The arithmetic average of seven consecutive measures of daily maximum temperatures. The 7-DADMax for any individual day is calculated by averaging that day's daily maximum temperature with the daily maximum temperatures of the three days prior and the three days after that date.

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

AKART -- The acronym for "all known, available, and reasonable methods of prevention, control and treatment." AKART is a technology-based approach to limiting pollutants from wastewater discharges, which requires an engineering judgment and an economic judgment. AKART must be applied to all wastes and contaminants prior to entry into waters of the state in accordance with RCW 90.48.010 and 520, WAC 173-200-030(2)(c)(ii), and WAC 173-216-110(1)(a).

Alternate point of compliance -- An alternative location in the groundwater from the point of compliance where compliance with the groundwater standards is measured. It may be established in the groundwater at locations some distance from the discharge source, up to, but not exceeding the property boundary and is determined on a site specific basis following an AKART analysis. An "early warning value" must be used when an alternate point is established. An alternate point of compliance must be determined and approved in accordance with WAC 173-200-060(2).

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.

Annual average design flow (AADF) -- The average of the daily flow volumes anticipated to occur over a calendar year.

Average monthly (intermittent) discharge limit -- The average of the measured values obtained over a calendar month's time taking into account zero discharge days.

Average monthly discharge limit -- The average of the measured values obtained over a calendar month's time.

Background water quality -- The concentrations of chemical, physical, biological or radiological constituents or other characteristics in or of groundwater at a particular point in time upgradient of an activity that has not been affected by that activity [WAC 173-200-020(3)]. Background water quality for any parameter is statistically defined as the 95% upper tolerance interval with a 95% confidence based on at least eight hydraulically upgradient water quality samples. The eight samples are collected over a period of at least one year, with no more than one sample collected during any month in a single calendar year.

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.

BOD5 -- Determining the five-day 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 BOD5 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_5 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.

Categorical pretreatment standards -- National pretreatment standards specifying quantities or concentrations of pollutants or pollutant properties, which may be discharged to a POTW by existing or new industrial users in specific industrial subcategories.

Chlorine -- A chemical 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 for the purpose of determining the compliance of a facility with the terms and conditions of its permit or with applicable statutes and regulations. In addition it includes 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. Ecology may conduct additional sampling.

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.

Date of receipt -- This is defined in RCW 43.21B.001(2) as five business days after the date of mailing; or the date of actual receipt, when the actual receipt date can be proven by a preponderance of the evidence. The recipient's sworn affidavit or declaration indicating the date of receipt, which is unchallenged by the agency, constitutes sufficient evidence of actual receipt. The date of actual receipt, however, may not exceed forty-five days from the date of mailing.

Detection limit -- The minimum concentration of a substance that can be measured and reported with 99 percent confidence that the pollutant concentration is above zero and is determined from analysis of a sample in a given matrix containing the pollutant.

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, for example, a dilution factor of 10 means the effluent comprises 10% by volume and the receiving water 90%.

Distribution uniformity -- The uniformity of infiltration (or application in the case of sprinkle or trickle irrigation) throughout the field expressed as a percent relating to the average depth infiltrated in the lowest one-quarter of the area to the average depth of water infiltrated.

Early warning value -- The concentration of a pollutant set in accordance with WAC 173-200-070 that is a percentage of an enforcement limit. It may be established in the effluent, groundwater, surface water, the vadose zone or within the treatment process. This value acts as a trigger to detect and respond to increasing contaminant concentrations prior to the degradation of a beneficial use.

Enforcement limit -- The concentration assigned to a contaminant in the groundwater at the point of compliance for the purpose of regulation, [WAC 173-200-020(11)]. This limit assures that a groundwater criterion will not be exceeded and that background water quality will be protected.

Engineering report -- A document that 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.

Groundwater -- Water in a saturated zone or stratum beneath the surface of land or below a surface water body.

Industrial user -- A discharger of wastewater to the sanitary sewer that is not sanitary wastewater or is not equivalent to sanitary wastewater in character.

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 stormwater and, also, leachate from solid waste facilities.

Interference -- A discharge which, alone or in conjunction with a discharge or discharges from other sources, both:

- Inhibits or disrupts the POTW, its treatment processes or operations, or its sludge processes, use or disposal; and

- Therefore is a cause of a violation of any requirement of the POTW's NPDES permit (including an increase in the magnitude or duration of a violation) or of the prevention of sewage sludge use or disposal in compliance with the following statutory provisions and regulations or permits issued thereunder (or more stringent State or local regulations): Section 405 of the Clean Water Act, the Solid Waste Disposal Act (SWDA) (including title II, more commonly referred to as the Resource Conservation and Recovery Act (RCRA), and including State regulations contained in any State sludge management plan prepared pursuant to subtitle D of the SWDA), sludge regulations appearing in 40 CFR Part 507, the Clean Air Act, the Toxic Substances Control Act, and the Marine Protection, Research and Sanctuaries Act.

Local limits -- Specific prohibitions or limits on pollutants or pollutant parameters developed by a POTW.

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 limit -- 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.

Maximum day design flow (MDDF) -- The largest volume of flow anticipated to occur during a one-day period, expressed as a daily average.

Maximum month design flow (MMDF) -- The largest volume of flow anticipated to occur during a continuous 30-day period, expressed as a daily average.

Maximum week design flow (MWDF) -- The largest volume of flow anticipated to occur during a continuous 7-day period, expressed as a daily average.

Method detection level (MDL) -- See Detection Limit.

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 permit specifies the area of the authorized mixing zone that Ecology defines following 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. It is the negative logarithm of the hydrogen ion concentration. A pH of 7 is defined as neutral and large variations above or below this value are considered harmful to most aquatic life.

Pass-through -- A discharge which exits the POTW into waters of the State in quantities or concentrations which, alone or in conjunction with a discharge or discharges from other sources, is a cause of a violation of any requirement of the POTW's NPDES permit (including an increase in the magnitude or duration of a violation), or which is a cause of a violation of State water quality standards.

Peak hour design flow (PHDF) -- The largest volume of flow anticipated to occur during a one-hour period, expressed as a daily or hourly average.

Peak instantaneous design flow (PIDF) -- The maximum anticipated instantaneous flow.

Point of compliance -- The location in the groundwater where the enforcement limit must not be exceeded and a facility must comply with the Ground Water Quality Standards. Ecology determines this limit on a site-specific basis. Ecology locates the point of compliance in the groundwater as near and directly downgradient from the pollutant source as technically, hydrogeologically, and geographically feasible, unless it approves an alternative point of compliance.

Potential significant industrial user (PSIU) --A potential significant industrial user is defined as an Industrial User that does not meet the criteria for a Significant Industrial User, but which discharges wastewater meeting one or more of the following criteria:

a. Exceeds 0.5 % of treatment plant design capacity criteria and discharges <25,000 gallons per day; or

b. Is a member of a group of similar industrial users which, taken together, have the potential to cause pass through or interference at the POTW (e.g. facilities which develop photographic film or paper, and car washes).

Ecology may determine that a discharger initially classified as a potential significant industrial user should be managed as a significant industrial user.

Quantitation level (QL) -- Also known as Minimum Level of Quantitation (ML) – The lowest level at which the entire analytical system must give a recognizable signal and acceptable calibration point for the analyte. It is equivalent to the concentration of the lowest calibration standard, assuming that the lab has used all method-specified sample weights, volumes, and

cleanup procedures. The QL is calculated by multiplying the MDL by 3.18 and rounding the result to the number nearest to (1, 2, or 5) x 10^n, where n is an integer (64 FR 30417).
ALSO GIVEN AS:
The smallest detectable concentration of analyte greater than the Detection Limit (DL) where the accuracy (precision & bias) achieves the objectives of the intended purpose. (Report of the Federal Advisory Committee on Detection and Quantitation Approaches and Uses in Clean Water Act Programs Submitted to the US Environmental Protection Agency, December 2007).

Reasonable potential -- A reasonable potential to cause a water quality violation, or loss of sensitive and/or important habitat.

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).

Sample Maximum -- No sample may exceed this value.

Significant industrial user (SIU) --

1) All industrial users subject to Categorical Pretreatment Standards under 40 CFR 403.6 and 40 CFR Chapter I, Subchapter N; and

2) Any other industrial user that: discharges an average of 25,000 gallons per day or more of process wastewater to the POTW (excluding sanitary, noncontact cooling, and boiler blow-down wastewater); contributes a process wastestream that makes up 5 percent or more of the average dry weather hydraulic or organic capacity of the POTW treatment plant; or is designated as such by the Control Authority* on the basis that the industrial user has a reasonable potential for adversely affecting the POTW's operation or for violating any pretreatment standard or requirement [in accordance with 40 CFR 403.8(f)(6)].

   Upon finding that the industrial user meeting the criteria in paragraph 2, above, has no reasonable potential for adversely affecting the POTW's operation or for violating any pretreatment standard or requirement, the Control Authority* may at any time, on its own initiative or in response to a petition received from an industrial user or POTW, and in accordance with 40 CFR 403.8(f)(6), determine that such industrial user is not a significant industrial user.

   *The term "Control Authority" refers to the Washington State Department of Ecology in the case of non-delegated POTWs or to the POTW in the case of delegated POTWs.

Slug discharge -- Any discharge of a non-routine, episodic nature, including but not limited to an accidental spill or a non-customary batch discharge to the POTW. This may include any pollutant released at a flow rate that may cause interference or pass through with the POTW or in any way violate the permit conditions or the POTW’s regulations and local limits.

Soil scientist -- An individual who is registered as a Certified or Registered Professional Soil Scientist or as a Certified Professional Soil Specialist by the American Registry of Certified Professionals in Agronomy, Crops, and Soils or by the National Society of Consulting Scientists or who has the credentials for membership. Minimum requirements for eligibility are: possession of a baccalaureate, masters, or doctorate degree from a U.S. or Canadian institution with a minimum of 30 semester hours or 45 quarter hours professional core courses in agronomy, crops or soils, and have 5, 3, or 1 year(s), respectively, of professional experience working in the area of agronomy, crops, or soils.

Solid waste -- All putrescible and non-putrescible solid and semisolid wastes including, but not limited to, garbage, rubbish, ashes, industrial wastes, swill, sewage sludge, demolition and construction wastes, abandoned vehicles or parts thereof, contaminated soils and contaminated dredged material, and recyclable materials.

Soluble BOD_5 -- Determining the soluble fraction of Biochemical Oxygen Demand of an effluent is an indirect way of measuring the quantity of soluble organic material present in an effluent that is utilized by bacteria. Although the soluble BOD_5 test is not specifically described in Standard Methods, filtering the raw sample through at least a 1.2 um filter prior to running the standard BOD_5 test is sufficient to remove the particulate organic fraction.

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 stormwater drainage system into a defined surface water body, or a constructed infiltration facility.

Technology-based effluent limit -- A permit limit based on the ability of a treatment method to reduce the pollutant.

Total coliform bacteria -- A microbiological test, which detects and enumerates the total coliform group of bacteria in water samples.

Total dissolved solids -- That portion of total solids in water or wastewater that passes through a specific filter.

Total maximum daily load (TMDL) -- A determination of the amount of pollutant that a water body can receive and still meet water quality standards.

Total suspended solids (TSS) -- Total suspended solids is the particulate material in an effluent. Large quantities of TSS discharged to a receiving water 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.

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 imposed on the concentration of an effluent parameter to prevent the concentration of that parameter from exceeding its water quality criterion after discharge into receiving waters.

Appendix D--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 in the PermitCalc workbook on Ecology's webpage at: https://www.ecy.wa.gov/Regulations-Permits/Guidance-technical-assistance/Water-quality-permits-guidance..

Simple Mixing:

Ecology uses simple mixing calculations to assess the impacts of certain conservative pollutants, such as the expected increase in fecal coliform bacteria at the edge of the chronic mixing zone boundary. Simple mixing uses a mass balance approach to proportionally distribute a pollutant load from a discharge into the authorized mixing zone. The approach assumes no decay or generation of the pollutant of concern within the mixing zone. The predicted concentration at the edge of a mixing zone (C_{mz}) is based on the following calculation:

$$C_{mz} = Ca + \frac{(Ce - Ca)}{DF}$$

where: Ce = Effluent Concentration
Ca = Ambient Concentration
DF = Dilution Factor

Reasonable Potential Analysis:

The spreadsheets Input 2 – Reasonable Potential, and LimitCalc in Ecology's PermitCalc Workbook determine reasonable potential (to violate the aquatic life and human health water quality standards) and calculate effluent limits. The process and formulas for determining reasonable potential and effluent limits in these spreadsheets are taken directly from the *Technical Support Document for Water Quality-based Toxics Control*, (EPA 505/2-90-001). The adjustment for autocorrelation is from EPA (1996a), and EPA (1996b).

Calculation of Water Quality-Based Effluent Limits:

Water quality-based effluent limits are calculated by the two-value wasteload allocation process as described on page 100 of the TSD (EPA, 1991) and shown below.

1. Calculate the acute wasteload allocation WLA_a by multiplying the acute criteria by the acute dilution factor and subtracting the background factor. Calculate the chronic wasteload allocation (WLA_c) by multiplying the chronic criteria by the chronic dilution factor and subtracting the background factor.

WLA_a = (acute criteria x DF_a) – [(background conc. x (DF_a - 1)]
WLA_c = (chronic criteria x DF_c) – [(background conc. x (DF_c -1)]

where: DF_a = Acute Dilution Factor
DF_c = Chronic Dilution Factor

2. Calculate the long term averages (LTA_a and LTA_c) which will comply with the wasteload allocations WLA_a and WLA_c.

$LTA_a = WLA_a \times e^{[0.5\sigma^2 - z\sigma]}$

where: $\sigma^2 = \ln[CV^2 + 1]$

$z = 2.326$

CV = coefficient of variation = std. dev/mean

$LTA_c = WLA_c \times e^{[0.5\sigma^2 - z\sigma]}$

where: $\sigma^2 = \ln[(CV^2 \div 4) + 1]$

$z = 2.326$

3. Use the smallest LTA of the LTA_a or LTA_c to calculate the maximum daily effluent limit and the monthly average effluent limit.

MDL = Maximum Daily Limit

$MDL = LTA \times e^{(Z\sigma - 0.5\sigma^2)}$

where: $\sigma^2 = \ln[CV^2 + 1]$

$z = 2.326$ (99th percentile occurrence)

LTA = Limiting long term average

AML = Average Monthly Limit

$AML = LTA \times e^{(Z\sigma_n - 0.5\sigma_n^2)}$

where: $\sigma^2 = \ln[(CV^2 \div n) + 1]$

n = number of samples/month

$z = 1.645$ (95^{th} % occurrence probability)

LTA = Limiting long term average

Ecology used this process to calculate chlorine limits carried over from the previous permit. We also used a modification of this method to calculate NBOD+CBOD limits. Since the TMDL establishes a Maximum Daily Limit as the Waste Load Allocation, we use that limit to back calculate the Long Term Average used to determine an appropriate Average Monthly Limit.

NBOD+CBOD Limit Calculations

1. Calculate Daily Maximum Limit based on TMDL Waste Load Allocations (WLAs)

Ammonia WLA	99	lbs/day
CBOD5 WLA, lbs/day	93	lbs/day
NBOD Exchange Rate	2.1	lbs NBOD per lb of ammonia
Equivalent NBOD+CBOD WLA	301	lbs/day
(Maximum Daily Limit)		

2. Calculate Long Term Average (LTA) from Maximum Daily Limit (MDL)

σ^2	0.307485	
z_{99}	2.326	
CV	0.60	
NBOD+CBOD LTA	97	lbs/day

3. Calculate Average Monthly Limit (AML) from LTA

# of Samples	8	per month
z_{95}	1.645	
σ_n^2	0.044017	
CV	0.60	
NBOD+CBOD AML	133.5	lbs/day

Reasonable Potential Calculations

Reasonable Potential Calculation

Facility	Snohomish WWTP
Water Body Type	Freshwater
Rec. Water Hardness	17.9 mg/L

Dilution Factors:	Acute	Chronic
Aquatic Life	11.0	28.0
Human Health Carcinogenic		28.0
Human Health Non-Carcinogenic		28.0

Pollutant, CAS No. & NPDES Application Ref. No.			AMMONIA, Criteria as Total NH3	ANTIMONY (INORGANIC) 7440361M	ARSENIC (dissolved) 7440382 2M	BIS(2-ETHYLHEXYL) PHTHALATE 117817 13B	CADMIUM - 7440439 4M Hardness dependent	CHLORODIBROMOMETHANE 124481 8V	CHLOROFORM 67663 11V	CHROMIUM(TRI) -16065831 5M Hardness dependent	COPPER - 7440508 6M Hardness dependent	DICHLOROBROMOMETHANE 75274 12V	LEAD - 7439921 7M Dependent on hardness
Effluent Data	# of Samples (n)		431	4	4	4	4	4	4	4	23	4	4
	Coeff of Variation (Cv)		1.28	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.19	0.6	0.6
	Effluent Concentration, ug/L (Max. or 95th Percentile)		19,400	0.5	0.8	0.7	0.03	3.9	42.6	1	16	1.6	1
	Calculated 50th percentile Effluent Conc. (when n>10)										11		
Receiving Water Data	90th Percentile Conc., ug/L		29		0.8		0			0.35	1.18	0	0.191
	Geo Mean, ug/L			0		0		0	0		0	0	0.002
Water Quality Criteria	Aquatic Life Criteria, ug/L	Acute	16,197	-	360	-	0.5723	-	-	134.11	3.3644	-	9.518
		Chronic	1,678	-	190	-	0.2882	-	-	43.503	2.6097	-	0.3709
	WQ Criteria for Protection of Human Health, ug/L		-	6	-	0.045	-	0.6	100	-	1300	0.73	-
	Metal Criteria	Acute	-	-	1	-	0.943	-	-	0.316	0.9885	-	0.466
	Translator, decimal	Chronic	-	-	1	-	0.943	-	-	0.86	0.9885	-	0.466
	Carcinogen?		N	N	Y	Y	N	Y	Y	N	N	Y	N

Aquatic Life Reasonable Potential

Effluent percentile value			0.950		0.950	0.950			0.950	0.950		0.950
s	$s^2=\ln(CV^2+1)$		0.985		0.555	0.555			0.555	0.188		0.555
Pn	$Pn=(1-\text{confidence level})^{1/n}$		0.993		0.473	0.473			0.473	0.878		0.473
Multiplier			1.00		2.59	2.59			2.59	1.00		2.59
Max concentration (ug/L) at edge of...		Acute	1,790		0.915	0.007			0.392	2.511		0.283
		Chronic	721		0.845	0.003			0.417	1.703		0.227
Reasonable Potential? Limit Required?			**NO**		**NO**	**NO**			**NO**	**NO**		**NO**

Human Health Reasonable Potential

s	$s^2=\ln(CV^2+1)$	0.5545	0.5545	0.5545	0.5545		0.1883	0.5545
Pn	Pn=(1-confidence level)1/n	0.473	0.473	0.473	0.473		0.878	0.473
Multiplier		1.0385	1.0385	1.0385	1.0385		0.8031	1.0385
Dilution Factor		28	28	28	28		28	28
Max Conc. at edge of Chronic Zone, ug/L		0.0185	0.026	1.4E-01	1.6E+00		0.3929	0.0593
Reasonable Potential? Limit Required?		**NO**	**NO**	**NO**	**NO**		**NO**	**NO**

Reasonable Potential Calculation - Page 2

Facility	Snohomish WWTP
Water Body Type	Freshwater
Rec. Water Hardness	17.9 mg/L

Dilution Factors:	Acute	Chronic
Aquatic Life	11.0	28.0
Human Health Carcinogenic		28.0
Human Health Non-Carcinogenic		28.0

Pollutant, CAS No. & NPDES Application Ref. No.		MERCURY 7439976 8M	NICKEL - 7440020 9M - Dependent on hardness	PHENOL 108952 10A	SELENIUM 7782492 10M	SILVER - 7740224 11M dependent on hardness.	ZINC- 7440666 13M hardness dependent					
Effluent Data	# of Samples (n)	4	4	4	4	4	4					
	Coeff of Variation (Cv)	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
	Effluent Concentration, ug/L (Max. or 95th Percentile)	0.0175	2	190	1	0.4	30					
	Calculated 50th percentile Effluent Conc. (when n>10)											
Receiving Water Data	90th Percentile Conc., ug/L	0.0022	0.54	0	0	0	5.45					
	Geo Mean, ug/L	0.036	0	0	0	0	0					
Water Quality Criteria	Aquatic Life Criteria, ug/L Acute	2.1	330.21	-	20	0.1789	26.641					
	Aquatic Life Criteria, ug/L Chronic	0.012	36.673	-	5	-	24.327					
	WQ Criteria for Protection of Human Health, ug/L	0.14	80	9000	60	-	1000					
	Metal Criteria Translator, decimal Acute	0.85	0.998	-	-	0.85	0.9217					
	Metal Criteria Translator, decimal Chronic	-	0.997	-	-	-	0.9217					
	Carcinogen?	N	N	N	N	N	N					

Aquatic Life Reasonable Potential

Effluent percentile value		0.950	0.950		0.950	0.950	0.950					
s	$s^2=\ln(CV^2+1)$	0.555	0.555		0.555	0.555	0.555					
Pn	$Pn=(1\text{-confidence level})^{1/n}$	0.473	0.473		0.473	0.473	0.473					
Multiplier		2.59	2.59		2.59	2.59	2.59					
Max concentration (ug/L) at edge of...	Acute	0.005	0.960		0.235	0.080	11.453					
	Chronic	0.004	0.705		0.092	0.037	7.808					
Reasonable Potential? Limit Required?		**NO**	**NO**		**NO**	**NO**	**NO**					

Human Health Reasonable Potential

s	$s^2=\ln(CV^2+1)$	0.5545	0.5545	0.5545	0.5545		0.5545					
Pn	Pn=(1-confidence level)1/n	0.473	0.473	0.473	0.473		0.473					
Multiplier		1.0385	1.0385	1.0385	1.0385		1.0385					
Dilution Factor		28	28	28	28		28					
Max Conc. at edge of Chronic Zone, ug/L		0.0354	0.0742	7.0467	0.0371		1.1E+00					
Reasonable Potential? Limit Required?		**NO**	**NO**	**NO**	**NO**		**NO**					

Ammonia Calculations

Freshwater Un-ionized Ammonia Criteria Calculation

Based on Chapter 173-201A WAC, amended November 20, 2006

		mixed @ Acute Boundary	mixed @ Chronic Boundary	mixed @ Whole River
INPUT				
1. Receiving Water Temperature (deg C):	18.2	18.8	18.5	18.5
2. Receiving Water pH:	7.4	6.4	6.9	7.5
3. Is salmonid habitat an existing or designated use?	Yes	Yes	Yes	Yes
4. Are non-salmonid early life stages present or absent?	Present	Present	Present	Present
OUTPUT				
Using mixed temp and pH at mixing zone boundaries?	no			
Ratio	21.132	Out of Range	30.111	18.616
FT	1.400	1.400	1.400	1.400
FPH	1.677	Out of Range	3.140	1.484
pKa	9.459	9.440	9.451	9.451
Unionized Fraction	0.008	0.001	0.003	0.010
Unionized ammonia NH3 criteria (mg/L as NH_3)				
Acute:	0.156	0.035	0.000	0.174
Chronic:	0.016	#VALUE!	0.006	0.021
RESULTS				
Total ammonia nitrogen criteria (mg/L as N):				
Acute:	16.197	**34.091**		13.921
Chronic:	1.678		**1.641**	1.653

Fecal Coliforms and Dissolved Oxygen Calculations

Calculation of Fecal Coliform at Chronic Mixing Zone

INPUT	
Chronic Dilution Factor	28.0
Receiving Water Fecal Coliform, #/100 ml	50
Effluent Fecal Coliform - worst case, #/100 ml	400
Surface Water Criteria, #/100 ml	*100*
OUTPUT	
Fecal Coliform at Mixing Zone Boundary, #/100 ml	**62**
Difference between mixed and ambient, #/100 ml	13

Conclusion: At design flow, the discharge has no reasonable potential to violate water quality standards for fecal coliform.

Calculation of Dissolved Oxygen at Chronic Mixing Zone

INPUT	
Chronic Dilution Factor	28.0
Receiving Water DO Concentration, mg/L	9.5
Effluent DO Concentration, mg/L	10.7
Effluent Immediate DO Demand (IDOD), mg/L	7
Surface Water Criteria, mg/L	*8*
OUTPUT	
DO at Mixing Zone Boundary, mg/L	**9.29**
DO decrease caused by effluent at chronic boundary, mg/L	**0.21**

Conclusion: At design flow, the discharge has no reasonable potential to violate water quality standards for dissolved oxygen.

Temperature Calculation

Freshwater Temperature Reasonable Potential and Limit Calculation

Based on WAC 173-201A-200(1)(c)(i)--(ii) and the Water Quality Program Guidance. All data inputs must meet WQ guidelines. The Water Quality temperature guidance document may be found at: https://fortress.wa.gov/ecy/publications/summarypages/0610100.html

	Core Summer Critera
INPUT	**July 1-Sept 14**
1. Chronic Dilution Factor at Mixing Zone Boundary	28.0
2. 7DADMax Ambient Temperature (T) (Upstream Background 90th percentile)	18.2 °C
3. 7DADMax Effluent Temperature (95th percentile)	26.9 °C
4. Aquatic Life Temperature WQ Criterion in Fresh Water	17.5 °C
OUTPUT	
5. Temperature at Chronic Mixing Zone Boundary:	18.5 °C
6. Incremental Temperature Increase or decrease:	0.3 °C
7. Maximum Allowable Incremental Temperature Increase:	0.3 °C
8. Maximum Allowable Temperature at Mixing Zone Boundary:	18.5 °C
A. If ambient temp is warmer than WQ criterion	
9. Does temp fall within this warmer temp range?	YES
10. Temperature Limit if Required:	NO LIMIT
B. If ambient temp is cooler than WQ criterion but within 28/(T_{amb}+7) and within 0.3 °C of the criterion	
11. Does temp fall within this incremental temp. range?	---
12. Temp increase allowed at mixing zone boundary, if required:	---
C. If ambient temp is cooler than (WQ criterion-0.3) but within 28/(T_{amb}+7) of the criterion	
13. Does temp fall within this Incremental temp. range?	---
14. Temp increase allowed at mixing zone boundary, if required:	---
D. If ambient temp is cooler than (WQ criterion - 28/(T_{amb}+7))	
15. Does temp fall within this Incremental temp. range?	---
16. Temp increase allowed at mixing zone boundary, if required:	---
RESULTS	
17. Do any of the above cells show a temp increase?	**NO**
18. Temperature Limit if Required?	**NO LIMIT**

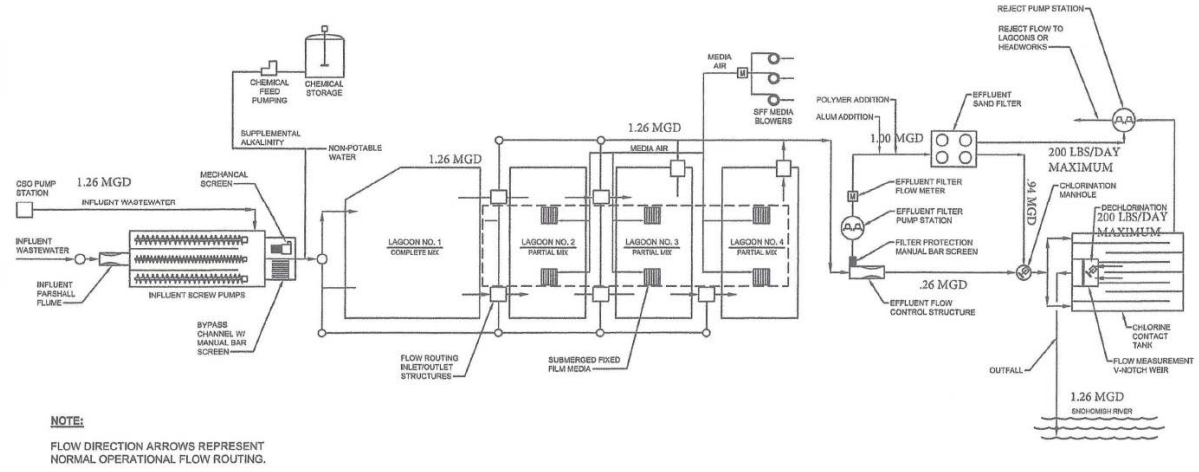
pH Calculation

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			
1. Dilution Factor at Mixing Zone Boundary	28.0	28.0	28.0
2. Ambient/Upstream/Background Conditions			
Temperature (deg C):	18.24	18.24	18.24
pH:	7.36	7.36	7.36
Alkalinity (mg CaCO3/L):	17.00	17.00	17.00
3. Effluent Characteristics			
Temperature (deg C):	24.80	24.80	24.80
pH:	6.00	6.40	9.00
Alkalinity (mg CaCO3/L):	136.00	136.00	136.00
OUTPUT			
1. Ionization Constants			
Upstream/Background pKa:	6.39	6.39	6.39
Effluent pKa:	6.35	6.35	6.35
2. Ionization Fractions			
Upstream/Background Ionization Fraction:	0.90	0.90	0.90
Effluent Ionization Fraction:	0.31	0.53	1.00
3. Total Inorganic Carbon			
Upstream/Background Total Inorganic Carbon (mg CaCO3/L):	19	19	19
Effluent Total Inorganic Carbon (mg CaCO3/L):	441	258	136
4. Condtions at Mixing Zone Boundary			
Temperature (deg C):	18.47	18.47	18.47
Alkalinity (mg CaCO3/L):	21.25	21.25	21.25
Total Inorganic Carbon (mg CaCO3/L):	33.93	27.37	23.04
pKa:	6.39	6.39	6.39
RESULTS			
pH at Mixing Zone Boundary:	**6.62**	**6.93**	**7.47**
Change in pH at Mixing Zone Boundary:	**-0.74**	**-0.43**	**0.11**

Appendix E--City of Snohomish WWTP Process Flow Diagram

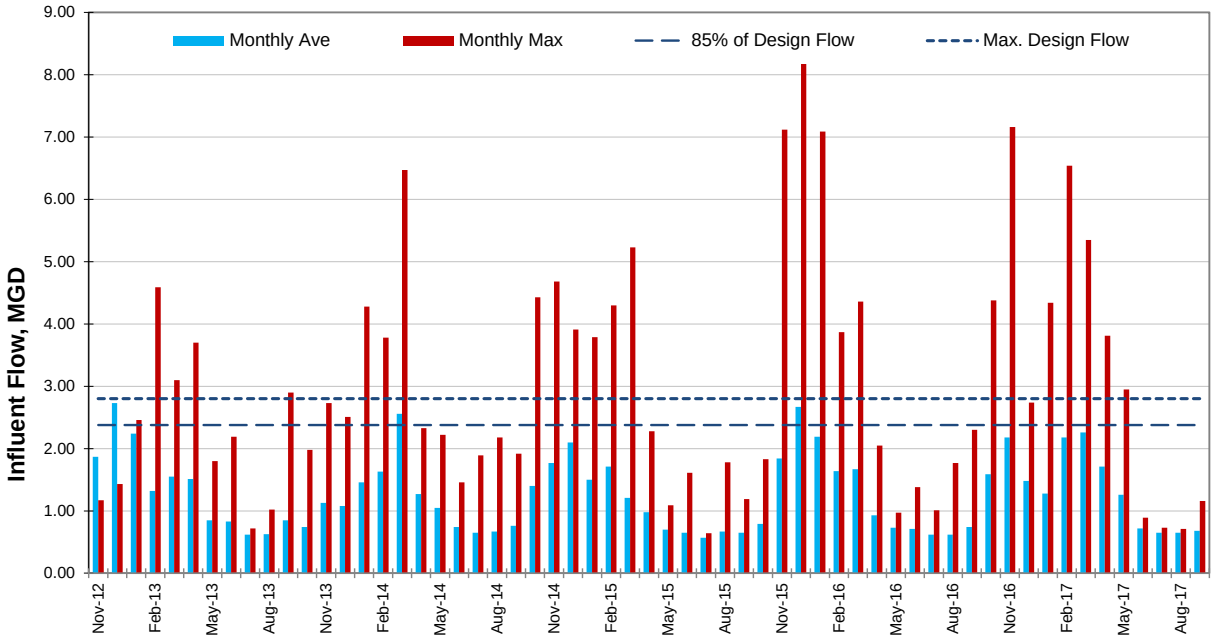


Appendix F--City of Snohomish WWTP Data

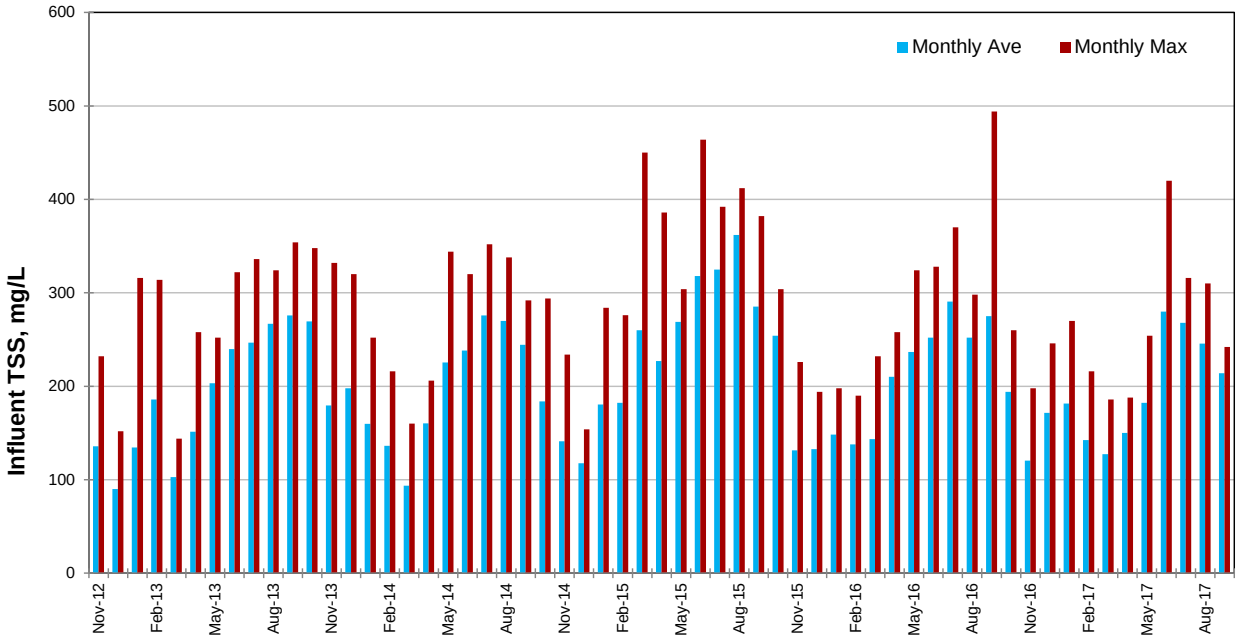
	Influent													
Date	Flow, MGD	Flow, MGD	BOD, mg/L	BOD, ppd	BOD, mg/L	BOD, ppd	CBOD, mg/L	CBOD, ppd	CBOD, mg/L	CBOD, ppd	TSS, mg/L	TSS, ppd	TSS, mg/L	TSS, ppd
	Monthly Ave	Monthly Max	Monthly Ave	Monthly Ave	Monthly Max	Monthly Max	Monthly Ave	Monthly Ave	Monthly Max	Monthly Max	Monthly Ave	Monthly Ave	Monthly Max	Monthly Max
November-12	1.9	1.2	156	2,560	218	5,017	138.5	2,160	185	1,805	136	1920	232	3,436
December-12	2.7	1.4	103	2,153	130	2,754	94.0	2,140	126	1,503	90	1846	152	3,423
January-13	2.2	2.5	125	1,921	185	2,626	125.1	2,337	223	4,575	135	2112	316	4,032
February-13	1.3	4.6	185	1,715	259	2,117	184.0	2,026	247	9,455	186	1826	314	2,647
March-13	1.6	3.1	129	1,769	144	2,610	114.5	1,480	145	3,749	103	1494	144	2,325
April-13	1.5	3.7	165	1,598	249	1,822	156.4	1,969	250	7,715	152	1441	258	1,880
May-13	0.9	1.8	234	1,817	278	2,538	220.6	1,564	274	4,113	203	1614	252	3,004
June-13	0.8	2.2	261	1,830	306	2,312	244.3	1,691	288	5,260	240	1804	322	2,797
July-13	0.6	0.7	321	1,624	350	1,839	314.9	1,628	370	2,222	247	1282	336	1,765
August-13	0.6	1.0	339	1,700	389	2,239	330.9	1,730	370	3,148	267	1372	324	2,027
September-13	0.9	2.9	340	1,941	390	2,439	322.1	2,284	368	8,900	276	1483	354	1,742
October-13	0.7	2.0	339	1,988	470	2,391	300.0	1,851	437	7,216	269	1617	348	2,510
November-13	1.1	2.7	198	1,664	250	1,942	195.3	1,840	245	5,578	180	1473	332	2,216
December-13	1.1	2.5	236	1,776	316	1,950	238.1	2,145	318	6,657	198	1448	320	1,975
January-14	1.5	4.3	189	2,216	257	3,663	159.1	1,938	230	8,210	160	1872	252	3,783
February-14	1.6	3.8	156	2,156	239	2,520	139.5	1,896	233	7,345	136	1725	216	2,573
March-14	2.6	6.5	125	2,449	168	2,861	104.3	2,226	177	9,551	94	1832	160	2,515
April-14	1.3	2.3	185	1,826	255	1,976	216.2	2,290	293	5,694	160	1736	206	2,906
May-14	1.0	2.2	212	1,620	260	1,744	222.8	1,949	290	5,369	226	1652	344	2,037
June-14	0.7	1.5	314	1,744	383	2,044	294.8	1,819	363	4,420	238	1329	320	1,708
July-14	0.7	1.9	318	1,556	368	1,719	314.6	1,705	384	6,053	276	1422	352	1,985
August-14	0.7	2.2	323	1,559	332	1,681	323.0	1,805	360	6,545	270	1846	338	5,891
September-14	0.8	1.9	328	2,724	427	3,907	304.9	1,932	419	6,709	245	1879	292	4,259
October-14	1.4	4.4	243	2,081	344	3,018	223.6	2,611	324	11,971	184	1606	294	2,583
November-14	1.8	4.7	158	1,964	240	2,632	158.6	2,342	263	10,265	141	1718	234	2,632
December-14	2.1	3.9	147	2,007	210	2,415	140.7	2,464	177	5,772	118	1901	154	3,924
January-15	1.5	3.8	162	1,703	208	1,821	178.1	2,228	257	8,123	181	1685	284	2,416
February-15	1.7	4.3	188	1,882	256	2,160	191.0	2,724	255	9,145	182	1938	276	3,828
March-15	1.2	5.2	258	2,200	322	2,567	249.0	2,513	319	13,914	260	2333	450	3,903
April-15	1.0	2.3	233	1,834	298	2,000	244.0	1,994	301	5,724	227	1716	386	2,930
May-15	0.7	1.1	323	2,082	400	2,536	324.0	1,892	412	3,745	269	1698	304	2,491
June-15	0.7	1.6	307	1,905	357	2,994	314.0	1,702	449	6,029	318	1848	464	2,981
July-15	0.6	0.6	401	1,887	476	2,183	379.0	1,802	485	2,589	325	1532	392	1,863
August-15	0.7	1.8	373	1,691	402	1,878	394.0	2,202	425	6,309	362	1830	412	2,912
September-15	0.7	1.2	363	1,963	436	2,678	357.6	1,939	409	4,059	285	1506	382	2,346
October-15	0.8	1.8	347	1,784	368	1,964	289.0	1,904	331	5,052	254	1507	304	1,985
November-15	1.8	7.1	167	2,089	244	2,714	176.4	2,707	261	15,498	131	1587	226	2,402
December-15	2.7	8.3	121	2,212	204	3,046	117.0	2,605	196	13,568	133	2140	194	3,122
January-16	2.2	7.1	158	2,446	190	3,668	143.0	2,612	216	12,772	148	2438	198	3,699
February-16	1.6	3.9	148	1,753	191	1,902	137.8	1,884	188	6,068	138	1737	190	2,946
March-16	1.7	4.4	154	1,775	199	2,063	148.0	2,061	181	6,582	143	1905	232	3,212
April-16	0.9	2.1	256	2,040	288	2,396	232.4	1,802	293	5,009	210	1578	258	2,130
May-16	0.7	1.0	287	1,633	313	1,921	273.0	1,662	311	2,516	237	1391	324	2,243
June-16	0.7	1.4	325	1,912	370	2,288	306.4	1,814	350	4,028	252	1423	328	2,055
July-16	0.6	1.0	343	1,693	416	2,047	330.5	1,709	434	3,656	291	1451	370	1,913
August-16	0.6	1.8	340	1,671	361	1,802	343.0	1,774	377	5,565	252	1241	298	1,466
September-16	0.7	2.3	299	1,802	336	2,173	298.0	1,839	377	7,232	275	1565	494	2,513
October-16	1.6	4.4	235	1,835	306	1,982	218.0	2,891	307	11,214	194	1941	260	3,183
November-16	2.2	7.2	125	1,937	190	2,276	125.5	2,282	175	10,450	120	1931	198	3,319
December-16	1.5	2.7	2	2,005	230	2,379	165.0	2,037	199	4,547	172	1882	246	3,076
January-17	1.3	4.3	176	1,971	209	3,512	161.2	1,721	196	7,094	181	1908	270	4,736
February-17	2.2	6.5	151	2,550	182	3,458	127.0	2,309	165	9,000	143	2613	216	4,909
March-17	2.3	5.4	115	2,237	142	2,626	105.9	1,996	135	6,024	127	2314	186	4,189
April-17	1.7	3.8	190	2,220	260	2,559	154.3	2,200	200	6,355	150	2195	188	4,385
May-17	1.3	3.0	198	1,988	279	2,484	188.2	1,978	297	7,307	182	1712	254	2,390
June-17	0.7	0.9	376	2,207	465	2,482	343.5	2,063	385	2,858	280	1643	420	2,242
July-17	0.7	0.7	361	1,921	410	2,209	337.3	1,828	398	2,423	268	1423	316	1,687
August-17	0.7	0.7	350	1,884	400	2,135	323.0	1,751	420	2,487	246	1333	310	1,655
September-17	0.7	1.2	373	1,984	416	2,151	385.0	2,183	470	4,547	214	1108	242	1,191
AVE:	1.3	3.0	237.8	1,943.3	297.3	2,437.8	231.2	2,041.2	297.2	6,463	204.7	1,717.0	288.8	2,794.8
MIN:	0.6	0.6	1.9	1,556.1	130.0	1,680.5	94.0	1,480.1	126.0	1,503	90.0	1,108.5	144.0	1,190.8
MAX:	2.7	8.3	401.0	2,724.1	476.0	5,016.7	394.0	2,890.8	485.0	15,498	362.0	2,612.7	494.0	5,890.7
Median	1.1	2.3	233.8	1,911.5	288.0	2,311.9	222.8	1,969.4	293.0	6,029	197.8	1,712.5	294.0	2,573.4
95th Percentile	2.3	7.1	373.0	2,458.9	438.9	3,663.4	359.7	2,621.3	438.2	12,852	293.5	2,316.2	423.0	4,420.1

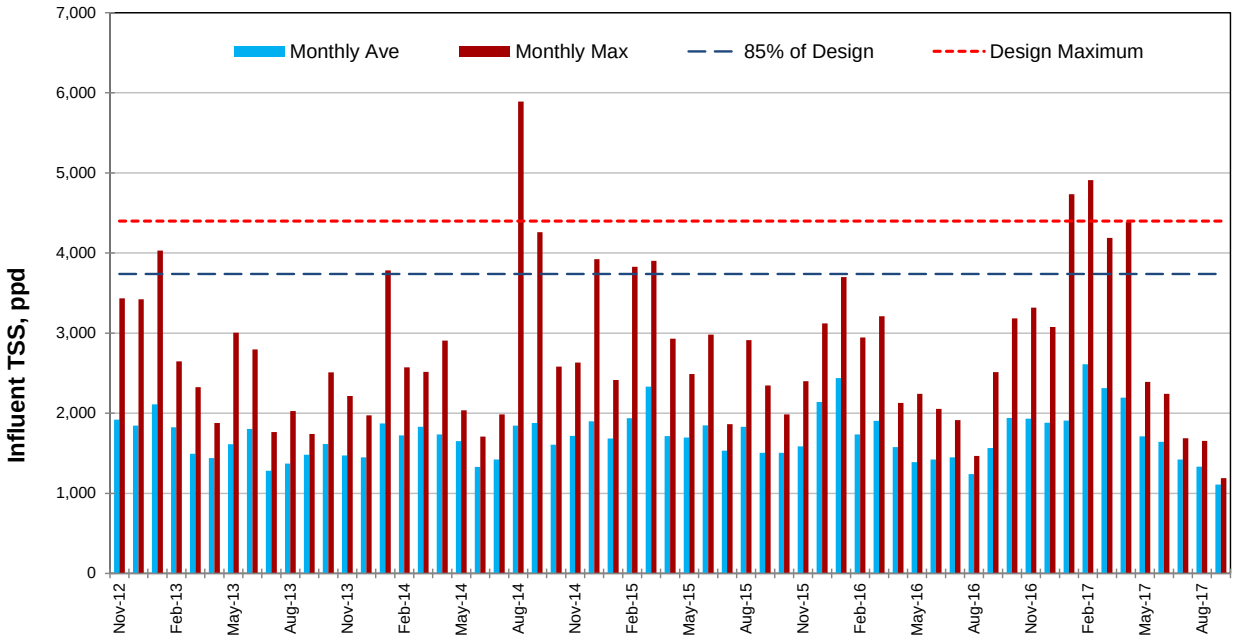
	Effluent																				
Date	Flow, MGD	Flow, MGD	CBOD, mg/L	CBOD, mg/L	CBOD, ppd	CBOD, ppd	CBOD, ppd	CBOD, % Removal	Ammonia, mg/l (as N)	Ammonia, ppd (as N)	TSS, mg/L	TSS, mg/L	TSS, ppd	TSS, ppd	TSS, % Removal	PH	PH	Fecal Coliform, #/100 ml	Fecal Coliform, #/100 ml	Chlorine, µg/L	Chlorine, µg/L
	Monthly Ave	Monthly Max	Monthly Ave	Wkly Ave	Monthly Ave	Wkly Ave	Monthly Max	Ave	Monthly Ave	Monthly Average	Monthly Ave	Wkly Ave	Monthly Ave	Wkly Ave	Ave	Min	Max	GEM	GM7	Monthly Ave	Daily Max
November-12	1.8	2.6	6.6	12.5	169	151	456.5	95	0.1	1.4	22	33	384	802	84	6.6	7.17	10.92	76.50	2.13	10
December-12	3.0	3.1	5.6	8.5	174	216	297.0	94	3.1	62.6	12	15	304	410	87	6.6	7.50	5.17	91.49	10.58	**291**
January-13	2.2	2.9	4.9	7.5	135	133	374.4	98	10.4	247.6	13	16	319	728	91	6.6	7.19	1.23	2.83	2.84	12
February-13	1.5	5.4	4.8	5.5	52	316	66.9	97	12.4	130.3	6	7	61	76	97	6.7	7.38	1.00	1.00	0.61	3
March-13	1.6	2.5	4.9	6.0	65	532	85.3	96	13.9	183.1	9	11	121	161	91	6.8	7.55	1.00	1.00	1.13	6
April-13	1.5	2.5	4.5	5.5	61	247	98.5	97	10.1	133.3	7	10	97	180	95	6.8	7.52	1.07	1.00	2.00	15
May-13	0.9	1.3	4.0	5.0	32	205	40.4	98	1.9	18.0	8	10	64	83	96	6.9	7.41	1.17	2.00	1.16	6
June-13	0.9	1.3	3.4	4.0	24	178	31.3	99	0.1	0.7	10	15	71	135	96	7.0	7.38	1.00	1.00	2.47	7
July-13	0.6	0.8	3.8	5.0	20	70	23.9	99	0.1	0.6	10	12	52	63	96	7.1	7.67	1.07	1.00	3.61	14
August-13	0.6	0.8	3.8	5.0	18	110	24.6	99	0.1	0.5	10	14	48	66	96	7.3	7.62	1.30	2.00	3.71	10
September-13	0.8	1.1	3.3	4.0	21	141	24.1	99	0.1	0.7	12	16	76	95	96	7.1	7.64	3.85	12.00	6.03	14
October-13	0.9	1.2	5.1	7.0	37	92	42.1	98	0.2	1.6	19	22	142	178	93	6.8	7.16	1.71	2.83	3.03	11
November-13	1.2	1.5	4.5	5.0	46	99	58.2	98	0.1	1.4	16	18	159	181	90	7.0	7.15	3.41	2.00	4.27	12
December-13	1.1	1.4	7.2	8.0	68	115	85.3	97	9.2	87.6	34	43	326	463	83	7.0	7.39	2.26	6.93	6.61	23
January-14	1.5	4.1	6.0	7.0	69	248	118.3	96	7.0	85.3	20	28	250	483	88	6.6	7.09	1.28	1.59	3.03	9
February-14	1.8	2.3	7.9	9.0	132	222	171.9	93	8.6	144.6	29	38	479	716	79	6.6	7.03	2.29	4.90	3.25	22
March-14	2.7	6.2	4.5	6.0	110	898	164.6	95	6.1	141.2	11	17	270	466	88	6.4	7.14	2.19	1.00	3.45	11
April-14	1.4	2.0	4.8	7.0	56	250	99.3	98	4.0	42.7	8	12	96	163	95	6.8	7.12	1.00	1.00	3.73	12
May-14	1.2	1.8	3.6	3.0	39	166	70.1	98	0.2	2.0	9	11	94	154	96	6.9	7.20	1.00	1.00	1.16	6
June-14	0.7	0.7	4.0	6.0	23	161	30.8	99	0.1	0.7	10	11	55	62	96	7.0	7.27	1.08	1.00	1.90	24
July-14	0.6	0.8	3.3	4.0	17	169	24.2	99	0.1	0.5	7	11	38	63	97	7.1	7.57	1.47	2.00	2.32	10
August-14	0.9	1.2	3.7	4.0	27	139	32.2	99	0.1	0.8	9	10	64	72	97	7.1	7.30	1.49	4.00	3.36	8
September-14	0.7	1.1	3.0	3.0	17	123	20.9	99	0.1	0.6	5	8	28	38	98	7.0	7.23	1.00	1.00	2.17	7
October-14	1.4	2.7	3.2	4.0	36	107	81.4	98	0.1	1.1	14	28	192	559	89	7.0	7.22	1.42	4.90	1.10	10
November-14	2.0	3.4	4.0	5.0	64	69	111.9	97	1.8	25.5	15	20	255	547	87	6.7	7.34	1.41	2.00	1.37	9
December-14	2.3	3.0	5.3	7.0	99	84	122.3	96	5.7	105.4	24	33	451	703	78	6.6	7.11	1.47	4.00	1.87	12
January-15	1.7	2.0	4.5	6.0	68	133	121.6	97	7.6	102.2	19	28	277	565	86	6.6	7.02	1.19	2.00	0.71	7
February-15	1.8	3.6	5.0	7.0	75	289	180.7	97	9.6	135.2	18	22	274	516	88	6.7	7.17	2.00	2.00	2.00	10
March-15	1.4	2.0	6.0	7.0	70	392	98.4	97	16.0	187.6	14	16	165	225	94	6.7	7.16	1.00	1.00	1.06	8
April-15	1.2	1.3	5.0	6.5	49	292	69.5	98	12.4	123.2	11	12	104	123	95	6.9	7.21	1.00	1.00	2.87	13
May-15	0.8	1.0	4.0	5.0	31	103	36.9	99	5.2	41.2	13	15	91	115	95	6.9	7.28	1.19	2.00	6.23	34
June-15	0.7	1.0	4.0	4.0	23	273	33.7	99	1.6	9.5	13	16	74	121	96	6.9	7.22	1.32	2.45	7.53	91
July-15	0.6	0.7	3.0	3.0	13	153	16.0	99	0.1	0.7	6	8	32	39	98	7.1	7.57	1.17	2.00	7.81	66
August-15	0.6	1.0	4.0	5.5	21	107	36.9	99	1.9	9.0	8	15	42	98	97	6.9	7.23	1.00	1.00	3.60	17
September-15	0.8	0.9	3.0	3.0	19	121	23.0	99	0.2	1.0	7	13	49	100	97	6.8	7.66	1.32	12.00	0.43	3
October-15	0.8	0.9	3.0	3.0	19	77	20.0	99	0.1	0.6	7	11	47	70	97	6.8	7.20	1.30	2.00	0.19	6
November-15	2.2	6.7	4.9	6.5	120	27	266.0	96	0.8	20.9	12	15	329	619	89	6.4	7.11	6.75	21.17	0.10	2
December-15	3.0	8.1	6.8	9.0	191	40	562.2	92	5.5	170.7	17	20	539	1,022	87	6.3	7.02	15.00	20.00	2.00	11
January-16	2.4	5.8	7.3	8.5	121	120	180.7	95	8.9	147.9	25	29	525	776	83	6.4	7.14	7.06	12.96	3.81	29
February-16	1.8	2.9	4.4	5.0	65	156	90.2	97	8.1	122.2	12	20	199	395	91	6.3	7.11	1.32	100.00	0.10	2
March-16	1.8	3.3	4.6	6.0	65	403	111.3	97	8.5	112.9	10	13	140	219	93	6.5	7.09	1.08	1.41	0.19	6
April-16	1.2	1.5	4.6	5.0	46	385	52.1	98	7.4	74.7	7	9	74	104	97	6.6	7.22	1.33	3.16	0.03	1
May-16	0.8	1.1	3.8	4.0	26	75	26.7	97	0.1	0.7	4	5	25	33	99	7.1	7.33	3.04	7.75	0.52	7
June-16	0.8	1.1	5.2	7.5	36	70	63.8	98	0.1	0.7	7	9	47	64	97	7.1	7.40	1.29	3.16	9.10	26
July-16	0.7	0.8	3.8	4.0	21	138	25.0	99	0.1	0.6	5	6	31	38	98	7.1	7.37	2.28	4.47	11.32	28
August-16	0.7	1.2	4.0	4.0	30	92	36.2	99	0.1	0.8	9	13	63	70	96	7.1	7.43	3.63	8.94	9.83	25
September-16	0.8	1.3	3.9	4.5	27	167	35.9	99	0.1	0.7	6	8	40	67	98	7.2	7.40	2.18	2.00	5.33	33
October-16	1.6	2.7	4.0	4.5	45	27	66.2	98	0.1	1.1	8	11	88	143	96	7.0	7.44	4.81	8.37	1.71	9
November-16	2.2	4.2	4.8	9.0	109	26	304.6	96	0.2	2.8	10	24	237	811	92	7.0	7.40	5.53	23.62	2.47	11
December-16	1.8	3.6	5.9	6.5	78	63	104.7	96	10.9	131.6	18	23	235	332	89	6.9	7.38	3.00	5.00	5.00	37
January-17	1.6	2.3	6.4	9.0	83	44	136.1	96	15.1	189.1	26	37	327	549	86	6.9	7.54	3.42	10.58	5.00	81
February-17	2.4	4.0	7.0	8.0	133	150	176.8	94	11.4	206.0	17	23	339	500	88	6.6	7.34	3.00	4.00	0.20	5
March-17	2.4	3.7	6.3	7.5	132	216	189.7	94	13.7	280.8	12	16	250	341	90	6.6	7.27	2.29	3.00	0.06	1
April-17	1.9	2.5	4.9	6.0	72	146	89.8	97	11.8	173.4	7	11	102	163	95	7.1	7.52	2.18	2.83	0.13	4
May-17	1.4	2.3	4.7	7.0	58	117	118.8	98	1.0	12.8	7	9	79	152	96	7.2	7.56	2.40	3.74	2.35	10
June-17	0.8	1.1	3.3	4.0	20	217	24.6	99	0.1	0.6	7	8	45	66	98	7.3	7.62	2.00	2.00	6.30	17
July-17	0.6	0.7	4.1	4.5	20	121	21.6	99	0.1	0.5	5	7	25	34	98	7.5	7.76	2.22	2.00	16.50	24
August-17	0.6	0.6	4.3	5.5	22	105	27.8	99	0.1	0.4	4	7	22	33	98	7.5	7.92	6.25	7.83		
September-17	0.6	1.4	5.0	5.0	31	99	39.0	99	0.1	0.7	4	5	24	39	98	7.5	7.90	32.00	139.00	0.00	0
AVE:	1.4	2.3	4.7	5.8	60	173	104.1	97.4	4	62.4	12	16	160	274	93	6.9	7.3	3.0	11.1	3.3	20.7
MIN:	0.6	0.6	3.0	3.0	13	26	16.0	92.0	0.1	0.4	4	5	22	33	78	6.3	7.0	1.0	1.0	0.0	0.0
MAX:	3.0	8.1	7.9	12.5	191	898	562.2	99.3	16	280.8	34	43	539	1022	99	7.5	7.9	32.0	139.0	16.5	291.0
Median	1.2	1.8	4.5	5.5	46	138	69.5	97.8	2	12.8	10	14	96	154	95	6.9	7.3	1.5	2.8	2.4	10.5
95th Percentile	2.5	5.9	7.0	9.0	138	393	311.6	99.0	14	190.7	25	33	454	779	84	7.3	7.7	7.4	78.0	9.9	68.3

City of Snohomish WWTP Influent – Flow

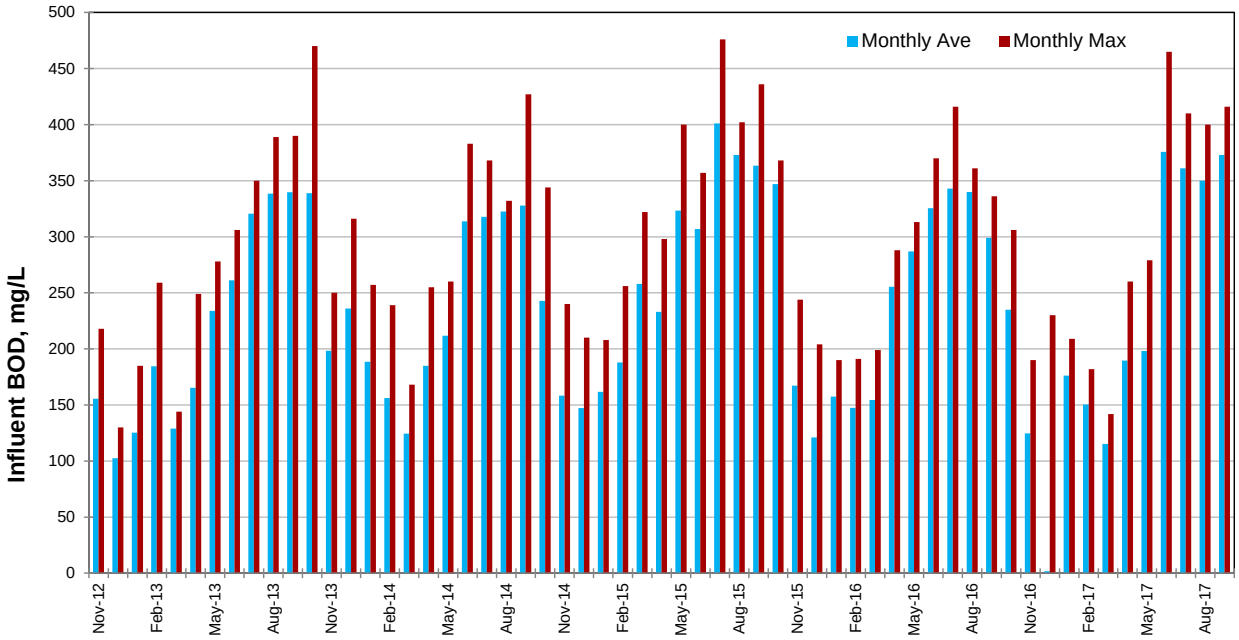


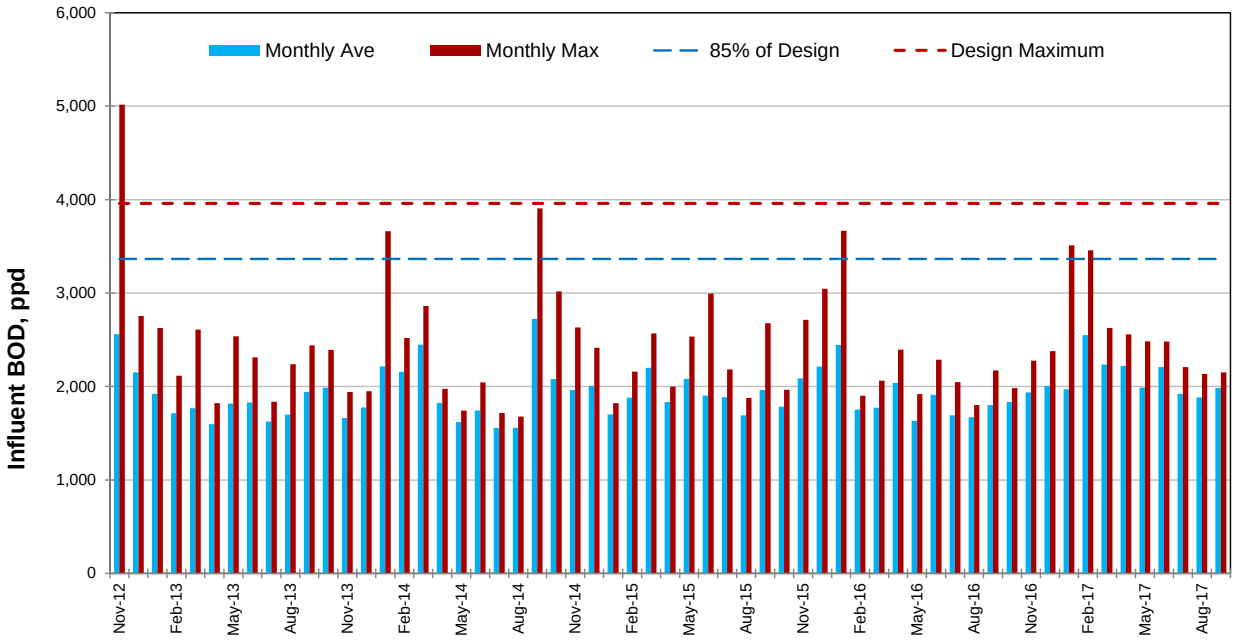
City of Snohomish WWTP Influent – TSS



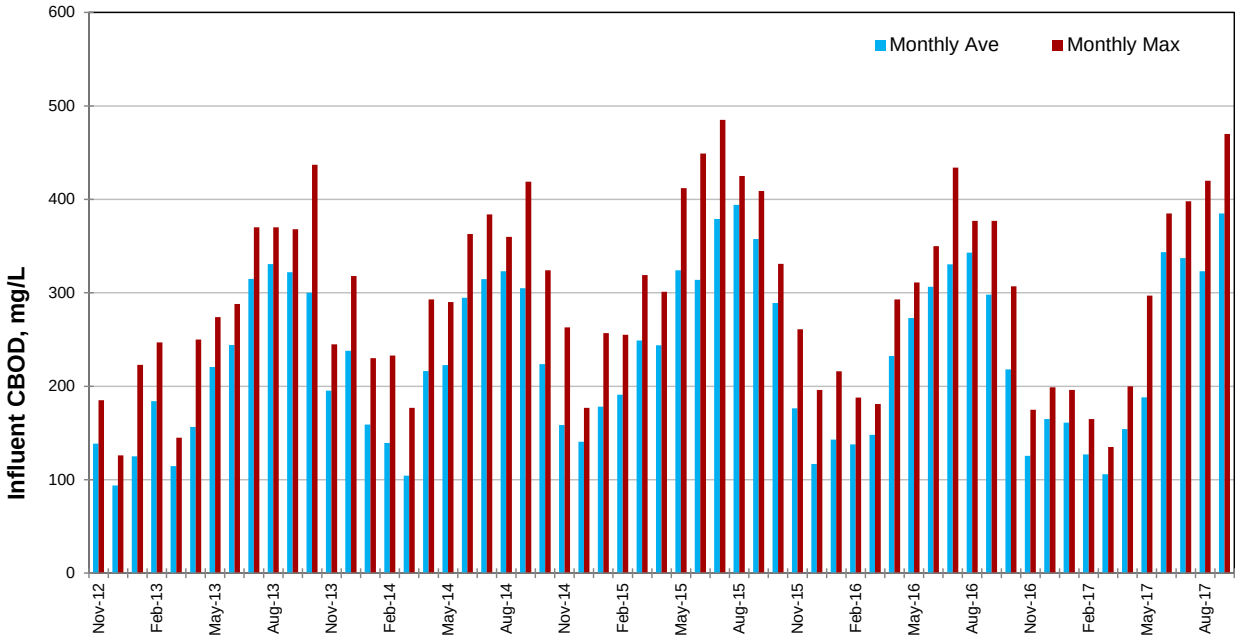


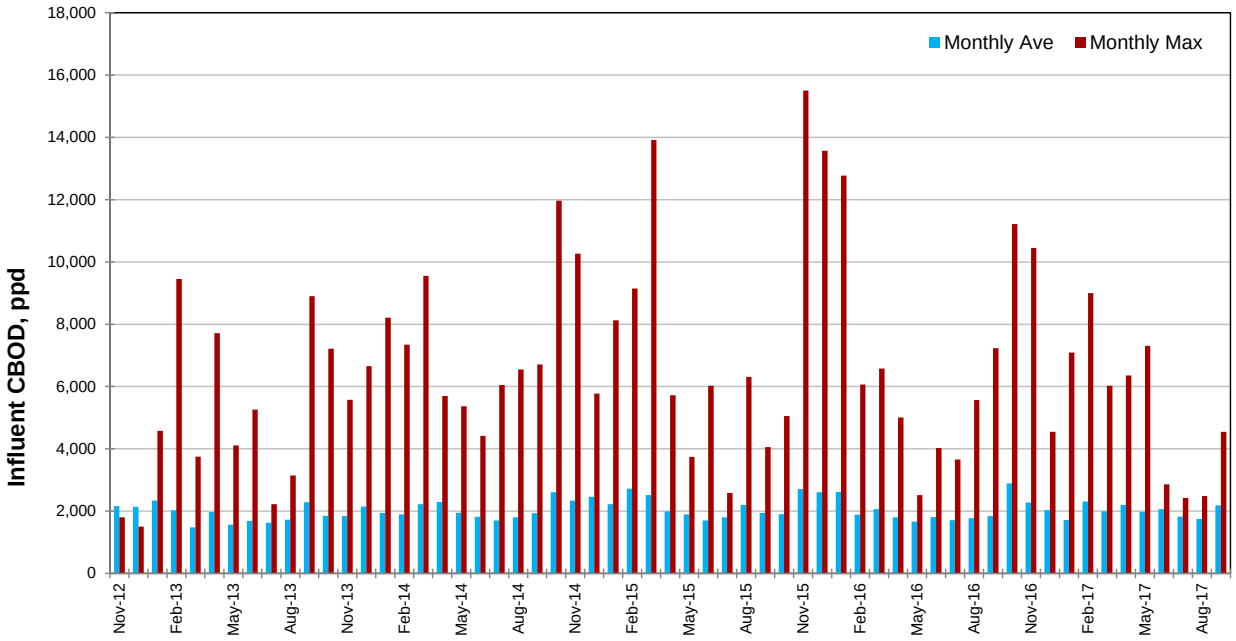
City of Snohomish WWTP Influent – BOD_5



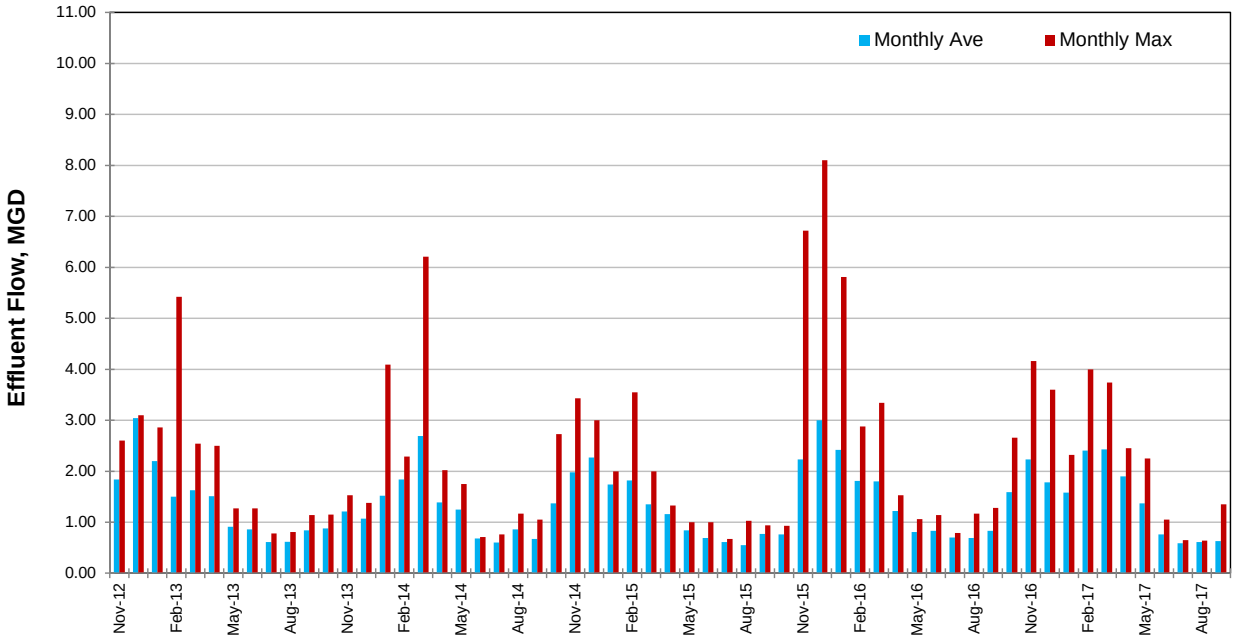


City of Snohomish WWTP Influent – $CBOD_5$

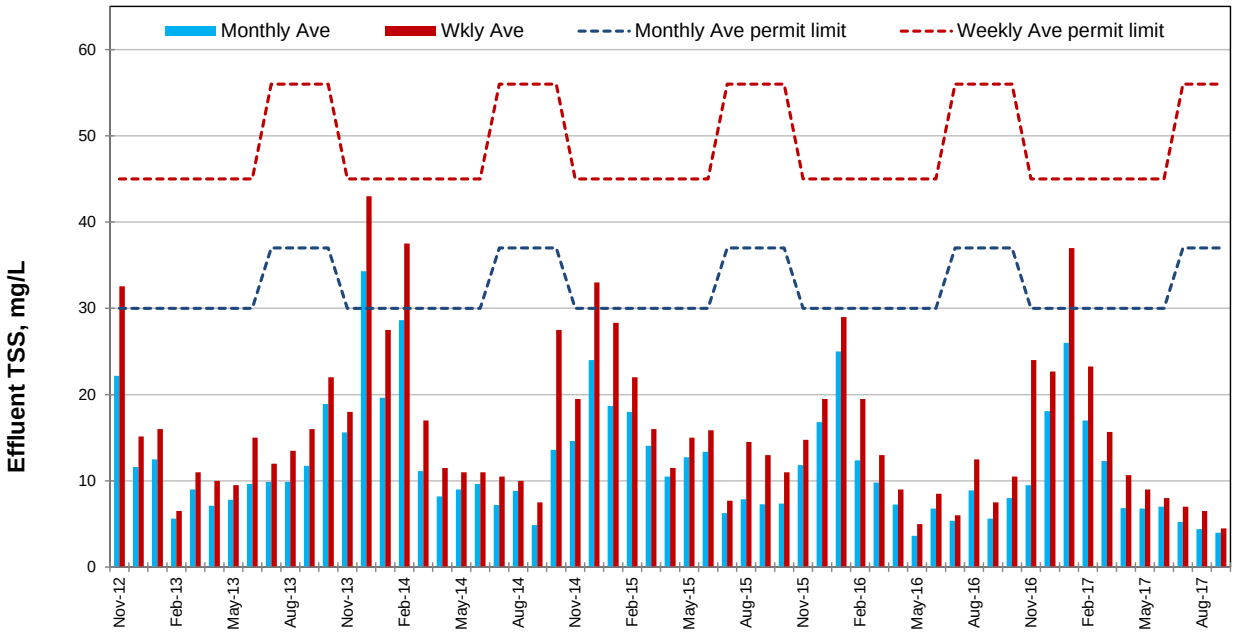


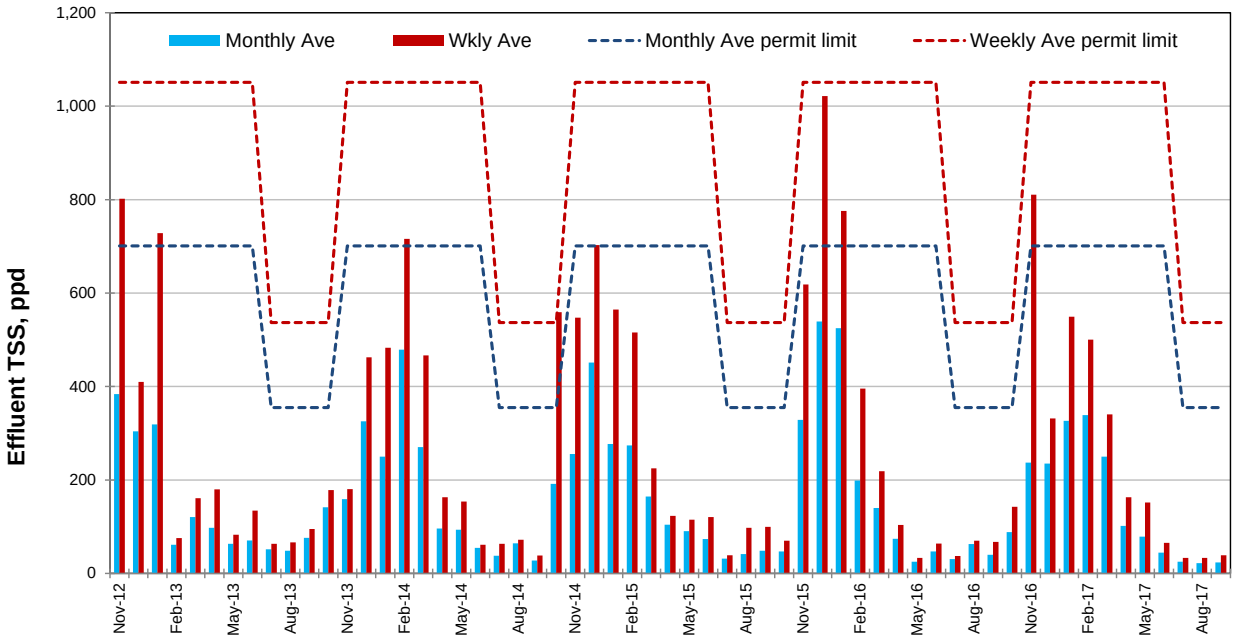


City of Snohomish WWTP Effluent – Flow

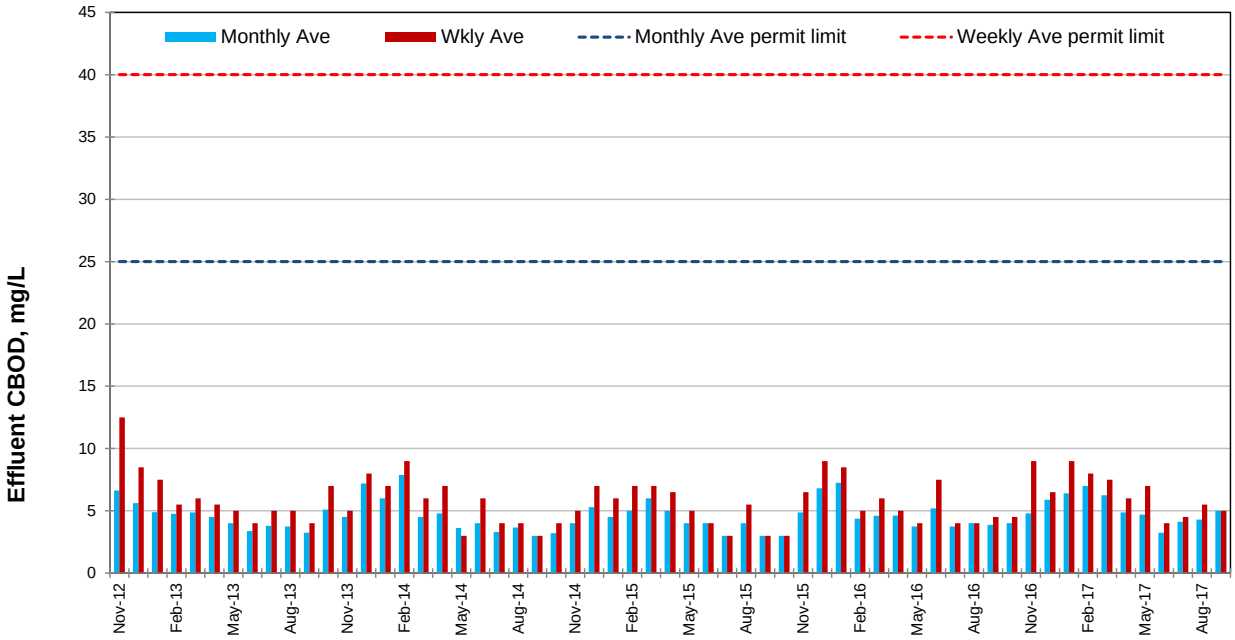


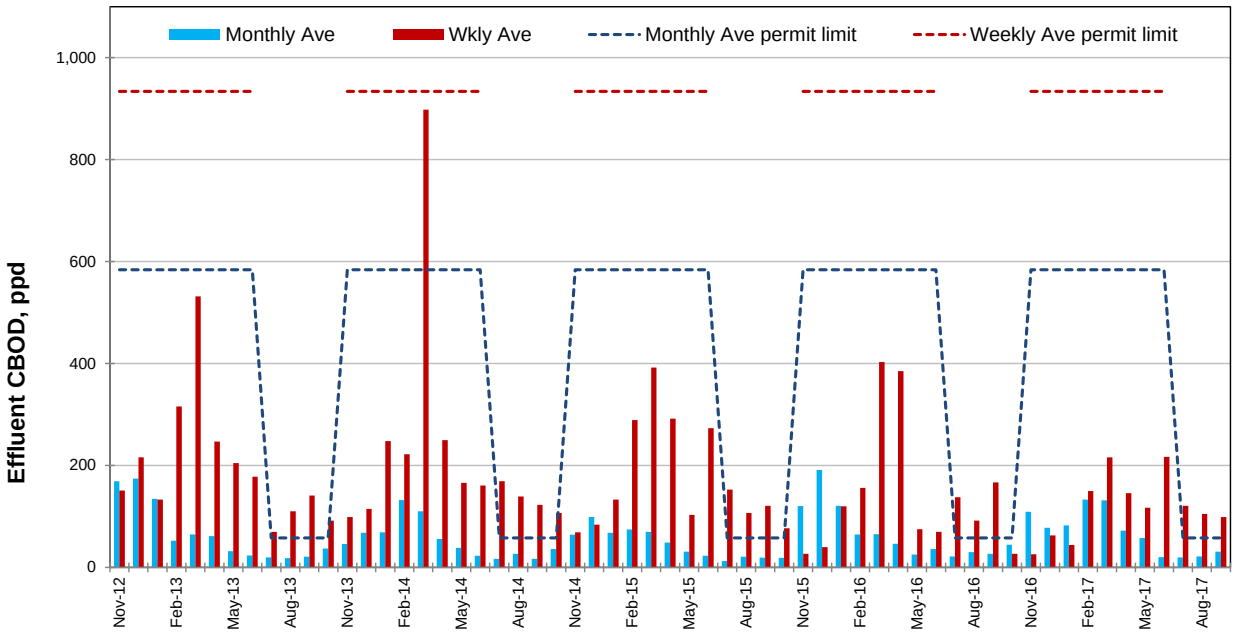
City of Snohomish WWTP Effluent – TSS



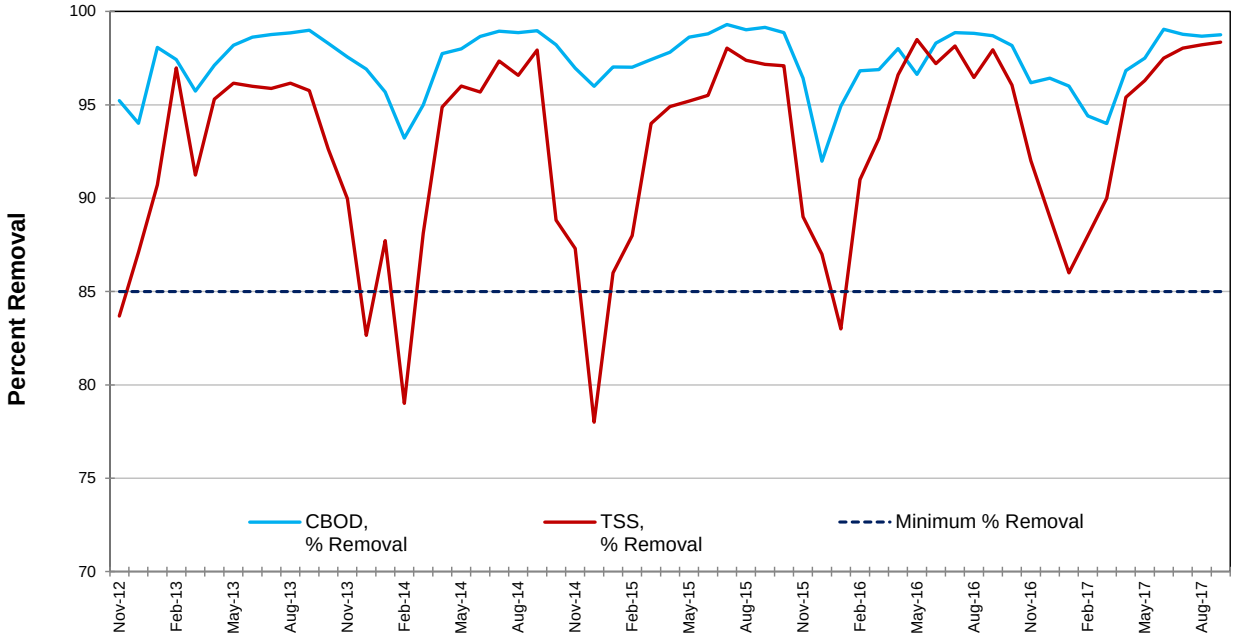


City of Snohomish WWTP Effluent – $CBOD_5$

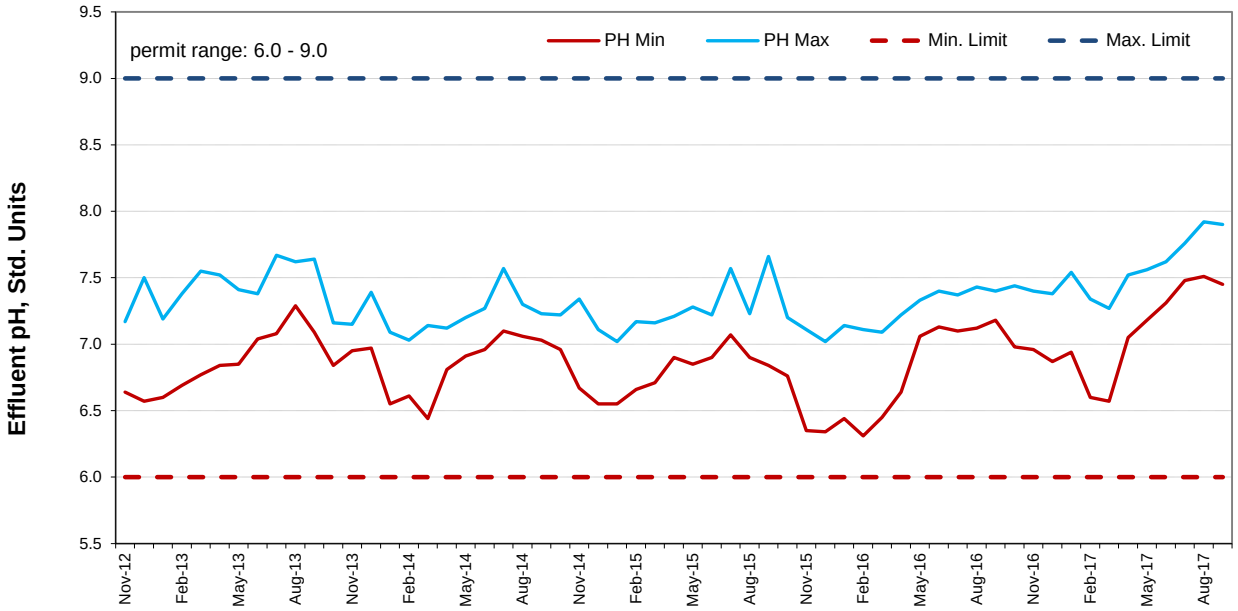




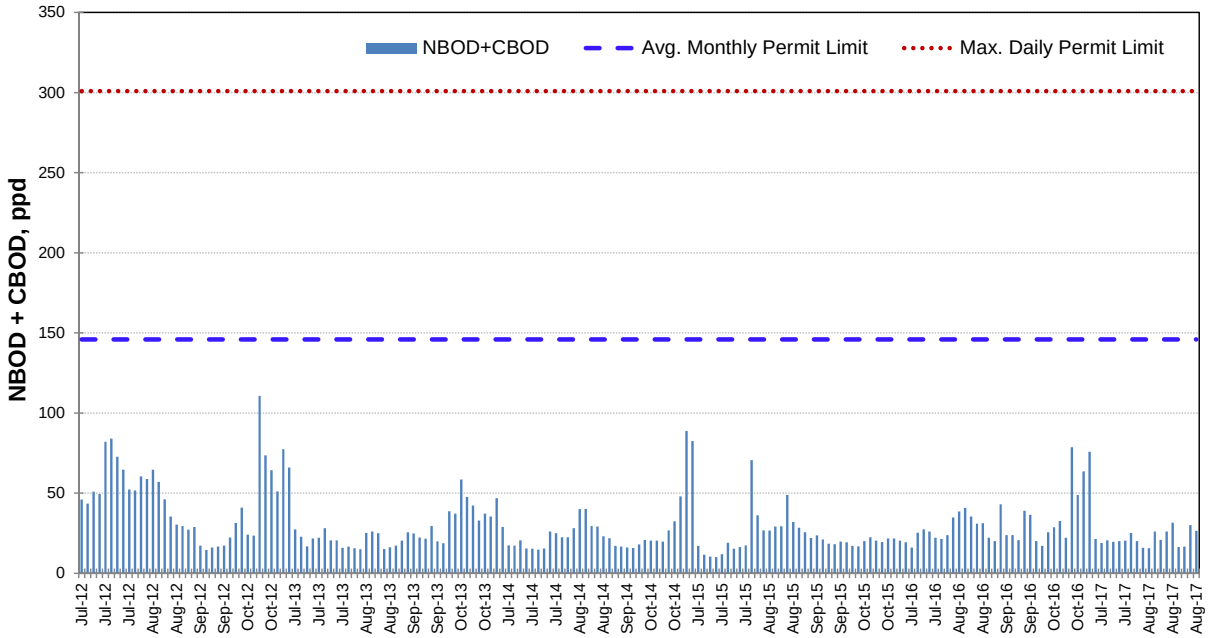
CBOD and TSS Percent Removals



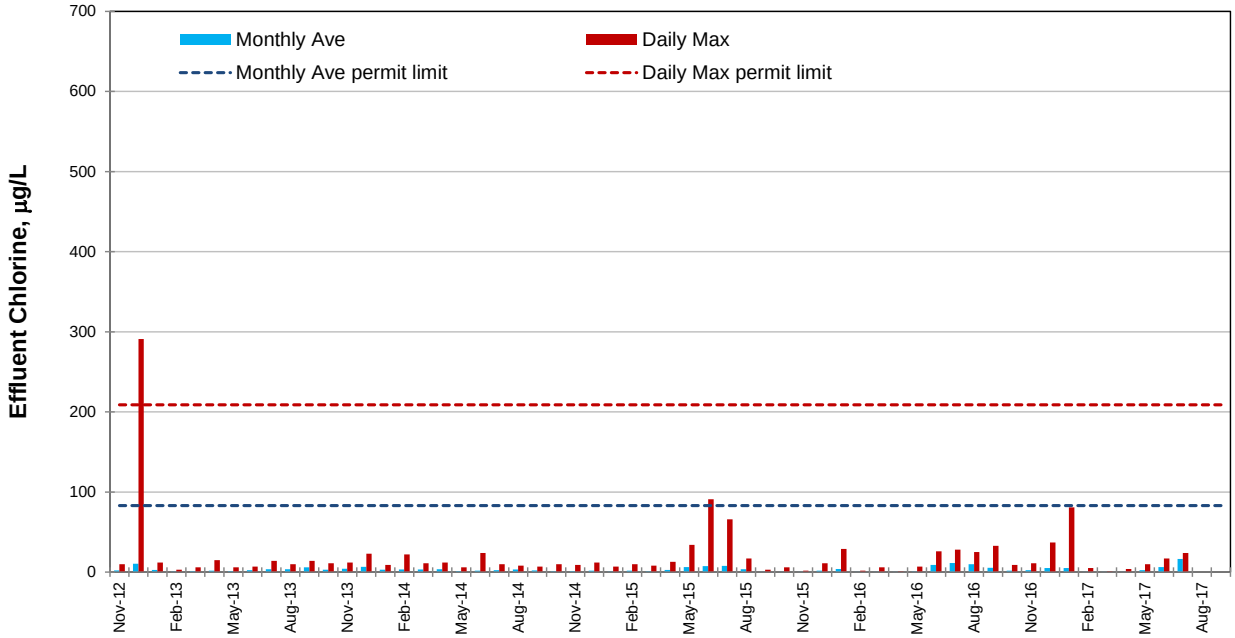
Effluent pH

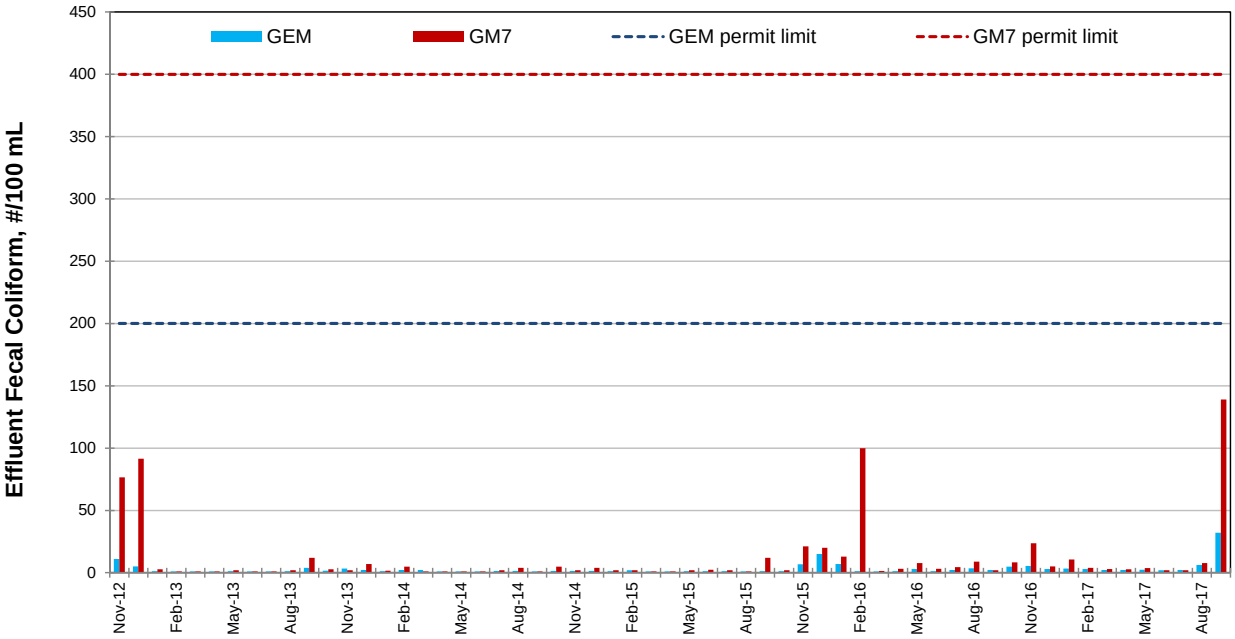


City of Snohomish WWTP Effluent – NBOD + CBOD



City of Snohomish WWTP Effluent – Chlorine and Fecal Coliform





Summary of WET Test Results

WET Test Results for Snohomish WWTP (WA00229548)								
Scheduled	**Test Code**	**Collected**	**Start Date**	**Duration**	**Organism**	**Endpoint**	**Effluent Survival (100%)**	**Met Performance Standard?**
2017 January	JAMM0061	1/21/2016	1/22/2016	Acute	*Ceriodaphnia dubia* Water flea	48-Hour Survival	100%	Yes
2017 January	JAMM0062	1/21/2016	1/22/2016	Acute	*Pimephales promelas* Fathead minnow	96-Hour Survival	65.0%	Yes
2017 February	JAMM0063	4/11/2016	4/12/2016	Chronic	*Ceriodaphnia dubia* Water flea	7-Day Survival & Repro	100.0%	Yes
2017 February	JAMM0064	4/11/2016	4/12/2016	Chronic	*Pimephales promelas* Fathead minnow	7-Day Survival & Growth	90%	Yes
2017 March	JAMM0065	7/13/2016	7/13/2016	Acute	*Ceriodaphnia dubia* Water flea	48-Hour Survival	100.0%	Yes
2017 August	JAMM0066	7/13/2016	7/13/2016	Acute	*Pimephales promelas* Fathead minnow	96-Hour Survival	100%	Yes
2017 May	JAMM0067	10/3/2016	10/4/2016	Chronic	*Ceriodaphnia dubia* Water flea	7-Day Survival & Repro	100%	Yes
2017 May	JAMM0068	10/3/2016	10/4/2016	Chronic	*Pimephales promelas* Fathead minnow	7-Day Survival & Growth	100%	Yes

NOEC, LOEC, and PMSD as Percent Effluent Acute WET Test Results for Snohomish WWTP (WA00229548)								
Scheduled	**Test Code**	**Collected**	**Start Date**	**Organism**	**Endpoint**	**NOEC**	**LOEC**	**PMSD**
2016 January	JAMM0061	1/21/2016	1/22/2016	*Ceriodaphnia dubia* Water flea	48-Hour Survival	100%	>100%	9.2%
2016 January	JAMM0062	1/21/2016	1/22/2016	*Pimephales promelas* Fathead minnow	96-Hour Survival	65%	>100%	12.9%
2016 July	JAMM0065	7/13/2016	7/13/2016	*Ceriodaphnia dubia* Water flea	48-Hour Survival	100%	>100%	n/a%
2016 July	JAMM0066	7/13/2016	7/13/2016	*Pimephales promelas* Fathead minnow	96-Hour Survival	100%	>100%	5.6%

LOEC = Lowest observed effect concentration.
NOEC = No observed effect concentration.
PMSD = Percent minimum significant difference.

NOEC, LOEC, and PMSD as Percent Effluent Chronic WET Test Results for Snohomish WWTP (WA00229548)								
Scheduled	**Test Code**	**Collected**	**Start Date**	**Organism**	**Endpoint**	**NOEC**	**LOEC**	**PMSD**
2016 April	JAMM0063	4/11/2016	4/12/2016	*Ceriodaphnia dubia*	7-day Survival	100%	>100%	n/a
				Water flea	Reproduction	100%	>100%	13.0%
2016 April	JAMM0064	4/11/2016	4/12/2016	*Pimephales promelas*	7-day Survival	100%	>100%	7.5%
				Fathead minnow	Biomass	50%	100%	18.1%
					Weight	100%	>100%	17.9%
2016 October	JAMM0067	10/3/2016	10/4/2016	*Ceriodaphnia dubia*	7-day Survival	100%	>100%	n/a
				Water flea	Reproduction	100%	>100%	27.0%
2016 October	JAMM0068	10/3/2016	10/4/2016	*Pimephales promelas*	7-day Survival	100%	>100%	10.4%
				Fathead minnow	Biomass	50%	100%	16.1%
					Weight	199%	>100%	20.8%

LOEC = Lowest observed effect concentration.
NOEC = No observed effect concentration.
PMSD = Percent minimum significant difference.

Appendix G--Response to Comments

City of Snohomish Entity Review Comments:

The City appreciates the opportunity to submit its preliminary comments to the draft Permit and Fact Sheet, which were provided to the City's Wastewater Treatment Plant Operator, Duane Leach, on February 26, 2018. The email transmitting the draft documents, which encompass about 150 pages, stated that the City's comments were due March 19th.

Comments to Draft Permit:

Summary of Permit Report Submittals (page 5):

City's Comment # 1: Summary of Permit Report Submittals (S5.G): Operations and Maintenance Manual Update - The following footnote should be added to submittal date portion of the chart, to be consistent with the language of S5.G: "This submittal date applies only if the City decides to fully implement PAA as its primary method of disinfection, or makes any other significant modifications/upgrades to the WWTP."

Ecology's Response*: Section S5.G. - Operations and maintenance (O&M) manual of the NPDES permit No. WA0029548 - establishes that the City of Snohomish (City) will update the O&M manual only if the City decides to fully implement PAA as its primary method of disinfection.*

City's Comment # 2: Summary of Permit Report Submittals (S8.1): Compliance Schedule: Engineering Report - The following footnote should be added to the submittal date portion of the chart to be consistent with the language of S8.1: "This submittal date applies only if the City decides to fully implement PAA as its primary method of disinfection."

Ecology's Response*: Section S8 of the NPDES permit No. WA0029548 establishes that the Engineering Report will be required only if the City decides to fully implement PAA as its primary method of disinfection.*

City's Comment # 3: Summary of Permit Report Submittals (S8.2): Compliance Schedule: Plans and Specifications - The following footnote should be added to the submittal date portion of the chart to be consistent with the language of S8.2: "This submittal date applies only if the City decides to fully implement PAA as its primary method of disinfection."

Ecology's Response*: Section S8 of the NPDES permit No. WA0029548 establishes that the Plans and Specifications will be required only if the City decides to fully implement PAA as its primary method of disinfection.*

S1.A Effluent Limit for Copper:

City's Comment # 4: As mentioned during our phone call with Laura Fricke on March 15, 2018, the City has significant concerns with the copper limit that Ecology has included in the Permit for at least the following reasons. First, the City was not told that Ecology was going to impose copper limits before receiving the draft Permit. The City's current NPDES permit does not impose copper limits. Second, the limits were calculated based on a reasonable potential analysis that considered only four samples, which is an extremely limited sample set. Third, if the City had been forewarned of a reasonable potential to exceed water quality limits for copper, it would have collected at least 20 samples and provided the sampling data to Ecology for a more representative reasonable potential analysis. The City is providing Ecology additional copper data with these preliminary comments, but also requests an additional 30 days within which to collect at least a total of 20 samples to provide Ecology with a more representative data set.

Ecology's Response: *Ecology is unable to communicate to the permittees whether a discharge limit has been established or not until Ecology completes the statistic analysis and the reasonable potential calculations. Per phone conversation with the City and BHC Consultants on February 26, 2018, Ecology communicated the results of the reasonable potential analysis (RPA) and requested additional copper data. The updated RPA using additional data shows that copper poses no risk to exceed the water quality criteria at the critical conditions using procedures given in EPA, 1991 guidelines. As a result, the proposed permit has no water quality-based limits for copper.*

S2.A Monitoring Schedule:

City's Comment # 5: Footnote 11 – The City requests that reported measurement of the initial PAA concentration be removed. This parameter is only used for process control and does not directly impact effluent quality. As stated in Section 13.2.2.1 regarding monitoring guidelines in Ecology's Permit Writer's Manual "Process control monitoring should not be required in permits." If the requirement to report measurements of the initial PAA concentration is not removed, the City requests that this provision be revised to allow the use of daily grab samples as an alternate to a continuous online measurement. The City has not definitively identified a probe type/configuration that can produce reliable measurements at the low concentration doses that would be applied. Currently, the City is testing at least one alternate probe configuration and may continue to explore options to achieve a reliable probe type/configuration during testing or eventual startup if a full-scale installation is to be implemented.

Ecology's Response: *Ecology has maintained this requirement because the City is still conducting PAA pilot testing. Once the pilot testing is completed, the City will switch back to chlorine disinfection and the initial PAA monitoring will no longer be required.*

City's Comment # 6: TSS Composite Sampling – It is noted that the influent TSS composite sampling is proposed to increase from twice to four times a week during the months of November through March. The effluent TSS sampling will remain at twice per week, so a % removal will not be calculated for every influent TSS sample. To provide "representative sampling" as discussed in Section S2.C, please confirm that the City has the flexibility to also conduct effluent TSS composite sampling up to four times per week during the months of November through March concurrent with the influent TSS composite sampling.

Ecology's Response: *Ecology confirms that the City has the flexibility to monitor effluent TSS up to four times per week during the months of November through March. The primary purpose of the increased monitoring frequency of the TSS influent is to better characterize the influent wastewater.*

S4.E Infiltration and Inflow Evaluation:

City's Comment # 7: The City requests that this Permit condition be eliminated for the following reasons. The City is currently in the process of preparing an updated General Sewer Plan, which evaluates the entire collection system, including consideration of impacts due to I/I. The City knows that there is excessive I/I because a significant portion of the City's collection system is a combined system. The City is including plans for further sewer separation in the capital improvement program of the General Sewer Plan, which will reduce inflow. This will have the greatest impact in reducing I/I as compared to pipeline replacement in other areas that already have separate sewers. This approach will also help further limit CSO events at both of the City's CSO outfalls, even though both outfalls are already controlled to the required standards. For these reasons, further evaluation of I/I will provide no additional information beyond that which will be addressed in the updated General Sewer Plan.

Ecology's Response: *Per phone conversation with the City on March 20, 2018, Ecology has changed the due date of the Infiltration and Inflow Evaluation to June 30, 2019, which is approximately two months after the General Sewer Plan's completion (March 2019). The I/I evaluation that will be included in the General Sewer Plan will be accepted as a submission of the permit requirement and no further I/I evaluation will be required during this permit cycle.*

S9.A Effluent Mixing Plan of Study and Mixing Plan Report:

City's Comment # 8: The General Sewer Plan update that is currently in progress includes initial justification for increasing the rated capacity of the WWTP. The re-rating effort will require conducting a mixing zone study. To allow the City sufficient time within which to finalize the updated General Sewer Plan, submit it to Ecology for the review and approval process, and if approved, to begin the mixing zone study, the Permit's timelines for the mixing zone study and plan report must be extended by at least 12 months from Ecology's approval date of GSP.

Ecology's Response: *Ecology has changed the due dates of the Effluent Mixing Plan of Study and Effluent Mixing Report to August 1, 2020, and August 1, 2021, respectively, to allow more time for planning and completion of the mixing zone study.*

S9.B.8 Model Selection and Results:

City's Comment # 9: The City may choose to utilize dynamic modeling in the mixing study, for which there is precedence through many similar studies, to allow modeling of the most representative conditions. This allows consideration of historic effluent and river flow patterns for example in which the 7Q10 river flow and maximum day effluent flow would likely not coincide, as they would with a traditional static model. The following text should be added: "Dynamic modeling may be utilized in accordance with Ecology's Permit Writer's Manual."

Ecology's Response: *The use of dynamic modeling in the mixing study is acceptable to Ecology.*

Preliminary Comments to Draft Fact Sheet:

Attached is a redlined version of the Fact Sheet, which contains some of the City's preliminary comments in addition to the comments below:

II.E Summary of Compliance with Previous Permit Issued:

City's Comment # 10: Table 7 "Violations/Permit Triggers" – The table incorrectly identifies three instances where influent flow was greater than 85% of the permitted flow capacity and categorizes them as "permit triggers." According to Condition S4.B.a of the NPDES permit, to constitute "permit triggers," there must be three consecutive months where influent flow is greater than 85% of the permitted flow capacity. Because the three instances identified in the table are not from consecutive months they do not constitute "permit triggers" and should be removed from the Table.

Ecology's Response: *The "permit trigger" language is generated by Ecology's Permit and Reporting Information System (PARIS). It is not a permit violation. It is just a "heads up" to inform Ecology's permit managers and permittees that the influent conditions have reached 85 percent of the treatment design in a given month. It has been Ecology's practice to bring this information to permittees' attention in a timely fashion, so that actions can be taken to minimize the risk of a permit violation.*

City's Comment # 11: TSS and Chlorine - The City requests that this section acknowledge that the NPDES permit violations for TSS and chlorine residual in November and December 2012 are attributed to startup of the new submerged fixed-film (SFF) media system that initially redistributed settled sediment in the lagoons as the new SFF media modules worked themselves through the sediment to the bottom of the lagoons over a period of a few months, as was noted in the August 2014 "Submerged Fixed-Film Media Performance Assessment Report". Additionally, following the December 2013 TSS violation, the City planned and executed dredging of the

lagoons to mitigate further TSS violations and since then has not exceeded the permit limit of 30 mg/L. Lastly, this section should acknowledge that violations for percent removal of TSS are attributed to the very low influent concentrations during wet weather that makes achieving 85% removal extremely difficult, even with effluent filtration.

Ecology's Response: *While Ecology acknowledges the challenges associated to maintaining compliance during construction and startups, it is well established in the NPDES permit that permittees must maintain compliance at all times.*

City's Comment # 12: The language in this section suggests the City ignored the requirements of Condition S2.C of the NPDES permit. This was not the case. The City followed a sampling schedule with a good faith belief that following that schedule provided a good averaging of results. It was only when the City asked Ecology directly for clarification of Section S2.C, which does not provide any specific instructions, that Ecology suggested the City alter its sampling routine. This information should be included in the Fact Sheet to accurately describe the facts.

Ecology's Response: *During the past permit term Ecology advised plant staff during site visits, in inspection reports and in emails that the City's monitoring practices did not fully comply with the requirements of special condition S.2.C of their NPDES permit. That condition requires the City to conduct representative sampling of any unusual discharge or discharge conditions. This includes ensuring representative sampling of influent on days when influent flows are high due to rainfall. DMR records show that the samples were typically collected on days were flow was lower than the average flow for the month in question. Specifically, DMR reports show that sampling did not occur on the highest flow days of the year unless those high flow days were on a normal sampling day of Tuesday or Wednesday. Of the 30 days of 2015 where flows were more than 20% over the average for the month in question, 10 days had influent TSS sampling done; only 2 of those were on days other than Tuesday or Wednesday. The records also show that sampling was not done on the highest flow day of the year (12/8/15 with 8.3 MGD) despite it being a normal sampling day (Tuesday).*

III.B Technology-Based Effluent Limits:

City's Comment # 13: TSS Removal Limits for Combined Sewer Systems – The City appreciates that Ecology recognizes the difficulty of achieving certain levels of percent removal, particularly TSS, during wet weather events and has adjusted the permit requirement accordingly.

Ecology's Response: *The fact that the City of Snohomish WWTP receives flow from combined sewers during wet weather coupled with the results of the statistic analysis of operating data indicate that the City qualifies for alternative monthly percent removal limits.*

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

City's Comment # 14: Dissolved Oxygen--BOD5 and Ammonia Effects – It is noted that the NBOD+CBOD average monthly load for July through October has been reduced from 146 lbs/day to 134 lbs/day based on 8 samples per month and a calculated coefficient of variation. Since the sampling schedule has not changed (8 samples per month for the previous permit as well), was it the generally lower reported measurements that caused the permit limit to change?

Ecology's Response: *No, this change is due to effluent variability observed during the last permit cycle and the 2012 biological treatment process improvements.*

City's Comment # 15: pH – It is noted that the minimum pH has increased from 6.2 to 6.4. It appears this was due to a correction in the calculation that had previously used the average ambient pH rather than the 90^{th} percentile of ambient pH. Is that correct?

Ecology's Response: *Yes, Ecology has erroneously used average ambient pH data in the previous permit. "EPA Technical Support Document for Water Quality-based Toxic Control (1991)" recommends the use of the ninetieth percentile.*

City's Comment # 16: Toxic Pollutants (Copper) – The City incorporates by reference its comments to the Permit regarding the copper effluent limit.

Ecology's Response: *Ecology requested additional copper data and reassessed the copper limits. The updated reasonable potential analysis shows that copper poses no risk to exceed the water quality criteria at the critical conditions using procedures given in EPA, 1991 guidelines.*

City's Comment # 17: Toxic Pollutants (Copper) – Currently, the text below the proposed copper limits references chlorine.

Ecology's Response: *The text is referring to the chlorine limits, not copper limits. The text explains why Ecology has retained the previous water quality-based limit for chlorine. That limit remains sufficiently protective of water quality in the receiving water.*

III.H Human Health:

City's Comment # 18: The first sentence of this section appears to be repeated.

Ecology's Response: *Repeated sentence has been deleted.*

IV.A Wastewater Monitoring:

City's Comment # 19: The second paragraph of this section suggests that the City was given guidance by Ecology that was not followed. Rather, the City requested guidance and clarification on this issue from Ecology on a few occasions and after Ecology responded the City adjusted sampling procedures to reflect what Ecology communicated and clarified. For instance, in winter 2017 the City sampled 3 or 4 times per week to provide more representative results. See also the earlier related comment regarding the summary of compliance with the previous permit.

Ecology's Response: *Please, see Ecology's response to City's comment # 12.*

V.C Operation and Maintenance:

City's Comment # 20: The City has not made a final decision to install a new peracetic acid system. Consequently, the text should be adjusted so that the operations and maintenance manual update described in this section would only be required if the City decided to install the peracetic acid system or made other significant improvements to the WWTP.

Ecology's Response: *Please, see Ecology's response to City's comment # 1.*

City's Comment # 21: The City incorporates by reference its comments to the Permit regarding the I/I evaluation.

Ecology's Response: *Please, see Ecology's response to City's comment # 7.*

V.F Effluent Mixing Study:

City's Comment # 22: The City incorporates by reference its comments to the Permit regarding the Effluent Mixing Study.

Ecology's Response: *Please, see Ecology's response to City's comment # 8.*

Public Review 30-Day Comment Period:

No comments were submitted to the Department of Ecology during the official 30-day public review comment period.