Section 4
Chambers Creek Wasterwater Treatment Plant
Existing Treatment

Section 4 –Chambers Creek Wastewater Treatment Plant Existing Treatment

4.1 Chambers Creek Regional Wastewater Treatment Plant (WWTP)

The WWTP is an anoxic selector-assisted activated sludge secondary treatment facility with primary sedimentation and anaerobic sludge digestion. The treatment plant is rated to treat 24.4 million gallons per day (MGD) Average Dry Weather Flow (ADWF) with discharge to the Gordon Point zone of South Puget Sound. Table 4.1-1 describes the WWTP process sizing and design criteria.

Table 4.1-1 Chambers Creek Regional WWTP Process Sizing & Design Criteria [1]

Treatment Process	Units	Design Criteria
Step Screens	3	
Spacing		0.24 inches
Width		4 feet
Total Capacity		100MGD
Grit Chamber	4	
Volume		53,100 gallons
Detention time at average flow		12.8 minutes
Primary Clarifiers	6	
Length		114 feet
Width		40 feet
Sidewater Depth		8.5 feet
Surface Overflow Rate @ Peak Daily Flow		1,316 gpd/ft2
Aeration Basins	5	
Length		132 - 150 feet
Width		30 - 40 feet
Depth		20.7 feet
Hydraulic detention Time (no recycle)		7.10 hours
Hydraulic detention Time (30 percent recycle)		4.73 days
Secondary Clarifiers	6	
Diameter		105 feet
Sidewater Depth		2@12 feet 4@17 feet
Surface Overflow Rate @ Peak Daily Flow		693 gpd.ft2
Ultraviolet (UV) Treatment	2	
Length		96 feet
Channel Width		5 feet/114 feet total
Sidewater Depth		9 feet
Detention Time		4-8 seconds
Gravity Belt (Sludge) Thickener	3	
Belt Width		2.2 meters
Anaerobic Digesters	3	
Diameter		80 feet
Volume		155,700 cubic feet
Detention Time		37 days
Biosolids Dryer	1	
Evaporation Rate		4,400 lbs/hour
Centrifuge	2	
Capacity		100 gpm

[1] Source: Brown and Caldwell Strategic Planning Reference Documents 2008/2009.

4.1.1 Process Description - Chambers Creek Regional WWTP

Treatment begins with screening of paper, plastics, and other materials, followed by grit removal. In primary treatment, solids are removed. Primary effluent undergoes secondary treatment via bioselectors and secondary clarification.

Secondary effluent is disinfected with ultraviolet light and discharged into Puget Sound through a deep water diffuser. Wastewater flows through the process by gravity.

Solids from primary treatment and waste activated sludge (WAS) from secondary treatment are digested anaerobically then forwarded to the Fertilizer Manufacturing Facility where it is processed into an "Exceptional Quality" (EQ) Class A pelletized fertilizer for use in commercial, residential and reclamation applications.

Please refer to Chapter 6 – Fertilizer, Biosolids Management, and Reclaimed Water Management for information pertaining to the Fertilizer Manufacturing process and Exceptional Quality Class A biosolids production.

4.1.2 Headworks/Preliminary Treatment

The preliminary treatment processes consist of two major steps: screenings and grit removal.

Screening – Step/plate screens separate larger non-soluable solids in the wastewater. Using screens that wastewater passes through debris collects against the plates and is conveyed to a washer/compactor. In the washer/compactor, organics are washed out of the screenings, and returned to the treatment process. The compactor removes excess water from the remaining debris, which is conveyed to a dumpster and disposed in a sanitary landfill.

Grit Removal - Grit tanks use air diffusers to keep the solids suspended in the waste water while allowing heavier mostly inorganic matter, such as sand and grit, to settle to the bottom of the tank. The sand and grit is conveyed to a dumpster then disposed in a sanitary landfill.

4.1.3 Primary Treatment

Primary treatment process consists of removing the solids, such as fine sediment and grease.

Flow Measurement - Following grit removal, wastewater passes through a 6-foot wide Parshall flume, where the amount of wastewater entering the plant is measured. After flow is measured, wastewater enters the primary influent channel, from which it is distributed among the primary clarifiers.

Primary Sedimentation Tanks (Clarifiers) - Six primary sedimentation tanks are placed into service by the operation staff on an as needed basis. The influent flow rate governs the number of primary sedimentation tanks operating at any time. Tanks are 114 feet long, 41.5 feet wide, with an 8.5 foot side water depth.

A flight and chain mechanism is used to collect settable solids (primary sludge) from the bottom of the tanks. Primary sludge is pumped to gravity belt thickeners and then is pumped to the solids digesters. Floatable solids (primary scum) are pumped to a rotary fine screen at the headworks. Screenings are taken to a sanitary landfill. With settleable solids and scum removed, primary effluent flows to the first stage of secondary treatment.

4.1.4 Secondary Treatment

Secondary treatment removes additional solids and more than 90 percent of the biological oxygen demand of organic matter in the wastewater so that dissolved oxygen in the water receiving treated effluent does not have to be used to break down the organics. Biological Oxygen Demand (BOD) is a measure of the amount of oxygen consumed in the biological and chemical processes that break down organic matter in wastewater.

Bioselector Basins (Bioselectors) - Bioselectors are used to propagate the bacteria in the wastewater most beneficial in breaking down organics. Five bioselector basins are divided into three sections each for filamentous bacteria control. Baffle walls inside the basins create a series of selector and aeration cells. One cell is anaerobic/anoxic, one is a swing cell, anaerobic/anoxic/oxic, and one large cell is oxic (large quantities of air are diffused through the wastewater to maximize the amount of oxygen available to the aerobic bacteria). In each basin, some of the mixed liquor from the oxic zone can be recycled to the first and second cells.

Process Air - The blower building houses seven blowers, three 500 hp and four 150 hp centrifugal blowers. Air supplied to the bioselectors is controlled at the Secondary Treatment Building. Each zone is monitored by dissolved oxygen meters to maintain the desired concentration of dissolved oxygen in the respective zones.

Secondary Clarifiers - Six secondary clarifiers have a diameter of 105-feet each. The two original clarifiers have a side water depth of 12 feet and mixed liquor from the bioselectors enters the original clarifiers along the outside edge. Mixed liquor sent to secondary clarifiers 3 and 5 flows into pipes that deliver it to the center well of the clarifiers. Clarifiers 4 and 6 are also center-fed with an energy-dissipating inlet and flocculation feedwell. Their side water depths are 17 feet.

In the secondary clarifiers, the mixed liquor or activated solids (also referred to as biomass) is settled in a quiescent environment. The biomass that settles is drawn off the bottom and becomes return activated sludge (RAS). This mass is returned to the head end of the bioselectors. A fraction of the RAS is continuously removed to maintain the balance between the new organic materials applied each day and the total mass of organisms contained within the secondary system. The material removed is referred to as waste activated sludge (WAS). The WAS is routed to thickening processes, and then conveyed to the anaerobic digesters.

After it passes over weirs, at the outside edge of the secondary clarifiers, treated wastewater enters a channel and moves to final disinfection.

Final Disinfection - Ultraviolet Treatment - Combined effluent from the secondary clarifiers flows to an inlet chamber before ultraviolet light (UV) disinfection. UV light dosage is set by the operator and is paced with the combined total primary effluent flow entering the aeration basins in service to ensure proper eradication of pathogens.

Discharge - UV treated effluent is discharged through a 42-inch outfall for a distance of 85 feet then into a 60 inch outfall and diffuser section that extends 780 feet offshore into the Gordon Point zone of Puget Sound to a depth of approximately 110 feet below mean lower low water. The nominal capacity of the effluent pipeline is 100MGD and the capacity of the outfall is 100MGD.

Performance of the WWTP is monitored daily and summarized in a year end evaluation of wastewater quantities and plant efficiency. Performance parameters are presented in Table 4.3-1.

4.2 Biosolids at Chambers Creek Regional WWTP

Wastewater solids extracted from primary sedimentation and the activated sludge process are stabilized by anaerobic sludge digestion, dewatered by centrifuge, and transferred to the Fertilizer Manufacturing Facility (FMF).

The digestion system consists of three anaerobic digesters and utilizes the two-stage digestion process. Each digester is designed for high-rate digestion, and flexibility is built into the system to allow each digester to be configured as a primary or secondary digester. Total digestion volume is 501,000 cubic feet.

Digested solids are withdrawn from the bottom of the secondary digester in batches and pumped to one of two centrifuges located within the FMF, where extraneous water is removed from the digested solids. Polymer is injected to aid in separating the solids from the water. Excess water is returned to the Headworks. Dewatered solids from the centrifuges are transferred via screw conveyor to the FMF.

At the FMF the biosolids are further processed into an 'Exceptional Quality' (EQ) Class A pelletized fertilizer and either stored in silos within the building, sold in bulk, or sold in individual 50 pound bags to the general public. Refer to Chapter 6 – Fertilizer, Biosolids, and Reclaimed Water Management for information pertaining to the Fertilizer Manufacturing process and EQ Class A biosolids production.

The fertilizer product is also used in the restoration of the adjoining gravel pits as part of the *Chambers Creek Properties Master Site Plan.*

4.3 Volume & Loading Characteristics – Chambers Creek Regional WWTP

Table 4.3-1 summarizes the wastewater flows and loading from 2006-2009. Downward trending flow numbers are the result of increased I/I controls.

Table 4.3-1 Chambers Creek Regional WWTP Wastewater Flows and Loadings 2006 to 2009

Parameter	2006	2007	2008	2009	Average
Average Annual Flow (AAF), MGD[1]	18.88	18.41	17.89	17.81	18.25
Average Dry[2] Weather Flow (ADWF), MGD	16.25	16.18	15.97	15.75	16.04
Average Wet[3] Weather Flow (AWWF), MGD	23.67	21.52	19.57	20.08	21.21
Peak Month Flow (PMF), MGD	26.23	24.51	20.19	23.15	23.52
Peak Day Flow (PDF), MGD	35.07	34.43	24.69	41.32	33.88
Peaking Factors	**2006**	**2007**	**2008**	**2009**	**Average**
PMF/AAF	1.39	1.33	1.13	1.30	1.29
PDF/PMF	1.34	1.40	1.22	1.22	1.30
PDF/AAF	1.86	1.87	1.38	1.38	1.62
Average Annual CBOD[4] loading, lb/d[5]	27,869	28,078	36,297	34,778	31,755
Average Dry Weather CBOD loading, lb/d	26,173	27,173	29,403	32,434	28,796
Peak Month CBOD loading, lb/d	33,148	31,006	41,448	42,109	36,928
Peak Day CBOD loading, lb/d	54,888	49,444	53,049	61,742	54,781
5-Day BOD_5 loading	35,698	36,900	36,271	37,610	36,620
Average Annual TSS[6] loading, lb/d	39,199	40,944	39,999	40,380	40,130
Average Dry Weather TSS loading, lb/d	38,668	39,483	37,769	39,121	38,760
Peak Month TSS loading, lb/d	49,307	48,754	47,101	41,056	46,554
Peak Day TSS loading, lb/d	75,190	101,604	91,689	50,999	79,870

[1] Millions of Gallons per Day
[2] Dry weather period = May through October
[3] Wet weather period = November through April
[4] Carbonaceous Biochemical Oxygen Demand
[5] Pounds per day
[6] Total Suspended Solids
Data Source: Chambers Creek Regional Wastewater Treatment Plant Level of Service Report 2009

4.4 Industrial Pretreatment – Chambers Creek Regional WWTP

Pierce County Code Title 13 - Public Sanitary Sewer Systems Chapter 13.06 outlines the requirements for pretreatment of industrial wastewater. Upon review by the Utility of the type of industrial use requested by a user, pretreatment requirements will be addressed at the plan review stage and be required to be installed and operational prior to the industrial use beginning on site.

- Section 13.06.130 Providing and Maintaining Pretreatment Facilities – outlines standards required to comply with providing and maintaining pretreatment facilities
- Section 13.06.140 Reports for Industrial Facilities – outlines submittal requirements that shall be followed for submittal of documents for County review.
- Section 13.06.150 Deadline for Compliance with Applicable Pretreatment Requirements – outlines timelines for compliance with state and county guidelines.
- Section 13.06.160 Additional Pretreatment Measures – outlines additional measures that may be required by an individual user.

4.4.1 Major Industrial Users

Four industries qualify as major users in the 2009 Pierce County Sewer Utility Industrial Pretreatment Program 2009 Annual Report requiring an industrial discharge permit for industrial process wastewater in the Chambers Creek Regional WWTP service area:

- **Boeing Corporation**
  Skin and Spar Fabrication Facility
  The skins and spar facility is a metal finishing category user. The Boeing facility performs a boric acid anodizing process on aluminum airplane parts, along with cleaning and inspection. The main discharge from the facility is neutralized acidics and caustic rinse water. In 1998, Boeing was authorized to operate a metals precipitation facility used to reduce water consumption without exceeding categorical metals limits.
- **James Hardie Building Products**
  Manufacturer of cement-based building material, principally a wallboard product made from cement and paper fiber. Pretreatment includes reduction of chromium and paint solids.
- **Land Recovery Incorporated** (LRI) Hidden Valley Landfill
  Discharges treated leachate from a lined landfill cell that receives municipal solid waste.
- **Frederickson Power LP - Frederickson Generating Station**
  Operation of a combustion type turbine generator, the station does not discharge a categorical waste stream, but is permitted as a minor industry for its water treatment system discharge, which includes a pH neutralization facility.

4.4.2 Priority and Minor Industrial Users

The following table shows the type and number of businesses with pretreatment devices and/or odor control mechanisms monitored for Priority and Minor Industrial Users under the Pretreatment Program. These industrial users comply with the Best Management Practices (BMP) developed for each type of discharge.

Pretreatment program activities include inspection and/or contact with businesses classified as food services, automobile services, schools, hospitals, dry cleaners, pest control, and pest spraying services, photographic processing, printing, and metal fabrication. The program emphasizes keeping petroleum products, fats, oils, and grease out of the collection and treatment system.

Pretreatment reviews and site visits are conducted to insure compliance with these discharge prohibitions and other ordinance conditions. The jurisdictions within the County's service area of DuPont, Tacoma, Lakewood, University Place, and Steilacoom have adopted equivalent pretreatment regulations. This allows the County to adequately regulate both major and minor industrial users of the sewer system.

Table 4.4-1 Types and Number of Pretreatment Uses*

Type	Amount
Grease Interceptors	284
Silver Recovery Units	52
Offsite Silver Recycling	86
Oil/Water Separators	59
Amalgam Separators/Traps	65
Total	**546**

*Data from Pierce County Sewer Utility Industrial Pretreatment Program 2009 Annual Report

Pierce County began implementing BMPs for dental practices requiring amalgam removal devices in 2005. Levels of silver and cadmium in the biosolids have show significant declines in 2007 and 2009. Mercury levels showed a somewhat less significant reduction in 2009. These metals are all components of dental amalgam.

4.5 Adequacy of Treatment – Chambers Creek Regional WWTP

The primary enforcement mechanism is the National Pollutant Discharge Elimination System (NPDES) permit issued by the DOE. The limitations in the permit include 5-day carbonaceous biochemical oxygen demand ($CBOD_5$), total suspended solids (TSS), pH, and fecal coliform bacteria.

Pierce County Wastewater Utility is continually making process improvements in anticipation of increases in water quality regulations. A Capacity Re-Rate Study was approved by the Department of Ecology that increased the rated capacity of the WWTP from 18.0MGD to 28.7MGD Maximum Monthly Average (24.4MGD operational capacity) in 1998.

4.6 NPDES Permit

The WWTP is operating under the terms of a National Pollutant Discharge Elimination System (NPDES) permit. Effluent discharge limitations are shown in Table 4.6-1. In addition to the specific discharge limitations, the NPDES Permit stipulates a number of other conditions for permit compliance, including:

- Influent and effluent monitoring.
- Marine sediment monitoring, effluent particulate analysis and outfall evaluation.
- Full Industrial Pretreatment Program.
- Accidental Spill Prevention Program.
- Sludge Management Program.
- Infiltration and Inflow Program.

Table 4.6-1 Chambers Creek Regional WWTP NPDES Performance Based Limitations[1]

Parameter	Units	Monthly Average All Samples	Weekly Average All Samples
Effluent	Millions of Gallons per day	28.7[2]	--
Carbonaceous Biochemical Oxygen Demand	milligrams per liter	25	40
	pounds/day	5,984	9,574
Suspended Solids	milligrams per liter	30	45
	pounds/day	7,181	10,771
Fecal Coliform Bacteria [3]	MPN[4]/100 milligrams	200	400
pH	--	6.0 to 9.0	6.0 to 9.0

[1] Source: Chambers Creek Regional WWTP NPDES Permit.
[2] As of December 31, 2010.
[3] Geometric Mean of samples taken.
[4] MPN = Most Probable Number.

4.7 Wastewater Collection System for the Chambers Creek Basin

Pierce County owns the collection facilities in Parkland, Spanaway, Frederickson, South Hill, the cities of University Place and Lakewood, and the City of DuPont. The City of Tacoma, Milton, and Town of Steilacoom own the collection facilities within their respective jurisdictions.

The WWTP conveyance system has more than 58,960 connections and includes approximately 658 miles of public sewer pipelines ranging in size between 8-inches (for local collection) and 84-inches in diameter (for the largest interceptor), 172 miles of private sewer lines, and more than 15,500 manholes to access the sewer lines. The Utility operates and maintains 95 pump stations with four new stations in design, and 825 residential grinder pumps in the Chambers Creek Basin.

4.8 Conveyance System Backbone - Existing Interceptors & Force Mains

Interceptors and force mains form the backbone of the conveyance system. They are the trunk and large branches of the system into which the wastewater from local collection systems flow. Existing interceptors, force mains, and pump stations for the WWTP sewer service basin are detailed in a complete inventory of Pierce County's sewer conveyance system found in USP Appendix K.

4.9 Infiltration and Inflow

Collection system capacity is significantly influenced by how much surface water and groundwater enters the system. In the WWTP sewer service basin infiltration and inflow (I/I) data is collected by the Utility and reported to the DOE on an annual basis as required by the WWTP's NPDES permit.

Previous planning efforts in the County used a 95 gallon per day per capita sewage flow multiplier, which included wastewater and a reasonable allowance for dry weather ground water infiltration.[1] This reflects the location of sewer pipelines in areas with perched water tables. The effect is that there is always a certain amount of infiltration of groundwater occurring.

The Chambers Creek collection system generates an average dry weather flow of 18-20MGD[2]. The annual average flow at the WWTP in January 2001 was 15.7MGD. The 4.3MGD additional flow is an indicator of both new construction and connections over the past eight years.

[1] Taken from the 1991 *Chambers – Clover Creek Sewerage General Plan Update*
[2] Based on January 2009 flow measurements

The addition of the Town of Steilacoom to the Chambers Creek Regional WWTP service area increased infiltration and inflow to the WWTP. Average dry weather flows from Steilacoom are approximately 82,000 gallons per day (.082MGD). The Steilacoom contract with Pierce County caps peak flows at 2.8 times the average, with the potential consequence of additional charges if peak flows are not contained.

Recently measured peak flows imply that the Town of Steilacoom system is responsive to I/I influences. The Town is pursuing a 10-year I/I reduction program which includes pipe bursting and replacement with annual progress report submittals to Pierce County.

Additional infiltration and inflow is received from the Western Slopes Service Area. Flow modeling indicates that as much as 2.0MGD of inflow and infiltration enters the WWTP system at Tacoma's pump station on Grandview Drive during storm events. Specific information regarding I/I remains unavailable at this time and additional studies may be needed to better quantify this known I/I source.

I/I driven peak flows consume conveyance system capacity in the existing sewer system. Control of inflow sources into the interceptor system paralleling Clover Creek is important to prevent surcharging. This may require coordination of surface drainage and flood control activities to prevent extraneous flows from entering the sanitary sewer system. Collections maintenance crews actively repair identified I/I sources on County owned and maintained sewer systems.

4.10 Capacity Restrictions

Identification of capacity restrictions is driven by NPDES regulations that require planning for additional conveyance capacity when peak flows reach 85 percent of the peak flow a pipeline was designed to carry. Sanitary Sewer systems are designed and constructed to contain and transport only wastewater.