Fact Sheet for NPDES Permit WA0029581
King County South Wastewater Treatment Plant
July 1, 2015

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 King County's South Wastewater Treatment Plant (South Plant).

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 King County's South Plant, NPDES permit WA0029581, are available for public review and comment from April 16, 2015 until May 17, 2015. For more details on preparing and filing comments about these documents, please see *Appendix A - Public Involvement Information.*

King County 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

King County owns and operates the South Plant WWTP which treats domestic, commercial, and industrial wastewater using an activated sludge biological treatment process with chlorine disinfection before discharging the treated effluent to central Puget Sound off the Duwamish Head in West Seattle. Ecology issued the previous permit for this facility on September 30, 2009. The proposed permit contains the same effluent limits for total suspended solids, fecal coliform, pH, and chlorine as the permit issued in 2009. At the request of King County, the proposed permit replaces BOD_5 (5-day biological oxygen demand) effluent limits with equivalent $CBOD_5$ (5-day carbonaceous biological oxygen demand) limits. The proposed permit also reduces fecal coliform monitoring from 7 times each week to 5 times each week as supported by statistical analysis. The proposed permit does not include any other significant changes from the previous permit.

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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).

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 comments. 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	King County Department of Natural Resources and Parks Wastewater Treatment Division 201 S. Jackson Street, MS KSC-NR-0500 Seattle, WA 98104-3855
Facility Name and Address	King County South Wastewater Treatment Plant 1200 Monster Road SW Renton, WA 98057
Contact at Facility	Process Control Supervisor, (206) 263-1810
Responsible Official	Christie True Director, King County DNRP 201 S. Jackson Street, Seattle, WA 98104
Type of Treatment	Secondary Treatment, Activated Sludge
Facility Location (NAD83/WGS84 reference datum)	Latitude: 47.467683 Longitude: -122.240323
Discharge Waterbody Name and Location (NAD83/WGS84 reference datum)	Puget Sound *North Diffuser* *South Diffuser* Latitude: 47.602778˚ 47.599722˚ Longitude: -122.429000˚ -122.429028˚ Emergency/Maintenance (Green River) Latitude: 47.470750˚ Longitude: -122.241861˚

Permit Status	
Renewal Date of Previous Permit	September 30, 2009
Application for Permit Renewal Submittal Date	September 25, 2013
Date of Ecology Acceptance of Application	October 15, 2013

Inspection Status	
Date of Last Sampling Inspection	April 14-15, 2008
Date of Last Non-sampling Inspection Date	January 13, 2015

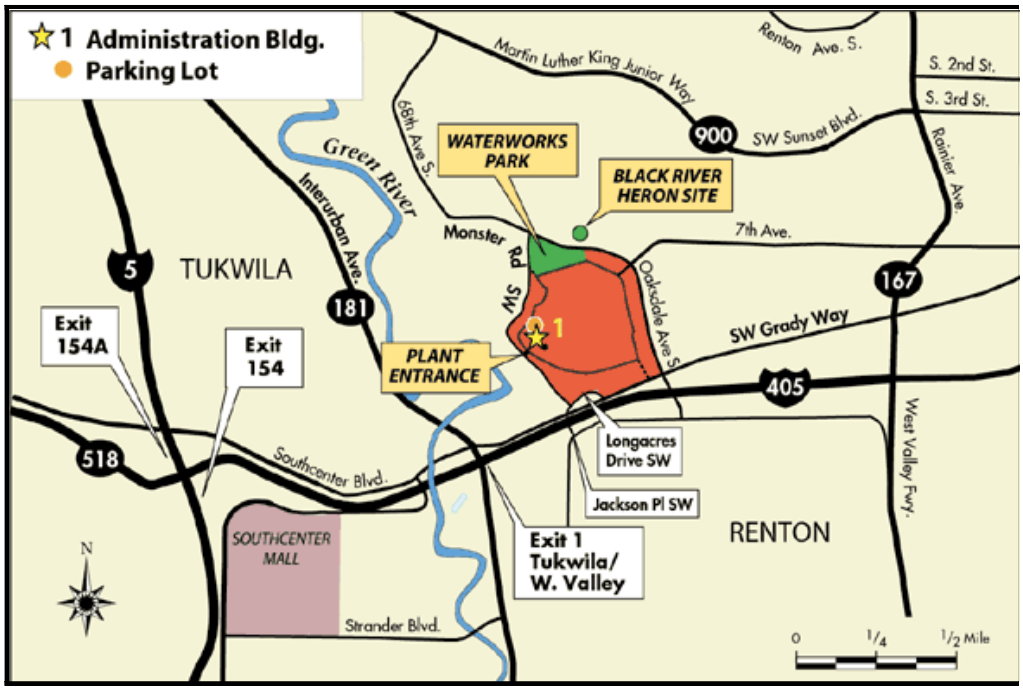


Figure 1. Facility Location Map

A. Facility description

History

In 1958, voters in Seattle and King County created Metro, an agency charged with creating a regional wastewater conveyance and treatment system. The South Wastewater Treatment Plant located in Renton is often referred to by County staff as the South Treatment Plant (South Plant or STP). Metro completed construction of the plant in 1965. The original plant had the capacity to treat 24 million gallons per day (MGD) of wastewater to secondary treatment levels using an activated sludge biological process. The third, and latest, expansion of the plant began in 1991 and was considered complete in 2000-2001. This last upgrade brings the plant design capacity to 144 MGD maximum month flow. In 2003, the County replaced the 90-ton railcar chlorine system with an interim sodium hypochlorite (12.5% NaOCl solution) disinfection facility because the City of Renton required the County to remove gaseous chlorine from the site. The County completed construction of a permanent 12.5% sodium hypochlorite disinfection facility in early 2010. In 2005, the County expanded the solids dewatering facility by replacing eight belt filter presses (50-gpm each) with three high-solids centrifuges (325-gpm capacity each).

South Plant is designated as an EPA major facility due to the magnitude of its daily discharge volume.

Treatment processes

Figure 2 displays the flow schematic for the South Plant facility.

Headworks - Under normal flow conditions, the raw sewage flows through four bar screens with 3/8" openings for rags and plastics removal. Flows exceeding approximately 150 MGD are screened with barscreens with 7/16 inch openings. The screenings are conveyed down a trough to the grinder pumps, then cleaned and dewatered in preparation for disposal at a landfill. The raw (influent) pumps lift the wastewater 40 feet to a division channel providing for gravity flow through the remaining treatment processes. The wastewater flows through the aerated grit channels to allow for grit to settle out. The grit is pumped to the cyclones, discharged to the classifiers, and then into dumpsters.

Primary Treatment - The division channel splits flow between a north set of 4 primary clarifiers and south set of 8 primary clarifiers. The north clarifiers use return flights and tipping troughs to capture and remove scum and grease. The south clarifiers use surface water spray to move scum and grease to a helical screw located at the upstream end of the tank; the return flights stay submerged on the south clarifiers. Primary clarifier effluent overflows via launders with submerged orifices. The launders saw-tooth weirs allow it to handle higher flows. Primary effluent flows by gravity to the aeration tanks. Primary sludge is continuously pumped from the bottom of the clarifiers to the dissolved air flotation tanks (DAFTs) for further treatment.

Secondary Treatment - Secondary treatment is accomplished using an activated sludge process. There are 4 aeration basins with fine bubble diffusers. The first part of each aeration basin is anaerobic when operating in the selector mode. Operators adjust the dissolved oxygen and sludge age to achieve a settable sludge. The wastewater flows from the aeration basins to the mixed liquor channel then on to the secondary clarifiers. There are 6 secondary clarifier pods each with 4 clarifiers for a total of 24 secondary clarifiers. Each pod has an effluent control center (ECC) where flow and turbidity are monitored. Pumps return the solids that settle out in the secondary clarifiers back to the aeration basins as return activated sludge (RAS) or pump them to solids handling as waste activated sludge (WAS).

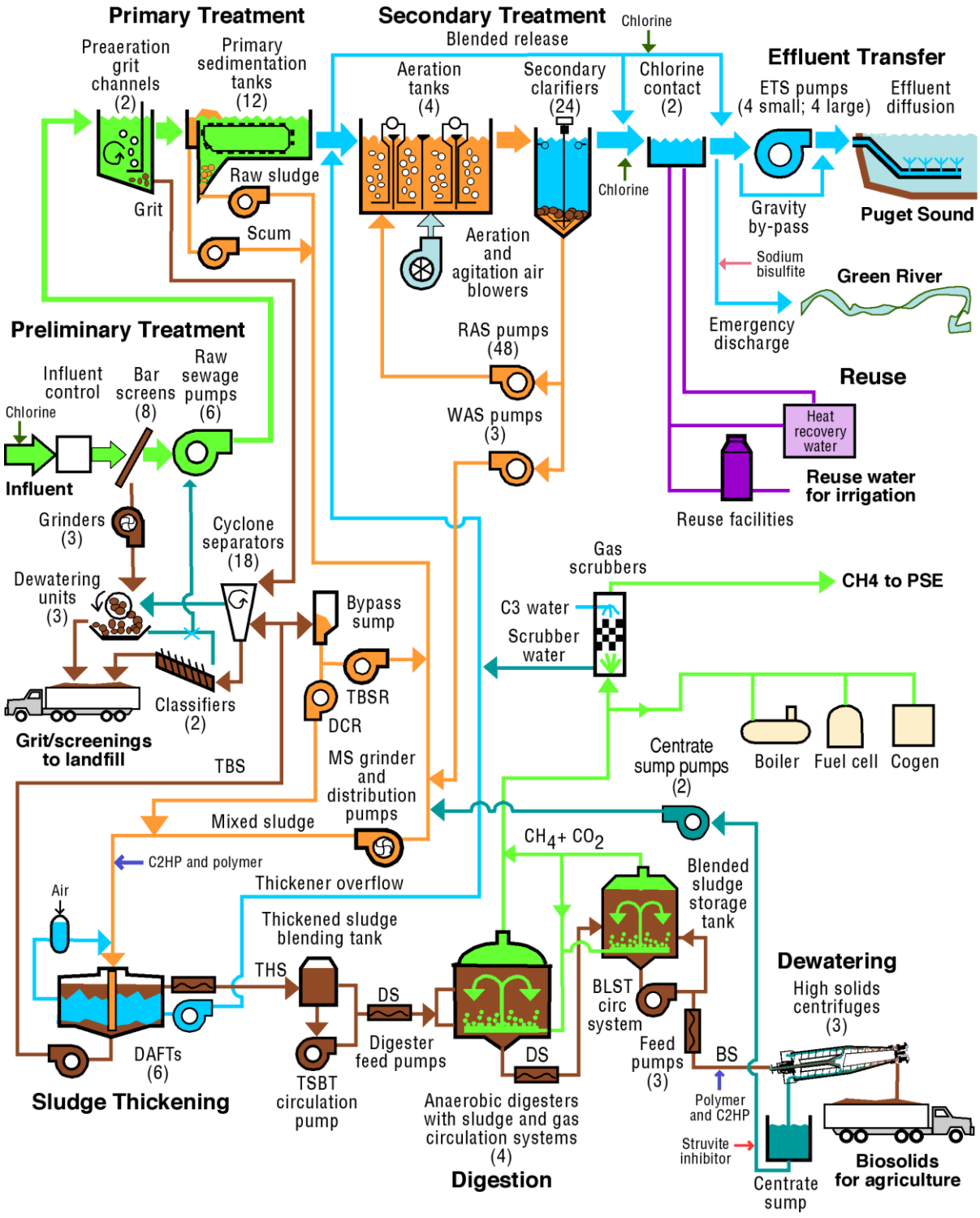


Figure 2. South Wastewater Treatment Plant – Simplified Process Flow Schematic

Disinfection and Effluent Pumping - Beginning in June 2003, the facility converted to sodium hypochlorite for disinfection in order to eliminate handling of chlorine gas. Hypochlorite is added at several locations along the chlorine contact channels. The chlorinated effluent flows through the chlorine contact channel to the forebay tank located before the effluent pumps. The effluent pumps discharge the treated wastewater from the forebay to the plant's Puget Sound outfall located 12 miles away off of Alki Point.

Solids - Solids from the primary clarifiers, WAS from the secondary clarifiers, and scum are pumped to the DAFTs. The DAFTs (4 older tanks, 2 new larger tanks) thicken the sludge. Inside these tanks, a mixture of sludge, polymer, and air form a thick layer of sludge that floats to the surface. A scraper arm controls the thickness of the floating sludge blanket and moves solids out of the DAFT to the Thickened Sludge Blending Tank. The water layer below the sludge blanket in the DAFT is pumped to the aeration tanks. The thin sludge layer that forms on the bottom of the DAFT is pumped to grit cyclones for degritting and sent back to the DAFTS for reprocessing.

The contents of the thickened sludge blending tank are pumped on level control to 1 of 4 anaerobic digesters. Operators collect daily process control samples of the digester sludge. The digested sludge is transferred to the 5^{th} digester that serves as the blended sludge storage tank. Polymer is added as a coagulant to the sludge as it is pumped from the blended sludge storage tanks to the centrifuges. The centrifuges produce a biosolids product that is about 20-25% solids. The biosolids are hauled to beneficial reuse sites in Eastern Washington (agriculture applications), and Western Washington (forest applications and commercial composting).

Odor Control - Odor control consists of a couple different air scrubbing systems. Chemical scrubbers use caustic and hypochlorite solutions to control odors from the secondary treatment area, the primary treatment area, the sludge thickeners, and the dewatering area. Carbon scrubbers control odors in the sludge thickening and dewatering areas. In addition, the facility maintains a biofilter to control odors on the influent interceptor collection system.

Emergency Backup Power - The facility's two independent power feeders to the plant provide redundancy. In addition, an emergency generator powers essential services, for example, lighting, alarms, security, etc., although it is not sufficient to power the influent pumps or other plant processes. An 8-Mega Watt (MW) cogeneration facility is also located on-site. It consists of two 3.5-MW gas turbine generators and a 1-MW steam turbine generator. The cogeneration facility is fueled by pipeline natural gas or scrubbed digester gas produced at the South Plant.

Industrial and Commercial Users - Ecology delegated King County the authority to run a Pretreatment Program. King County's South Plant application for permit renewal lists 53 industrial users that discharge to the collection system. There are 28 non-categorical Significant Industrial Users (SIUs) and 25 Categorical Industrial Users (CIUs). Please refer to Appendix F for a list of the industrial users.

Discharge outfalls

Puget Sound Outfall 001

Figure 3 shows the location South Plant's marine outfall. Secondary treated and disinfected effluent is discharged from the facility via a 12-mile long 8-foot diameter transfer line. The outfall consists of two pipelines, each extending over 10,000 feet northwest into the Puget Sound from Duwamish Head. For nearshore protection, the initial portion is supported by legs and the remainder of the outfall rests along the seafloor in a shallow trench. An outfall junction structure is located at the end of the effluent transfer system (ETS) force main just west of Luna Park in West Seattle. The structure contains a 64-inch diameter manifold connecting the 96-inch ETS to the two 64-inch diameter outfall lines. The diffuser sections are on the final 500-ft of each leg. Each diffuser has 168-sweep radius diffuser ports (a total of 336 diffuser ports), each 14 inches long and 4 inches in diameter. The diffusers are staggered side-to-side every 3 feet. Each diffuser port is made of a copper-nickel alloy to inhibit bio-fouling. The diffusers are about 625 feet deep as measured during MLLW conditions.

The County inspected the marine outfall in 2004-2005 and 2011. The extensive inspections concluded that all external components of the outfalls and associated structures appeared in good condition with no evidence of damage or need for remedial action. The diffusers were flowing freely. The 2011 inspection report noted that sediments have buried significant portions of both pipelines and that there is a minor suspension between stations 61 and 62 on pipeline B.

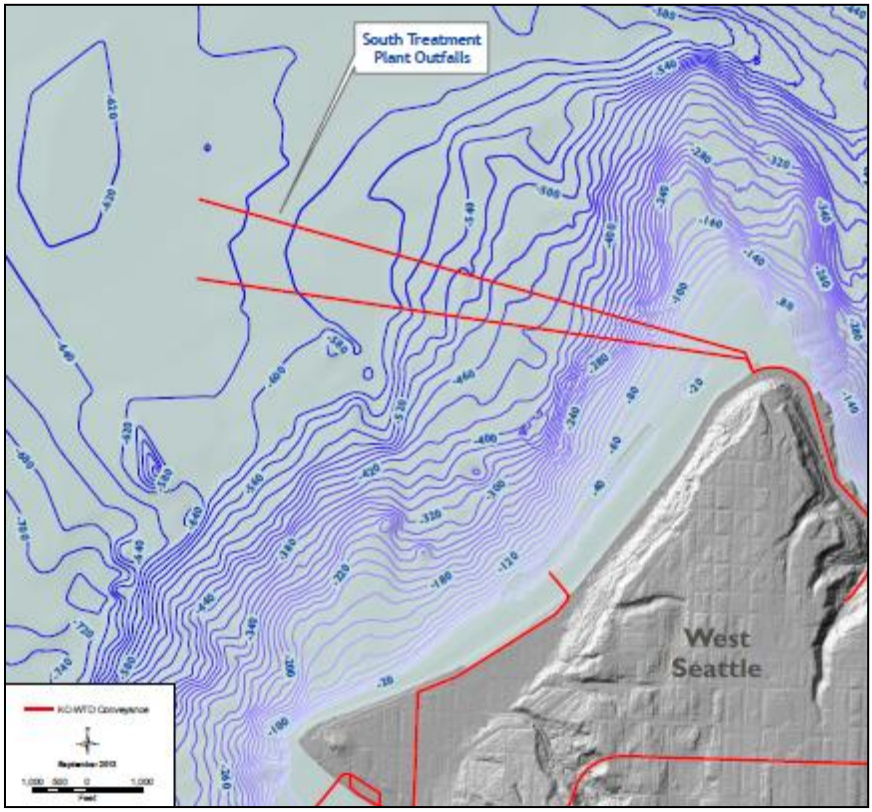


Figure 3. South Plant marine outfall location.

Green River Outfall (Maintenance & Emergency Purposes Only)

Figure 4 shows the Green River outfall location. This outfall was the South Plant's sole discharge point prior to the construction of the marine outfall in 1987. The County increased the firm capacity (total capacity with one pump out of service) of the effluent transfer system (ETS), which carries flow to the marine outfall, to 325 MGD with the pumping system upgrade in 1999. With all pumps running, the predicted capacity is 340-360 MGD (depending on the tide). The proposed permit authorizes the treatment plant to discharge to the Green River for maintenance purposes only.

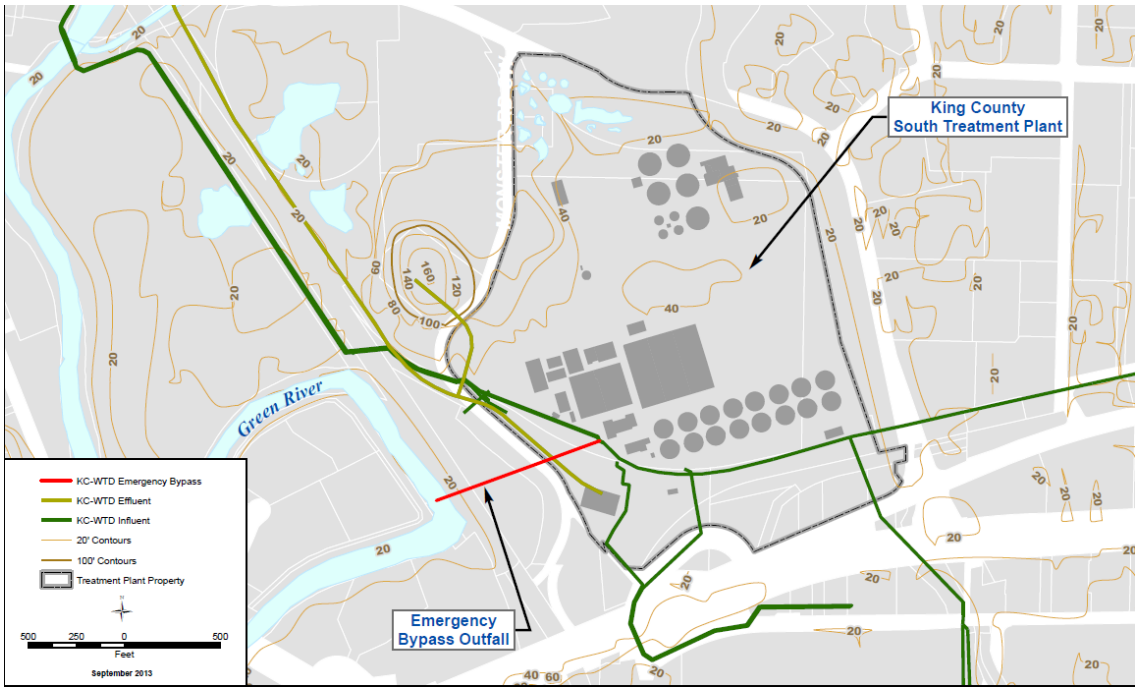


Figure 4. South Plant emergency backup Green River outfall location.

An emergency discharge is an unplanned and unavoidable discharge which is necessary to prevent sewage overflows or damage to the plant. Emergency discharges could occur during a severe, heavy rain event when the flow exceeds the capacity of the ETS, or in the extreme event that the ETS loses significant capacity due to multiple equipment failures or power failure.

Maintenance discharges are performed periodically to ensure that the outfall will function normally during an emergency event. During a maintenance discharge, the County uses a sufficient flow rate of disinfected and dechlorinated effluent to flush sediment from the diffuser ports. The proposed permit specifically authorizes discharges to the Green River for maintenance purposes.

The diffuser is a 12-foot by 12-foot structure that is 44 feet long extending into the river. There are 8 discharge ports located on the downstream side of the diffuser. The top of each port is at the elevation of the river bottom.

During the last permit cycle, King County conducted one maintenance discharge on the Green River outfall. The County timed the discharge to minimize impacts during fish passage windows. During the discharge the County monitored effluent quality and the impacts to the receiving water 300' downstream as required by their permit.

Collection system status

The South Plant serves an area of 152 square miles. King County owns and operates the major sewer interceptors and pump stations that carry the wastewater to the treatment plant. The component agencies, listed in Table 2 individually own, operate, and maintain the pipelines and other conveyance facilities that carry wastewater to the County's interceptors. Wastewater is conveyed to the treatment plant via three interceptors, the Tukwila Interceptor, the South Interceptor, and the Eastside Interceptor and by the 20 pump stations in the system. The County monitors and controls the collection system using a SCADA (Supervisory Control and Data Acquisition) system located at South Plant.

The South Plant serves 25 jurisdictions and utility districts as noted in the County's 2013 NPDES permit application and as listed in Table 2.

Table 2. Agencies Tributary to South Plant

Cities	Sewer/Utility Districts	Other
Algona	Cedar River Water And Sewer District	Muckleshoot Indian Tribe
Auburn	Coal Creek Utility District	Sammamish State Park
Bellevue	Lakehaven Utility District	Shorewood Apartments
Black Diamond	Northeast Sammamish Sewer And Water District	
Issaquah	Northshore Utility District	
Kent	Sammamish Plateau Water And Sewer District	
Kirkland	Seattle Public Utilities	
Mercer Island	Skyway Water And Sewer District	
Pacific	Soos Creek Water And Sewer District	
Redmond	Valley View Sewer District	
Renton		
Tukwila		

Inflow and Infiltration - King County created a Regional Infiltration and Inflow (I/I) Control Program in 1999 as part of the Regional Wastewater Services Plan (RWSP) to explore the feasibility of regional I/I control. The purpose of the program is to reduce the amount of peak wet weather flow entering the County's wastewater conveyance system when it is cost-effective to do so. Reduction of I/I in the system may prevent sanitary sewer overflows and decrease the costs of conveying and treating extraneous flows.

In response to the RWSP I/I Control Program policies, County staff, working in a consensus-based approach with the local sewer agencies, conducted a comprehensive 6-year, $41 million, I/I control study. The study began in 2000 and culminated with the County Executive's recommendation for a regional I/I control program. The following work was completed as part of this study:

- Levels of I/I for each local agency tributary to the regional system were defined through extensive flow monitoring and modeling program (2001-2002).
- 10 pilot projects were selected and constructed in 12 local agency jurisdictions to demonstrate the effectiveness of collection system rehabilitation projects and to test various technologies and gain cost information (2003-2004).

- Final draft model standards, procedures, policies, and guidelines were developed (October 2004) for use by local agencies to reduce I/I in their systems.
- A thorough benefit-cost analysis was conducted to determine the cost-effectiveness of I/I reduction (November 2005).
- A long-term regional I/I control plan was developed; approved by the King County Council in May 2006.
- King County worked with the local sewer agencies to conduct an I/I reduction feasibility analysis and selected three initial I/I reduction project areas (2007-2009).
- The Skyway Water and Sewer District I/I reduction project (2010-2014).

For more information see the full report on the County's I/I Program website.

CSO Status - All component agencies that provide flow to South Plant are separated sanitary systems with the exception of a small portion (approximately 4%) of the Seattle system that is a combined system. South Plant will continue to treat a portion of the flow from the Henderson CSO and Martin Luther King (MLK) diversion structure combined systems during the term of this permit. During heavy rain events, King County's West Point WWTP treats some of the flow. The MLK/Henderson/Norfolk project provides a tunnel for the storage and primary sedimentation of flows from Henderson, Martin Luther King, and Norfolk CSOs. During small rain events, the tunnel stores CSO flows for transfer to the South Plant for secondary treatment. During the largest storms and when the tunnel fills, any flows that exceed tunnel storage capacity are treated, disinfected, and discharged through the Norfolk CSO (which is permitted under King County's West Point WWTP permit).

Capacity analysis

With its application for permit renewal, King County submitted a *Flow and Waste Load Assessment*. Table 3 summarizes South Plant's design capacity and its current and projected flow and loadings through 2018. The County projected that all of the flows and loadings between 2014 and 2018 will be below South Plant's current design capacity assuming an average growth rate of 1% per annum. When Brightwater WWTP started operation in November 2012, South Plant's annual average flow decreased about 8 mgd and its wet weather season flow decreased about 16 mgd, as expected.

Table 3. Current and Projected (2009-2014) Influent Flow and Loadings

Parameter	Design Capacity	2009-2014 Max [1]	Projected 2018 [2]
Flow Average Wet Weather, MGD	115	100	82
Flow Max Month, MGD	144	108	112
BOD Max Month Load, lbs/day	251,000	222,000 [3] 185,000 [2,4]	195,000
TSS Max Month Load, lbs/day	235,000	218,000 [3] 180,000 [2,4]	185.000

[1] Source: DMR data reported by King County
[2] Source: King County's *2014 Annual Flow and Wasteload Assessment Memorandum.*
[3] Values are artificially inflated due to leaky seals in secondary clarifier.
[4] Values estimated using solids mass balance.

Facility Bypasses - King County's South Plant historically utilized flow blending to manage peak flow events. The South Plant had no blending events between February 2009 and September 2014; a significant reduction from the twelve that occurred between October 2004 and February 2009. The County initiates blending only when solids started to wash out of the secondary process or when secondary flows are notably above 190-200 MGD. According to King County operators, blending reduces washout of secondary solids from the secondary clarifiers. This permit does not authorize the use of flow blending, but rather relies on the bypass provision in Special Condition S5 of the permit to address any bypassing of treatment units.

Solid wastes/Residual solids

The treatment facilities remove solids during the treatment of the wastewater at the headworks (grit and screenings), and at the primary and secondary clarifiers, in addition to incidental solids (rags, scum, and other debris) removed as part of the routine maintenance of the equipment. Grit, rags, and screenings are drained and disposed of as solid waste at a landfill. Primary and waste secondary sludge are co-thickened in the dissolved air flotation tanks. The thickened sludge is fed to the anaerobic, mesophilic digesters. The County blends and stores digested sludge in a tank then dewaters the sludge using centrifuges to produce biosolids. The biosolids are applied to forest and agriculture lands under a permit from the King County Health Department.

The County periodically analyzes the biosolids for various chemical contaminants. Regulatory and compliance issues regarding biosolids are managed by the Department of Ecology's Biosolids Program.

Reuse - Secondary treated effluent

A separate state Reclaimed Water Permit covers the existing South Plant water reclamation facility including the distribution of the Class A water it produces.

Condition S12 of the proposed NPDES permit authorizes the County to distribute effluent from the ETS to Boeing for a specifically-identified use. King County is permitted to enlist other customers along the ETS corridor for noncontact use of the secondary treated effluent, with return to the ETS for discharge at the Puget Sound Outfall, provided the County receives written approval from both Ecology and the Department of Health. Ecology approval is required for each application of direct reuse to ensure that such use does not cause a violation of the state water quality standards. The intent of the NPDES permit is to allow the Permittee flexibility to provide noncontact reuse water to customers with sufficient safeguards to ensure that the water quality standards are not violated.

At the writing of this permit, King County had one customer using treated secondary effluent in this manner. The Boeing Company uses secondary treated effluent in a closed-loop chiller system primarily during the summer months at the Boeing Training Center in Renton.

B. Description of the receiving water

The South Plant WWTP discharges to the Puget Sound. Ecology used ambient data from sampling station LSNT01 in King County's 2013 receiving water study to assess compliance with water quality standards. This sampling station is located approximately five miles south of the South Plant outfall (47.533333˚, -121.433333˚).

Table 4. Ambient Background Data [1]

Parameter	Value
Temperature (highest annual 1-DADMax)	12.7° C (at 1.3 m below surface)
pH (minimum / maximum)	7.4 / 8.0 std units
Salinity (minimum)	27.7 pss
Alkalinity (10th percentile)	97.5 mg/L $CaCO_3$
Dissolved Oxygen (10th percentile)	5.8 mg/L
Total Ammonia (max)	0.085 mg/L as N
Fecal Coliform (max)	1 / 100 mL
TSS (max)	7.5 mg/L
Antimony (90th percentile), Dissolved / Total	0.172 / 0.178 µg/L
Arsenic (90th percentile), Dissolved / Total	1.450 / 1.450 µg/L
Cadmium (90th percentile), Dissolved / Total	0.073 / 0.081 µg/L
Chromium (90th percentile), Dissolved / Total [2]	0.150 / 0.145 µg/L
Copper (90th percentile), Dissolved / Total	0.354 / 0.428 µg/L
Lead (90th percentile), Dissolved / Total	0.006 / 0.045 µg/L
Mercury (90th percentile), Dissolved / Total	0.00020 / 0.00038 µg/L
Nickel (90th percentile), Dissolved / Total	0.427 / 0.476 µg/L
Silver (90th percentile), Dissolved / Total	0.026 / 0.029 µg/L
Zinc (90th percentile), Dissolved / Total [2]	0.605 / 0.538 µg/L

[1] Data source: *King County Receiving Water Characterization Study - Final Report*, June 2013.

[2] Data reported in 2013 report shows 90th percentile of dissolved fraction as slightly larger than total concentration. This discrepancy is likely within the precision of the analytical method.

C. Wastewater influent characterization

King County reported the concentration of influent pollutants in discharge monitoring reports. The influent wastewater is characterized as shown in Table 5.

Table 5. Wastewater Influent Characterization

Parameter	Units	# of Samples	Average Value	Maximum Value
BOD_5	mg/L	≈1000	269	612
	lbs/day	≈1000	180,387	394,229
TSS	mg/L	≈1000	262	834
	lbs/day	≈1000	175,762	461,223

D. Wastewater effluent characterization

King County reported the concentration of pollutants in the discharge in their permit application and in discharge monitoring reports. The tabulated data represents the quality of the wastewater effluent discharged from November 2009 through July 2014. The wastewater effluent is characterized as listed in Table 6.

Table 6. Wastewater Effluent Characterization

Parameter	Units	# of Samples	Average Monthly Averaqe	Maximum Monthly Average
BOD_5	mg/L	≈1000	17	28
	lbs/day	≈1000	10,734	19,456
TSS	mg/L	≈1000	11	20
	lbs/day	≈1000	7,425	14,755
			Maximum Monthly Geometric Mean	**Maximum Weekly Geometric Mean**
Fecal Coliforms	#/100 mL	≈1800	159	272
			Minimum Value	**Maximum Value**
pH	Standard units	*Continuous monitoring*	6.5	9.0
Temperature – 1DADMax	Deg C	≈1800	95th percentile = 22.3	
			Maximum Monthly Average	**Maximum Daily Maximum**
Chlorine, Total Residual	µg/L	Continuous	110	360
Ammonia, as N	mg/L	≈60	38	45
	lbs/day	≈60	21,500	28,500
Total Kjeldahl Nitrogen, as N	mg/L	≈60	42	50
Nitrate + Nitrite, as N	mg/L	≈60	16	18
Phosphorus, total, as P	mg/L	≈60	4.6	6.7
Phosphate, ortho, as P	mg/L	≈60	3.9	5.4

Detected Chemicals	Units	# of Samples	Minimum	Maximum	95th Percentile	50th Percentile	cv
1,4-Dichlorobenzene	ug/L	23	0.50	4.32	4.26	0.50	1.03
2,4,6-Trichlorophenol	ug/L	22	0.25	1.20	1.20	0.95	0.33
2,4-Dichlorophenol	ug/L	22	0.12	1.67	1.66	0.28	0.91
Antimony, Total	ug/L	29	0.15	0.64	0.63	0.42	0.28
Arsenic, Total	ug/L	29	1.10	1.75	1.74	1.38	0.12
Bis(2-Ethylhexyl) Phthalate	ug/L	22	0.33	5.10	3.23	1.37	0.62
Cadmium, Total	ug/L	29	0.03	0.11	0.05	0.03	0.61
Chloroform	ug/L	23	0.50	1.70	1.39	0.50	0.50
Chromium, Total	ug/L	29	0.45	0.97	0.90	0.57	0.22
Copper, Total	ug/L	29	5.62	13.80	13.28	9.73	0.24
Cyanide, Weak & Diss.	ug/L	28	2.5	18.4	12.1	2.5	0.91
Diethyl Phthalate	ug/L	22	0.07	0.57	0.50	0.24	0.52
Lead, Total	ug/L	29	0.25	1.63	0.90	0.34	0.66
Mercury	ug/L	29	0.0027	0.0068	0.0065	0.0051	0.21
Nickel, Total	ug/L	29	1.90	3.53	3.15	2.32	0.17
Nonylphenol Isomer	ug/L	2	3.02	3.26	--	--	0.05
Silver, Total	ug/L	29	0.02	0.14	0.13	0.07	0.51
Tetrachloroethylene	ug/L	23	0.50	1.40	1.22	0.50	0.43
Zinc, Total	ug/L	29	23.00	44.60	43.72	31.20	0.18

Whole effluent toxicity testing

The County conducted acute toxicity tests in August 2012 and February 2013, and chronic toxicity tests in October 2012 and February 2013. Acute toxicity tests were conducted with Daphnia pulex (water flea) and Pimephales promelas (fathead minnow). Chronic toxicity tests were conducted with Atlantic Mysid and topsmelt. Please refer to Appendix D for toxicity test results.

For acute toxicity, the performance standard is the median survival in 100% effluent being equal to or greater than 80% and no individual test result showing less than 65% survival in 100% effluent. For the tests conducted in 2012 and 2013, the lowest survival in 100% effluent was 95%.

For chronic toxicity, the performance standard is no chronic toxicity test demonstrating a statistically-significant difference in response between the control and a test concentration equal to the acute critical effluent concentration (ACEC). South WWTP had no chronic toxicity near the previous ACEC of 0.54% effluent in any recent test.

Since the discharge met the performance standards for toxicity in the previous permit cycle, the proposed permit does not include WET limits but includes WET monitoring as required for permit renewal.

E. Sediment characterization

Ecology has promulgated sediment management standards under Chapter 173-204 WAC. The sediment management standards contain numeric chemical and biological criteria that protect benthic organisms that live in the sediment of the marine waters of Puget Sound. These standards state that Ecology may require permitted facilities to evaluate the potential for the discharge to cause a violation of applicable standards.

Between 1994 and 1997, King County performed annual sediment sampling from 0 to 2 cm depth at locations near the two outfalls (EIM Data User Study ID RENT9497). In October 1997, the County measured concentrations of hexachlorobenzene at three locations (RT700NS, RT625ND, RT625SD) that exceeded the sediment quality standards numeric criteria. In October 1995, one location (LSDS02) exceeded CSL numeric criteria for benzoic acid. One sample, RT625SD, had bis(2-ethylhexyl) phthalate concentration of 42 ppm, compared to the SQS criteria of 47 ppm OC (total organic carbon normalized). For four chemicals (1,2,4-trichlorobenzene, benzyl alcohol, hexachlorobenzene, and hexachlorobutadiene) many of the samples had non-detect concentrations with reported detection limits above the sediment quality standard numeric criteria.

In October 1999, King County performed sediment sampling from 0 to 2 cm depth at 13 sample locations near the two outfalls (EIM Data User Study ID RENT99). Sediment samples were analyzed for the 47 chemicals with numeric criteria in the sediment management standards. The County did not detect the following four chemicals (2,4-dimethyl phenol, 2-methylphenol, benzyl alcohol, and hexachlorobutadiene), but most of the samples had reported detection limits above the sediment quality standards numeric criteria. Most of the other 47 chemicals were not present at detectable levels below the SQS numeric criteria. The County measured low concentrations of PAHs, PCBs, phthalates, and metals below the numeric criteria for benthic toxicity.

In November 2001, King County performed sediment sampling from 0 to 2 cm depth at 13 sample locations near the two marine outfalls (EIM Data User Study ID RENT01). Sediment samples were analyzed for the 47 chemicals with numeric criteria in the sediment management standards. All samples met the sediment quality standards (SQS) numeric criteria. One sample (RT625SD) had a bis(2-ethylhexyl) phthalate concentration of 43 ppm, compared to the SQS criteria of 47 ppm. All other samples had bis(2-ethylhexyl) phthalate concentrations below 10 ppm. Five samples had detection limits for 2-methylphenol that were slightly above the sediment quality standards criteria, but were not detected in the sediment nor in the effluent. Most of the 47 chemicals were not present at detectable levels. The County measured low concentrations of PAH, phthalates, and metals below the numeric criteria for benthic toxicity.

In 2011, results from station STP625SP (sample ID: L53537-12) showed elevated bis(2-ethylhexyl) phthalate concentrations at 116 ppm OC, exceeding the SMS cleanup screening level (CSL) of 78 ppm OC. Based on the low level concentrations of bis(2-ethylhexyl) phthalate from the other stations and historical data from previous sampling events, King County determined the sample to be anomalous and elected to re-analyze the sample from remaining preserved sample matrix in triplicate to verify if the result was reproducible. Results from the triplicate analysis were 3.6, 3.7, and 3.2 ppm OC. These concentrations were then averaged along with the original measurement to yield 31.6 ppm OC, below the SQS criterion. Ecology approves of and appreciates the additional steps King County took to verify the integrity of a potentially anomalous result. Bis(2-ethylhexyl) phthalate can easily be imparted to a sample by a number of processes (e.g., airborne deposition during sample collection or transfer, a small piece of plastic not representative of the bulk sample matrix, handling cross-contamination).

In summary, historic sediment monitoring does not indicate sediment toxicity or a violation of the sediment management standards at this site. The proposed permit includes additional sediment monitoring to ensure continued compliance because of the large volume of discharge, some past instances of detection limits above the SQS numeric criteria, and 1997 concentrations in the chemical analyses of sediments above SQS near the site.

F. Summary of compliance with previous permit issued

The previous permit placed effluent limits on BOD_5, TSS, total residual chlorine, pH, and fecal coliform. The South Plant facility complied with effluent limits and permit conditions throughout the duration of the previous permit except for late DMR submittals in February 2010, March 2010, April 2010, and January 2012. The facility also exceeded the 85% loading criteria for TSS and BOD_5 for several months, which, while not a violation, would typically trigger capacity planning, according to permit condition S4. However, King County sufficiently demonstrated that these elevated loadings were due to leaking primary and secondary clarifier seals through which solids were routed back to the influent line causing artificially high influent numbers. King County fixed these seals in the summer of 2014 and loading values have decreased accordingly.

Ecology assessed compliance based on its review of the facility's information in Ecology's Permitting and Reporting Information System (PARIS), discharge monitoring reports (DMRs) and on inspections.

G. 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. Ecology-approved design criteria for this facility's treatment plant, as listed in Table 7, were obtained from the October 1993 Plans and Specifications (*Metro's Regional Treatment Plant in Renton, Liquid Stream Improvements IIIB Part C*, Volume 9 of 11) and the October 1997 *East Division Reclamation Plant Stage 2 Liquid Stream Improvements – III2B.1*. Both documents were prepared by Brown and Caldwell Consultants and associated firms.

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.

Table 7. Design Criteria for King County South Wastewater Treatment Plant

Parameter	Design Quantity
Monthly average flow (max. month)	144 MGD
Monthly average dry weather flow (AWDF)	96 MGD
Monthly average wet weather flow (AWWF)	115 MGD
Instantaneous peak flow	325 MGD
Maximum Month BOD_5 influent loading	251,000 lb/day
Maximum Month TSS influent loading	235,000 lb/day

The table below identifies technology-based limits for pH, fecal coliform, BOD_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 8. Technology-based Limits

Parameter	Average Monthly Limit	Average Weekly Limit
BOD_5 (concentration)	30 mg/L	45 mg/L
	In addition, the BOD_5 effluent concentration must not exceed fifteen percent (15%) of the average influent concentration.	
$CBOD_5$ (concentration)	25 mg/L	40 mg/L
	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
	In addition, the TSS effluent concentration must not exceed fifteen percent (15%) of the average influent concentration.	
Chlorine	0.5 mg/L	0.75 mg/L

Parameter	Monthly Geometric Mean Limit	Weekly Geometric Mean Limit
Fecal Coliform	200 organisms/100 mL	400 organisms/100 mL
Parameter	**Daily Minimum**	**Daily Maximum**
pH	6.0 standard units	9.0 standard units

King County requested Ecology replace BOD_5 limits with $CBOD_5$ limits because they were measuring artificially high BOD_5 levels as a result of nitrifying bacteria in the sampling system. Ecology granted this substitution, as allowable under WAC 173-221-050.

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.

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 carbonaceous oxygen demand ($CBOD_5$) 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

The resulting technology-based mass limits are summarized in Table 9.

Table 9. Technology-based Mass Limits

Parameter	Concentration Limit (mg/L)	Mass Limit (lbs/day)
$CBOD_5$ Monthly Average	25	30,000
$CBOD_5$ Weekly Average	40	48,000
TSS Monthly Average	30	36,000
TSS Weekly Average	45	54,000

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

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

Narrative criteria

Narrative water quality criteria (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.

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.

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 end-of-pipe discharge exposure to prevent harm to 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)].

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 liters/day for drinking water.
- A one-in-one-million cancer risk for carcinogenic chemicals.

This permit authorizes a small acute mixing zone, surrounded by a chronic mixing zone around the point of discharge (WAC 173-201A-400) for the Puget Sound outfall 001. 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 sizes and locations 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 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 critical conditions used for modeling the Puget Sound and Green River outfalls are listed in Table 10 and Table 11.

Table 10. Critical Conditions Used to Model the Puget Sound Outfall 001

Critical Condition	Value
Water depth at MLLW	623 feet
Density profile with a difference of 0.61 sigma-t units between -607 feet and the surface	
90th percentile current speeds for acute mixing zone	0.14 -0.39 m/sec
50th percentile current speeds for chronic and human health mixing zones	0.069 – 0.125 m/sec
Maximum average monthly effluent flow for chronic and human health non-carcinogen	144 MGD
Annual average flow for human health carcinogen	106 MGD
Maximum daily flow for acute mixing zone	235 MGD
1 DAD MAX effluent temperature	12˚C

Ecology obtained ambient data at critical conditions in the vicinity of the Puget Sound outfall from the King County Study called *Effluent Dilution Modeling for South Wastewater Treatment Plant Outfall Study* conducted in September 2013.

Table 11. Critical Conditions Used to Model the Green River Outfall 002

Critical Condition	Value
Minimum Green River daily average flow: June 1 – October 31	500 cfs
Minimum Green River daily average flow: November 1 – May 31	1000 cfs
Maximum daily discharge flow: June 1 – October 31	16 MGD
Maximum daily discharge flow: November 1 – May 31	32 MGD

Ecology obtained critical condition ambient data in the vicinity of the Green River outfall from various studies as entered into Ecology's EIM database and from USGS's website.

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 discharges, the receiving waters characteristics, and the discharge locations. Based on this review, Ecology concluded that the discharges do 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 boundaries of the mixing zones 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 sizes of the mixing zones authorized in the proposed permit.

7. *Maximum size of chronic mixing zone.*

   The authorized chronic mixing zone for the Puget Sound discharge does not exceed the maximum size restriction. Ecology did not authorize a chronic mixing zone for the Green River discharge.

8. *Acute mixing zone.*

Puget Sound Outfall No. 001

- *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.

Green River Outfall No. 002 (maintenance)

WAC 173-201A-400(8) limits freshwater acute mixing zones to 2.5% of river flow or less. King County must use flows larger than 2.5% of the Green River flow to achieve the maintenance goal of clearing settled sediments from the outfall diffuser ports. WAC 173-201A-400(12) allows extended mixing zones if: (1) the discharge existed prior to November 24, 1992, or (2) if the altered size results in greater protection of existing and characteristic uses. Maintenance discharges at the Green River outfall meet both of these requirements. The outfall existed prior to 1992 and the discharge impacts to salmon migration are minimized if King County performs maintenance discharges during summer months when the river flow is low. Ecology continues to permit discharges from this outfall for maintenance purposes because this outfall provides a backup discharge option should the primary outfall line become unuseable or not meet capacity requirements.

Ecology therefore granted a mixing zone that encompasses 25% of the Green River flow for maintenance discharges. These discharges will occur infrequently and are permitted for a maximum duration of 4 hours. During the previous permit cycle, King County discharged to the Green River once in five years.

9. *Overlap of mixing zones.*

The mixing zones authorized in this permit do not overlap other mixing zones.

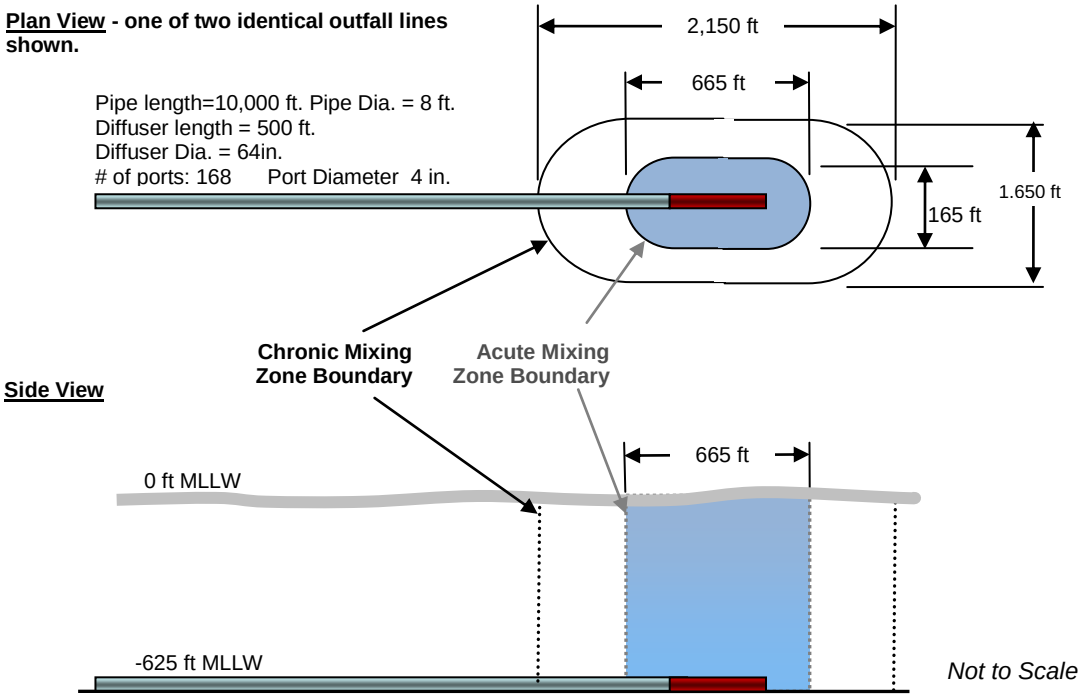


Figure 5. South Plant's Outfall 001 Mixing Zone Diagram.

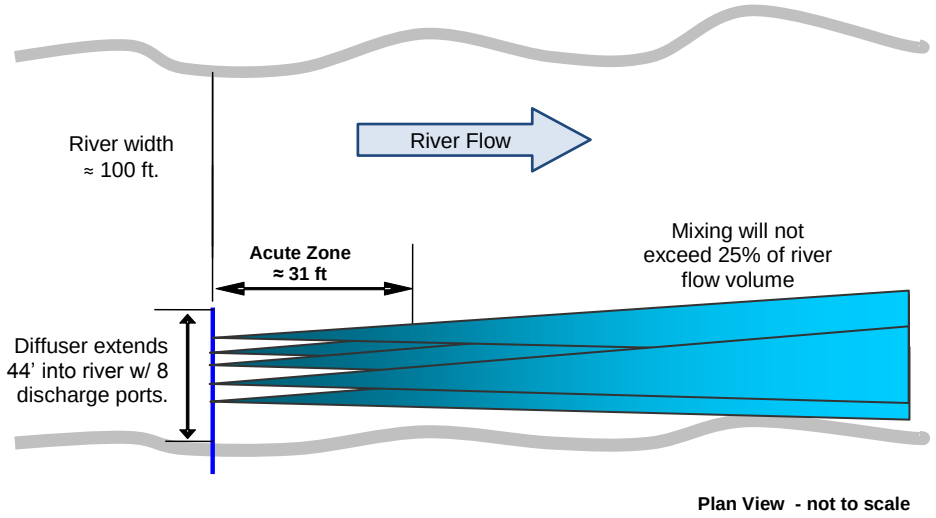


Figure 6. South Plant's Outfall 002 Mixing Zone Diagram (Green River)

D. Designated uses and surface water quality criteria

Applicable designated uses and surface water quality criteria are defined in chapter 173-201A WAC. In addition, the U.S. EPA set human health criteria for toxic pollutants (EPA 1992). The tables included below summarize the criteria applicable to the receiving waters' designated uses.

Puget Sound Outfall No. 001 (marine)

Aquatic life uses for marine discharges are designated using the following general categories. All indigenous fish and non-fish aquatic species must be protected in waters of the state.

a. Extraordinary quality salmonid and other fish migration, rearing, and spawning; clam, oyster, and mussel rearing and spawning; crustaceans and other shellfish (crabs, shrimp, crayfish, scallops, etc.) rearing and spawning.

b. Excellent quality salmonid and other fish migration, rearing, and spawning; clam, oyster, and mussel rearing and spawning; crustaceans and other shellfish (crabs, shrimp, crayfish, scallops, etc.) rearing and spawning.

c. Good quality salmonid migration and rearing; other fish migration, rearing, and spawning; clam, oyster, and mussel rearing and spawning; crustaceans and other shellfish (crabs, shrimp, crayfish, scallops, etc.) rearing and spawning.

d. Fair quality salmonid and other fish migration.

The *Aquatic Life Uses* and the associated criteria for this receiving water are identified below.

Table 12. Marine Aquatic Life Uses and Associated Criteria

Extraordinary Quality	
Temperature Criteria – Highest 1D Max	13°C (55.4°F)
Dissolved Oxygen Criteria – Lowest 1-Day Min	7.0 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.
pH Criteria	pH must be within the range of 7.0 to 8.5 with a human-caused variation within the above range of less than 0.2 units.

To protect shellfish harvesting, fecal coliform organism levels must not exceed a geometric mean value of 14 colonies/100 mL, and not have 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 43 colonies/100 mL.

The *recreational use categories include* primary contact recreation and secondary contact recreation. The recreational uses for this receiving water are identified below.

Table 13. Recreational Uses

Recreational Use	**Criteria**
Primary Contact Recreation	Fecal coliform organism levels must not exceed a geometric mean value of 14 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 43 colonies /100 mL.

The *miscellaneous marine water uses* are wildlife habitat, harvesting, commerce and navigation, boating, and aesthetics.

Green River Discharge (freshwater):

Aquatic Life Uses for freshwater discharges 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 the Green River at the Emergency Outfall location are identified below.

Table 14. Aquatic Life Uses & Associated Criteria

Salmonid Spawning, Rearing, and Migration	
Temperature Criteria – Highest 7DAD Max	17.5°C (63.5°F)
Dissolved Oxygen Criteria – Lowest 1-Day Min	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.
pH Criteria	pH shall be within the range of 6.5 to 8.5 with a human-caused variation within the above range of less than 0.5 units.

The *recreational uses* are extraordinary primary contact recreation, primary contact recreation, and secondary contact recreation. 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

Central Puget Sound is not listed for any 303(d) impairments in the vicinity of the South Plant WWTP outfall 001. Ecology is conducting a South Puget Sound Dissolved Oxygen study which should be finalized in the next few years.

Ecology lists the Green River as a category 5 waterbody for dissolved oxygen and bacteria in their 2012 303(d) assessment. EPA approved Ecology's Green River Temperature TMDL in 2011. In 1992 Ecology issued an ammonia-nitrogen TMDL in the Green/Duwamish system that identified a zero ammonia-nitrogen wasteload allocation for King County's Renton South Plant (except during emergencies and planned short-term maintenance). King County responded to this TMDL by relocating their South Plant WWTP outfall to the Puget Sound.

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.

Puget Sound Outfall No. 001

The two 64 inch diameter diffusers at Outfall 001 are 500 feet long. The diffusers each have 168 staggered four inch diameter ports which are spaced 3 feet apart. The diffusers are approximately 625 feet deep mean lower low water (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 horizontal dimensions of the chronic mixing zone for Outfall 001 are 2150 by 1650 feet. The mixing zone extends from the bottom to the top of the water column.

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. The acute mixing zone for Outfall 001 extends 82.5 feet in any direction from each discharge port.

Ecology provided a thorough review of the County's data, dilution factors, and modeling in 2009 and again in 2014. Ecology verified that the County used conservative assumptions and provided rigorous modeling to obtain the dilution factors. Using updated density profile and plant flow data, King County concluded that the dilution factors are the same as those predicted in 2009 due to very similar plant flow conditions. Design flow rates were used for the chronic mixing zone and human health mixing zone analyses so those did not change from the previous analysis. The dilution factors are listed Table 16.

Table 16. Dilution Factors

Criteria	Acute	Chronic
Aquatic Life	186	225
Human Health, Carcinogen		428
Human Health, Non-carcinogen		428

Ecology determined the impacts of dissolved oxygen deficiency, nutrients, pH, fecal coliform, turbidity, 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.

Ecology modeled the impact of BOD_5 on the receiving water at critical conditions using an effluent concentration of 45 mg/L (the technology-based effluent limit for BOD_5) and an oxidation rate of 0.23/day (see Appendix E). Ecology predicts no violation of the surface water quality standards for dissolved oxygen due to the impacts of BOD_5, therefore, the proposed permit contains the technology-based effluent limits for $CBOD_5$. The permit does not contain a limit for ammonia for dissolved oxygen impacts; ammonia toxicity is examined elsewhere in this fact sheet.

pH--Compliance with the technology-based limits of 6.0 to 9.0 will assure compliance with the water quality standards of surface waters because of the high buffering capacity of marine water.

Fecal Coliform--Ecology modeled the numbers of fecal coliform by simple mixing analysis using the technology-based limit of 400 organisms per 100 ml and a dilution factor of 225. 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, bis(2-ethylhexyl)phthalate, cadmium, chloroform, chromium, copper, cyanide, diethyl phthalate, lead, mercury, nickel, silver, tetrachloroethylene, zinc, 1,4-dichlorobenzene, 2,4,6-trichlorophenol, 2,4-dichlorophenol, and nonylphenol isomer. Ecology conducted a reasonable potential analysis (see Appendix E) on these parameters to determine if any required effluent limits are necessary in this permit.

King County provided ambient data in their 2013 receiving water study and the following parameters were detected in the receiving water: ammonia, antimony, arsenic, cadmium, chlorine, chromium (hex), copper, lead, mercury, nickel, silver, and zinc. Ecology used the 90% concentrations for these pollutants in the reasonable potential analysis and assumed zero for ambient concentrations if data was not available.

Ammonia's toxicity depends on that portion which is available in the unionized form. The amount of unionized ammonia depends on the temperature, pH, and salinity of the receiving marine water. To evaluate ammonia toxicity, Ecology used the available receiving water information from King County's 2013 ambient study and Ecology spreadsheet tools.

Ecology determined that none of the toxics detected in the effluent pose a reasonable potential to exceed the water quality criteria at the critical condition using procedures given in EPA, 1991. Ecology's determination assumes that this facility meets the other effluent limits of this permit.

For chlorine, calculations show that technology-based limits are more stringent than water quality-based limits. The discharge will meet the chlorine water quality criteria if the technology-based limits are met.

Temperature--The state temperature standards (WAC 173-201A-200-210 and 600-612) include multiple elements: annual summer maximum threshold criteria, supplemental spawning and rearing season criteria, incremental warming restrictions, and 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 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 for Annual summer maximum and incremental warming criteria - Ecology calculated 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 conditions (see Appendix E). No reasonable potential exists to exceed the temperature criterion where:

(Criterion + 0.3) > [Criterion + (Teffluent95 – Criterion)/DF].
(13 + 0.3) > (13 + (22.3 – 13.0)/225)
13.3 > 13.04

King County reported temperature data with their monthly discharge monitoring reports; Ecology used the 95th percentile of the 1DADmax value reported. Using a dilution factor of 225 and maximum daily temperature of 12.7°C for the receiving water, the predicted maximum daily temperature at the mixing zone boundary is 12.74°C. Thus, under the worst case scenario, the effluent discharge from this facility results in warming of the ambient temperature by 0.04°C, which is less than the allowable warming temperature of 0.3°C. Therefore, the proposed permit does not include a temperature limit.

Green River Outfall No. 002 (maintenance only)

Ecology limits maintenance discharges to four hours therefore chronic water quality standards do not apply. Ecology calculated the acute dilution factor based the conditions expected during discharges for maintenance purposes. Ecology also assumed dilution with 25% of the river flow, consistent with WAC 173-201A-400(12). The resultant dilution factor is 5.0, as shown in Table 17.

Table 17. Dilution Factors - Green River Outfall No. 002

Green River Outfall	Acute	Chronic
Aquatic Life – Maintenance	5.0	Not Applicable
Aquatic Life – Emergency	Permitted Under S5.F	Not Applicable

Ecology assessed compliance with water quality standards using this dilution factor. To guarantee this dilution is achieved under the various flow conditions of the river, and to allow larger discharge volumes during the winter months when the river flows are higher, the permit includes the flow restrictions listed in Table 18.

Table 18. Discharge flow restrictions to achieve required dilution in the Green River

	Minimum Green River daily average flow	Maximum daily discharge flow
June 1 – October 31	500 cfs	16 MGD (25 cfs)
November 1 – May 31	1000 cfs	32 MGD (50 cfs)

The dilution factor was calculated assuming the effluent mixes with 25% of the river flow (0.25*500/25=5.0). This dilution applies to *planned maintenance* discharges only; *emergency* discharges are permitted under Special Condition S5.F. Effluent limits were not imposed for emergency use because it is Ecology's understanding that such use will only occur under extreme and unpredictable circumstances.

Dissolved Oxygen--BOD_5—The DO water quality criteria for freshwater are based on lowest 1-day minimums. Since the duration of maintenance discharges at the Green River outfall is at maximum 4 hours, Ecology assumes that the one day average DO in the receiving water will not be impacted significantly by this discharge.

Temperature—The temperature water quality criteria for freshwater are based on seven day averages. Since the duration of maintenance discharges at the Green River outfall is at maximum 4 hours, Ecology assumes that the seven day average temperature in the receiving water will not be significantly impacted by this discharge.

Fecal Coliform—The numbers of fecal coliform were modeled by simple mixing analysis using the technology-based limit of 200 organisms per 100 ml and a chronic dilution factor of 5.0. The resulting fecal coliform at the edge of the chronic dilution zone is 65 per 100 ml. Under critical conditions there is no predicted violation of the water quality standards for surface waters with the technology-based limit. Therefore, the technology-based effluent limit for fecal coliform bacteria was placed in the proposed permit.

Toxic Pollutants—Federal regulations (40 CFR 122.44) require NPDES permits to contain effluent limits for toxic chemicals in an effluent whenever there is a reasonable potential for those chemicals to exceed the surface water quality criteria. A reasonable potential

calculation on the priority pollutants measured during the previous permit term showed no reasonable potential for any toxins measured except for chlorine, see Appendix E. Ecology derived effluent limits for chlorine using methods from EPA, 1991 and the acute criteria, as shown in Appendix E. Ecology also confirmed that there is no reasonable potential for the Green River discharge to exceed the ammonia water quality criteria when effluent and river flows meet the requirements of the proposed permit.

H. Human health

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

Ecology determined the effluent may contain chemicals of concern for human health, based on the facility's status as an EPA major discharger and data indicating the discharge contains regulated chemicals. 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 any of the 91 numeric human health-based criteria and that effluent limits for human health pollutants are not needed.

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. http://www.ecy.wa.gov/programs/tcp/smu/sediment.html

Even though sediment sampling conducted during the previous permit term showed no violations of the sediment quality standards, Ecology determined that this discharge has potential to cause a violation of the sediment quality standards because:

- Many significant industrial users discharge to the facility's collection system
- This facility is considered an EPA major facility and discharges a very large volume of treated municipal wastewater to the Puget Sound.
- In some of the past testing, detection limits were above the SQS numeric criteria.
- In 1997, three locations had detected concentrations of hexachlorobenzene above the SQS numeric criteria for benthic toxicity.

The proposed permit includes a condition requiring King County to:

- Sample and analyze sediments in the vicinity of South Plant's outfall to characterize sediment quality (the nature and extent of chemical contamination and biological toxicity) in the vicinity of the Permittee's discharge locations. Specifically, sediment sampling will be required for 0 to 10 cm depth at 8 locations near the two diffusers.

Chemical analysis of the 47 chemicals in the sediment management standards plus conventional analytes will be required at all 8 sites. Bioassays will be performed, if the chemical concentrations are near or above the sediment management standards numeric chemical criteria.

- The Permittee must develop a *Sampling and Analysis Plan* in accordance with the current Sediment Sampling and Analysis Plan Appendix. The *Sampling and Analysis Plan* must be approved by Ecology before performing sediment sampling. After the sediment sampling is completed, the Permittee must submit a Sediment Data Report and Environmental Information Management (EIM) templates to Ecology for review and approval.
- If the sediment evaluation shows toxicity at any station, the Permittee must perform additional testing to investigate the source of sediment toxicity.

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/SummaryPages/9580.html), which is referenced in the permit. Ecology recommends that King County send a copy of the acute or chronic toxicity sections(s) of its NPDES permit to the laboratory.

WET testing conducted during previous permit terms showed no reasonable potential for effluent discharges to cause receiving water acute or chronic toxicity. The proposed permit will not include WET limits. King County 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. King County 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).

The South Plant WWTP does not discharge wastewater to the ground under this NPDES permit, therefore no permit limits are required to protect groundwater. Groundwater impacts will be addressed in the facility's reclaimed water permit.

L. Comparison of effluent limits with the previous permit

For marine outfall 001, the proposed limits are the same as those in the 2009 permit except as listed in Table 19.

Table 19. Comparison of Previous and Proposed Effluent Limits for Outfall 001

		Previous Effluent Limits		Proposed Effluent Limits	
Parameter	**Basis of Limit**	**Average Monthly**	**Average Weekly**	**Average Monthly**	**Average Weekly**
BOD_5	Technology	30 mg/L 36,000 lbs/day	45 mg/L 54,000 lbs/day	None - replaced with $CBOD_5$ limits	
$CBOD_5$	Technology	none		25 mg/L 30,000 lbs/day	40 mg/L 48,000 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 generally consistent with agency guidance given in the current version of Ecology's *Permit Writer's Manual* (Publication Number 92-09) for municipal activated sludge facilities with design flows greater than 5 MGD.

King County requested a reduction in monitoring frequency for fecal coliform from 7 times each week to 4 times each week. Consistent with Ecology's *Permit Writers' Manual,* Ecology used EPA guidance (EPA memorandum from Robert Perciasepe and Steven A. Herman to Regional Administrators, April 1996), to assess data from the past two years for treatment plant reliability and data consistency and concluded that a reduction in monitoring frequency to 5 times each week for fecal coliform is warranted. The analysis is summarized in Appendix E.

Permittees receiving monitoring frequency reductions are still expected to take all appropriate measures to minimize pollutants levels as well as to minimize variability (variance), regardless of any reductions in monitoring frequencies granted from the baseline levels. To remain eligible for these reductions, the permittee may not have any violations for effluent limitations of the parameters for which reductions have been granted or failure to submit DMRs, or may not be subject to a new formal enforcement action. For facilities that do not maintain performance levels, Ecology may require increased monitoring by minor permit modification or Administrative Order. Permittees should also be aware that the probability of reporting a violation increases as the monitoring frequency decreases due to a smaller sample set from which to calculate weekly and monthly geometric mean values.

Ecology included additional nutrient monitoring in the proposed permit. Ecology will use this data if a TMDL is developed for dissolved oxygen; such a TMDL will likely establish waste load allocations for nutrients.

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

As a pretreatment publicly owned treatment works (POTW), King County is required to sample influent, primary clarifier effluent, final effluent, and biosolids for toxic pollutants in order to characterize the industrial input. Sampling is also done to determine if pollutants interfere with the treatment process or pass-through the plant to the biosolids or the receiving water. King County will use the monitoring data to develop local limits which commercial and industrial users must meet.

The proposed permit requires King County to monitor for sediments, whole effluent toxicity, and priority pollutants to further characterize the discharges. These pollutants could have a significant impact on the quality of the surface water.

B. Lab accreditation

Ecology requires that facilities must 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). Ecology accredited the

laboratory at this facility for General Chemistry and Microbiology, as listed in Table 20. The County's environmental lab at W. Ewing Street is additionally accredited for trace metals by ICP-OES and ICP-MS, mercury, inorganics, organics by GC and GC-MS, bioassays, and microbiology in matrices including liquids, sediments, and tissues.

Table 20. Lab Accredited Parameters

Parameter Name	Analyte ID	Method Name	Method Code
Solids, Total Volatile	1970	EPA 160.4_1971	10010409
Turbidity	2055	SM 2130 B-01	20048219
Alkalinity	1505	SM 2320 B-97	20045607
Hardness, Total (as CaCO3)	1755	SM 2340 C-97	20047603
Specific Conductance	1610	SM 2510 B-97	20048606
Solids, Total	1950	SM 2540 B-97	20049405
Solids, Total Dissolved	1955	SM 2540 C-97	20050402
Solids, Total Suspended	1960	SM 2540 D-97	20051201
Chlorine (Residual), Total	1940	SM 4500-Cl D-00	20080108
Chlorine (Residual), Total	1940	SM 4500-Cl G-00	20081612
pH	1900	SM 4500-H+ B-00	20105219
Ammonia	1515	SM 4500-NH3 F-97	20023556
Nitrite	1835	SM 4500-$NO2^{-}$ B-00	20113104
Nitrate	1805	SM 4500-$NO3^{-}$ F-00	20117617
Nitrate + Nitrite	1820	SM 4500-$NO3^{-}$ F-00	20117617
Nitrogen, Total Kjeldahl	1795	SM 4500-Norg B-97	20119204
Dissolved Oxygen	1880	SM 4500-O G-01	20121408
Orthophosphate	1870	SM 4500-P F-99	20125013
Phosphorus, total	1910	SM 4500-P F-99	20125013
Biochemical Oxygen Demand (BOD)	1530	SM 5210 B-01	20135006
Chemical Oxygen Demand (COD)	1565	SM 5220 D-97	20136805
Total coliforms-count	2500	SM 9222 B (M-endo)-97	20203207
Fecal coliform-count	2530	SM 9222 D (m-FC)-97	20210008

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 King County to:

- Take the actions detailed in proposed permit Special Condition S4.
- 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.

Special Condition S4 restricts the amount of flow.

If a municipality intends to apply for Ecology-administered funding for the design or construction of a facility project, the plan must meet the standard of a "Facility Plan", as defined in WAC 173-98-030. A complete "Facility Plan" includes all elements of an "Engineering Report" along with State Environmental Review Process (SERP) documentation to demonstrate compliance with 40 CFR 35.3140 and 40 CFR 35.3145, and a cost effectiveness analysis as required by WAC 173-98-730. The municipality should contact Ecology's regional office as early as practical before planning a project that may include Ecology-administered funding.

C. Operation and maintenance

The proposed permit contains Special Condition S5 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 King County takes adequate safeguards so that it uses constructed facilities to their optimum potential in terms of pollutant capture and treatment.

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.

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

E. 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 biosolids 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 Public Health – Seattle and King County.

Requirements for monitoring biosolids 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. Spill plan

This facility stores a quantity of chemicals on-site that have the potential to cause water pollution if accidentally released. Ecology can require a facility to develop best management plans to prevent this accidental release [Section 402(a)(1) of the Federal Water Pollution Control Act (FWPCA) and RCW 90.48.080].

King County developed a plan for preventing the accidental release of pollutants to state waters and for minimizing damages if such a spill occurs. The proposed permit requires the facility to update this plan as needed.

G. 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

Ecology, December 2011. *Permit Writer's Manual*. Publication Number 92-109 (https://fortress.wa.gov/ecy/publications/SummaryPages/92109.html)

Ecology, October 2010 (revised). *Water Quality Program Guidance Manual – Procedures to Implement the State's Temperature Standards through NPDES Permits*. Publication Number 06-10-100 (https://fortress.wa.gov/ecy/publications/summarypages/0610100.html)

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

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

EPA, 1992. National Toxics Rule. Federal Register, V. 57, No. 246, Tuesday, December 22, 1992.

EPA, 1991. *Technical Support Document for Water Quality-based Toxics Control*. EPA/505/2-90-001.

EPA, 1985. *Water Quality Assessment: A Screening Procedure for Toxic and Conventional Pollutants in Surface and Ground Water*. EPA/600/6-85/002a.

EPA, 1983. *Water Quality Standards Handbook*. USEPA Office of Water, Washington, D.C.

King County, September 2011. *Diving Inspection, Repair Work Order 2009, King County Contract Number C00398C08, Work Order No. 06- Renton Effluent Transfer System Outfall Inspections, August 29-30 and September 16, 2011.*

King County, *2013 Receiving Water Characterization Study, King County NPDES Monitoring Program, Final Report for Brightwater, South, Vashon, and West Point Treatment Plants and Alki, Carkeek, Elliott West, and Henderson/MLK CSO Storage and Treatment Facilities,* June 2013.

Water Pollution Control Federation, 1976. *Chlorination of Wastewater*.

Appendix A — Public Involvement Information

Ecology proposes to reissue a permit to King County's South Plant 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 16, 2015, in the *Seattle Times* 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, 425-649-7201, 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 Alison Evans, P.E.

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 months 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.

BOD_5 -- 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 biosolids 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.

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 — Facility Data

South Plant Treatment Plant DMR Data, p1

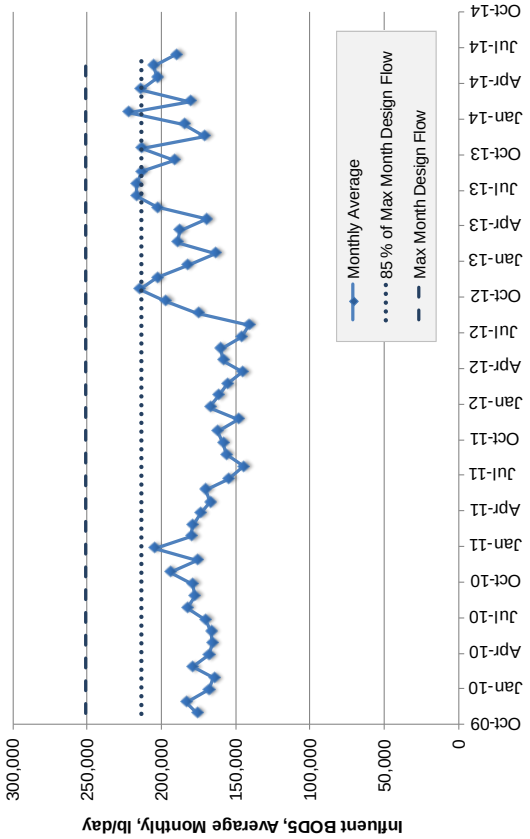
Influent								
	BOD5, lbs/day		BOD5, mg/L		TSS, lbs/day		TSS, mg/L	
	Ave	Max Day	Ave	Max Day	Ave	Max Day	Ave	Max Day
1-Nov-09	175,786	211,308	223	352	169,848	246,943	208	324
1-Dec-09	183,306	332,985	266	424	159,913	231,832	232	370
1-Jan-10	168,147	241,798	215	351	155,202	330,664	198	480
1-Feb-10	164,761	m	244	312	151,071	m	225	396
1-Mar-10	179,039	249,166	272	385	180,583	315,826	275	488
1-Apr-10	167,946	246,263	261	379	165,768	450,433	255	670
1-May-10	165,624	230,106	276	388	150,474	198,081	251	334
1-Jun-10	166,440	261,358	254	389	154,447	252,623	235	376
1-Jul-10	170,141	222,879	295	368	153,959	201,308	268	380
1-Aug-10	182,458	290,225	318	492	167,765	249,779	292	452
1-Sep-10	177,641	332,704	299	598	154,554	218,094	259	392
1-Oct-10	179,208	223,214	276	357	170,304	227,171	260	338
1-Nov-10	194,124	273,729	263	405	170,560	241,413	229	352
1-Dec-10	175,762	241,760	208	324	180,904	299,403	207	348
1-Jan-11	204,352	293,586	232	411	217,739	386,978	241	524
1-Feb-11	180,070	345,932	234	365	166,165	390,476	215	412
1-Mar-11	179,000	224,735	205	277	189,251	263,765	215	286
1-Apr-11	173,917	205,417	213	275	190,296	285,424	233	362
1-May-11	167,428	204,613	243	292	176,745	311,720	255	422
1-Jun-11	170,413	338,452	303	612	177,232	461,223	315	834
1-Jul-11	154,978	211,984	308	405	143,322	229,257	285	438
1-Aug-11	145,016	215,236	295	432	151,940	251,493	310	500
1-Sep-11	156,338	193,614	278	345	167,313	222,235	298	396
1-Oct-11	158,597	227,512	258	381	153,671	193,605	250	310
1-Nov-11	161,977	332,784	243	329	156,607	440,299	231	356
1-Dec-11	148,584	195,328	222	279	150,383	201,949	225	308
1-Jan-12	167,679	222,817	199	291	161,236	215,670	192	308
1-Feb-12	161,548	394,229	191	395	150,204	204,434	179	220
1-Mar-12	155,921	268,615	171	352	164,060	240,672	178	254
1-Apr-12	145,377	211,446	186	293	160,490	259,798	206	360
1-May-12	158,915	257,584	225	364	155,573	277,124	218	388
1-Jun-12	160,285	230,916	228	358	156,971	314,764	223	450
1-Jul-12	145,938	196,237	236	300	161,321	270,776	258	384
1-Aug-12	141,345	247,545	231	399	159,390	217,334	261	356
1-Sep-12	175,722	319,701	282	512	185,307	387,138	298	620
1-Oct-12	197,141	304,342	310	460	183,482	250,089	287	378
1-Nov-12	214,482	301,129	292	405	193,361	275,598	261	356
1-Dec-12	203,348	275,843	219	323	200,959	346,657	216	360
1-Jan-13	182,552	258,445	243	314	194,018	325,381	257	420
1-Feb-13	163,418	190,017	249	314	163,181	204,786	247	314
1-Mar-13	188,925	283,645	287	386	172,661	239,882	264	368
1-Apr-13	187,747	237,920	262	350	204,029	315,923	284	444
1-May-13	169,832	231,505	283	399	204,938	308,674	342	532
1-Jun-13	202,850	269,575	342	444	203,550	269,195	345	476
1-Jul-13	216,794	322,387	376	494	196,005	313,603	341	552
1-Aug-13	216,566	260,021	373	451	178,790	212,416	308	368
1-Sep-13	213,021	329,739	346	536	197,869	439,650	317	527
1-Oct-13	191,616	251,976	294	363	198,353	300,526	304	482
1-Nov-13	213,018	258,867	324	405	204,517	312,442	310	432
1-Dec-13	170,975	250,344	283	421	173,736	275,682	288	464
1-Jan-14	184,916	237,451	285	383	179,512	263,822	274	338
1-Feb-14	222,114	311,698	300	502	194,514	334,934	258	436
1-Mar-14	180,805	319,387	202	290	190,746	335,141	212	396
1-Apr-14	213,848	269,082	310	399	177,724	385,088	249	304
1-May-14	203,296	260,502	310	430	191,069	273,211	291	378
1-Jun-14	205,529	262,273	377	489	213,783	320,735	392	598
1-Jul-14	189,979	241,744	374	464	198,475	373,434	392	735
AVE:	178,887	261,137	268	390	175,366	288,689	262	418
MIN:	141,345	190,017	171	275	143,322	193,605	178	220
MAX:	222,114	394,229	377	612	217,739	461,223	392	834
5th %tile:								
95th %tile:								
85%	213,350				199,750			
Limits	251,000				235,000			

South Plant Treatment Plant DMR Data, p2

Effluent

	Flow, MGD		BOD5, lbs/day		BOD5, mg/L		BOD5, % Removal	TSS, lbs/day		TSS, mg/L		TSS, % Removal	Fecal Coliform, #/100 ml		pH		Res. Chlorine, mg/L		TKN, mg/L as N		Ammonia, lbs/day		Ammonia, mg/L		Nitrate+ Nitrite, mg/L as N		Ortho Phos, mg/L as P		Total Phos, mg/L as P		Temp, deg C	
	Ave	Max Day	Mnth Ave	Wk Ave	Mnth Ave	Wkly Ave	Ave	Mnth Ave	Wk Ave	Mnth Ave	Wk Ave	Ave	GEM	GM7	max	min	Mnth Ave	Max Day	Mnth Ave	Max Day	Mnth Ave	Max Day	Mnth Ave	Max Day	Mnth Ave	Max Day	Mnth Ave	Max Day	Mnth Ave	Max Day	Ave	Max
1-Nov-09	96	141	17055	20190	22	25	90	9081	10107	11	12	95	90	205	7.1	6.3	0.05	0.05	28	39	18,168	22,819	25	37	1.8	2.1	1.8	2.1	2.4	3.1		
1-Dec-09	78	108	18322	20380	28	30	90	11718	13476	18	19	93	106	143	7.4	6.8	0.05	0.05	32	37	17,834	19,517	28	33	1.4	2.8	1.5	1.7	2.0	2.4	15.3	16.1
1-Jan-10	92	134	13746	15453	18	21	92	11265	13141	15	17	92	61	80	7.4	7.0	0.06	0.31	30	37	18,716	23,068	25	31	0.6	1.5	1.1	1.3	1.7	1.9	14.2	14.9
1-Feb-10	76	95	12354	13516	20	22	92	9312	10557	15	17	94	78	96	7.4	6.9	0.11	0.05	33	39	18,709	20,573	30	34	0.7	0.8	1.2	1.5	1.8	2.3	14.9	15.4
1-Mar-10	75	108	13239	14477	21	21	93	11023	16798	18	23	94	51	94	7.3	7.0	0.05	0.05	35	41	18,741	22,483	31	37	0.8	1.3	1.5	1.5	2.3	2.9	15.9	15.3
1-Apr-10	72	90	10892	13737	18	24	94	12039	12680	20	21	92	81	197	7.2	6.0	0.05	0.05	34	41	18,342	21,426	31	37	0.1	0.2	1.8	2.4	3.0	6.3	15.7	16.4
1-May-10	65	78	10077	10409	19	19	94	8663	11825	16	22	94	65	104	6.8	6.4	0.05	0.05	38	45	18,144	20,831	34	39	0.5	0.6	1.9	2.3	2.5	2.9	17.0	17.6
1-Jun-10	73	91	12343	16559	20	26	93	9957	12076	16	19	94	135	187	6.8	6.5	0.05	0.05	35	43	17,907	21,504	30	33	0.4	0.8	1.3	1.9	2.0	3.0	17.9	18.9
1-Jul-10	63	69	8920	9930	17	20	95	5332	5753	10	11	96	127	272	7.2	6.3	0.05	0.05	31	41	14,208	16,958	27	33	3.8	4.6	1.5	1.6	1.7	2.4	20.0	20.1
1-Aug-10	63	67	6277	6930	12	13	96	5160	5969	10	12	97	66	109	7.3	6.9	0.05	0.05	26	33	11,346	15,975	22	29	6.1	8.4	2.5	5.1	3.2	5.7	21.3	22.1
1-Sep-10	67	86	6082	7517	11	14	96	4455	5016	8	9	97	32	57	7.2	6.4	0.05	0.07	17	32	8,068	15,145	15	28	8.6	12.6	3.9	5.4	4.6	6.7	21.1	21.4
1-Oct-10	73	106	9783	11457	16	17	95	5538	6181	9	10	97	17	26	7.1	6.4	0.06	0.07	22	33	11,606	17,176	18	29	5.9	14.2	2.6	4.4	2.7	4.7	19.6	20.6
1-Nov-10	84	114	11561	12503	16	16	94	6638	7132	9	9	96	76	108	7.2	6.9	0.05	0.05	26	30	15,389	19,480	21	26	1.9	3.6	0.4	0.5	0.8	1.0	17.4	18.3
1-Dec-10	105	235	14323	22730	16	17	92	9752	16627	11	12	95	65	263	7.2	6.1	0.05	0.11	24	33	18,484	22,738	22	29	1.6	3.6	2.1	3.6	2.0	3.9	15.1	16.4
1-Jan-11	108	159	15493	19285	18	19	92	14755	18750	16	18	93	34	59	7.6	6.9	0.05	0.05	26	31	18,803	21,156	23	28	0.5	0.8	1.4	2.0	1.6	2.2	13.9	14.7
1-Feb-11	86	111	13999	16210	19	22	92	10780	12662	15	16	93	43	63	8.0	6.9	0.05	0.15	33	43	20,228	22,115	28	33	0.8	1.6	1.1	1.3	1.7	1.9	14.4	17.6
1-Mar-11	101	156	13148	16472	15	21	93	14444	18056	17	18	92	20	32	7.6	6.6	0.05	0.11	28	34	20,948	26,987	25	31	0.5	0.5	1.1	1.5	1.7	2.2	13.7	14.4
1-Apr-11	94	147	10124	12971	13	14	94	10860	14070	14	15	94	33	79	7.5	6.6	0.05	0.13	30	37	20,065	23,115	27	33	0.4	0.6	1.2	1.5	1.7	2.0	14.6	15.8
1-May-11	77	126	10068	12907	16	17	94	7413	9948	11	13	96	51	67	7.5	7.0	0.05	0.05	34	42	19,679	25,361	30	38	0.7	1.2	2.0	2.9	2.4	3.2	16.2	17.1
1-Jun-11	61	66	10149	12009	20	24	94	5187	5631	10	11	97	22	47	7.5	6.7	0.05	0.09	29	34	12,378	14,742	24	29	4.6	5.5	2.1	2.4	2.5	3.2	18.2	19.1
1-Jul-11	56	60	10904	15119	23	32	93	4460	6187	9	13	97	31	48	7.5	6.6	0.05	0.16	19	30	6,837	11,182	15	24	9.3	15.5	2.2	3.5	2.4	4.0	19.9	20.9
1-Aug-11	53	68	5924	6922	13	15	96	4096	4849	9	11	97	27	65	7.6	6.5	0.05	0.07	19	31	6,706	13,274	15	29	9.5	12.2	2.6	4.0	2.8	4.5	21.1	21.7
1-Sep-11	62	70	7339	7884	14	15	95	4621	6057	9	11	97	77	106	7.6	6.8	0.06	0.11	30	40	15,233	19,079	29	36	5.2	9.1	2.0	3.6	2.3	4.5	21.1	28.5
1-Oct-11	67	85	7269	7920	13	15	95	5334	6186	10	11	97	39	67	7.5	7.1	0.06	0.1	31	42	14,651	19,949	26	34	4.0	5.4	1.6	3.2	1.8	3.5	19.1	19.8
1-Nov-11	74	147	13394	23581	21	28	92	10295	21437	15	25	94	90	106	7.4	6.9	0.05	0.13	27	32	15,058	23,573	25	29	4.1	6.5	1.9	2.6	2.8	4.7	16.6	17.8
1-Dec-11	73	93	8280	11528	13	17	94	6876	8791	11	13	95	22	38	7.5	6.4	0.05	0.07	34	39	18,851	22,033	31	36	0.9	1.2	2.1	2.7	2.6	4.7	15.2	15.7
1-Jan-12	97	165	17706	24488	22	27	90	12085	18022	14	19	93	56	68	7.1	6.4	0.06	0.09	22	28	16,295	18,668	20	26	2.1	3.0	1.6	2.4	2.2	4.8	14.4	15.4
1-Feb-12	94	127	11135	15403	14	17	93	9074	10900	12	14	94	27	75	7.2	6.3	0.05	0.1	28	36	18,868	22,211	25	32	0.9	1.1	1.5	2.3	1.8	2.7	14.2	14.8
1-Mar-12	106	160	11753	18736	13	16	92	12429	19676	13	18	92	80	115	8.2	6.2	0.05	0.05	29	41	21,542	28,515	25	33	0.6	1.1	1.5	2.0	2.0	2.5	14.2	15.1
1-Apr-12	88	114	9349	14493	13	20	94	6304	7541	9	9	96	33	45	7.0	6.7	0.05	0.08	31	39	19,510	24,574	27	33	0.3	0.8	1.3	1.8	1.7	2.3	15.8	16.7
1-May-12	80	107	12404	16593	19	24	92	5929	6571	9	10	96	85	97	6.9	6.1	0.05	0.11	20	35	11,836	25,791	17	32	5.1	11.2	3.3	4.0	4.1	5.1	17.8	18.9
1-Jun-12	77	89	8194	11470	13	18	95	6227	8745	10	14	96	49	155	6.9	6.3	0.05	0.05	6	13	2,350	5,427	4	9	13.1	14.7	3.5	3.6	4.0	4.5	19.2	20.4
1-Jul-12	68	84	5315	6462	9	12	96	4101	4688	7	9	97	55	100	6.7	6.2	0.05	0.06	5	7.8	1,249	2,487	2	5	12.6	14.0	3.7	4.1	4.0	4.6	21.2	22.1
1-Aug-12	66	72	6643	10009	12	17	95	4276	5130	8	10	97	46	64	7.1	6.4	0.06	0.1	12	19	3,586	8,090	6	14	10.3	12.7	3.9	4.2	4.2	5.2	22.4	23.0
1-Sep-12	68	74	8585	9214	15	16	95	4573	5018	8	9	97	33	59	7.2	6.4	0.05	0.1	19	25	9,169	14,017	16	25	6.0	9.6	2.6	3.7	3.2	4.2	22.3	22.8
1-Oct-12	70	115	10873	15112	19	23	94	4345	5382	7	10	98	26	32	7.2	6.3	0.06	0.1	28	34	14,973	18,346	26	34	1.8	3.1	1.4	2.1	2.0	3.5	20.7	22.0
1-Nov-12	85	153	13296	14204	20	25	94	6040	9325	8	10	97	45	147	7.0	6.6	<.06	0.1	26	49	12,718	15,343	19	27	5.4	6.8	0.9	1.9	1.2	2.2	18.1	19.6
1-Dec-12	106	154	19456	27070	22	27	90	9965	15507	11	15	95	68	136	7.0	6.4	<.05	0.07	21	26	15,550	19,028	18	22	2.6	3.7	1.4	1.9	1.5	2.1	15.7	16.7
1-Jan-13	85	150	12720	15471	18	23	93	8585	10412	12	13	96	62	93	6.9	6.5	<.05	<.05	31	41	17,749	23,138	25	35	0.6	1.1	1.3	1.9	1.7	2.5	14.8	15.7
1-Feb-13	72	91	8820	9525	15	17	95	6382	7059	11	11	96	135	238	6.9	6.7	<.05	0.13	33	38	17,653	20,357	29	33	1.3	3.4	1.7	2.3	2.0	2.8	15.1	15.6
1-Mar-13	73	95	11587	13862	19	24	94	6887	7640	11	13	96	25	45	6.9	6.5	<.05	0.06	25	32	13,514	19,413	22	27	4.5	6.4	2.4	2.6	2.8	3.3	15.4	16.5
1-Apr-13	82	122	11288	12040	16	19	94	8240	9516	12	13	96	28	43	6.9	6.4	<.06	0.21	25	38	14,990	21,588	23	35	1.9	3.9	2.2	2.7	2.6	3.1	15.9	16.8
1-May-13	66	77	7217	10499	13	18	96	6104	7052	11	12	97	35	55	7.0	6.9	<.05	<.05	41	48	21,277	25,087	38	45	0.2	0.2	1.8	3.1	2.4	3.7	18.1	18.8
1-Jun-13	65	71	9891	16012	18	28	95	5296	7201	10	13	97	25	45	7.1	6.5	<.05	0.13	31	50	13,878	23,006	26	42	3.4	7.6	2.9	3.8	3.5	4.5	20.1	22.1
1-Jul-13	63	73	11008	15203	21	29	95	8231	11895	16	23	96	33	74	6.8	6.2	<.05	0.09	11	20	3,606	7,345	7	14	15.6	16.4	3.6	4.0	4.6	5.4	21.9	22.8
1-Aug-13	64	75	6447	8335	12	16	97	4270	4274	8	8	98	17	21	6.7	6.0	<.05	0.07	4	7.3	387	1,339	1	3	15.6	17.7	3.9	4.4	4.4	4.8	22.9	23.3
1-Sep-13	69	113	8512	11946	14	20	96	5211	6748	9	11	97	55	123	9.0	6.2	<.05	0.09	5	9.4	1,312	4,920	2	6	14.7	17.3	3.4	4.0	4.2	5.0	22.3	23.2
1-Oct-13	69	95	15938	20544	28	38	92	6038	7844	11	11	97	159	267	7.1	6.2	<.05	0.16	25	36	12,338	18,864	22	34	5.9	13.7	1.7	2.6	2.1	3.2	19.8	20.5
1-Nov-13	69	92	6375	8036	11	14	97	6621	7480	12	13	97	19	31	7.1	6.6	<.05	0.07	26	37	13,442	18,295	23	34	3.9	7.2	1.2	1.7	1.4	2.1	18.2	19.2
1-Dec-13	64	80	6242	6700	12	13	96	5944	6548	11	13	96	47	91	7.2	6.8	<.05	<.05	42	47	18,949	22,425	36	42	0.2	0.2	1.1	1.5	1.7	2.0	16.2	16.7
1-Jan-14	72	107	10488	13239	17	20	94	6650	9484	11	15	96	44	60	7.0	6.6	<.05	<.05	35	50	17,568	22,220	30	39	0.8	2.0	0.5	0.7	1.1	1.7	15.3	15.7
1-Feb-14	86	158	16731	23519	23	34	92	8764	12620	12	14	96	47	72	6.9	6.4	<.06	0.12	24	32	13,521	18,124	20	29	2.3	5.2	0.6	1.5	1.1	2.0	14.1	14.7
1-Mar-14	104	164	10187	13374	12	13	95	7055	8780	8	9	96	25	42	7.0	6.4	<.06	0.3	23	29	17,541	21,329	21	25	0.8	2.1	0.9	1.4	1.4	2.1	14.4	16.0
1-Apr-14	76	106	12732	18619	20	26	94	5171	6747	8	9	97	62	154	7.0	6.2	<.07	0.36	22	33	11,633	19,180	18	31	7.5	16.8	2.4	3.3	2.8	4.0	16.1	17.1
1-May-14	73	103	8067	10052	13	16	96	4768	5511	8	9	97	17	57	7.0	6.3	<.06	0.15	20	32	10,289	13,640	16	24	7.6	10.6	2.3	2.4	2.8	3.5	18.1	19.3
1-Jun-14	59	63	7307	10949	15	22	96	5391	8428	11	17	97	49	74	7.0	6.3	<.05	0.14	15	36	5,197	12,059	11	24	12.1	15.5	2.6	3.2	3.1	4.2	20.2	21.3
1-Jul-14	56	70	4517	5054	10	11	98	3237	4280	7	9	98	48	62	7.2	6.3	<.06	0.16	13	21	4,400	7,641	10	16	12.5	16.9	2.7	3.6	2.4	3.7	22.1	22.7
AVE:	77	107	10734	13769	17	20	94	7425	9579	11	14	96	54	96	7.2	6.5	0.05	0.10	25	34	13,895	18,329	22	29	4.3	6.4	2.0	2.7	2.4	3.5	17.6	18.6
MIN:	53	60	4517	5054	9	11	90	3237	4274	7	8	92	17	21	6.7	6.0	0.05	0.05	4	7	387	1,339	1	3	0.1	0.2	0.4	0.5	0.8	1.0	13.7	14.4
MAX:	108	235	19456	27070	28	38	98	14755	21437	20	25	98	159	272	9.0	7.1	0.11	0.36	42	50	21,542	28,515	38	45	16	18	3.9	5.4	4.6	6.7	22.9	28.5
5th %tile:													18.6																			
95th %tile:														243				0.25						40						22.3		
85%	122																															
Limits	144		36,000	54,000	30	45	85	36,000	54,000	30	45	85	200	400	6.0	9.0	0.50	0.75														
																	cv=	0.63														

Exceeds Permit Limit


Influent BOD5, Average Monthly, lb/day
300,000
250,000
200,000
150,000
100,000
50,000
0
Monthly Average
85 % of Max Month Design Flow
Max Month Design Flow
Oct-09
Jan-10
Apr-10
Jul-10
Oct-10
Jan-11
Apr-11
Jul-11
Oct-11
Jan-12
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Jul-13
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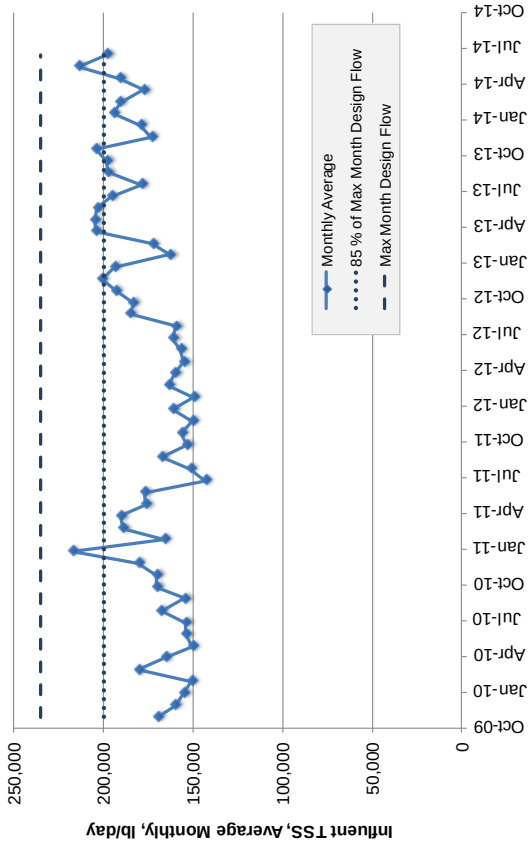
Jan-14
Apr-14
Jul-14
Oct-14


Influent TSS, Average Monthly, lb/day
250,000
200,000
150,000
100,000
50,000
0
Monthly Average
85 % of Max Month Design Flow
Max Month Design Flow
Oct-09
Jan-10
Apr-10
Jul-10
Oct-10
Jan-11
Apr-11
Jul-11
Oct-11
Jan-12
Apr-12
Jul-12
Oct-12
Jan-13
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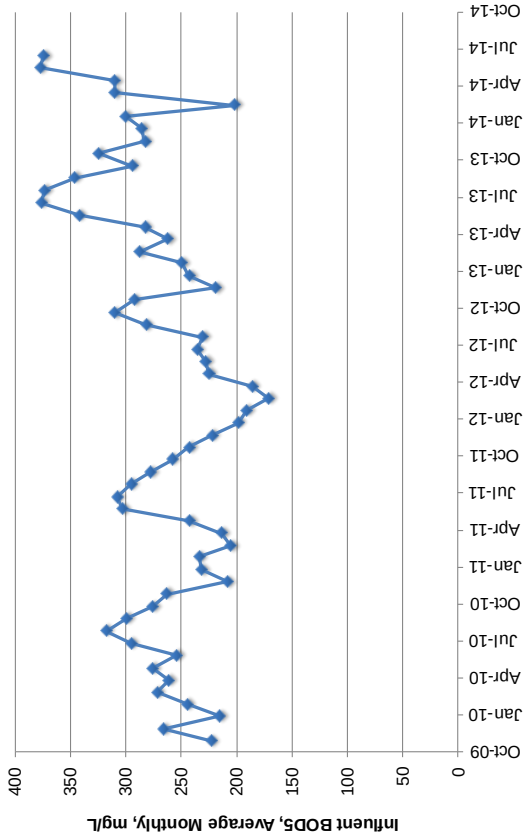
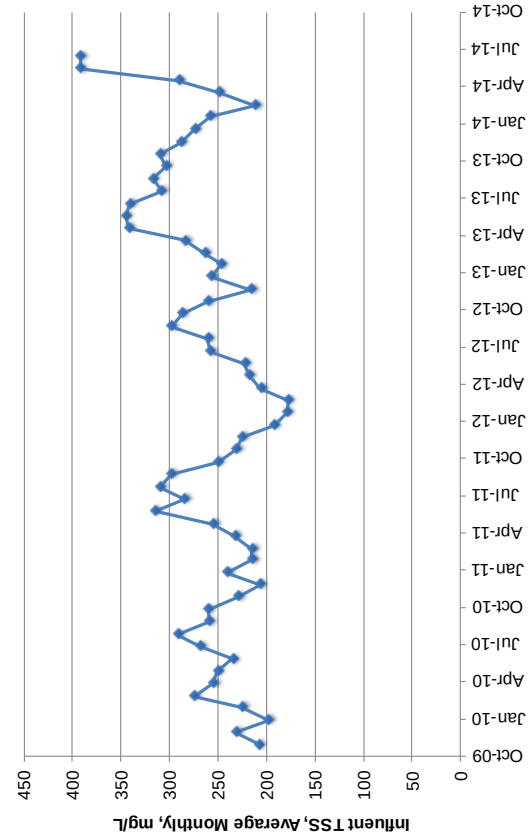
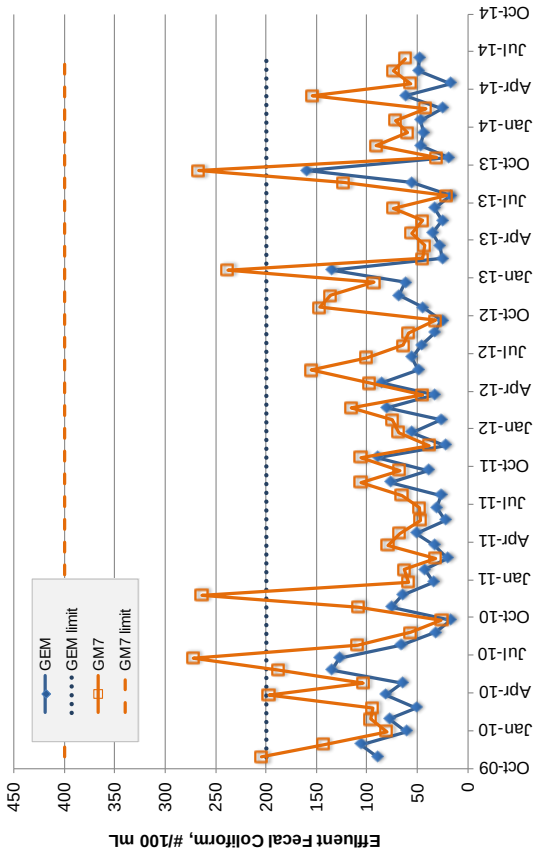
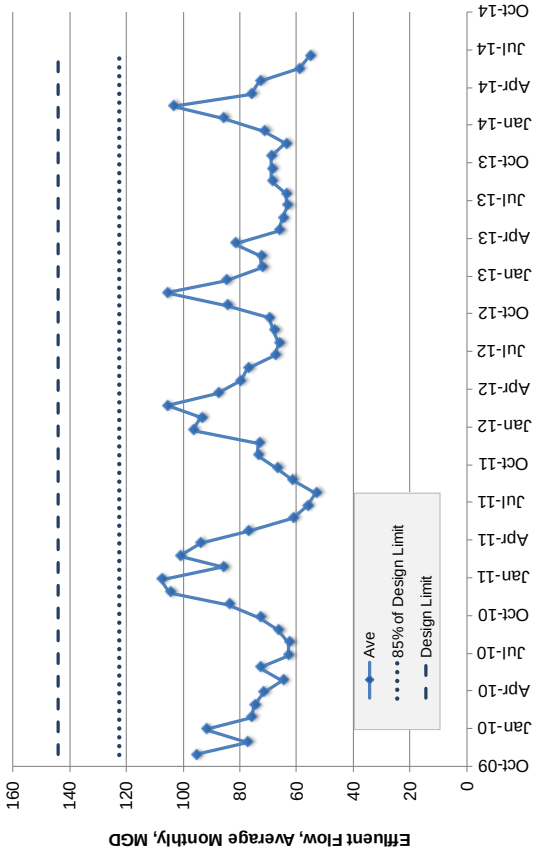
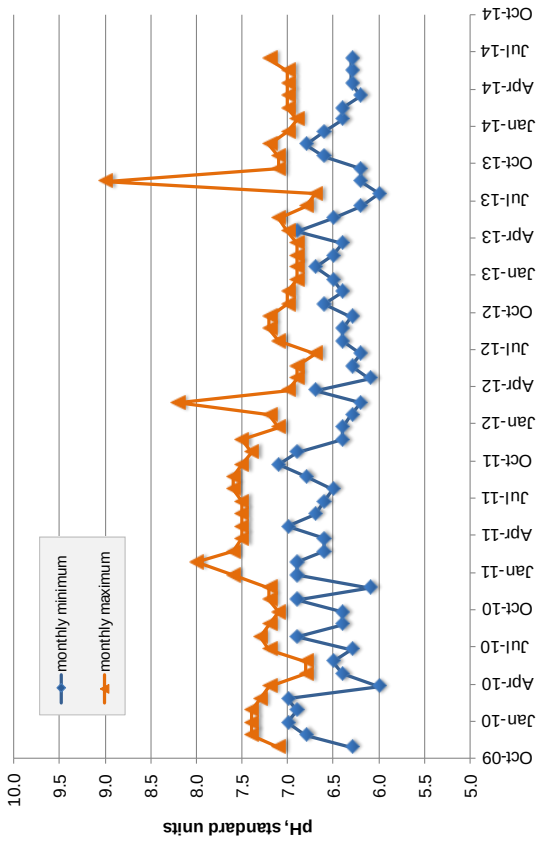
Jul-13
Oct-13
Jan-14
Apr-14
Jul-14
Oct-14

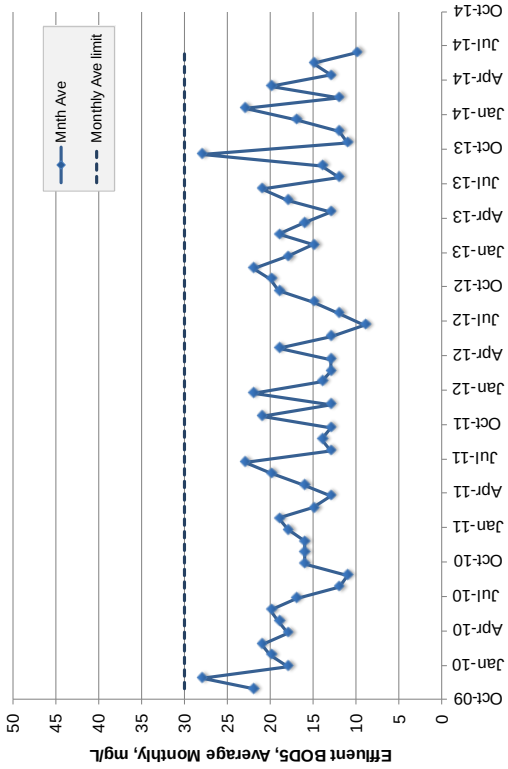

Influent BOD5, Average Monthly, mg/L
400
350
300
250
200
150
100
50
0
Oct-09
Jan-10
Apr-10
Jul-10
Oct-10
Jan-11
Apr-11
Jul-11
Oct-11
Jan-12
Apr-12
Jul-12
Oct-12
Jan-13
Apr-13
Jul-13
Oct-13
Jan-14
Apr-14
Jul-14
Oct-14

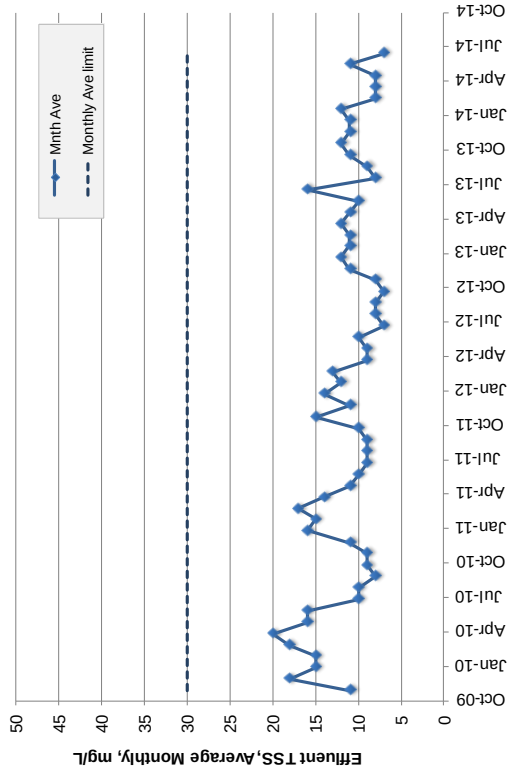

Influent TSS, Average Monthly, mg/L
450
400
350
300
250
200
150
100
50
0
Oct-09
Jan-10
Apr-10
Jul-10
Oct-10
Jan-11
Apr-11
Jul-11
Oct-11
Jan-12
Apr-12
Jul-12
Oct-12
Jan-13
Apr-13
Jul-13
Oct-13
Jan-14
Apr-14
Jul-14
Oct-14

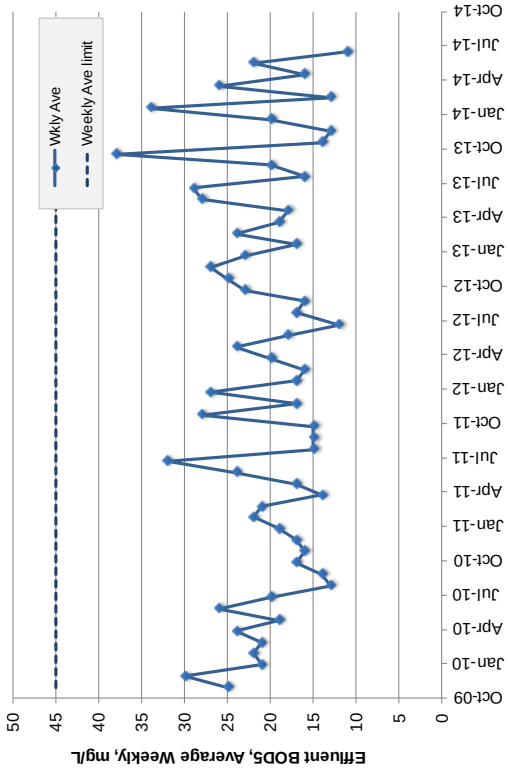

Effluent Fecal Coliform, #/100 mL
GEM
GEM limit
GM7
GM7 limit
0
50
100
150
200
250
300
350
400
450
Oct-09
Jan-10
Apr-10
Jul-10
Oct-10
Jan-11
Apr-11
Jul-11
Oct-11
Jan-12
Apr-12
Jul-12
Oct-12
Jan-13
Apr-13
Jul-13
Oct-13
Jan-14
Apr-14
Jul-14
Oct-14

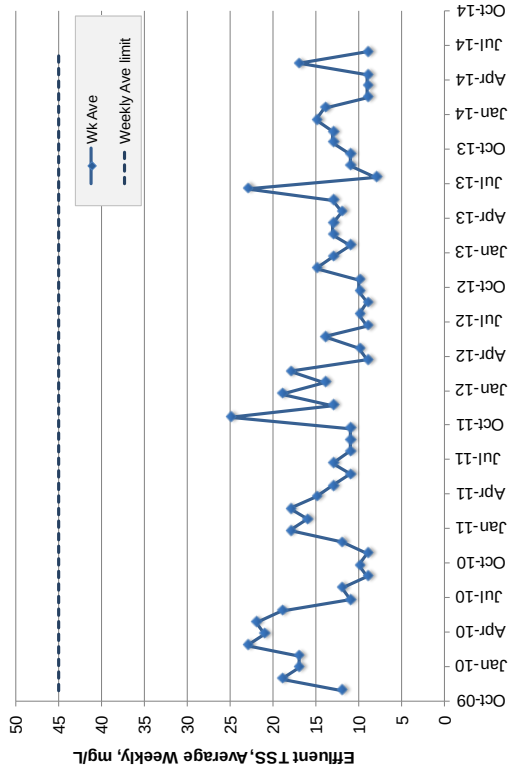

Effluent Flow, Average Monthly, MGD
Ave
85% of Design Limit
Design Limit
0
20
40
60
80
100
120
140
160
Oct-09
Jan-10
Apr-10
Jul-10
Oct-10
Jan-11
Apr-11
Jul-11
Oct-11
Jan-12
Apr-12
Jul-12
Oct-12
Jan-13
Apr-13
Jul-13
Oct-13
Jan-14
Apr-14
Jul-14
Oct-14

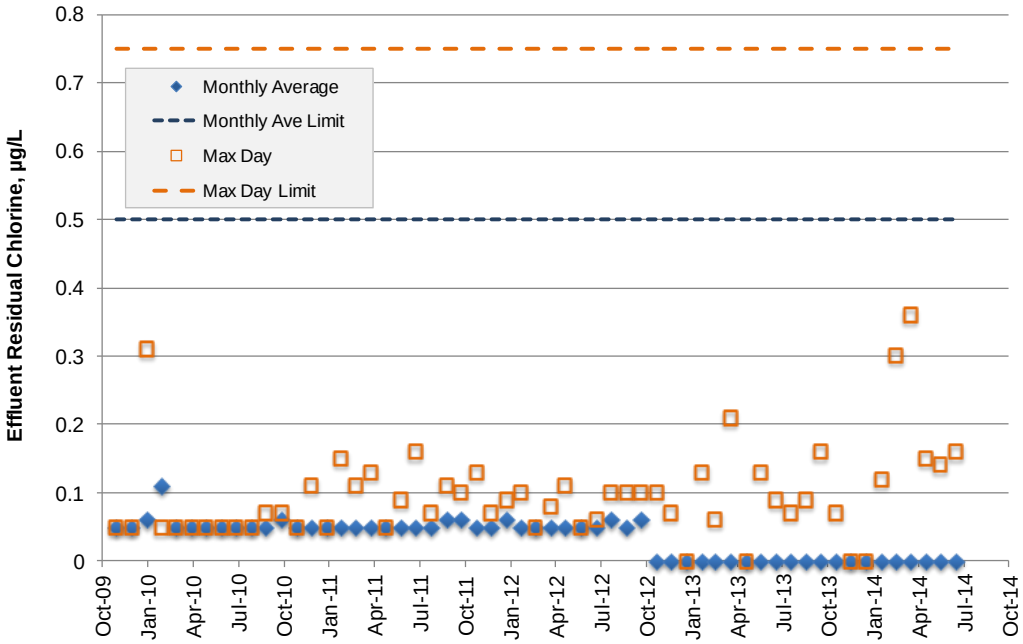

pH, standard units
monthly minimum
monthly maximum
5.0
5.5
6.0
6.5
7.0
7.5
8.0
8.5
9.0
9.5
10.0
Oct-09
Jan-10
Apr-10
Jul-10
Oct-10
Jan-11
Apr-11
Jul-11
Oct-11
Jan-12
Apr-12
Jul-12
Oct-12
Jan-13
Apr-13
Jul-13
Oct-13
Jan-14
Apr-14
Jul-14
Oct-14


Effluent BOD5, Average Monthly, mg/L
Mnth Ave
Monthly Ave limit
0
5
10
15
20
25
30
35
40
45
50
Oct-09
Jan-10
Apr-10
Jul-10
Oct-10
Jan-11
Apr-11
Jul-11
Oct-11
Jan-12
Apr-12
Jul-12
Oct-12
Jan-13
Apr-13
Jul-13
Oct-13
Jan-14
Apr-14
Jul-14
Oct-14


Effluent TSS, Average Monthly, mg/L
Mnth Ave
Monthly Ave limit
0
5
10
15
20
25
30
35
40
45
50
Oct-09
Jan-10
Apr-10
Jul-10
Oct-10
Jan-11
Apr-11
Jul-11
Oct-11
Jan-12
Apr-12
Jul-12
Oct-12
Jan-13
Apr-13
Jul-13
Oct-13
Jan-14
Apr-14
Jul-14
Oct-14


Effluent BOD5, Average Weekly, mg/L
Wkly Ave
Weekly Ave limit
0
5
10
15
20
25
30
35
40
45
50
Oct-09
Jan-10
Apr-10
Jul-10
Oct-10
Jan-11
Apr-11
Jul-11
Oct-11
Jan-12
Apr-12
Jul-12
Oct-12
Jan-13
Apr-13
Jul-13
Oct-13
Jan-14
Apr-14
Jul-14
Oct-14


Effluent TSS, Average Weekly, mg/L
Wk Ave
Weekly Ave limit
0
5
10
15
20
25
30
35
40
45
50
Oct-09
Jan-10
Apr-10
Jul-10
Oct-10
Jan-11
Apr-11
Jul-11
Oct-11
Jan-12
Apr-12
Jul-12
Oct-12
Jan-13
Apr-13
Jul-13
Oct-13
Jan-14
Apr-14
Jul-14
Oct-14


Effluent Residual Chlorine, µg/L
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
Monthly Average
Monthly Ave Limit
Max Day
Max Day Limit
Oct-09
Jan-10
Apr-10
Jul-10
Oct-10
Jan-11
Apr-11
Jul-11
Oct-11
Jan-12
Apr-12
Jul-12
Oct-12
Jan-13
Apr-13
Jul-13
Oct-13
Jan-14
Apr-14
Jul-14
Oct-14

King County South Plant Acute WET Test Results

Test Code	Date Collected	Organism	Endpoint	NOEC	LOEC	PMSD	% Survival
AQTX1261	2/7/1997	rainbow trout	96-hour Survival	0.68	100	20%	23%
AQTX1253	4/14/1997	fathead minnow	96-hour Survival	0.68	100	11%	78%
AQTX1522	8/19/1997	*Daphnia pulex*	48-hour Survival	100	> 100		100%
AQTX003007	9/23/1997	fathead minnow	96-hour Survival	100	> 100	13%	90%
AQTX1640	11/18/1997	*Daphnia pulex*	48-hour Survival	100	> 100		100%
AQTX1639	11/18/1997	fathead minnow	96-hour Survival	50	100	7%	88%
AQTX1884	2/26/1998	*Daphnia pulex*	48-hour Survival	100	> 100	9%	95%
AQTX1883	2/26/1998	fathead minnow	96-hour Survival	100	> 100	8%	95%
AQTX1888	5/19/1998	*Daphnia pulex*	48-hour Survival	100	> 100	8%	100%
AQTX1887	5/19/1998	fathead minnow	96-hour Survival	100	> 100	5%	100%
AQTX002998	8/4/1999	*Daphnia pulex*	48-hour Survival	100	> 100		100%
AQTX002997	8/4/1999	fathead minnow	96-hour Survival	100	> 100		100%
AQTX002994	7/19/2001	fathead minnow	96-hour Survival	100	> 100	12%	93%
AQTX002993	7/19/2001	*Daphnia pulex*	48-hour Survival	100	> 100		100%
AQTX002989	12/5/2001	*Daphnia pulex*	48-hour Survival	100	> 100		100%
AQTX002990	12/5/2001	fathead minnow	96-hour Survival	100	> 100	11%	100%
RMAR1177	2/8/2008	*Daphnia pulex*	48-hour Survival	100	> 100	14%	75%
RMAR1178	2/11/2008	fathead minnow	96-hour Survival	100	> 100	11%	88%
RMAR1210	4/2/2008	*Daphnia pulex*	48-hour Survival	100	> 100	5%	100%
RMAR1208	4/7/2008	fathead minnow	96-hour Survival	100	> 100	29%	78%
RMAR1298	7/9/2008	*Daphnia pulex*	48-hour Survival	100	> 100	9%	100%
RMAR1296	8/18/2008	fathead minnow	96-hour Survival	100	> 100	19%	85%
RMAR1327	10/8/2008	*Daphnia pulex*	48-hour Survival	100	> 100	5%	100%
RMAR1325	10/13/2008	fathead minnow	96-hour Survival	100	> 100	9%	93%
RMAR2684	8/21/2012	*Daphnia pulex*	48-hour Survival	100	> 100	11%	100%
RMAR2683	8/21/2012	fathead minnow	96-hour Survival	100	> 100	8%	98%
RMAR2829	2/6/2013	*Daphnia pulex*	48-hour Survival	100	> 100	5%	100%
RMAR2831	2/11/2013	fathead minnow	96-hour Survival	100	> 100	5%	95%

King County South Plant Chronic WET Test Results

Test Code	Collected	Organism	Endpoint	NOEC	LOEC	PMSD
AQTX1262	2/7/1997	*Ceriodaphnia dubia*	7-day Survival	0.68	> 0.68	
			Reproduction	0.68	> 0.68	23%
AQTX1252	4/11/1997	fathead minnow	7-day Survival	0.68	> 0.68	3%
			Biomass	0.68	> 0.68	14%
			Weight	0.68	> 0.68	14%
RMAR0141	9/12/1997	Atlantic mysid	7-day Survival	25	50	7%
			Biomass	12.5	25	10%
			Weight	12.5	25	11%
RMAR0142	9/12/1997	inland silverside	7-day Survival	50	100	3%
			Biomass	25	50	17%
			Weight	25	50	17%
AQTX1651	12/3/1997	Atlantic mysid	7-day Survival	50	100	12%
			Biomass	6.25	12.5	17%
			Weight	0.76	6.25	15%
AQTX1652	12/3/1997	inland silverside	7-day Survival	50	100	12%
			Biomass	25	50	11%
			Weight	25	50	10%
AQTX1886	3/4/1998	Atlantic mysid	7-day Survival	50	100	16%
			Biomass	25	50	20%
			Weight	100	> 100	31%
AQTX1885	3/4/1998	inland silverside	7-day Survival	50	100	15%
			Biomass	25	50	15%
			Weight	25	50	13%
AQTX1890	6/3/1998	Atlantic mysid	7-day Survival	25	50	20%
			Biomass	25	50	22%
			Weight	25	50	23%
AQTX1889	6/3/1998	inland silverside	7-day Survival	50	100	
			Biomass	50	100	25%
			Weight	50	> 50	22%
AQTX002996	8/11/1999	Atlantic mysid	7-day Survival	50	100	19%
			Biomass	25	50	28%
			Weight	100	> 100	80%
AQTX002995	8/11/1999	inland silverside	7-day Survival	25	50	10%
			Biomass	12.5	25	17%
			Weight	12.5	25	17%
AQTX002991	7/11/2001	Atlantic mysid	7-day Survival	50	100	23%
			Biomass	50	100	26%
			Biomass	50	100	26%
AQTX002992	7/11/2001	inland silverside	7-day Survival	12.5	25	11%
			Biomass	25	50	22%
			Weight	50	> 50	24%
AQTX002988	11/28/2001	Atlantic mysid	7-day Survival	50	100	17%
			Biomass	50	100	23%
			Weight	50	100	22%
AQTX002987	11/28/2001	inland silverside	7-day Survival	50	100	18%
			Biomass	50	100	18%
			Weight	50	100	17%
RMAR1180	2/6/2008	Atlantic mysid	7-day Survival	12.5	25	15%
			Biomass	0.43	12.5	15%
			Weight	0.43	12.5	15%
RMAR1179	2/6/2008	topsmelt	7-day Survival	12.5	25	13%
			Biomass	0.43	12.5	16%
			Weight	0.43	12.5	11%
RMAR1207	4/2/2008	Atlantic mysid	7-day Survival	50	100	12%
			Biomass	12.5	25	14%
			Weight	0.43	12.5	12%
RMAR1209	4/2/2008	topsmelt	7-day Survival	25	50	12%
			Biomass	12.5	25	15%
			Weight	12.5	25	13%
RMAR1299	7/9/2008	Atlantic mysid	7-day Survival	50	100	13%
			Biomass	12.5	25	13%
			Weight	12.5	25	12%
RMAR1297	7/9/2008	topsmelt	7-day Survival	50	100	15%
			Biomass	25	50	22%
			Weight	25	50	19%
RMAR1328	10/8/2008	Atlantic mysid	7-day Survival	50	100	16%
			Biomass	25	50	15%
			Weight	25	50	12%
RMAR1326	10/8/2008	topsmelt	7-day Survival	50	100	7%
			Biomass	50	100	20%
			Weight	50	> 50	19%
RMAR2771	10/31/2012	Atlantic mysid	7-day Survival	50	100	16%
			Biomass	25	50	17%
			Weight	25	50	16%
RMAR2770	10/31/2012	topsmelt	7-day Survival	50	100	16%
			Biomass	25	50	24%
			Weight	25	50	16%
RMAR2828	2/6/2013	Atlantic mysid	7-day Survival	50	100	13%
			Biomass	12.5	25	15%
			Weight	0.54	12.5	10%
RMAR2830	2/6/2013	topsmelt	7-day Survival	50	100	14%
			Biomass	25	50	18%
			Weight	25	50	15%

Appendix E — 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: http://www.ecy.wa.gov/programs/wq/permits/guidance.html.

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 (MC) is based on the following calculation:

MC = [EC + (AC x DF)]/(1 + DF)

where:

EC = Effluent Concentration
AC = Ambient Concentration
DF = Dilution Factor

Reasonable Potential Analysis:

The process and formulas for determining reasonable potential and effluent limits 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.

Maximum Daily Limit = MDL

$MDL = LTA \times e^{[Z\sigma - 0.5\sigma^2]}$ where: $\sigma^2 = \ln[CV^2 + 1]$
$z = 2.326$ (99^{th} percentile occurrence)
LTA = Limiting long term average

Average Monthly Limit = AML

$AML = LTA \times e^{[Z\sigma_n - 0.5\sigma_n^2]}$ where: $\sigma_n^2 = \ln[(CV^2 \div n) + 1]$
n = number of samples/month
$z = 1.645$ (95^{th} percentile occurrence)
LTA = Limiting long term average

Mixing Model Output Files

Critical Case: South TP 17-December 2001 Acute 90% Currents

/ UM3. Case 2; ambient file P:\plumes\vplumes\South\South.012.db; Diffuser table record 1: ----------

Ambient Table:

Depth m	Amb-cur m/s	Amb-dir deg	Amb-sal psu	Amb-tem C	Amb-pol kg/kg	Decay s-1	Far-spd m/s	Far-dir deg	Disprsn m0.67/s2	Density sigma-T
0.0	0.39	0.0	29.57	10.0	0.0	0.0	0.02	0.0	0.0003	22.75
5.0	0.39	0.0	29.98	9.99	0.0	0.0	0.02	0.0	0.0003	23.07
15.0	0.39	0.0	30.0	10.0	0.0	0.0	0.02	0.0	0.0003	23.08
25.0	0.39	0.0	30.01	10.01	0.0	0.0	0.02	0.0	0.0003	23.09
35.0	0.39	0.0	30.02	10.02	0.0	0.0	0.02	0.0	0.0003	23.09
45.0	0.39	0.0	30.03	10.03	0.0	0.0	0.02	0.0	0.0003	23.1
55.0	0.14	0.0	30.05	10.05	0.0	0.0	0.02	0.0	0.0003	23.11
65.0	0.14	0.0	30.07	10.06	0.0	0.0	0.02	0.0	0.0003	23.13
75.0	0.14	0.0	30.11	10.1	0.0	0.0	0.02	0.0	0.0003	23.16
85.0	0.14	0.0	30.14	10.1	0.0	0.0	0.02	0.0	0.0003	23.18
95.0	0.14	0.0	30.2	10.11	0.0	0.0	0.02	0.0	0.0003	23.22
105.0	0.14	0.0	30.23	10.12	0.0	0.0	0.02	0.0	0.0003	23.24
115.0	0.14	0.0	30.23	10.13	0.0	0.0	0.02	0.0	0.0003	23.24
125.0	0.18	0.0	30.3	10.12	0.0	0.0	0.02	0.0	0.0003	23.29
135.0	0.18	0.0	30.33	10.1	0.0	0.0	0.02	0.0	0.0003	23.32
145.0	0.18	0.0	30.38	10.13	0.0	0.0	0.02	0.0	0.0003	23.36
155.0	0.18	0.0	30.38	10.13	0.0	0.0	0.02	0.0	0.0003	23.36
165.0	0.14	0.0	30.39	10.13	0.0	0.0	0.02	0.0	0.0003	23.36
175.0	0.14	0.0	30.39	10.13	0.0	0.0	0.02	0.0	0.0003	23.36
185.0	0.14	0.0	30.39	10.13	0.0	0.0	0.02	0.0	0.0003	23.36

Diffuser table:

P-dia (in)	P-elev (ft)	V-angle (deg)	H-angle (deg)	Ports ()	Spacing (ft)	SttTime (hr)	EndTime (hr)	Incrmnt (hr)	AcuteMZ (ft)	ChrncMZ (ft)	P-depth (ft)	Ttl-flo (MGD)	Eff-sal (psu)	Temp (C)	Polutnt (kg/kg)
4.0	5.0	60.0	0.0	168.0	3.0	3.0	27.0	3.0	82.0	823.0	623.0	117.0	0.0	12.0	100.0
P-dia (in)	P-elev (ft)	V-angle (deg)	H-angle (deg)	Ports ()	Spacing (ft)	SttTime (hr)	EndTime (hr)	Incrmnt (hr)	AcuteMZ (ft)	ChrncMZ (ft)	P-depth (ft)	Ttl-flo (MGD)	Eff-sal (psu)	Temp (C)	Polutnt (kg/kg)
4.0	5.0	60.0	0.0	168.0	3.0	3.0	27.0	3.0	82.0	823.0	623.0	117.0	0.0	12.0	100.0

Simulation:

Froude number: 24.43; effluent density (sigma-T) -0.43777851; effluent velocity 3.764(m/s);

Step	Depth (ft)	Amb-cur (cm/s)	P-dia (in)	Polutnt (kg/kg)	Dilutn ()	x-posn (ft)	y-posn (ft)	
0	623.0	14.0	4.0	100.0	1.0	0.0	0.0;	
100	619.2	14.0	26.0	13.8	7.099	2.606	0.0;	
119	617.7	14.0	36.01	9.475	10.33	3.794	0.0;	merging;
200	596.4	14.0	249.4	1.905	51.29	22.94	0.0;	
265	521.8	16.16	971.2	0.526	185.7	82.29	0.0;	acute zone;
300	443.1	18.0	2023.2	0.263	371.4	151.5	0.0;	
312	406.8	17.96	2730.3	0.208	470.7	190.8	0.0;	trap level;
323	383.8	14.98	3475.1	0.179	544.8	221.7	0.0;	begin overlap;
382	348.3	14.0	5032.6	0.155	628.8	337.1	0.0;	local maximum rise or fall;

Critical Case: South TP 21-Sept 1999 Chronic 50% Currents

```
     1 : case 3 (NRFIELD)
   3.1536       168    0.1016   60.0000  188.5000
   0.0690   90.0000    1.8300
       20     0.998945    0.0000   16.0000
   0.0000 1.0221621   29.5120   12.9160    0.1250    0.0000
   5.0000 1.0222872   29.5920   12.5800    0.1250    0.0000
  15.0000 1.0223851   29.6490   12.2900    0.1250    0.0000
  25.0000 1.0223939   29.6530   12.2600    0.1250    0.0000
  35.0000 1.0225008   29.7250   11.9800    0.1250    0.0000
  45.0000 1.0226498   29.8500   11.6900    0.1250    0.0000
  55.0000 1.0227789   29.9660   11.4700    0.0510    0.0000
  65.0000 1.0227952   29.9800   11.4400    0.0510    0.0000
  75.0000 1.0228463   30.0320   11.3800    0.0510    0.0000
  85.0000 1.0228694   30.0570   11.3600    0.0510    0.0000
  95.0000 1.0228750   30.0640   11.3600    0.0510    0.0000
 105.0000 1.0228966   30.0870   11.3400    0.0510    0.0000
 115.0000 1.0229409   30.1370   11.3100    0.0510    0.0000
 125.0000 1.0229897   30.1840   11.2400    0.0750    0.0000
 135.0000 1.0230134   30.2120   11.2300    0.0750    0.0000
 145.0000 1.0230953   30.2970   11.1400    0.0750    0.0000
 155.0000 1.0231742   30.3850   11.0800    0.0750    0.0000
 165.0000 1.0232422   30.4590   11.0200    0.0690    0.0000
 175.0000 1.0232739   30.4950   11.0000    0.0690    0.0000
 185.0000 1.0233255   30.5460   10.9310    0.0690    0.0000
```

```
 Results:

 Lengthscale ratios       s/lb     lm/lb
                          .078      .071
   .07  = Froude number, u3/b, F
  61.4  = Height to wastefield top, ze (m)
 127.1  = Wastefield submergence below surface (m)
  42.5  = Wastefield thickness, he = (m)
  40.1  = Height to level of cmax, zm (m)
  47.2  = Mixing region length, xi (m)
   187. = Minimum dilution, Sm
   215. = Flux-average dilution, Sfa =1.15 x Sm

FARFIELD CALCULATION Constant Diffusivity 0.0003 m^2/3/s
based on Wastefield width of 152.9 m

Distance (m)  Dilution
251     225
```

Critical Case: South TP 19-Sept 2000 Human Health 50% Currents

```
   2 : case 3 (NRFIELD)

   2.3214       168    0.1016   60.0000  188.5000
   0.0690   90.0000    1.8300
       20     0.998945    0.0000   16.0000
   0.0000 1.0222418   29.7070   13.2870    0.1250    0.0000
   5.0000 1.0225323   29.9990   12.9500    0.1250    0.0000
  15.0000 1.0226990   30.1190   12.5600    0.1250    0.0000
  25.0000 1.0227208   30.1300   12.4900    0.1250    0.0000
  35.0000 1.0227912   30.1870   12.3500    0.1250    0.0000
  45.0000 1.0228862   30.2500   12.1000    0.1250    0.0000
  55.0000 1.0229816   30.3330   11.9300    0.0510    0.0000
  65.0000 1.0230198   30.3680   11.8700    0.0510    0.0000
  75.0000 1.0230740   30.4190   11.7900    0.0510    0.0000
  85.0000 1.0231034   30.4450   11.7400    0.0510    0.0000
  95.0000 1.0231583   30.4970   11.6600    0.0510    0.0000
 105.0000 1.0231858   30.5230   11.6200    0.0510    0.0000
 115.0000 1.0231940   30.5310   11.6100    0.0510    0.0000
 125.0000 1.0232333   30.5630   11.5300    0.0750    0.0000
 135.0000 1.0232487   30.5780   11.5100    0.0750    0.0000
 145.0000 1.0232641   30.5930   11.4900    0.0750    0.0000
 155.0000 1.0232862   30.6190   11.4800    0.0750    0.0000
 165.0000 1.0232903   30.6240   11.4800    0.0690    0.0000
 175.0000 1.0233009   30.6350   11.4700    0.0690    0.0000
 185.0000 1.0233087   30.6430   11.4620    0.0690    0.0000
 Results:

 Lengthscale ratios       s/lb     lm/lb
                          .049      .030

   .09  = Froude number, u3/b, F

  96.8  = Height to wastefield top, ze (m)
  91.7  = Wastefield submergence below surface (m)
  67.0  = Wastefield thickness, he = (m)
  63.3  = Height to level of cmax, zm (m)
  74.5  = Mixing region length, xi (m)

   361. = Minimum dilution, Sm
   415. = Flux-average dilution, Sfa =1.15 x Sm

FARFIELD CALCULATION Constant Diffusivity 0.0003 m^2/3/s
based on Wastefield width of 152.9 m

Distance (m)  Dilution
251     428.
```

Calculation of BOD_5 Oxidation with Temperature Adjustment

INPUT		Notes
Effluent BOD_5 (mg/L)	45	Tech-based permitted max w eekly value
Effluent Dissolved Oxygen (DO) (mg/L)	1	Conservative estimate, small impact on results
Receiving Water Temperature (deg C)	12.7	1 DADMax value from KC's ambient study
Receiving Water DO (mg/L)	5.8	KC's 2013 Receving Water Rpt -10th percentile
DO WQ Standards (mg/L)	7	
Chronic Mixing Dilution Factor	225	
Time for effluent to travel from outfall to chronic mixing boundary (days)	0.580	Small impact, so approximate-->Mixing document show s min current = 0.005 m/s, therefore to reach chronic boundary at 825' (251 m) w ould take approx 0.58 days.
Oxidation rate of BOD, base e at 20 deg C, k_1 (day^-1)*	0.23	*k_1 = 0.12-0.23 day^{-1} for effluent from biological treatment process (*Metcalf and Eddy Wastewater Engineering Treatment and Reuse. Fourth edition* , page 86. 2003.)
OUTPUT		
Effluent Ultimate BOD (mg/L)	65.9	
Oxidation rate of BOD at ambient temperature, base e (day^-1)	0.16	
BOD oxidized between outfall and chronic mixing zone (mg/L)	6.0	
RESULTS		
DO at chronic mixing zone	5.75	
Difference between ambient DO and DO at chronic mixing boundary	0.05	
There is no reasonable potential of not meeting the DO criteria under these conditions.		

Calculation of Fecal Coliform at Chronic Mixing Zone

INPUT		
Chronic Dilution Factor	225	
Receiving Water Fecal Coliform, #/100 ml	1	Maximum value from KC's 2013 ambient study
Effluent Fecal Coliform - worst case, #/100 ml	400	Maximum permitted limit
Surface Water Criteria, #/100 ml	*14*	
OUTPUT		
Fecal Coliform at Mixing Zone Boundary, #/100 ml	**3**	
Difference between mixed and ambient, #/100 ml	2	

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

Reasonable Potential Calculation

Facility	King County South Plant WWTP
Water Body Type	Marine

Dilution Factors:	Acute	Chronic
Aquatic Life	186	225
Human Health Carcinogenic		428
Human Health Non-Carcinogenic		428

Pollutant, CAS No. & NPDES Application Ref. No.			AMMONIA, Criteria as Total NH3	ANTIMONY (INORGANIC) 7440360 1M	ARSENIC (dissolved) 7440382 2M	BIS(2-ETHYLHEXYL) PHTHALATE 117817 13B	CADMIUM - 7440439 4M Hardness dependent	CHLOROFORM 67663 11V	CHROMIUM(HEX) 18540299	COPPER - 7440508 6M Hardness dependent	CYANIDE 57125 14M	1,4 DICHLOROBENZENE 106467 22B	2,4 DICHLOROPHENOL 120832 2A
Effluent Data	# of Samples (n)		60	29	29	22	29	23	29	29	28	23	22
	Coeff of Variation (Cv)		0.6	0.28	0.12	0.62	0.61	0.5	0.22	0.24	0.91	1.03	0.91
	Effluent Concentration, ug/L (Max. or 95th Percentile)		45,000		1.74		0.05		0.9	13.3	12.1		
	Calculated 50th percentile Effluent Conc. (when n>10)			0.42		1.37		0.5			2.5	0.5	0.28
Receiving Water Data	90th Percentile Conc., ug/L		0.085		1.45		0.073		0.15	0.354	0		
	Geo Mean, ug/L			0.172		0		0			0	0	0
Water Quality Criteria	Aquatic Life Criteria, ug/L	Acute	9,900	-	69	-	42	-	1100	4.8	0.91	-	-
		Chronic	1,487	-	36	-	9.3	-	50	3.1	2.8	-	-
	WQ Criteria for Protection of Human Health, ug/L		-	4300	-	5.9	-	470	-	-	220000	2600	790
	Metal Criteria Translator, decimal	Acute	-	-	1	-	0.994	-	0.993	0.83	-	-	-
		Chronic	-	-	-	-	0.994	-	0.993	0.83	-	-	-
	Carcinogen?		N	N	Y	Y	N	Y	N	N	N	N	N

Aquatic Life Reasonable Potential

Effluent percentile value			0.950		0.950		0.950		0.950	0.950	0.950		
s	$s^2=\ln(CV^2+1)$		0.555		0.120		0.562		0.217	0.237	0.777		
Pn	$Pn=(1\text{-confidence level})^{1/n}$		0.951		0.902		0.902		0.902	0.902	0.899		
Multiplier			1.00		1.00		1.00		1.00	1.00	1.00		
Max concentration (ug/L) at edge of…		Acute	242		1.452		0.073		0.154	0.411	0.065		
		Chronic	200		1.451		0.073		0.153	0.401	0.054		
Reasonable Potential? Limit Required?			**NO**		**NO**		**NO**		**NO**	**NO**	**NO**		

Human Health Reasonable Potential

s	$s^2=\ln(CV^2+1)$	0.2747	0.5703	0.4724		0.7767	0.8504	0.7767
Pn	Pn=(1-confidence level)1/n	0.902	0.873	0.878		0.899	0.878	0.873
Multiplier		0.7012	0.5222	0.5769		0.372	0.3715	0.4128
Dilution Factor		428	428	428		428	428	428
Max Conc. at edge of Chronic Zone, ug/L		0.1726	0.0032	1.2E-03		0.0058	0.0012	0.0007
Reasonable Potential? Limit Required?		**NO**	**NO**	**NO**		**NO**	**NO**	**NO**

Comments/Notes:

References: WAC 173-201A,

Technical Support Document for Water Quality-based Toxics Control, US EPA, March 1991, EPA/505/2-90-001, pages 56/99

Reasonable Potential Calculation - Page 2

Facility	King County South Plant WWTP
Water Body Type	Marine

Dilution Factors:	Acute	Chronic
Aquatic Life	186	225
Human Health Carcinogenic		428
Human Health Non-Carcinogenic		428

Pollutant, CAS No. & NPDES Application Ref. No.			DIETHYLPHTHALATE 84662 24E	LEAD - 7439921 7M Dependent on hardness	MERCURY 7439976 8M	NICKEL - 7440020 9M - Dependent on hardness	NONYLPHENOL	SILVER - 7740224 11M dependent on hardness.	TETRACHLOROETHYLENE 127184 24V	TRICHLOROPHENOL 2,4,6 88062 11A	ZINC- 7440666 13M hardness dependent	CHLORINE (Total Residual) 7782505	Polychlorinated Biphenyls (PCB's)*
Effluent Data	# of Samples (n)		22	29	29	29	2	29	23	22	29	1800	11
	Coeff of Variation (Cv)		0.52	0.66	0.21	0.17	0.6	0.51	0.43	0.33	0.18	0.64	0.561
	Effluent Concentration, ug/L (Max. or 95th Percentile)		0.5	0.9	0.0065	3.15	3.26	0.13			43.7	750	0.12
	Calculated 50th percentile Effluent Conc. (when n>10)		0.24		0.0051	2.32			0.5	0.95			0.06
Receiving Water Data	90th Percentile Conc., ug/L			0.006	0.0002	0.427	0	0.026			0.605	0	0
	Geo Mean, ug/L		0		0.0002	0.427			0	0			0
Water Quality Criteria	Aquatic Life Criteria, ug/L	Acute	-	210	1.8	74	7	1.9	-	-	90	13	10
		Chronic	-	8.1	0.025	8.2	1.7	-	-	-	81	7.5	0.03
	WQ Criteria for Protection of Human Health, ug/L		120000	-	0.15	4600	-	-	8.85	6.5	-	-	0.0002
	Metal Criteria Translator, decimal	Acute	-	0.951	0.85	0.99	-	0.85	-	-	0.946	-	-
		Chronic	-	0.951	-	0.99	-	-	-	-	0.946	-	-
	Carcinogen?		N	N	N	N	N	N	Y	Y	N	N	Y

Aquatic Life Reasonable Potential

Effluent percentile value				0.950	0.950	0.950	0.950	0.950			0.950	0.950	0.950
s	$s^2=\ln(CV^2+1)$			0.601	0.208	0.169	0.555	0.481			0.179	0.586	0.523
Pn	$Pn=(1\text{-confidence level})^{1/n}$			0.902	0.902	0.902	0.224	0.902			0.902	0.998	0.762
Multiplier				1.00	1.00	1.00	3.79	1.00			1.00	1.00	1.63
Max concentration (ug/L) at edge of…		Acute		0.011	0.000	0.441	0.067	0.026			0.824	4.032	0.001
		Chronic		0.010	0.000	0.439	0.055	0.026			0.786	3.333	0.001
Reasonable Potential? Limit Required?				**NO**	**NO**	**NO**	**NO**	**NO**			**NO**	**NO**	**NO**

Human Health Reasonable Potential

s	$s^2=\ln(CV^2+1)$	0.4892		0.2077	0.1688	0.4119	0.3215	0.5231
Pn	Pn=(1-confidence level)1/n	0.873		0.902	0.902	0.878	0.873	0.762
Multiplier		0.5727		0.7646	0.804	0.619	0.6933	0.6893
Dilution Factor		428		428	428	428	428	428
Max Conc. at edge of Chronic Zone, ug/L		0.0006		0.0002	0.4314	1.2E-03	0.0022	0.0001
Reasonable Potential? Limit Required?		**NO**		**NO**	**NO**	**NO**	**NO**	**NO**

Comments/Notes: * PCBS were analyzed and reported as total arochlors using methods 608 and 8082A; all samples were below detection (0.059-0.24 ug/L depending on the sample). Values presented represent 1/2 MDL.

References: WAC 173-201A,
Technical Support Document for Water Quality-based Toxics Control, US EPA, March 1991, EPA/505/2-90-001, pages 56/99

Marine Un-ionized Ammonia Criteria Calculation

Calculation of seawater fraction of un-ionized ammonia from Hampson (1977). Un-ionized ammonia criteria for salt water are from EPA 440/5-88-004. Revised 19-Oct-

INPUT	
1. Receiving Water Temperature, deg C (90th percentile):	12.7
2. Receiving Water pH, (90th percentile):	8.0
3. Receiving Water Salinity, g/kg (10th percentile):	27.7
4. Pressure, atm (EPA criteria assumes 1 atm):	1.0
5. Unionized ammonia criteria (mg un-ionized NH_3 per liter) from EPA 440/5-88-004:	
Acute:	0.233
Chronic:	0.035
OUTPUT	
Using mixed temp and pH at mixing zone boundaries?	No
1. Molal Ionic Strength (not valid if >0.85):	0.568
2. pKa8 at 25 deg C (Whitfield model "B"):	9.311
3. Percent of Total Ammonia Present as Unionized:	1.9%
4. Total Ammonia Criteria (mg/L as NH_3):	
Acute:	12.04
Chronic:	1.81
RESULTS	
Total Ammonia Criteria (mg/L as N)	
Acute:	**9.90**
Chronic:	**1.49**

Aquatic Life and Human Health Limits Calculations - Outfall 001

Facility	King County South Plant WWTP
Water Body Type	Marine

Dilution Factors:	Acute	Chronic
Aquatic Life	186	225
Human Health Carcinogenic		428
Human Health Non-Carcinogenic		428

Pollutant, CAS No. & NPDES Application Ref. No.		CHLORINE (Total Residual) 7782505	Technology-based Limits
Effluent Data	Coeff of Variation (Cv)	0.6	
Receiving Water Data	90th Percentile Conc., ug/L	0	
	Geo Mean, ug/L		
Water Quality Criteria	Aquatic Life Criteria, Acute	13	
	ug/L Chronic	7.5	
	WQ Criteria for Protection of	-	
	Metal Criteria Acute	-	
	Translator, decimal Chronic	-	
	Carcinogen?	N	
Aquatic Life Limit Calculation			
# of Compliance Samples Expected per month		30	
LTA Coeff. Var. (CV), decimal		0.6	
Permit Limit Coeff. Var. (CV), decimal		0.6	
Waste Load Allocations, ug/L	Acute	2418	
	Chronic	1688	
Long Term Averages, ug/L	Acute	776	
	Chronic	890	
Limiting LTA, ug/L		776	
Metal Translator or 1?		1.00	
Average Monthly Limit (AML), ug/L		**924**	**500**
Maximum Daily Limit (MDL), ug/L		**2418**	**750**

References: WAC 173-201A,
Technical Support Document for Water Quality-based Toxics Control, US EPA, March 1991, EPA/505/2-90-001, pages 56/99

Marine Temperature Reasonable Potential and Limit Calculation

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

INPUT	
1. Chronic Dilution Factor at Mixing Zone Boundary	225
2. Annual max 1DADMax Ambient Temperature (Background 90th percentile)	12.7 °C
3. 1DADMax Effluent Temperature (95th percentile)	22.3 °C
4. Aquatic Life Temperature WQ Criterion	13.0 °C
OUTPUT	
5. Temperature at Chronic Mixing Zone Boundary:	12.74 °C
6. Incremental Temperature Increase or decrease:	0.04 °C
7. Incremental Temperature Increase 12/(T-2) if T≤ crit:	1.12 °C
8. Maximum Allowable Temperature at Mixing Zone Boundary:	13.00 °C
A. If ambient temp is warmer than WQ criterion	
9. Does temp fall within this warmer temp range?	NO
10. Temp increase allowed at mixing zone boundary, if required:	---
B. If ambient temp is cooler than WQ criterion but within 12/(T_{amb}-2) and within 0.3 °C of th	
11. Does temp fall within this incremental temp. range?	NO
12. Temp increase allowed at mixing zone boundary, if required:	---
C. If ambient temp is cooler than (WQ criterion-0.3) but within 12/(T_{amb}-2) of the criterion	
13. Does temp fall within this Incremental temp. range?	YES
14. Temp increase allowed at mixing zone boundary, if required:	NO LIMIT
D. If ambient temp is cooler than (WQ criterion - 12/(T_{amb}-2))	
15. Does temp fall within this Incremental temp. range?	NO
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**

Green River Outfall Calculations

Spread of a Plume from a Point Source in a River with Boundary Effects from the Shoreline

Based on the method of Fischer et al. (1979) with correction for the effective origin of effluent.

Approach: perform a very quick analysis to assess plume as if discharged from a single port (the Green River outfall has 8 ports). Assess dilution at acute mixing zone boundary (31' downstream). Note that this is a very rough estimate calculation, performed quickly due to limited resources.

INPUT		Notes
1. Effluent Discharge Rate (MGD)	20.2	
or, Effluent Discharge Rate (cfs)	31.3	*Assumes dilution of 5 using 25% of river flow & single port (conservative, diffuser has 8 ports).*
2. Receiving Water Characteristics Downstream from Discharge:		
River Depth (ft)	7.00	
River Flow (cfs) (7Q10 chronic & acute, 30Q5 for non-carc, harm. mean for carc)	500	
% of stream flow allowed for Dilution Factor (e.g., 25% for chronic & 2.5% for acute)	25	
Stream Velocity (fps)	0.71	
Channel Width (ft)	100	
Stream Slope (ft/ft) or Manning roughness "n"	0.00097	
0 if slope or 1 if Manning "n" in previous cell	0	
3. Discharge Distance from Nearest Shoreline (ft)	44	
4. Location of Point of Interest to Estimate Dilution:		
Distance Downstream to Point of Interest (ft)	31	
Distance From Nearest Shoreline (ft)	44	
5. Transverse Mixing Coefficient Constant (usually 0.6):	0.6	
6. Original Fischer Method (enter 0) or Effective Origin Modification (enter 1)	0	
7. Is the Plume bounded by the shoreline?	Yes	
OUTPUT		
1. Source Conservative Mass Input Rate:		
Concentration of Conservative Substance (%)	100.00	
Source Conservative Mass Input Rate (cfs*%)	3,125.00	
2. Shear Velocity based on slope (ft/sec)	0.468	
Shear Velocity based on Manning "n" (using Prasuhn equations 8-26 and 8-54 assuming hydraulic		
Darcy-Weisbach friction factor "f"	#N/A	
Shear Velocity from Darcy-Weisbach "f" (ft/sec)	#N/A	
Selected Shear Velocity for next step (ft/sec)	0.468	
3. Transverse Mixing Coefficient (ft2/sec)	1.964	
4. Plume Characteristics Accounting for Shoreline Effect (Fischer et al., 1979):		
Co	6.25E+00	
x'	8.52E-03	
y'o	4.40E-01	
y' at point of interest	4.40E-01	
Solution using superposition equation (Fischer eqn 5.9):		
Term for n= -2	1.52E-204	
Term for n= -1	1.11E-51	
Term for n= 0	1.00E+00	
Term for n= 1	1.05E-16	
Term for n= 2	9.93E-125	
Upstream Distance from Outfall to Effective Origin of Effluent Source (ft)	#N/A	
Effective Distance Downstream from Effluent to Point of Interest (ft)	31.0	
x' Adjusted for Effective Origin	8.52E-03	
C/Co (dimensionless)	3.06E+00	
Concentration at Point of Interest (Fischer Eqn 5.9)	1.91E+01	
Unbounded Plume half-width (ft)	26.1	
Distance from near shore to discharge point (ft)	44.0	
Distance from far shore to discharge point (ft)	56.0	
RESULTS		
W, Plume width bounded by shoreline (ft)	**52**	
W, Unbounded Plume Width at Point of Interest (ft)	**52**	
Approximate Downstream Distance to Complete Mix (ft)	**456**	
Theoretical Dilution Factor at Complete Mix	**16**	
Calculated Flux-Average Dilution Factor Across Entire Plume Width	**8**	
Calculated Dilution Factor at Point of Interest	**5.2**	*Conservative result since assessed as a single port discharge, diffuser actually has 8 ports. Plumes from ports likely overlap, but dilution would be higher than calculated here.*

Calculation of Fecal Coliform at Chronic Mixing Zone

INPUT - Green River Outfall		
Acute Dilution Factor	5.0	
Receiving Water Fecal Coliform, #/100 ml	31	Geomean- EIM data (2004-2011)
Effluent Fecal Coliform - worst case, #/100 ml	200	Maximum permitted limit
Surface Water Criteria, #/100 ml	*100*	
OUTPUT		
Fecal Coliform at Mixing Zone Boundary, #/100 ml	**65**	

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

Aquatic Life Limit Calculations

Facility	Green River Emergency Outfall
Water Body Type	Freshwater

Pollutant, CAS No. & NPDES Application Ref. No.			CHLORINE (Total Residual) 7782505
Acute Dilution Factor			5.0
Effluent Data	Coeff of Variation (Cv)		0.6
Receiving Water Data	90th Percentile Conc., ug/L		0
Water Quality Criteria	Aquatic Life Criteria, ug/L	Acute	19
	Metal Criteria Translator, decimal	Acute	-
	Carcinogen?		N

Aquatic Life Limit Calculation

# of Compliance Samples Expected per month		4
LTA Coeff. Var. (CV), decimal		0.6
Permit Limit Coeff. Var. (CV), decimal		0.6
Waste Load Allocations, ug/L	Acute	95
Long Term Averages, ug/L	Acute	30.5
Limiting LTA, ug/L		30.5
Metal Translator or 1?		1.00
Maximum Daily Limit (MDL), ug/L		**95**

References: WAC 173-201A,
Technical Support Document for Water Quality-based Toxics Control, US EPA, March 1991, EPA/505/2-90-001, pages 56/99

Reasonable Potential Calculation - Green River Outfall, page 1 of 2

Facility	Green River Emergency Outfall
Water Body Type	Freshwater

Dilution Factor:	Acute
Aquatic Life	5.0

Pollutant, CAS No. & NPDES Application Ref. No.			AMMONIA, Criteria as Total NH3	ANTIMONY (INORGANIC) 7440360 1M	ARSENIC (dissolved) 7440382 2M	BIS(2-ETHYLHEXYL) PHTHALATE 117817 13B	CADMIUM - 7440439 4M Hardness dependent	CHLOROFORM 67663 11V	CHROMIUM(HEX) 18540299	COPPER - 744058 6M Hardness dependent	CYANIDE 57125 14M	1,4 DICHLOROBENZENE 106467 22B	2,4 DICHLOROPHENOL 120832 2A
Effluent Data	# of Samples (n)		257	29	29	22	29	23	29	29	28	23	22
	Coeff of Variation (Cv)		0.6	0.28	0.12	0.62	0.61	0.5	0.22	0.24	0.91	1.03	0.91
	Effluent Concentration, ug/L (Max. or 95th Percentile)		45,000		1.74		0.05		0.9	13.3	12.1		
	Calculated 50th percentile Effluent Conc. (when n>10)			0.42		1.37		0.5			2.5	0.5	0.28
Receiving Water Data	90th Percentile Conc., ug/L		70		1.45		0.073		0.15	0.354	0		
	Geo Mean, ug/L			0.172		0		0			0	0	0
Water Quality Criteria	Aquatic Life Criteria, ug/L	Acute	9,644	-	360	-	1.131	-	15	6.072	22	-	-
	Metal Criteria Translator,	Acute	-	-	1	-	0.943	-	0.982	0.996	-	-	-
	Carcinogen?		N	N	Y	Y	N	Y	N	N	N	N	N

Aquatic Life Reasonable Potential

Effluent percentile value			0.950		0.950		0.950		0.950	0.950	0.950		
s	$s^2=\ln(CV^2+1)$		0.555		0.120		0.562		0.217	0.237	0.777		
Pn	$Pn=(1\text{-confidence level})^{1/n}$		0.988		0.902		0.902		0.902	0.902	0.899		
Multiplier			1.00		1.00		1.00		1.00	1.00	1.00		
Max concentration (ug/L) at edge of...		Acute	9,056		1.508		0.068		0.297	2.933	2.420		
Reasonable Potential? Limit Required?			**NO**		**NO**		**NO**		**NO**	**NO**	**NO**		

Comments/Notes:

References: WAC 173-201A,
Technical Support Document for Water Quality-based Toxics Control, US EPA, March 1991, EPA/505/2-90-001, pages 56/99

Reasonable Potential Calculation - Green River Outfall, page 2 of 2

Facility	Green River Emergency Outfall
Water Body Type	Freshwater

Dilution Factor:	Acute
Aquatic Life	5.0

Pollutant, CAS No. & NPDES Application Ref. No.		DIETHYLPHTHALATE 84662 24B	LEAD - 7439921 7M Dependent on hardness	MERCURY 7439976 8M	NICKEL - 7440020 9M - Dependent on hardness	NONYLPHENOL	SILVER - 7740224 11M dependent on hardness.	TETRACHLOROETHYLENE 127184 24V	TRICHLOROPHENOL 2,4,6 88062 11A	ZINC- 7440666 13M hardness dependent	Polychlorinated Biphenyls (PCB's)*	CHLORINE (Total Residual) 7782505
Effluent Data	# of Samples (n)	22	29	29	29	2	29	23	22	29	11	1800
	Coeff of Variation (Cv)	0.52	0.66	0.21	0.17	0.6	0.51	0.43	0.33	0.18	0.561	0.64
	Effluent Concentration, ug/L (Max. or 95th Percentile)	0.5	0.9	0.007	3.15	3.26	0.13			43.7	0.12	100
	Calculated 50th percentile Effluent Conc. (when n>10)	0.24		0.005	2.32			0.5	0.95		0.06	
Receiving Water Data	90th Percentile Conc., ug/L		0.006	2E-04	0.427	0	0.026			0.605	0	0
	Geo Mean, ug/L	0		2E-04	0.427			0	0		0	
Water Quality Criteria	Aquatic Life Criteria, ug/L Acute	-	19.28	2.1	561.1	28	0.526	-	-	45.31	2	19
	Metal Criteria Translator, Acute	-	0.466	0.85	0.998	-	0.85	-	-	0.996	-	-
	Carcinogen?	N	N	N	N	N	N	Y	Y	N	Y	N

Aquatic Life Reasonable Potential

Effluent percentile value			0.950	0.950	0.950	0.950	0.950		0.950	0.950	0.950
s	$s^2=\ln(CV^2+1)$		0.601	0.208	0.169	0.555	0.481		0.179	0.523	0.586
Pn	$Pn=(1\text{-confidence level})^{1/n}$		0.902	0.902	0.902	0.224	0.902		0.902	0.762	0.998
Multiplier			1.00	1.00	1.00	3.79	1.00		1.00	1.63	1.00
Max concentration (ug/L) at edge of…	Acute		0.089	0.001	0.970	2.474	0.043		9.189	0.039	20
Reasonable Potential? Limit Required?			**NO**	**NO**	**NO**	**NO**	**NO**		**NO**	**NO**	**YES**

Comments/Notes: * PCBS were analyzed and reported as total arochlors using methods 608 and 8082A; all samples were below detection (0.059-0.24 ug/L depending on the sample). Values presented represent 1/2 MDL.

References: WAC 173-201A,
Technical Support Document for Water Quality-based Toxics Control, US EPA, March 1991, EPA/505/2-90-001, pages 56/99

Freshhwater Ammonia Criteria Calculation

Green River Outfall - Maintenance Only

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

INPUT		Notes
1. Receiving Water Temperature (deg C):	16.7 °C	EIM User Location ID = KCM-3106
2. Receiving Water pH:	7.7	EIM User Location ID = KCM-3106 (min=6.3, max=7.7)
3. Is salmonid habitat an existing or designated use?	Yes	
4. Are non-salmonid early life stages present or absent?	Present	
OUTPUT		
Using mixed temp and pH at mixing zone boundaries?	no	
Ratio	13.489	
FT	1.400	
FPH	1.201	
pKa	9.509	
Unionized Fraction	0.015	
Unionized ammonia NH3 criteria (mg/L as NH_3)		
Acute:	0.179	
Chronic:	0.035	
RESULTS		
Total ammonia nitrogen criteria (mg/L as N):		
Acute:	9.644	
Chronic:	1.896	

South Plant WWTP - Fecal Coliform Sample Frequency Calculations

KC has requested for a reduction in fecal monitoring from 7/week to 4 /week, or 16/month. Based on past performance, O&M records, and on the fact that they operate at approx 20-40% of the their permit levels (depending on how calculated), a sample freq of 19/month (or 5 times/wk) is granted for fecal coliform.

	ln(fecal)
Mean	3.7
Standard Error	0.0
Median	3.7
Standard Deviation	1.0
Sample Variance	1.0
Minimum	0.1
Maximum	9.0
Sum	3833
Count	1029
Confidence Level (95.000%)	0.1
Coeff of Var	0.27
d (10% of mean)	0.37
d (20% of mean)	0.75
dr, relative error	0.10
dr, relative error	0.20
Z (95% confidence level)	1.645
Z (90% confidence level)	1.282
95% confid level, 10% rel error	
A.) n - samples per month	**19**
C.) n	19
D.) n	59

Appendix F — Significant Industrial Users

Company Name	Permit Number	Local Limits	Categorical Limits	If categorical, which category and sub-category
A.O. Smith Water Products Company	7718-05	Yes	Yes	METAL FINISHING- CFR 433
Accurate Industries	7864-01	Yes	Yes	METAL FINISHING- CFR 433
Aero Controls, Inc. - Pike Street	7708-03	Yes	Yes	METAL FINISHING- CFR 433
Aramark Uniform & Career Apparel LLC	7836-01	Yes	No	NA
B.S.B. Diversified Co. Inc.	7575-04	Yes	No	NA
Baker Commodities Inc.	7556-03	Yes	No	NA
Black Oxide, LLC	7702-04	Yes	Yes	METAL FINISHING- CFR 433
Boeing Commercial Airplane- Auburn	7599-06	Yes	Yes	METAL FINISHING- CFR 433
Boeing Commercial Airplane - Renton	7630-04	Yes	Yes	METAL FINISHING- CFR 433
Boeing Electronics Center	7508-04	Yes	Yes	METAL FINISHING- CFR 433
Burlington Environmental LLC - Kent	7159-08	Yes	Yes	Centralized Waste 437B PSES
Cedar Grove Composting, Inc.	7652-04	Yes	No	NA
Coca-Cola Bottling Co of Washington	7022-05	Yes	No	NA
Darigold, Inc. - Issaquah Plant	7075-05	Yes	No	NA
Davis Wire Corporation	7243-04	Yes	No	NA
Electrofinishing Inc.	7578-03	Yes	Yes	METAL FINISHING- CFR 433
Exotic Metals Forming Company	7672-05	Yes	Yes	METAL FINISHING- CFR 433
G & K Services	7857-01	Yes	No	NA
Hexcel Corporation	7808-02	Yes	No	NA
Honeywell International Inc.	7206-05	Yes	Yes	ELECT. COMPS - CFR 469
Hytek Finishes Company	7569-03	Yes	Yes	METAL FINISHING- CFR 433
Kenworth Truck Company	7627-04	Yes	Yes	METAL FINISHING- CFR 433
KC RSD - Renton Decant Facility	7756-04	Yes	No	NA
KC SWD - Bow Lake Transfer Station	7882-01	Yes	No	NA
King County SWD - Cedar Hills Landfill	7842-01	Yes	No	NA
KC SWD - Factoria Transfer Station	7586-04	Yes	No	NA
KC SWD - Houghton Transfer Station	7879-01	Yes	No	NA
KC SWD - Renton Transfer Station	7880-01	Yes	No	NA
King's Command Foods Inc.	7742-03	Yes	No	NA
Mikron Industries	7749-04	Yes	Yes	PLASTIC PROD MANF.-463
Oberto Brands	7706-05	Yes	No	NA
Pacific Propeller International LLC	7235-04	Yes	Yes	ELECTROPLATING- CFR 413
Port of Seattle, SeaTac Inter. Airport, BW	7772-02	Yes	No	NA
Port of Seattle, SeaTac Inter. Airport, IWS	7810-02	Yes	No	NA
Protective Coatings Inc.	7242-04	Yes	Yes	ELECTROPLATING- CFR 413
Qualawash Holdings LLC	7153-04	Yes	No	NA
Ralcorp Frozen Bakery Products	7671-04	Yes	No	NA
Red Dot Corporation	7866-02	Yes	Yes	METAL FINISHING- CFR 433
Rexam Beverage Can Company	7085-07	Yes	Yes	COIL COATING- CFR 465
Safeway Inc.- Beverage Plant	7042-04	Yes	No	NA
Safeway Inc.- Milk and Ice Cream Plant	7832-02	Yes	No	NA
Seattle, City of- SPU - Kent Highlands	7115-03	Yes	No	NA
Shasta Beverages	7881-01	Yes	No	NA
Silicon Designs Inc.	7887-01	Yes	Yes	ELECT. COMPS - CFR 469
Skills Inc. -Auburn Facility	7719-05	Yes	Yes	METAL FINISHING- CFR 433
Smith Fabrication Inc.	7801-02	Yes	Yes	METAL FINISHING- CFR 433
Stoller Metals, Inc.	7823-03	Yes	Yes	METAL FINISHING- CFR 433
Tim's Cascade Snacks	7865-01	Yes	No	NA
Triple B Corporation	7855-01	Yes	No	NA
Tri-Way Industries Inc.	7746-04	Yes	Yes	METAL FINISHING- CFR 433
Vectra Fitness Inc.	7760-03	Yes	Yes	METAL FINISHING- CFR 433
Western Pneumatic Tube Co.	7604-04	Yes	Yes	METAL FINISHING- CFR 433
WSDOT- SR 520 Bridge Replacement and HOV Program Construction Site	7868-02	Yes	No	NA

Appendix G — Response to Comments

King County Entity Review Comments
Significant comments are listed below; comments that provided clarification and/or corrections are not listed.

Comment Number	Page	Section/ permit or factsheet	Comments	Suggested Resolution/Change	Commentor	Ecology Response
1	4	permit - Summary of Submittals	S3.A submission lists Permit Application as annual. Typo? Also PP data is sent annually but does it have to be in March 31 each year?	remove application reference and revise date to XXX	Betsy Cooper	WebDMR annual submittals require a due date. Changed to July 31, consistent with West Point and with annual CSO report submittal.
5	6	S1A - green river	the mixing zone calculation appear to have changes because 500cfs was used in the calculation. We have concern that this overly restricts the MZ.	We would like to discuss this with you. Perhaps their should be a reconsideration of the assumptions to reflect the differences in flow rates seasonal.	Betsy Cooper	Due to unnecessary restrictions as pointed out by KC, Ecology changed the effluent flow limit for the Green River discharge to a calculated value based on a dilution factor of 5 which is required to assure wq criteria are met. The County must calculate the maximum flow allowed based on the existing river flow and not exceed that flow.
13	17	S4.E I&I	This section is calling for a new I&I analysis	KC undertook, several years ago, an extensive monitoring program and analysis of I&I in the service area and engaged the component agencies in process of considering i&I control. We are continuing to consider I&& actions and are engaged in the discussion of I&I with our component agencies. We would like to discuss the proposed evaluation with you to understand the intent of the effort and understand future that Ecology feels needs to be understood more fully.		Full I/I evaluation not required, looking to quantify inflow and infiltration (in gallons per day per capita) in separated basins using EPA procedure described in Publication No. 97-03 at: http://www.ecy.wa.gov/programs/wq/permits/guidance.html. KC discussion: KC historically reported I/I in gallons per acre per day for KC owned and maintained systems only: most of system is not KC owned and maintained. KC interceptor hard to assess, major flows from outside agencies. Overall general characterization in system done a few years ago. In the early 2000s KC evaluated I/I, 400 flow monitors in separated systems, worked hard to assess I/I, came back in 2010/2011, deployed 50 meters a second time. Not just in KC pipe, throughout service area. Steve forwarded KC's I/I online library with historical information. Component agencies: some more aggressively reducing I/I, others not so much (pumping energy a big factor), KC's contract with local agencies makes enforecement difficult. City of Renton 50-90 connections. KC's approach is more incentive-based encouraging a cooperative relationship. Conclusion: replaced I/I study with an I/I summary as part of the Wasteload Assessment Report.
14	19	S5.E prevent connection of	requirement is broader than KC jurisdiction	Please add "with in KC control" at the end of the sentence.	Betsy Cooper	Text added.
15	21	S5.g.b. O&M manual components	intro paragraph requires that the O&M manuals "must be consistent with the guidance in Table G1-3 in the Criteria for sewage works Design (Orange Book), 2008"	This statement of requirement with the Orange Book Table was not in the WP permit. Since the components of the manual are listed we request that this statement be removed so that the WP and SP permit are the same. Also since the Orange Book is guidance so it should not be "required" in a permit.	Betsy Cooper	Commented noted and text revised.
16	22	S.6.A.1.b Pretreatment - general	S6.A1.b contains a sentence at the end of the paragraph that West point doesn't have" Once issued, an industrial waste discharge permit takes precedence over a state-issued waste discharge permit .	We have no disagreement, would just like to discuss the intent of this statement.	Ed Abbasi /Despina	Outdated shell language was replaced with Pretreatment language from West Point permit, minus CSO-related requirements.

Comment Number	Page	Section/ permit or factsheet	Comments	Suggested Resolution/Change	Commentor	Ecology Response
17	24	S.6.A.1.j Pretreatment - general	SP S.6.A1.j includes the statement "In addition, the Permittee must develop a Memorandum of Understanding (or Inter-local Agreement) that outlines the specific roles, responsibilities, and pretreatment activities of each jurisdiction.	As in all other KC permits we have had this statement removed since we already have legal/contractual requirements in place. We suggest this be removed.	Betsy Cooper	Outdated shell language was replaced with Pretreatment language from West Point permit, minus CSO-related requirements.
18	24	S.6.A2. Pretreatment - general	This section requires development and submission of an updated Accidental Spill Prevention Program by April 30th 2019	This is a new requirement. Please explain what is the intent of the requirement and to what facilities, Industries it is to be applied.	Betsy Cooper	Outdated shell language was replaced with Pretreatment language from West Point permit, minus CSO-related requirements.
19	25	S6.A 5 Pretreatment	Pretreatment Report due date of March 31.	We would like to request Ecology change the due date for the Pretreatment Report from March 31 to April 30. This is to allow KC staff more time to compile all the data and review it before submitting the report. Much of the data needed for the report isn't available until late January to mid-February with a very short window to process and review. This will also allow for additional QC steps and the needed review steps for such additional QC.	Despina Strong	OK to shift submittal date by one month. However KC knows West Point submittal will remain at March 31st until next permit issuance; Despina stated KC will continue to meet this comliance requirement. Start new date with S Plant and eventually all other facilities will fall in line.
22	26	S.6.B.9 Pretreatment - general	This is a new language in S.6.B.9 with RSP that is missing from West point; "Sludge metals priority pollutant sampling and analysis must conform to U.S. EPA SW 846 6000/7000 Series Methods unless the Permittee requests an alternate method and Ecology has approved" . However these methods are for water samples only.	Indicate only that the methods must be approved by Ecology rather than require specific methods. Or like the metals comment further on, mandate that the GC/MS data must conform to the U.S. EPA SW 846 8000 Series Methods for GC/MS volatile and semi-volatile samples.	Environmental Lab	Outdated shell language was replaced with Pretreatment language from West Point permit, minus CSO-related requirements.
23	26	Permit S6(B)* in conjunction with Appendix A	This section refers handling, preparing and analyzing "all wastewater samples" with "EPA Methods 624 and 625". However it raises two questions 1) these methods are not appropriate for the sludge or other solids analyses which some might consider part of the requirement described in Section S.6.B.8. and 2) since the statement is in the Pretreatment Section of the permit, it could also be considered applying to wastewaters other then are treatment plants, such as Permittees.	We suggest this section should be consistent with WP by requiring procedure approved by 40 CFR 136 and SW 846 depending on the matrix instead of specific methods.	Environmental Lab/Abbasi/ Strong	Outdated shell language was replaced with Pretreatment language from West Point permit, minus CSO-related requirements.
26	29	Main Permit /S9.B.	calls for report of sediment data by August 31,2018	We request that date be modified to December 31, 2018 - the same period for report prep as in the West Point permit	Betsy Cooper	Dates changed to Dec 1, 2018 for consistency with WP permit. Also changed the SAP submittal to Dec 1, 2016 to be consistent with WP permit.
29	NA	Permit / Fact Sheet	General Comment: Since Ecology is issuing several NPDES permits to King County, could it consider creating a stand alone appendix for pretreatment program? Currently NPDES permits issued to two of King County's facilities have different requirements; A stand alone Pretreatment appendix could be updated every time a permit is issued and be effective in all active permits. The issue is consistency with compliance across plant areas.	This is a suggestion for Ecology to consider. It is has merit perhaps it could be instituted for the next permit renewal (BW).	Ed Abbasi /Despina	Agreed, something to consider with BW issuance. For this permit, the Pretreatment language was replaced with West Point language minus CSO-related requirements. KC requests all 5 facilities to be consistent, maybe an appendix that gets updated with each permit issuance. 'Appendix B'? or separate document.

Public Review Comments

Ecology received comments from King County and the Puget Soundkeeper Alliance during the 30-day public notice period. While drafting responses to these comments, Ecology noted and corrected typos in *Table 6* for BOD_5 and TSS effluent data.

King County's comment: "EPA is currently in the process of updating a number of sections under the 40 CFR Part 136 Clean Water Act [Update Rule for the Analysis of Effluent Proposed Rule: Vol. 80, No. 33, Thursday February 19, 2015]. While King County is commenting directly to EPA on many aspects of these proposed changes, due to the timing of the South Plant's NPDES new permit, we feel we should also provide comments to the WDOE during the permit renewal process regarding the impacts of the proposed changes. The proposed Determination of the Method Detection Limits portion of the 40 CFR Part 136 Clean Water Act will have a significant impact on our ability to fully comply with the proposed permit criteria listed in Appendix A.

EPA's proposed revisions to Appendix B, Part 136 (Definition and Procedure for the Determination of the Method Detection Limit – Revision 2) are specifically designed to make Method Detection Limits (MDLs) more "realistic" (i.e. higher) than the current procedure. Once promulgated, these changes require lab results to be collected over the course of a full year, therefore we can't predict at this time how much our MDLs will increase with the new procedure. While we know that we can meet the Appendix A MDLs with EPA's current MDL procedure (in reagent water), we are much less optimistic that this will be the case if the proposed EPA Rule is adopted as it is currently stated.

It is worth noting that the EPA has listed method-specific MDLs for many of the compounds in DOE's Appendix A, and that most are significantly higher than the listed MDLs in Appendix A. EPA anticipates that these method-listed MDLs will be achievable with the new procedure. We therefore would like to suggest to DOE that the permit writers include some language into our current draft permit that would allow enough flexibility for possible changes to Appendix A to account for EPA's proposed rule changes. Ideally this could occur without having to reopen the permit. Another possible approach would be to use the EPA method listed MDLs for methods 608, 624, and 625 in Appendix A since we are reasonably confident that we could meet these limits even with the new MDL procedure."

Ecology's response: *Ecology and the County have been in discussions regarding EPA's proposed revisions to 40 CFR Part 136. Until EPA's proposed updates are finalized, the County has agreed to strive to meet the method detection limits (MDLs) and quantifications limits (QLs) in Appendix A of active permits. If an MDL and/or QL cannot be achieved, the King County Environmental Labs will conduct additional QC samples on sample batches. They will use low level matrix spikes to show that the analysis was not able to meet the Appendix A detection limits in the given matrix. The County will submit a detailed description of the additional analysis with the priority pollutant data.*

Once EPA promulgates the updates to 40CFR 136 and it becomes clear how the changes will impact analytical methods, Ecology will engage the County in discussions on how to move forward to ensure both the requirements of the active permits and the revised methods can be met.

Puget Soundkeeper Alliance's comments (via Smith & Lowney, P.L.L.C.):

Comment #1: "The King County South Wastewater Treatment Plant ("County Plant") is one of the single largest wastewater discharges to Puget Sound, adding up to almost 150 million gallons per day of treated municipal wastewater to the Sound. The contamination of Puget Sound by toxic pollutants is widespread and well-documented. Waste streams comprising the County's Plant's influent are heterogeneous and include not only domestic wastewater but also industrial discharges from a wide variety of industrial facilities, as well as stormwater from urban streets and facilities. Consequently, a wide spectrum of toxic pollutants is introduced to

the County Plant and many of these can be expected to pass through the County Plant because they are not susceptible to efficient or effective removal by the treatment works. These pollutants are likely to include persistent bioaccumulative toxics ("PBTs"), such as PCBs, flame retardants, and pharmaceuticals. The permit should include rigorous effluent monitoring to determine whether toxic pollutants are being discharged at levels of concern, which would warrant the addition of effluent limitations or implementation of other measures to reduce or eliminate these discharges. As one of the largest dischargers operated by the largest county in the state, one that depends intimately on the health of Puget Sound for its economy and quality of life, the County Plant is an excellent place to start enhanced efforts to detect and control discharges of the numerous toxic pollutants that threaten the Sound.

While the draft permit does include a monitoring requirement for the EPA list of priority pollutants, this is inadequate to the task. First, the priority pollutant list excludes numerous toxic pollutants that are likely to be found in the discharge and that ought to be subject to NPDES regulatory controls in fulfillment of federal objectives to eliminate toxic discharges, 33 U.S.C. § 1251(a)(3), and the mandates of state law, RCW 90.48.010 and .520. A recent report by the EPA Office of the Inspector General (Report No 14-P-0363, Sept. 29, 2014, "More Action Is Needed to Protect Water Resources From Unmonitored Hazardous Chemicals") describes an aspect of this problem. Consistent with the findings of this report, a review of the toxic release inventory ("TRI") reports submitted by the Significant Industrial Users listed in the draft fact sheet appendix F reveals that the following facilities have reported discharges of toxic pollutants that are not among those on the priority pollutants list:

Boeing Commercial Airplane Group – Renton: diethanolamine, methyl isobutyl ketone, toluene
Boeing Commercial Airplane Group – Auburn: hydrogen fluoride, methyl isobutyl ketone, toluene
Hexel Corp.: tetrabromobisphenol A
Kenworth Truck Co.: ethylene glycol
Protective Coatings: N-butyl alcohol, nitric acid
Rexam Beverage Can Co: hydrogen fluoride, N-butyl alcohol
Western Pneumatic Tube Co.: hydrogen fluoride, nitric acid

The permit should require screening monitoring for these and other toxic pollutants that are likely to be present in the discharge."

Ecology's Response to Comment #1: Ecology appreciates the comments concerning the potential for toxicity in the South Plant WWTP discharge. In developing this permit, Ecology used priority pollutant data that King County collected from the South Plant WWTP effluent 22-29 times (depending on the pollutant) during the previous 5 year permit term. A summary of the priority pollutants that were detected in the effluent is included in Table 6 of this fact sheet (toluene was tested as required but was below detection, <1 ug/L, in all 23 samples). In addition to the required priority pollutant monitoring, King County conducted analysis on parameters such as PCB arochlors (see data in the response to comment #3 below). Ecology would be happy to provide the Puget Sound Alliance or other interested parties with this data if requested.

Ecology has established criteria for approximately 160 pollutants based on the National Toxics Rule (40 CFR 131.36) and the EPA National Recommended WQ Criteria (2004, 69 FR 342) (see WAC 173-201A). Ecology performed a reasonable potential analysis for each pollutant detected in the effluent for which a water quality standard has been established to determine the potential for a water quality exceedance (see Appendix E of the fact sheet). Ecology set a limit for chlorine based on this analysis and determined that all other parameters in the South Plant WWTP effluent meet their respective criteria.

While it may seem ideal to characterize the effluent for the pollutants listed above from the various industrial dischargers, Ecology considers other factors in determining monitoring requirements. N-butyl alcohol and ethylene glycol (automotive antifreeze) are both amenable to biological breakdown during biological treatment

at the sewage treatment plant; these organic compounds are food for the bacteria. Nitric acid breaks down to its molecular components of hydrogen, nitrogen, and oxygen. Individual chemicals from industrial processes are often undetectable after mixing with the other sewerage flows in the system. Ecology does not require monitoring for some of these parameters because (1) Washington State has not promulgated surface water criteria for the parameter, (2) pretreatment activities remove or greatly reduce the pollutant at the source, and/or (3)the pollutant is diluted or converted and is therefore not detectable in the effluent.

Often times the appropriate control method is to prevent the pollutant from entering the collection system through a reliable pretreatment program. This approach is supported by federal regulations. King County's Industrial Waste Program (KCIW) is responsible for regulating permitted and authorized discharges from significant industrial users. Ecology delegated pretreatment authority to King County and inspects their program annually. KCIW screens each industrial user individually and sets case-by-case local limits for PCB (Aroclor) and other pollutants with the aim to ensure industrial discharges do not contribute pollutants at levels that will cause measurable levels in the biosolids or exceed safe employee exposure levels. Occasionally KCIW sets limits for pollutants that do not have water quality criteria in order to minimize employee exposure. As part of KCIW's permit renewal process, they require base neutral acid and PCB characterization at select facilities to ensure pretreatment requirements continue to be met. In addition to meeting the case-specific limits, all potential dischargers of PCBs are required to use best practical treatment technology (usually granular activated carbon filtration) and to sample each batch after treatment and prior to discharge to the WWTP collection system. At this time, Ecology believes KCIW is doing an exemplary job and that the pretreatment requirements of permit condition S6 are appropriate for source characterization.

Another method Ecology uses to assess effluent toxicity is whole effluent toxicity (WET) testing. WET testing is a regulatory tool under the Clean Water Act that captures the effects of additive toxicity and other possible toxicity interactions specific to a given effluent. WET testing involves exposing living organisms (vertebrates, invertebrates) to set concentrations of the permitttee's effluent over a period of time and recording the results. WET testing is performed to determine both the acute (short term) and the chronic (longer term) effects of the effluent on sensitive species. The permittee must meet specific WET performance standards. For acute toxicity, a median of at least 80% survival in 100% effluent with no single test showing less than 65% survival in 100% effluent must be observed. For chronic toxicity, no toxicity in a concentration of effluent representing the edge of the acute mixing zone may be observed. More information regarding WET testing can be found at Ecology's WET testing website (http://www.ecy.wa.gov/programs/wq/wet/index.html). WET testing results for the South Plant WWTP are presented in Appendix D for 1997-2013. This facility passed all WET tests with greater than 95% survival of all species in 100% effluent concentration during the previous permit term. The WET testing frequency in the permit reflects South Plant's past WET performance and is consistent with the application of the WET requirements.

The proposed South Plant NPDES permit requires semi-annual monitoring of the priority pollutants listed in Appendix A of the permit (including conventional parameters, metals, cyanide, total phenols, acid compounds, volatile compounds, and base neutral compounds including several persistent bioaccumulative toxics). Additionally, the pretreatment section of the permit (Section 6) requires quarterly metals monitoring and annual organics monitoring of the influent, effluent, and biosolids. In response to this comment, Ecology is adding PCBs to the monitoring requirements so these pollutants can be better assessed during the next permit issuance. Ecology believes this level of monitoring provides adequate data to reassess compliance with the State's water quality standards at the next permit issuance.

In general, this comment applies more to Ecology's agency-wide policies, application of the State's WQ standards, and the sufficiency of EPA's National Toxics Rule, rather than to how these standards were applied to this individual permit. Ecology developed this permit consistent with the State's water quality standards, the methods described in its Permit Writers' Manual, and relevant Federal laws and rules.

Comment #2: "Second, screening monitoring is ineffective if the laboratory analytical methods used have detection and quantitation levels far in excess of pollutant concentrations of concern. Rather than default to the EPA-approved analytical methods for toxics screening, Ecology should evaluate the availability of newer and superior analytical methods and require their use for toxic pollutant screening wherever appropriate."

Ecology's Response to Comment #2: Ecology agrees that analytic detection and quantitation levels must be low enough to ensure compliance with water quality criteria. Ecology added Appendix A to its permit for this very reason to ensure permittees meet the detection and quantitation levels necessary for adequate assessment. Consistent with WAC 173-201A-260(3)(h), Appendix A was developed in accordance with the "Guidelines Establishing Test Procedures for the Analysis of Pollutants" (40 C.F.R. Part 136). Use of Part 136 test methods is required by 40 CFR Part 122.41(j)(4).

In general, this comment applies more to Ecology's agency-wide policies and application of the State's WQ standards and EPA required testing methods, rather than to how these standards were applied to this individual permit. Ecology developed this permit consistent with the State's water quality standards, the methods described in its Permit Writers' Manual, and relevant Federal laws and rules. Furthermore, Puget Soundkeeper Alliance filed an appeal of NPDES permit WA0031968 (PCHB 13-137). Puget Soundkeeper Alliance had a full and fair opportunity to raise this same issue before the PCHB during that appeal. Ecology will continue to follow the required testing methodologies set out in federal regulations until the rule is altered by EPA or some other relevant legal determination is made.

Comment #3: "Relatedly, the fact sheet reports (pp. 35 – 36) that a statistical reasonable potential determination for the 91 numeric human health-based criteria established under the National Toxics Rule ("NTR") was negative, eliminating the need for numeric effluent limitations for these 91 pollutants. Draft fact sheet appendix E seems to indicate that a dilution factor of 428 was used in these calculations. Soundkeeper objects to the use of mixing zones or dilution factors for PBTs, including those assigned criteria under the NTR. EPA has repeatedly cautioned that mixing zones are inappropriate to PBTs, and has even banned them from the Great Lakes. Mixing zones should be disallowed "because [bioaccumulative chemicals of concern, "BCCs," also known as PBTs], due to their persistent and bioaccumulative nature, are incompatible with mixing zones. By definition, BCCs are chemicals that do not degrade over time. These chemicals accumulate in organisms living in the water and become more concentrated as they move up the food chain – from biota to fish and wildlife to humans. Because the effects of these chemicals are not mitigated by dilution, using a mixing zone to 'dilute' BCC discharges is not appropriate." 65 Fed.Reg. 67638, 67640-641 (Nov. 13, 2000).

Soundkeeper notes that there are fish consumption advisories in place for Puget Sound in the vicinity of the discharge based on PBT fish tissue contamination, that there are 303(d)-listings for PBTs in the Sound, and that the Sound has a well-documented PCB contamination problem. Given these factors, Soundkeeper asserts that, with respect to the PBTs present in the County Plant discharge, Ecology has not and cannot identify "supporting information that clearly indicates that the [outfall 001] mixing zone would not have a reasonable potential to cause a loss of sensitive or important habitat, substantially interfere with the existing or characteristic uses of the water body, result in damage to the ecosystem, or adversely affect public health," which means that no mixing zone may be authorized under WAC 173-201A-400(4). Accordingly, the reasonable potential analysis for NTR human health criteria for PBTs should be redone without consideration of dilution."

Ecology's Response to Comment #3: We understand and appreciate the concern over elevated levels of PCBs in aquatic species in the Puget Sound. The best approach for PCB reduction is through source control. King County's Industrial Waste Program is actively identifying and eliminating sources of PCBS as described in the response to comment #1 above. The limited data available show PCBs consistently below detection as shown below:

South Plant WWTP Effluent – Total Aroclor data

Collection Date	Method	Value	MDL, ug/L	RDL, ug/L
8/1/2011	EPA 608	<MDL	0.24	0.472
8/2/2011	EPA 608	<MDL	0.24	0.472
8/3/2011	EPA 608	<MDL	0.24	0.472
3/5/2012	EPA 608	<MDL	0.12	0.472
3/6/2012	EPA 608	<MDL	0.12	0.472
3/7/2012	EPA 608	<MDL	0.12	0.472
8/20/2012	EPA 608/SW846 3520C*8082A	<MDL	0.059	0.236
8/21/2012	EPA 608/SW846 3520C*8082A	<MDL	0.059	0.236
8/22/2012	EPA 608/SW846 3520C*8082A	<MDL	0.059	0.236
2/6/2013	EPA 608/SW846 3520C*8082A	<MDL	0.094	0.377
2/4/2013	EPA 608/SW846 3520C*8082A	<MDL	0.094	0.377

This data illustrates that the South Plant WWTP effluent easily meets the acute aquatic life criteria of 10 ug/L, and, while the detection limits are higher than the chronic aquatic life criteria of 0.03 ug/L, no sample shows an exceedance of these detection limits, with 3 samples tested as below 0.059 ug/L. Ecology understands that EPA is revisiting EPA method 608 for PCBs to refine the methodology. Furthermore, in its challenge to NPDES permit WA0031968 (PCHB 13-137), Puget Soundkeeper Alliance had a full and fair opportunity to raise this same issue before the PCHB. Ecology will continue to follow the required testing methodologies set out in federal regulations until the rule is altered by EPA or some other relevant legal determination is made.

In general, this comment applies more to Ecology's agency-wide policies and application of the State's WQ standards than to how these standards were applied to this individual permit. Ecology developed this permit consistent with the State's water quality standards and the methods described in its Permit Writers' Manual. The human health criteria were calculated taking bioaccumulation factors into consideration. The standards allow mixing zones for those human health parameters and those standards were implemented in the draft South Plant WWTP NPDES permit.

Ecology did consider the narrative criteria described in Chapter 173-201A-260 WAC when it determined permit limits and conditions. Ecology considered the narrative criteria when it evaluated the characteristics of the wastewater and implementation of all known, available, and reasonable methods of treatment and prevention (AKART) as described in the technology-based limits section of the fact sheet. When Ecology determined that the facility is meeting AKART it considered the pollutants in the wastewater and the adequacy of treatment to prevent the violation of narrative criteria.

Comment #4: "Soundkeeper also has serious concerns about water quality protection with regard to the outfall 002 discharge to the Green River. The draft fact sheet explains that a dilution factor of 5 accompanies the mixing zone granted for the Green River discharge. There is no reference to a receiving water or mixing zone study for this discharge – was one prepared? If not, what is the basis for its establishment and the assignment of a dilution factor of 5? It appears that, while the dilution factor is identified as 5 in a couple of places, the footnote to the monitoring table on draft permit p. 10 states it as "= [0.25 * River Flow, MGD]/[Effluent Flow, MGD]." What is the dilution factor for this outfall and on what is it based?

The purported Green River mixing zone is also not adequately described in the draft permit in violation of WAC 173-201A-400(1) and WAC 173-220-130(3)(c) (requiring that permits specify the "dimensions" of a mixing zone). Neither the shape nor the horizontal distance across the river are specified. One result of this

inadequate description is the inability to discern whether the mixing zone comports with the restriction to 25% the width of the river. WAC 173-201A-400(7)(a)(iii). What shape is the mixing zone and how wide is it?"

Ecology's Response to Comment #4: Ecology's approach to the mixing calculation for the Green River maintenance discharge differs from other WWTP discharges due to the infrequent discharge events (one four hour discharge in the past 5 years) and uncertain receiving water conditions during the short discharges. The NPDES permit allows for a discharge through the Green River outfall for maintenance purposes only. To minimize impacts to migrating salmon, King County consulted with the Washington State Department of Fish and Wildlife to schedule maintenance discharges around fish passage windows. Ecology wants to encourage this approach and therefore is proposing a sliding calculation to limit effluent flow to assure compliance with water quality criteria. Instead of using the critical flow condition for the mixing calculation, Ecology is proposing to use real-time river flow to ensure adequate mixing occurs during the actual discharge.

Ecology conducted a reasonable potential analysis using effluent priority pollutant data (see Appendix E), and concluded that a dilution factor of 5 is (1) conservative (the previous permit included a dilution factor of 9) and (2) minimizes the mixing zone while assuring compliance with the criteria. Based on these results, the proposed permit limits effluent flow based on the river flow during the time of discharge. The proposed permit includes the following limits on the Green River discharge:

1. *Effluent flow must be less than or equal to [0.25 * River Flow]/5. This limits mixing to 25% of the river flow, consistent with WAC 173-201A-400 (7)(a), and assures a minimum dilution factor of 5 (sufficient dilution to meet water quality criteria).*
2. *The duration of the discharge must not exceed four (4) hours.*
3. *The Permittee may discharge only when the Green River flow is greater than 500 cfs.*

This approach is consistent with WAC 173-201A-400(7)(a). Due to limited resources and the infrequent nature of this discharge, Ecology is proposing to limit the mixing zone to 25% of the river flow as described in WAC 173-201A-400(7)(a)(ii). Since this diffuser extends 44 feet into the river with 8 discharge ports, mixing, and therefore dilution, will occur fairly rapidly. The proposed permit also requires monitoring 300' downstream of the diffuser to monitor impacts to the receiving water.

The mixing zone for outfall 002 is greater than 25% of the width of the river, because the diffuser is 44 feet long and the river width is approximately 100 feet. Exceptions to the numeric size criteria for mixing zones are allowed by WAC 173-201A-400(12) in cases where the discharge existed prior to November 24.1992.

In response to this comment, Ecology added a mixing zone diagram in Section III.C of the fact sheet and a mixing zone analysis to Appendix E. The mixing zone analysis confirms that a dilution greater than 5 is achieved before the acute mixing zone boundary 31 feet downstream of the diffuser.

Comment #5: "Soundkeeper also doubts that consideration of a Green River mixing zone and dilution factor in reasonable potential analysis for the PBTs present in the County Plant's effluent is appropriate for the same reasons as it is inappropriate for outfall 001. Although discharged at relatively low concentrations, the substantial flow volume may result in significant and harmful loads of toxic pollutants to the Green River. Specific to PCBs, recent King County ambient water quality data indicates that the Green River violates the ambient NTR criteria for PCBs. Of course, the Green River flows into the Duwamish, which is very heavily contaminated with PCBs and the subject of a Superfund cleanup effort. There is no remaining assimilative capacity in the Green River for PCBs and possibly for other toxic pollutants, so no mixing zone should be allowed. *See, e.g.*, 63 Fed.Reg. 36742, 36791 (July 7, 1998) ("EPA's mixing zone guidance emphasizes that the determination by a State or Tribe that a mixing zone is appropriate must be preceded by a separate determination that there is available assimilative capacity in the receiving water."); Water Quality Standards Handbook, EPA-820-B-14-004 (Sept. 2014) at 5.1.2. Ecology has not and cannot identify "supporting

information that clearly indicates that the [outfall 002] mixing zone would not have a reasonable potential to cause a loss of sensitive or important habitat, substantially interfere with the existing or characteristic uses of the water body, result in damage to the ecosystem, or adversely affect public health," with regard to PCBs, other PBTs, and toxic pollutants in general, which means that no mixing zone may be authorized under WAC 173-201A-400(4)."

Ecology's Response to Comment #5: The Green River maintenance discharges occur infrequently (only one occurrence in the past 5 years) and for very short durations (limited to 4 hours maximum). The secondary treated effluent is expected to have de minimis PCB loading to the Green and Duwamish Rivers. With that said, Ecology assessed compliance with water standards by performing reasonable potential analyses for each pollutant detected in the South Plant's effluent. This analysis looks at the quantities of pollutants in the effluent and determines whether the aquatic life or human health will be negatively impacted based on the water quality criteria. The analysis can be found in Appendix E of the fact sheet. Based on these calculations, Ecology is confident the States's water quality standards will be met if the County meets the permit's flow and duration restrictions for the Green River discharges.

However, again, this comment applies more to Ecology's agency-wide policies and application of the State's WQ standards than to how these standards were applied to this individual permit. Ecology developed this permit consistent with the State's water quality standards and the methods described in its Permit Writers' Manual. The human health criteria were calculated taking bioaccumulation factors into consideration. The standards allow mixing zones for those human health parameters and those standards were implemented in the draft South Plant WWTP NPDES permit. Additionally, Puget Soundkeeper Alliance's appeal of NPDES permit WA0031968 (PCHB 13-137) provided it with full and fair opportunity to raise these types of policy issues before the PCHB.

Ecology is in the process of modifying the state's water quality standards for toxics (173-201A WAC) in light of updated fish consumption data. Ecology solicited comments during the public review period which ended March 23, 2015. Hopefully Puget Soundkeeper Alliance provided comments during that process. Final adoption of the new rule is expected in July or August 2015.

Comment #6: "The draft fact sheet discusses sediment monitoring in the vicinity of outfall 001, and describes the periodic violations of sediment quality standards for toxics found, as well as Ecology's determination of reasonable potential for sediment impacts at outfall 001 based on facility characteristics. Where is the evaluation of sediment impacts on the maintenance discharge to the Green River? Shouldn't the sediment reasonable potential determination also apply to the Green River discharge? Potential Green River sediment impacts must be evaluated under WAC 173-204 Part IV. If such potential exists, the County Plant must seek a sediment impact zone or comply with effluent limitations adequate to ensure against sediment quality standards violations. The draft permit appears not to include such limitations."

Ecology's Response to Comment #6: Ecology is confident that the very infrequent maintenance discharges of secondary treated effluent to the Green River will not measurably alter the sediment chemistry in the vicinity of the outfall. These discharges occur approximately once every 4-5 years and are limited by the permit in volume and duration (limited to 4 hours). In addition, the facility is very efficient at removing solids; the average TSS concentration over the past 5 years was 11 mg/L. The reason for the Green River discharge is to clear accumulated sediments, due to river transport, away from the outfall's diffuser ports. The transport of sediment in the Green river is substantial and any sediment monitoring that could be required would not represent or align with the very infrequent and intermittent nature of treated secondary effluent to Green River. Ecology has collected sediment data from many WWTP outfalls that discharge <u>continuously</u> and have found the vast majority of sites meet sediment quality standards.