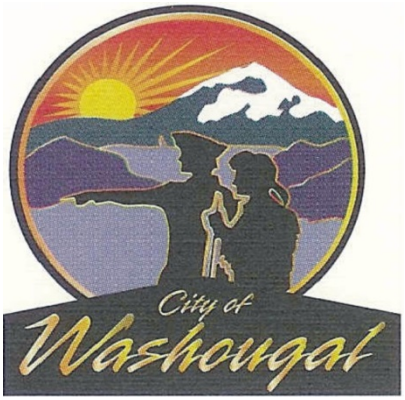
City of Washougal



General Sewer Plan

July 2016

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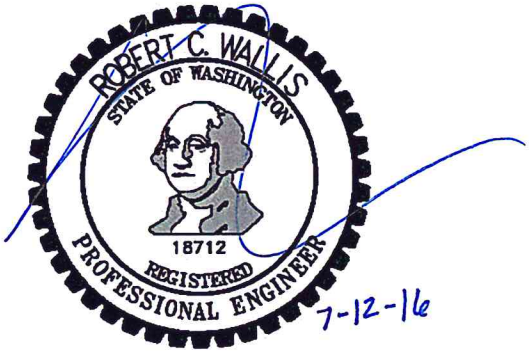
City of Washougal
General Sewer Plan

July 2016



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City of Washougal
General Sewer Plan
July 2016

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Section 1:
Executive Summary

1.1 Overview

General sewer plans are used by cities to guide the construction of sewer facilities necessary to correct deficiencies in the existing system, and to provide additional capacity to accommodate growth. The City of Washougal currently relies upon a plan which was completed in 2006. This document updates and replaces the 2006 General Sewer Plan.

Since that 2006 Plan, the City's population has grown by 25%, new residential developments have been constructed, and a number of capital improvements related to capacity have been built. Because of the changes since the last sewer plan, an update is needed to fully evaluate the City's current sewer system, identify system deficiencies, and define the capital improvements necessary to provide adequate sewer service over a 20-year planning period.

1.2 Existing Conditions

Study Area

The City of Washougal's urban growth boundary (UGB) encompasses approximately 5,500 acres. The study area for this sewer plan consists of the entire area inside the current UGB, but also considers the future expansion of the UGB for areas north of the City. Further discussion of the study area, existing environmental conditions, land use, and other utilities within the City is included in Section 3 – Study Area Characteristics.

Sewerage System

The City of Washougal's existing sewer collection system is comprised of a network of gravity sewers and force mains totaling 83 miles in length. Portions of that collection system were originally constructed in the 1950's. It has been expanded many times since then, and now provides sewer service to most of the developed land in Washougal. Within that collection system there are fourteen (14) sewage pump stations that receive sewage from portions of the collection system and discharge it to other portions of the collection system, where it ultimately flows to the City's wastewater treatment plant. A detailed description of the existing sewer system and treatment facilities is included in Section 4 – Existing Sewerage Facilities.

The existing collection system is generally in good condition, and performing well from both capacity and maintenance perspectives. Although most of the existing mains and pump stations have capacity to accommodate projected future growth, several components of the existing system will require replacement or bypassing in the future.

The existing wastewater treatment plant was constructed in the late 1990's. A major expansion is currently under construction and scheduled to be complete in May 2016.

Planning Criteria

This Plan has been prepared for a 20-year planning period, from 2016 to 2036. Three conditions were examined during the evaluation of the sewer system: existing conditions, conditions after 20 years of growth, and conditions at buildout. Buildout conditions assumed that 80% of the land within the urban growth boundary would be fully developed according to each land use designation.

An annual growth rate of 1.74% has been projected for the City of Washougal within this planning period, based on the 2010 Census and projected population data from Clark County and Washington State. A growth rate of 1% is assumed for heavy industrial sewer users, and a growth rate of 3% is assumed for public, commercial, and light industrial sewer users. Based on these growth rates, the equivalent service population is anticipated to be 30,461by the year 2036.

Further discussion of the planning criteria used for this Plan, as well as regulatory and design criteria, is included in Section 5 – Planning Criteria and Regulatory Issues.

1.3 Evaluation of Existing Sewerage System

An evaluation of the existing and future performance of the existing sewer system was completed in order to determine capital improvements needed to serve the City in the future. Existing sewer flows and wasteloads were analyzed based on data collected by the City at the Wastewater Treatment Plant. Future flows and wasteloads were projected based on land use and population projections. An analysis of infiltration and inflow within the existing collection system was also completed. These projections and analyses are discussed in Section 6 – Flow and Wasteload Projections.

Software modeling of the existing sewer collection system was completed in order to evaluate the anticipated performance of the system under future flows. The existing collection system was modelled using the InfoSWWM program with existing sewer flows, as well as two future condition flows – 20-year flows, and buildout flows. The service area was divided into 29 sewer basins for the purposes of modeling the collection system. Based on the results of the modeling and discussions with City staff, several maintenance and growth-related deficiencies within the existing collection system were found. A number of capital improvements are proposed in order to correct these deficiencies. Section 7 – Collection System Evaluation and Improvement Options, describes the basis for modeling, the collection system evaluation, system deficiencies, and proposed improvements.

The City's wastewater treatment plant is currently under construction for a number of improvements. Section 8 – Treatment System Evaluation, describes the existing plant's components, constructed improvements, deficiencies, and proposed capital improvements to address those deficiencies.

The City currently operates sewage lagoons for the purpose of storage and facultative treatment of the biosolids produced by the wastewater treatment plant. The current biosolids management strategy has several shortcomings, including high costs. Rather than continuing to rely solely upon those lagoons, there are a number of alternative unit processes that could be used to stabilize, thicken and dewater these biosolids. These options are discussed in Section 9 – Biosolids Treatment and Disposal Evaluation, along with their capital and long-term maintenance cost implications.

1.4 Proposed Capital Improvements

Based on the evaluation of the sewerage system through existing and future conditions, a number of capital improvements have been proposed in this sewer plan update. These include improvements to the collection system and wastewater treatment plant. Improvements are listed below in Table 1.1 (and also in Table 10.1 in Section 10). Costs are in 2016 dollars, and include 40% for engineering, tax, administration, and contingencies.

Table 1.1: Proposed Collection and WWTP System Improvements Cost Estimates

Item	Cost ($)
6-year Capital Improvements Plan (CIP) (2016 to 2022)	
Collection System Maintenance Upgrades	
1. Pump Station #1 Upgrade	350,000
2. Pump Station #2 Upgrade	25,000
3. Pump Station #3 Upgrade	4,500
4. Pump Station #4 Upgrade	65,000
5. Pump Station #5 Upgrade	4,200
6. Pump Station #6 Upgrade	7,400
7. Pump Station #9 Upgrade	19,000
8. Pump Station #13 Upgrade	11,000
9. Pump Station #14 Upgrade	14,000
10. SCADA System Upgrade	1,160,900
6-year CIP Collection System Maintenance Improvements Total	**1,661,000**
Collection System Capacity Upgrades	
1. Pump Station #8 Upgrade (550 gpm capacity)	250,000
6-year CIP Collection System Capacity Improvements Total	**250,000**
Treatment Plant Upgrades	
1. Facility Plan Amendment	260,000
2. Anoxic Selector	900,000
6-year CIP Treatment Plant Improvements Total	**1,160,000**
6-YEAR CIP GRAND TOTAL	**3,071,000**
Year 2023 to Year 2036 Capital Improvements Plan (CIP)	
Collection System Maintenance Upgrades	
1. Pump Station 7 Abandonment (800’ of 8” gravity sewer)	440,000
2. Pump Station 10 Abandonment (1,600’ of 8” gravity sewer)	640,000
3. Pump Station 11 Abandonment (1,000’ of 8” gravity sewer)	520,000
4. ‘U’ Street Bypass (1,400’ of 8” sewer)	617,000
Year 2023 to Year 2036 CIP Collection System Maintenance Improvements Total	**2,217,000**

Item	Cost ($)
Collection System Capacity Upgrades	
1. Pump Station 15 (150 gpm capacity)	656,000
2. Force Main 15 (3,100' of 4-inch)	620,000
3. Pump Station 16 (100 gpm capacity)	644,000
4. Force Main 16 (4,600' of 6-inch)	920,000
5. Trunk Sewer #T26 (4,300' of 12-inch)	2,197,000
6. Interceptor Sewer I8 (4,000' of 36-inch)	3,717,000
7. Pump Station #17 (100 gpm capacity)	644,000
8. Force Main #17 (2,000' of 4-inch)	400,000
9. Stiles Road Interceptor I9 (4,500' of 8-inch)	2,490,000
10. Interceptor I10 (2,300' of 8-inch)	1,250,000
11. Pump Station #9 Upgrade	650,000
Year 2023 to Year 2036 CIP Collection System Capacity Improvements Total	**14,188,000**
Treatment Plant Upgrades	
1. Biosolids Management Facilities (Alternative B)	7,150,000
2. Clarifier No. 3	3,081,000
3. RAS/WAS Facility	2,535,000
Year 2023 to Year 2036 CIP Treatment Plant Improvement Total	**12,766,000**
YEAR 2023 TO YEAR 2036 CIP GRAND TOTAL	**29,171,000**

1.5 System Management and Operation

An evaluation was completed of the City's wastewater operating division in operating and maintaining the collection system and treatment facility infrastructure. In order to inform this evaluation, a detailed assessment was completed of City staffing tasks, additional work that is not currently capable of being completed due to staffing limitations, staffing requirements at wastewater treatment facilities similar in size, and self-assessments completed by City staff.

There are currently four operational staff positions managed by the Wastewater Operations Manager, which are responsible for both collection system and treatment facility maintenance and operation tasks. These tasks include:

- Providing oversight and control of the wastewater treatment processes in order to ensure compliance with the NPDES permit issued by Washington State Department of Ecology.
- Maintenance of treatment facilities.
- Cleaning and inspecting sewer mains and manholes.
- Cleaning, inspection, and maintenance of pump station wetwells, valves, pumps and buildings.
- Repairs of damaged collection system components.

- Construction management and inspection.
- Public education and interface.
- Internal and external reporting and training.

Based upon an evaluation of existing conditions and desired operation and maintenance needs, there appears to be a need for an additional position at the wastewater treatment plant and for the collection system.

Section 2:
Introduction

2.1 Background

The City of Washougal's current sewer plan was prepared in 2006. The General Sewer Plan addressed proposed collection and treatment facility upgrades and expansions through a 20-year planning period [1]. (See Appendix A for cited documents which are noted in brackets.) The 2006 plan was the latest update to a plan originally prepared in the early 1970's. The planning update reflected in this document continues a long practice of updating the sewer plan to reflect changes that have occurred in sewer land use, flows, and sewer system conditions.

The City of Washougal authorized Wallis Engineering to complete this update to the City's General Sewer Plan in an agreement dated July 6, 2015.

2.2 Purpose

The objective of this General Sewer Plan is to develop comprehensive long-range plans for the orderly development of adequate wastewater collection and treatment facilities for the City of Washougal and its Urban Growth Area (UGA). The Plan has been written to meet the requirements of the Washington Administrative Code (WAC) 173-240-050.

2.3 Scope

Included within the scope of the General Sewer Plan are the following objectives:

1. Evaluation and review of the existing sewer system and wastewater treatment plant.
2. Population determination and projections for the service area as defined by the Washougal Urban Growth Area.
3. Forecast of future flows and wasteloads.
4. Establishment of general planning criteria for sewer facilities and wastewater treatment plant, including water quality standards for receiving streams.
5. Determination of a general plan for sewer facilities required to satisfy existing and future needs of the service area.
6. Determination of cost-effective treatment facilities to handle the proposed flows and wasteloads and meet required water quality standards.
7. Development of cost estimates for proposed sewer facilities identified in this Plan.
8. Addressing the financial and administrative issues related to the plan and its implementation.
9. Providing general planning information to assist the City in finalizing growth management planning efforts.

All of the aforementioned information relative to wastewater treatment facilities will summarize and/or reference information from approved facility plans or engineering reports previously prepared by others.

Section 3:
Study Area Characteristics

3.1 Study Area

The study area includes the area within the existing incorporated city limits of the City of Washougal and the Washougal Urban Growth Area designated by the Growth Management Act of Washington State. The Urban Growth Area (UGA) used as a basis for planning in this document was last designated in 2007. Further discussion of the UGA and other planning issues is included in Section 5.

The study area is generally bordered by the Columbia River to the south, the City of Camas to the west, and the Columbia River Gorge National Scenic Area to the east. The northern boundary runs along, from west to east: 23rd Street, 313th Street, and Jennings Road. Figure 3.1 represents the vicinity map for the City, and Figure 3.2 depicts the city limits and UGA.

3.2 Environmental Conditions

Topography

Topographic information of the study area is shown on Figure 3.2. The topography of the area is dominated by the Columbia and Washougal Rivers. The City's core is bordered by two rivers, the Columbia to the south and the Washougal to the north. In general, this area is characterized by gentle slopes. The area to the south (where the wastewater treatment plant is located) is very flat and was formerly located within the Columbia River Flood Plain until the construction of a dike by the United States Army Corps of Engineers.

North of the City's core, the topography is divided by the Washougal River, which flows in a southerly direction. The areas near the Washougal River are characterized by steep slopes extending down toward the river. In general, the remaining area north of the City slopes upward to the north with moderate to steep slopes, rising near the 600 foot elevation.

A significant issue in relation to the City's topography is the fact that the northern limits of the UGA extend beyond the top of hills on each side of the Washougal River. The area north of these two hilltops extends downhill to the north toward drainageways which flow into the Washougal River. A significant planning issue relates to the challenge of serving the areas north of the hillsides without relying upon an excessive number of pump stations.

Flood Plains

The existing treatment plant is influenced by two flood plains. The primary one, which influences treatment plant site facilities, is the Steigerwald Lake flood plain, which is protected from the Columbia River floodwaters by a Columbia River flood-control dike constructed and maintained by the Corps of Engineers. The other is the Columbia River flood plain, which influences the outfall to which the treatment plant's effluent pump station discharges.

Figure 3.1
Vicinity Map

City of Washougal
General Sewer Plan
July 2016

0 1000 2000

SCALE IN FEET

Gorge Scenic
Area Boundary

Wastewater
Treatment Plant

Steigerwald
Lake

Legend

UGA Boundary

Existing City Limits

100' Contour

20' Contour

Figure 3.2
Topographic & Boundary Map

City of Washougal
General Sewer Plan
July 2016

The 100-year flood for the Steigerwald Lake floodplain is dependent upon drainage pumps operated by the Port of Camas/Washougal. These pumps discharge water from the Steigerwald Lake area to the Columbia River over the flood control levee. FEMA has designated the 100-year flood elevation of the Steigerwald Lake area at elevation 17.50 feet. The ordinary high water level for the Steigerwald Lake area is at elevation 15.00 feet.

The top elevation of the dike that surrounds the Steigerwald Lake floodplain is approximately 42 feet. This elevation will protect the treatment plant from the 25 and 100 year Columbia River floods, which are at elevations 30.5 feet and 35.0 feet respectively. The existing wastewater treatment plant effluent pumps have enough head capacity to continue discharging at the 100-year flood elevation in the Columbia River.

Climate

Washougal has the mild climate typical of the valleys between the Coast Range and Cascade Range in Oregon and Washington. Local weather is occasionally influenced by the effects of the Columbia River Gorge, bringing in extreme heat and cold from the east. Precipitation averages approximately 50 inches annually, most of which falls in a 6-month period, November through April.

Soils

Soils in the study area fall into two general categories. In the lower flatlands and flood plains upon which the older part of the City was developed, soils are comprised of alluvial deposits composed of sand, gravels, and silt. The soils in the hills at the northern portions of the study area are comprised of a relatively shallow layer of silt and clay over bedrock.

Groundwater

As with soils, groundwater conditions vary between the lowlands upon which the older portions of the City are constructed, and the hilly upland areas.

The lowlands are underlain by the Columbia River Lowlands aquifer. This aquifer occupies the alluvial deposits of the floodplain, and is recharged from upland areas and possibly infiltration from the Washougal and Columbia Rivers. The direction of groundwater flow is assumed to be in a southerly direction, toward the Columbia River.

In the lowlands, the depth to groundwater is at least 20 feet in the areas north of ‘F’ Street. The soils in this area allow the groundwater to drain into the Washougal River, which is in a river bed with steep sides. Groundwater gets closer to the surface the further south of ‘F’ Street one goes, because of the influence of the Columbia River. In fact, south of State Highway 14, the groundwater can be at the surface in low areas (below elevation 15 feet).

In the hilly upland area, groundwater is seasonal. The bedrock which underlies this hilly area is free of groundwater except for short periods following high rainfall events. During these periods, most of the rainfall either flows overland or percolates into the shallow surface soils and follows the bedrock downhill to surface in intermittent springs along the Washougal River or its adjacent drainageways.

Surface Water

The City of Washougal and its UGA is located in the Washougal River Drainage Basin. The Washougal River Drainage Basin is in the foothills of southeast Clark County and consists of the little, middle and lower Washougal sub-basins. The river is mainly used for recreational purposes

and supports a significant fish and wildlife population. A portion of the UGA to the east lies within the Gibbons Creek Drainage Basin.

The wastewater treatment plant discharges effluent to the Columbia River.

3.3 Land Use

Land use within the boundaries of the City is established by a zoning ordinance. Most of the area is residential. The majority of commercial activity is concentrated in the downtown core area. Industrial development is concentrated in the Camas-Washougal Industrial Park and at other sites located south of State Route 14.

Land use within the Washougal UGA is addressed in the City of Washougal's Comprehensive Plan [2][3]. The Comprehensive Plan defines the types and distribution of land uses in the UGA.

Figure 3.3 represents the City's current Urban Growth Area Zoning Map.

Land use outside of Washougal's UGA is currently governed by the City of Camas to the west and the Clark County Comprehensive Plan to the north. Development to the east is governed by a number of public agencies, because that area lies within the Columbia River Gorge National Scenic Area.

3.4 Public Water System

A hydraulic profile schematic of Washougal's water system is shown in Figure 3.4. Since 1957, the City has owned and operated the water system that serves the City, as well as areas outside the city limits. The City recently adopted a Water System Plan update (dated June 2012) [4]. That document provides detailed information about the water system. Figure 3.4 is excerpted from this document.

The water source for the system is groundwater obtained from two principal wellfields, one located in Hathaway Park and the other on the west side of town near the Camas - Washougal city limits, both located near the Washougal River. In general, the wells are an excellent source of high-quality water. Treatment in the form of disinfection is provided by gas chlorination systems.

The distribution system consists of a network of pipelines ranging from 3/4 to 16 inches in diameter, and seven water storage reservoirs.

The City's water system serves areas currently not located within the city limits, per the adopted 2012 Plan. Residents in the rural areas surrounding Washougal also rely upon private wells for their water supply.

0 1000 2000
SCALE IN FEET

Legend

SINGLE FAMILY RESIDENTIAL
- R1-15
- R1-10
- R1-7.5
- R1-5

MULTI-FAMILY RESIDENTIAL
- R-16
- R-22

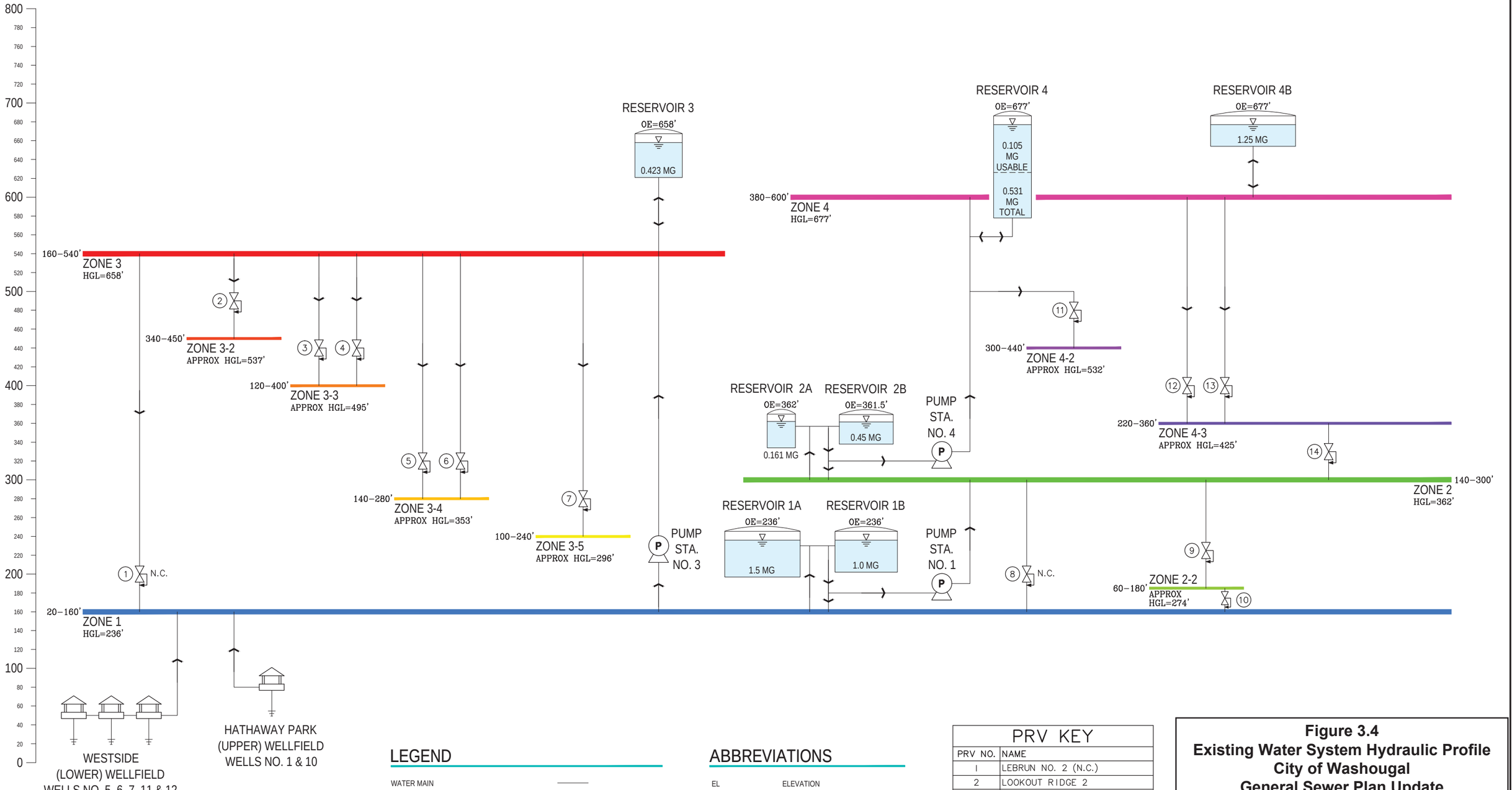
- Rural-5
- Highway Commercial
- Community Commercial
- Convenience Commercial
- Light Industrial
- Heavy Industrial
- Parks and Open Space
- Schools and Public Facilities
- Agriculture
- Urban Reserve-10

- UGA Boundary
- Existing City Limits

Columbia River Gorge Scenic Area Boundary

Figure 3.3
General Land Use

City of Washougal
General Sewer Plan
July 2016



LEGEND

- WATER MAIN
- HIGHEST GROUND ELEVATION SERVED BY PRESSURE ZONE OR SUBZONE
- RESERVOIR (OE=240', OVERFLOW ELEVATION; 1.0 MG, CAPACITY)
- ALTITUDE VALVE
- PRESSURE REDUCING VALVE
- PUMP STATION
- WELL

ABBREVIATIONS

EL	ELEVATION
FT	FEET
GPM	GALLONS PER MINUTE
HP	HORSE POWER
MG	MILLION GALLONS
OE	OVERFLOW ELEVATION
PRV	PRESSURE REDUCING VALVE
PS	PUMP STATION
TDH	TOTAL DYNAMIC HEAD
WTP	WATER TREATMENT PLANT
N.C.	NORMALLY CLOSED

PRV KEY

PRV NO.	NAME
1	LEBRUN NO. 2 (N.C.)
2	LOOKOUT RIDGE 2
3	LOOKOUT RIDGE 1
4	LEBRUN
5	N 10th STREET
6	COLUMBIA RIDGE
7	CROWN POINTE
8	WASHOUGAL HIGH SCHOL (N.C.)
9	SUSNSET RIDGE
10	EVERGREEN BLVD
11	ARBORVIEW
12	SUMMER SLOPE
13	49th STREET
14	57th STREET

Figure 3.4
Existing Water System Hydraulic Profile
City of Washougal
General Sewer Plan Update
Draft April 2016

Water System Plan

May 2012

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09-1046.405

G:\PDX_Projects\09\1046\405 Draft Plan & Presentations\CAD\09-1046-405-WA-FIGURE 1-2.dwg FIG 1-2 5/18/2012 3:04 PM HCM 18.1s (LMS Tech)

Section 4:
Existing Sewerage Facilities

4.1 History of the Sewerage System

Washougal's initial sewer system was constructed in the mid-1950s. It consisted of a collection system serving about twenty-five percent of the developed part of the City, and a sewage lagoon located adjacent to the current wastewater treatment plant. Over the next five decades, that collection system gradually expanded to accommodate growth. However, it was not until a second major collection system expansion in the late 1960's that sewer service was available to the majority of the built city.

The City's sewage lagoons were replaced with a mechanical treatment plant in the late 1990's. Also, in the late 1990's, the City completed a major collection system expansion which provided sewer service to the Woodburn Hill area north of the Washougal River.

The City's wastewater treatment plant is currently under construction with upgrades designed in 2014 by Brown and Caldwell. Those upgrades, which are discussed in Section 8, are the first phase of a two phase plan which will nearly double the treatment plant capacity. Upgrades include a second influent pump station with a valve vault and flow meter, a second oxidation ditch, a new ultraviolet disinfection facility and effluent meter, and an effluent pump station. An oxidation ditch flow distribution structure is being added to control influent flow and return activated sludge flow, and distribute it to the two oxidation ditches. A stormwater decant facility is also under construction at the treatment plant.

4.2 Current Service Area

The current service area consists of most of the area within the city limits, as shown in the existing sewer system map, Figure 4.1. A complete map of the collection system is shown in a large-scale map included as Figure B1 in Appendix B.

In order to analyze sewer flows within the collection system, the service area is divided into a total of twenty-nine (29) sewer basins. These basins are drawn according to which sewers flow into larger sewer gravity mains or force mains.

Washougal's sewer system currently serves the majority of the City's residents, a number of large industries, plus some limited property outside the city limits. A few small areas within the city limits are on individual septic systems. There have been no indications that significant failures of individual septic systems have occurred.

The sewer system serves a population of approximately 15,764, and consists of 5,246 sewer service connections (as of December 2015).

4.3 Collection System

Gravity Sewers

The City of Washougal operates and maintains approximately 83 miles of sanitary sewer collection lines and mains. The majority of the collection system consists of 6 and 8-inch diameter pipe, with mains constructed of larger diameter pipe, ranging from 8 to 30-inches. The system utilizes gravity flow as much as possible, with the majority of lines sloping toward the lowlands to the south. Figure 4.1 shows the existing collection system.

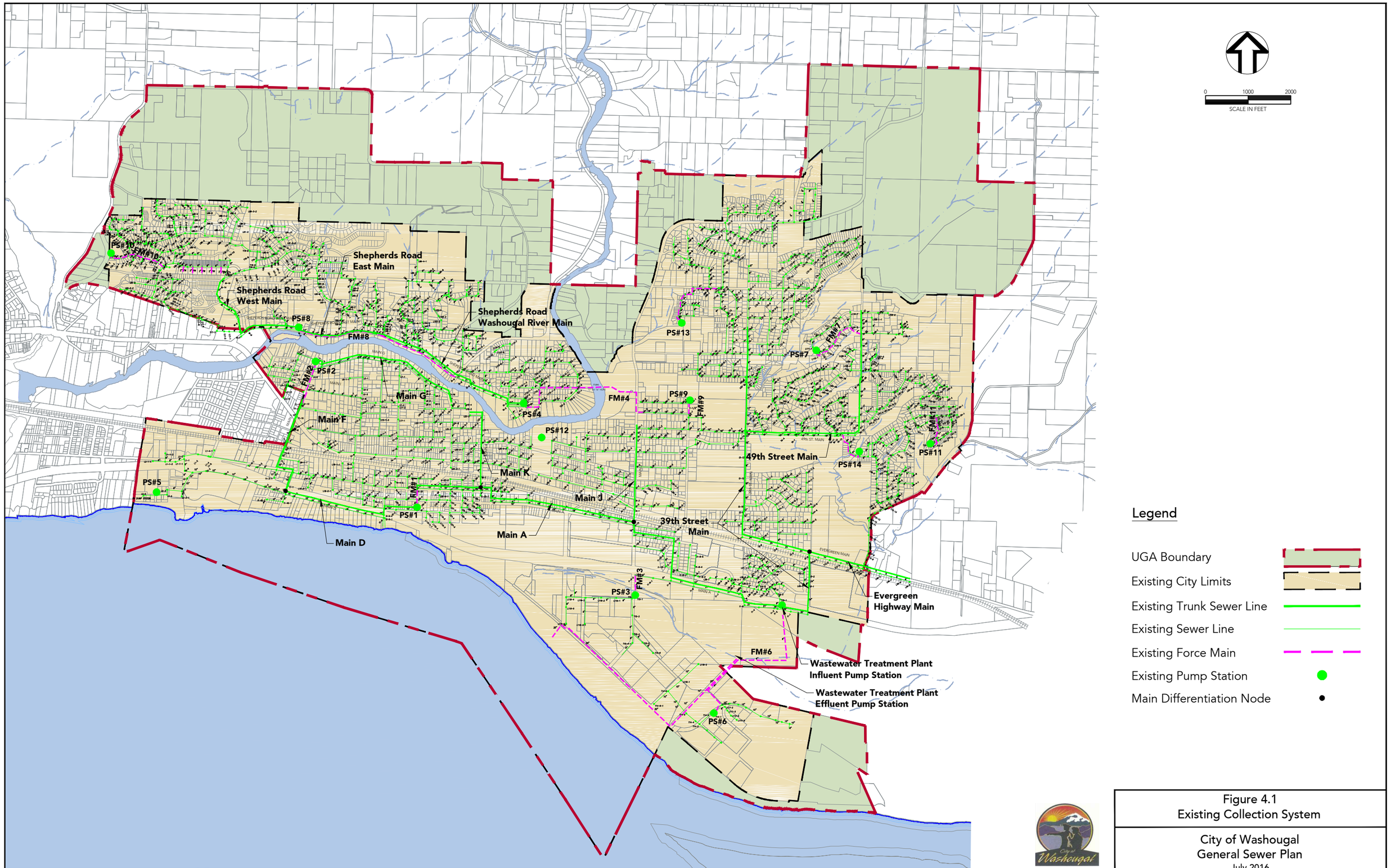


Figure 4.1
Existing Collection System

City of Washougal
General Sewer Plan
July 2016

Pump Stations

The collection system utilizes fourteen sewage pump stations and approximately 5 miles of force mains to adequately transport sewage to the treatment facility. The majority of the pump stations are duplex systems with 4 to 12-inch diameter force main discharge piping. Table 4.1 below summarizes the data for the City's pump stations. Table 4.2 below summarizes pump station runtimes. A condition assessment of the existing pump stations was completed and is summarized in Appendix C.

Table 4.1: Sewage Pump Station Data Summary

Pump Station #	Name and Location	Pumps	Approximate Capacity	Force Main Size
1	Fire Station 1401 'A' St	Two – 7.5 HP, Flygt	675 gpm	8-inch
2	Martell's 607 'K' St	Two – 7.5 HP, Flygt	282 gpm	6-inch
3	West Industrial Park 625 S. 32nd St	Two – 10 HP, Flygt	600 gpm	6-inch
4	Turtle Terrace 2395 N. 'L' St	Two – 47 HP, Flygt	1000 gpm	12-inch
5	The Marina 34 S. 'A' St	Two – 2.2 HP, Flygt	220 gpm	4-inch
6	East Industrial Park 628 S. 37th St	Two – 7.5 HP, Flygt	315 gpm	6-inch
7	Eldridge 4621 Dr. Eldridge Dr	Two – 10 HP, Flygt	100 gpm	4-inch
8	Shepherd Road 465 N. Shepherd Rd	Two – 10 HP, Flygt	725 gpm	8-inch
9	Gause 3400 'L' St	Two – 2.7 HP,Flygt	85 gpm	2-inch
10	Lookout Ridge 1095 W. Lookout Ridge Dr.	Two – 10 HP, Flygt	75 gpm	4-inch
11	Sunset Ridge 5510 'I' St	Two – 7.4 HP, Flygt	150 gpm	4-inch
12	Hathaway Park 799 25th St	One – 1 HP Paco	100 gpm	4-inch
13	Daniel Park 1968 34th St	Two – 2.3 HP Flygt	135 gpm	4-inch
14	Orchard View 4920 'G' St	Two – 6.5 HP Flygt	170 gpm	4-inch

Note: Pump Station # 4 is a tri-plex station currently using two pumps, but with the capacity to add another submersible pump.

Pump station run times were recorded by the City for the last five years. An analysis of these run times yielded values for a number of flow conditions. Table 4.2 includes these values.

Table 4.2: Summary of Pump Station Run Time Values

Pump Station #	Name	Average Run Time (hrs/day)	Dry Weather Run Time (hrs/day)	Wet Weather Run Time (hrs/day)	Maximum Run Time (hrs/day)	Minimum Run Time (hrs/day)
1	Fire Station	7.3	7.1	7.5	9.5	5.8
2	Martell's	3.6	3.2	3.9	6.6	1.1
3	West Industrial Park	0.8	0.5	1.0	1.8	0.0
4	Turtle Terrace	3.8	3.1	4.4	6.4	2.7
5	The Marina	0.2	0.2	0.1	1.1	0.0
6	East Industrial Park	0.7	0.5	0.6	1.5	0.4
7	Eldridge	0.9	0.9	1.0	1.3	0.7
8	Shepherd Road	7.6	6.8	8.2	10.7	5.3
9	Gause	0.4	0.3	0.4	0.8	0.2
10	Lookout Ridge	5.1	5.0	5.2	7.0	3.9
11	Sunset Ridge	0.9	0.8	0.9	1.2	0.7
12	Hathaway Park[1]	0.0	0.0	0.0	0.04	0.0
13	Daniel Park	1.1	1.0	1.2	2.4	0.3
14	Orchard View	0.5	0.6	0.5	1.1	0.3

Note: Pump Station # 12 conveys sewage solely from the Hathaway Park restroom facilities, and as such, has extremely low flows (an average of 4 to 5 minutes per month).

4.4 Treatment and Disposal Facilities

Description

The City's current system relies upon an activated sludge treatment plant that discharges treated effluent to the Columbia River. The various components of that treatment plant are described in the following paragraphs. Appendix D includes an existing process flow diagram and hydraulic profile in the Brown and Caldwell Facility Plan Amendment dated May 29, 2014.

Administration Building

There is one administration building with a total floor space of about 700 square feet located in the northeast corner of the facility. This building contains separate rooms for restroom, laboratory, control, and offices. The building was originally constructed in the 1950's, with additions in the 1970's and 1990's.

Headworks

A new headworks was constructed in 2008. Influent wastewater is conveyed by gravity sewers to the facility headworks where it passes through a mechanical spiral screen. After passing through the screen, wastewater enters the grit chamber and exits the headworks through a 36-inch effluent pipe.

Secondary Treatment

Biological treatment is provided by an oxidation ditch activated sludge process. The system includes two oxidation ditches (one currently under construction), two clarifiers, return activated sludge (RAS) pumps, and waste activated sludge (WAS) pumps. Raw wastewater from the influent pump station enters an oxidation ditch flow distribution structure (currently under construction), and then into one of two 1,800,000 gallon oxidation ditches. Each oxidation ditch consists of an oval-shaped channel equipped with mechanical aeration and mixing devices. The effluent from the oxidation ditches flows to a clarifier distribution structure and then to two 84-foot diameter clarifiers where solids are settled. The solids are then separated from the aeration basin effluent and either returned to the aeration basin by the RAS pumps, or wasted to the sludge lagoons with the WAS pumps.

Disinfection

Effluent from the plant passes through ultraviolet radiation (UV) disinfection before discharge. UV radiation has proven to be an effective bactericide and virucide for wastewater, while not contributing to the formation of toxic byproducts.

Solids Treatment

Treatment of waste solids is accomplished by long-term storage in three of the four lagoon cells (Cells #2, #3, and #4). In the lagoon, sludge undergoes facultative biological treatment. Both aerobic and anaerobic processes are present, which work to make the sludge suitable for land application by reducing volatile solids and pathogens. Compared to alternative types of sludge treatment and disposal systems available, the existing facilities require a relatively high amount of manpower.

The 1997 Engineering Report addressed the fact that the sludge lagoons had limited capacity and would require supplemental stabilization facilities in the future. The lagoons are currently treating biosolids adequately, but can create odor problems if not maintained.

Part of Cell #1 is currently under construction for a stormwater decant facility. The remainder of the cell will remain open for sludge storage.

Sludge Disposal

The City has disposed of biosolids through land application in the past, but currently utilizes a private contractor to remove and dispose of sludge from the lagoon cells.

Effluent Outfall

From the effluent pump station, effluent is discharged via a 20-inch diameter force main to the southwest corner of the Port of Camas/Washougal industrial park to a 20-inch diameter submerged outfall into the Columbia River. Private industry – All Weather Wood – also discharges flow through this outfall. The outfall has several diffusers that assist with effluent mixing. A new enlarged port was recently added to the diffuser assembly based on the recommendations made by the Mixing Zone Study Update completed by Cosmopolitan Marine Engineering in January 2013 for the WWTP outfall. This Study Update is included as an Appendix to Brown and Caldwell's Preliminary Design Engineering Report [5].

Reliability Classification

The Washougal Wastewater Treatment Facility meets the criteria for a reliability classification of Class II. Washington State Department of Ecology's criteria for Class II reliability are as follows:

> These are works whose discharge, or potential discharge, as a result of its volume and/or character, would not permanently or unacceptably damage or affect the receiving waters or public health during periods of short-term operations interruptions, but could be damaging if continued interruption of normal operations were to occur (on the order of several days).
>
> Examples of a reliability Class II works are works with a discharge or potential discharge moderately distant from shellfish areas, drinking water intakes, areas used for water contact sports, and residential areas.

This facility qualifies for Class II reliability because it has very small discharges relative to the receiving stream. In general, Class II reliability requirements stipulate that there shall be a sufficient number of treatment units such that with the largest flow capacity unit out of service, the remaining units shall have a design capacity of at least half the capacity of that operation. Furthermore, during power outages Ecology requires that the facility maintain hydraulic capacity, primary treatment, and disinfection prior to disposal.

Treatment Plant Performance Evaluation

The performance of the treatment plant has been excellent.

NPDES Permit

General

Washougal's most recent NPDES permit, dated November 16, 2011, is included as Appendix E.

NPDES Design Criteria and Effluent Limitations

NPDES design criteria are presented in Table 4.3. Effluent limitations are presented in Table 4.4.

Table 4.3: NPDES Permit – Design Criteria

	Permit
Monthly Average Wet Weather Flow	2.24 mgd
BOD Influent Loading	3,960 lbs/day
TSS Influent Loading	3,960 lbs/day

Table 4.4: Current NPDES Permit – Effluent Limitations

Parameter	Monthly Average	Weekly Average
Biochemical Oxygen Demand (5 day)	30 mg/l, 560 lbs/day	45 mg/l, 840 lbs/day
Suspended Solids	30 mg/l, 560 lbs/day	45 mg/l, 840 lbs/day
Fecal Coliform Bacteria	200/100 ml	400/100 ml
Ammonia (NH3-N)	21.1 mg/l	42.3 mg/l
pH	Shall not be outside the range of 6.0 - 9.0	

Section 5:
Planning Criteria and Regulatory Issues

5.1 Growth Management Planning Basis

The objective of the Urban Growth Area (UGA) is to encourage growth in areas where public services can be effectively and efficiently provided, and in a manner that is compatible with the needs of the community. The UGA represents the areas in which growth is expected to occur over the next 20 years.

In response to the requirements of the State of Washington Growth Management Act, the City of Washougal is currently updating their Comprehensive Plan. Currently, expansions to the boundary of the UGA have been proposed. Those proposed expansions were evaluated and determined not to influence the size or locations of sewers needed to serve the current UGA.

5.2 Planning Period and Service Area

For the purpose of this Sewer Plan, the collection system was planned for a 20-year planning period ending in year 2036. As discussed in Subsection 5.3 below, certain collection system improvements are sized for buildout. Based on population projections, the current Urban Growth Area (UGA) is expected to reach buildout density within 50 to 60 years.

The City of Washougal's sewer system currently serves the majority of the City's residents and some residents outside the city limits. The service area addressed in this plan is shown on Figure 3.2 in Section 3.

5.3 Collection System Design Criteria

DOE Design Standards

Standard textbook design criteria was used in the conceptual design of the collection facilities presented in the Plan, along with guidelines presented in the Washington State Department of Ecology's (DOE) "Criteria for Sewage Works Design"[6].

Gravity Sewer Service Policy

The City of Washougal has an informal policy of requiring new growth areas to be served by gravity sewers (as opposed to pump stations) whenever possible. Pump stations are discouraged due to their high cost of operation and maintenance.

Design Period

This Plan addresses collection system improvements to serve the current UGA. As discussed in the following paragraphs, proposed trunk sewers and permanent pump station wetwells are designed with capacity to accommodate drainage basins at build-out.

Sewer System Sizing

Gravity Sewer Sizing. All sewers were sized assuming minimum slope to provide a velocity of 2 feet per second. A conservative Manning's Roughness Coefficient of n = 0.013 was used in the calculations of pipe capacities. Proposed trunk sewers were designed with capacity to accommodate build-out flow estimates. Development of buildout flow estimates is described in Section 7.

Sizing Proposed Pump Stations. Because pump stations can be upgraded by increasing pump capacity and the normal life cycle of a pump is 10 to 15 years, it is not necessary to size stations for flows beyond the 20-year projections. For the purpose of this Plan, pump station mechanical equipment and pipes were sized to accommodate the 20-year flow conditions. The primary consideration for pump station and force main design is that they should provide a velocity of flow in the force main between 2 and 7 feet per second, based on a Hazen-Williams Coefficient of 130. The pump station wetwells were sized for build-out conditions. In all cases, they were sized large enough to provide adequate cycle time for the pumps.

Peaking Factors. Peaking factors were applied to the full buildout and 20-year flow conditions in order to properly size and evaluate the collection system components. The value of the peaking factor was based on the area served and determined by the following equation:

$$\text{Peaking Factor} = 14 / (4 + P) + 1 \qquad (P = \text{population in thousands})$$

Peaking factors varied from 4.0 to 3.1, depending on the service area. In general, the larger the service area, the smaller the peaking factor.

5.4 Treatment Criteria

Receiving Water Quality

The City's wastewater treatment plant outfall to the Columbia River was constructed in 1992. As part of the 1998 wastewater treatment plant expansion, a mixing zone study was completed to address receiving water quality issues. An update to the mixing zone study was completed by Cosmopolitan Marine Engineering in January 2013 for the WWTP outfall, and is included in the Preliminary Design Engineering Report for the 2014 Wastewater Treatment Plant Improvements [5].

It shall be noted that there is a potential for a 303(D) listing on the Columbia River for impaired oxygen, which could affect the future TMDL for the City of Washougal.

Secondary Treatment Effluent Limitations

Table 5.1 below lists the required effluent limitations for proposed long term treatment facilities to meet existing NPDES Permit Conditions.

Table 5.1: Secondary Treatment Effluent Limitations for Proposed Treatment Facilities

Parameter	Monthly Average (mg/L)	Monthly Average (% Removal)	Weekly Average (mg/L)
Conventional Secondary Treatment			
Total BOD	30	85%	45
Total Suspended Solids (TSS)	30	85%	45
Ammonia	21.1	--	42.3

Effluent Water Reuse and Reclamation Requirements

There are a number of requirements for reuse of water from wastewater treatment plants which are dictated by RCW Chapter 90.46 of Washington State Law. As discussed, improvements to Washougal's Wastewater Treatment Plant are currently under construction. These improvements do not include any provision to reuse or reclaim effluent for other use.

The feasibility of water reclamation and reuse is addressed in the Preliminary Design Engineering Report completed for the 2014 Wastewater Treatment Plant Improvements by Brown and Caldwell in December 2013 [5], the Wastewater Treatment Plant Facility Plan completed by Kennedy/Jenks Consultants for the City of Washougal in 2011 [7], and the Facility Plan Amendment for Wastewater Treatment Plant Expansion Project by Brown and Caldwell [8].

Federal Biosolids Regulations

In selecting the appropriate methods of solids processing, consideration must be given to the appropriate regulations. The treatment and reuse of biosolids requires the adherence to federal 40 CFR Part 503 requirements and state Chapter 173-308 requirements.

Federal 40 CFR PART 503 Requirements

In the United States, the Environmental Protection Agency implemented regulations in 1993 that established pollutant limits and management practices for the reuse and disposal of solids generated from the processing of municipal wastewater and septage. These regulations were designed to protect public health and the environment from any reasonably anticipated adverse effects of pollutants contained in the biosolids.

The regulations addressed by 40 CFR Part 503 cover specifically: 1) land application of biosolids; 2) surface disposal of biosolids; 3) pathogen and vector reduction in treated biosolids; and 4) incineration.

1. Land Application. Land application relates to biosolids reuse and includes all forms of applying bulk or bagged biosolids to land for beneficial use at agronomic rates (rates designed to provide the amount of nitrogen needed by crop or vegetation while minimizing the amount that passes below the root zone). The regulations establish two levels of biosolids quality with respect to heavy metals, two levels of quality with respect to pathogen densities (Class A and B), and two types of approaches for meeting vector attraction.

2. Surface Disposal. The surface disposal part of the Part 503 regulations applies to: 1) dedicated surface disposal sites; 2) monofills, i.e. solids-only landfills; 3) piles or mounds; and 4) impoundments or lagoons. Disposal sites and solids placed on those sites for final disposal are addressed in the surface disposal rules. Surface disposal does not include placement of solids for storage or treatment purposes. Where surface disposal sites do not have a liner or leachate collection system, limits are established for pollutants such as arsenic and nickel and vary based on the distance of the active surface disposal site boundary from the property line.

3. Pathogen and Vector Attraction Reduction. The 40 CFR Part 503 regulations divide the quality of biosolids into two categories, referred to as Class A and Class B. Class A biosolids must meet specific criteria to ensure they are safe to be used by the general public and for nurseries, gardens, and golf courses. Class B biosolids have lesser treatment requirements than Class A, and typically are used for application to agricultural land or disposed of in a landfill.

   Class B pathogen requirements are the minimum level of pathogen reduction for land application and surface disposal. The only exception to achieving at least Class B level occurs when the solids are placed in a surface disposal facility that is covered daily.

Biosolids that do not qualify as Class B cannot be land applied. To meet Class B requirements, biosolids must be treated by a process that reduces but does not eliminate pathogens or that must be tested to meet fecal coliform limits.

To meet pathogen and vector reduction requirements, two levels of preapplication treatment are required, and have been defined by the EPA as Processes to Further Reduce Pathogens (PFRP) and Processes to Significantly Reduce Pathogens (PSRP). Because PFRPs reduce but do not eliminate pathogens, PFRPs still have the potential to transmit disease. Because PSRPs reduce pathogens below detectable levels, there are no pathogen related restrictions for land application. Minimum frequency of monitoring, record-keeping, and reporting requirements are required to be met, however.

4. Incineration. The Part 503 regulations establish requirements for wastewater biosolids-only incinerators. The regulations cover incinerator feed solids, the furnace itself, operation of the furnace, and exhaust gases from the stack. The rule indirectly limits emissions of heavy metals and directly limits total hydrocarbon emissions from incinerator stacks. Pollutant limits for wastewater solids fired in an incinerator are established for beryllium, mercury, lead, arsenic, cadmium, chromium, and nickel. Incinerators must also meet a monthly average limit for total hydrocarbons. Monitoring and reporting are also required.

State Biosolids Regulations (WAC-173-308)

EPA allows each state the ability to enforce its own version of biosolids regulations. Under 40 CFR 503, these state biosolids regulations must be at least as stringent as the federal 503 regulations. The State of Washington has adopted the 503 requirements in its own regulations governing the use or disposal of biosolids, as WAC 173-308. These regulations became effective in March 1998 and are enforced by the Department of Ecology. The requirements in WAC 173-308 pertaining to pollutant limits, vector attraction reduction, pathogen reduction, operational standards and management practices are very similar to the requirements of the federal 503 regulations.

Compliance with the State Environmental Policy Act

Treatment works treating domestic sewage must also comply with requirements of the State Environmental Policy Act (SEPA). Generally, compliance involves completing an environmental checklist to be reviewed by the lead SEPA agency, which makes a threshold determination of environmental impacts and carries out a public notice of the determination. Potential outcomes are a Determination of Nonsignificance (DNS), Mitigated Determination of Nonsignificance, or Determination of Significance. The latter leads to preparation of an Environmental Impact Statement (EIS).

It is expected that most biosolids related proposals will not result in significant adverse environmental impacts, and in most cases a Determination of Nonsignificance (DNS) will probably be issued. Mitigation may be appropriate in some cases, but alternatively can probably be addressed as a condition of permit coverage or approval of a general or site specific land application plan.

DOE has established a framework for the treatment and disposal of wastewater sludge through a manual entitled the "Biosolids Management Guidelines for Washington State". [9]. The primary purpose of these guidelines is to assist biosolids managers in developing proper requirements for biosolids management programs, and to assist regulatory officials in developing proper

requirements for biosolids permits. These regulations will be followed by the City in expanding the expansion of their biosolids management program.

5.5 Capacity, Management, Operations, and Maintenance (CMOM) Regulations

CMOM stands for "Capacity, Management, Operations, and Maintenance". These regulations were created by the EPA in order to reduce the occurrence of Sanitary Sewer Overflows (SSOs) nationwide. It was created as a framework for municipalities to identify and incorporate widely accepted wastewater industry practices in order to:

- Better manage, operate, and maintain collection systems
- Investigate capacity constrained areas of the collection system
- Respond to sanitary sewer overflow (SSO) events

In CMOM planning, the utility selects performance goal targets, and designs CMOM activities to meet the goals. Information collection and management practices are used to track how well each CMOM activity is meeting the performance goals, and whether overall system efficiency is improving.

Status of CMOM Regulations

The CMOM regulations are currently waiting for finalization and publication, which was initially expected in mid-2004. The EPA continues to develop guidance and information to encourage the implementation of the Combined Sewer Overflow (CSO) policy. State and federal NPDES permitting authorities are working with permittees to incorporate CSO conditions into NPDES permits and other enforceable mechanisms, such as administrative and judicial orders.

CMOM Requirements and Program Elements

There are four major documentation requirements of the CMOM permit. These requirements vary based on the size and complexity of the municipal wastewater collection system and include a written summary of the CMOM Program; an Overflow Emergency Response Plan; a Program Audit Report; and a System Evaluation and Capacity Assurance Plan.

For municipalities to meet CMOM requirements, the following legal, administrative, and management elements will be required:

Legal Authority. Adopt a sewer use ordinance that requires proper design installation, testing and inspection (including service lines) and includes pretreatment standards for fats, oils, and greases.

Information Management. Maintain up-to-date mapping of the collection system and establish a process to update maps with new development; maintain a database on pipes including size, material and date constructed; maintain overflow data, three years of work order history, complaint records, performance and implementation measures, and a list of system components with inadequate capacity.

Overflow Response Plan. Develop and implement an SSO response plan to stop and mitigate impacts as soon as possible. The plan must outline staff training in SSO response procedures, a process for plan review and updating, a public notification program, and steps for immediate notification of health officials and the National Pollutant Discharge Elimination System (NPDES) authority.

Condition Assessments. Conduct periodic video pipe inspections and smoke testing to identify structural deficiencies and illicit connections. Update information management systems as needed based on the condition assessment.

Capacity Assurance. Identify deficient components of the system for both existing and future conditions through system modeling. Develop a master plan that includes a capital improvement plan to address deficiencies. Budget for capital improvements.

Construction Standards. Adopt and enforce defined design criteria that include evaluation of downstream impacts for new development, capital improvements, and rehabilitation. Require proper review of construction drawings as well as acceptance tests and inspection, including laterals.

Staff Training. Provide a training program for operation and administrative personnel that includes all elements of the CMOM program. Develop a mandatory certification program.

Compliance Audits. Assign responsible staff to conduct an audit of the CMOM program based on interviews with staff, observations of crews, SSO data records, and work order records. The audit review report is to identify apparent deficiencies, steps taken to address problems, and additional measures needed.

Implications for the City of Washougal

The City of Washougal already has many elements of the CMOM program currently in place or in the process of being developed. The adoption of this General Sewer Plan will meet many of the requirements of these regulations. Section 11 of this Plan evaluates the ability of the City's wastewater operations division in operating and maintaining collection system and treatment system infrastructure. Based on the results of this evaluation, it appears that additional staff will be necessary in order to meet CMOM program requirements. It is recommended that the City assign staff to monitor the EPA's final adoption of CMOM regulations, and eventually oversee the City's compliance.

5.6 Site Planning Issues

Regional Treatment Issues

The City of Camas wastewater treatment plant is located about three miles east of Washougal's wastewater treatment plant. Based on recent discussions, it appears that regional treatment of biosolids is not feasible due to capacity limitations at the Camas treatment plant. Although the Camas facility currently has excess biosolids treatment capacity, treating Washougal's biosolids would not provide capacity for significant additional growth. In addition, expensive facilities would have to be constructed to accommodate biosolids delivery and off-loading at the Camas treatment plant.

Several years ago, there were discussions amongst various cities and the Clark Regional Wastewater District regarding County-wide regional biosolids treatment and disposal facilities. Based on recent conversations with representatives of Clark Regional Wastewater District, there are no current or planned discussions for regional facilities in the near future.

Section 6:
Flow and Wasteload Projections

6.1 Land Use Projections

As discussed in Section 5, the City is currently examining the previously-established UGA with a view to changing the boundary. However, sufficient information is currently available to provide a sound basis for development of this General Sewer Plan.

Land use within the City has been established by a zoning ordinance, with the majority of land in residential use. Figure 3.3 in Section 3 shows current land use within the City's boundaries.

6.2 Population Projections

Residential population projections were made using the most current information available and from the State and County's population projections. Historically, residential population growth has varied between 0.5% and 6%, with an average over the last 30 years of approximately 2%. From ongoing comprehensive planning efforts, the City of Washougal provided two population numbers as a basis of planning for this sewer plan: 1) an estimated 2015 population of 15,932, and 2) a 2035 population of 22,347. These values are projections from Clark County and Washington State, based on an estimated growth rate and 2010 Census data, taken from the Clark County Comprehensive Plan 2016 Update, Planning for growth 2015 – 2035: Preferred Alternative –Urban VBLM and Rural Capacity Estimates – Issue Paper 7 [10].

Population growth through the planning period was assumed to progress at a constant growth rate, which equates to 1.69 percent per year. That percentage growth rate was utilized to project population to the year 2036, which is the end of the 20-year planning period used for this sewer plan. Table 6.1 on the following page presents population projections through the planning period.

6.3 Equivalent Residential Unit (ERU) Projections

For purposes of sewer planning, flow and wasteload projections are based upon equivalent residential units (ERUs). An ERU represents the equivalent flow and wasteload from a typical single family residence. For non-residential customers, City ordinances establish the method by which ERUs are established. Existing and future ERU values were estimated based upon the following assumptions:

1. The total number of residential units being served by sewers in 2015 was estimated based upon billing information for both water and sewer services, and a count of dwelling units from a 2015 aerial photograph.
2. New (future projected) residential units beyond year 2015 are determined based on an assumed household size of 2.61 persons per residential unit, and population projections as discussed in Subsection 6.2 above. The total for each future year is the sum of the projected number of new units for that year and the total from the previous year. Note that the existing household size is larger than that projected for the future. In addition, note that the value of 2.61 people per household for future growth was selected to be consistent with values for population and residential service connections which are included in the City's 2012 Water System Plan Update [4].
3. Existing (2015) values for commercial/light industrial and public ERUs were estimated using data from the City's current Comprehensive Plan, the 2006 General Sewer Plan, the

2012 Water System Plan, and billing records for water and sewer services. A growth rate of 3% was assumed for future growth, which corresponds to planning assumptions used in the 2012 Water System Plan. "Commercial/light industrial" is defined as the total of both commercial and light industrial land uses. "Public" is defined as public land uses, such as publicly-owned buildings, schools, and parks.

4. Existing heavy industrial ERU values were determined based on flow and loading data reported by large industries and the calculation required by Washougal Municipal Code 3.92.020. A growth rate of 1% was assumed for future large industry growth.

Table 6.1 includes the population and ERU projections for each contributing group.

Table 6.1: Population and ERU Projections

Year	Actual Population	Residential ERUs		Non-residential ERUs			Total ERUs	Equivalent Population
		New	*Total*	*Commercial/ Light Industrial*	*Public*	*Heavy Industrial*		
2015	15,932		5,047	1,202	181	314	6,744	20,361
2016	16,202	103	5,150	1,238	186	317	6,892	20,747
2017	16,476	105	5,255	1,275	192	320	7,043	21,141
2018	16,754	107	5,362	1,313	198	324	7,197	21,543
2019	17,038	109	5,471	1,353	204	327	7,354	21,953
2020	17,326	110	5,581	1,393	210	330	7,514	22,372
2021	17,619	112	5,693	1,435	216	333	7,678	22,799
2022	17,917	114	5,808	1,478	223	337	7,845	23,235
2023	18,220	116	5,924	1,523	229	340	8,016	23,680
2024	18,529	118	6,042	1,568	236	343	8,190	24,135
2025	18,842	120	6,162	1,615	243	347	8,367	24,598
2026	19,161	122	6,284	1,664	251	350	8,549	25,072
2027	19,485	124	6,408	1,714	258	354	8,734	25,555
2028	19,815	126	6,535	1,765	266	357	8,923	26,048
2029	20,150	128	6,663	1,818	274	361	9,116	26,552
2030	20,491	131	6,794	1,873	282	365	9,313	27,066
2031	20,838	133	6,927	1,929	290	368	9,514	27,591
2032	21,190	135	7,062	1,987	299	372	9,719	28,127
2033	21,549	137	7,199	2,046	308	376	9,929	28,674
2034	21,913	140	7,339	2,108	317	379	10,143	29,233
2035	22,347	166	7,505	2,171	327	383	10,386	29,866
2036	22,725	145	7,650	2,236	337	387	10,609	30,450

It should be noted that the projected population growth rate used in this Plan is lower than the rate assumed for the 2006 General Sewer Plan. In consequence, projections of future residential ERU values completed for this Plan are lower than those included in the previous Plan.

6.4 Existing Flow and Wasteloads

Monthly operation reports from the City have been compiled to determine historical wastewater characteristics. Table 6.2 summarizes the data for the past five years. It includes influent flows, loadings and measured precipitation for the year.

Table 6.2: Summary of Influent Wastewater Characteristics

Parameter	2011	2012	2013	2014	2015
Average Daily Flow (mgd)	1.10	1.03	0.96	0.95	1.17
Average Dry Weather Flow[a] (mgd)	0.85	0.78	0.80	0.75	1.02
Average Wet Weather Flow[b] (mgd)	1.22	1.15	1.07	1.09	1.40
Maximum Monthly Flow (mgd)	1.69	1.31	1.14	1.25	1.87
Annual Rainfall (inches)	55	74	50	59	56
Maximum 24-Hour Flow (mgd)	2.33	2.22	2.32	1.70	3.13
Minimum 24-Hour Flow (mgd)	0.75	0.64	0.67	0.64	0.76
Peak flow (mgd)	8.58	8.70	6.68	8.52	6.74
Average BOD_5 Strength (mg/l)	247	268	288	267	271
Average TSS Strength (mg/l)	281	273	293	267	246
Average BOD_5 Loading (lbs/day)	2,231	2,259	2,270	2,098	2,456
Average TSS Loading (lbs/day)	2,664	2,299	2,299	2,094	2,401

a. Dry weather: May through October

b. Wet weather: November through April

The peak hourly flows noted above are very random throughout the year and do not necessarily occur during periods of heavy rainfall, which would normally be the case. An evaluation of the operating history of the plant indicates that these peaks are the result of industrial discharge practices. The City is currently investigating the source or sources of these peak flows, and will be taking measures to reduce them.

6.5 Industrial Wastewater

Several industries discharge large volumes of wastewater to the treatment plant, contributing approximately 13% of the average annual influent flow. BBA Nonwovens, Pendleton Woolen Mills, and Kemira Chemicals are the largest dischargers.

It should be noted that this discharge volume does not account for flows anticipated in the future from the B. Crystal plant anticipated to begin discharge to the WWTP in 2016. The actual flows that would occur are unknown at this time. However, based on the maximum permitted flows and wasteloads included in the plant's NPDES permit, it is not likely that this new plant would increase flows beyond those projected for industrial ERUs in Table 6.1.

Other minor industrial dischargers in the area contribute primarily sanitary waste to the Washougal Treatment Facility. Several of these industries have their own NPDES permits, and some have their own treatment works and discharge directly into adjacent waterways.

The City has developed a Pretreatment Ordinance. An important part of this ordinance is the requirement for an industrial survey which gathers the data necessary to determine what industrial wastes are or may be discharged to the City's sewers. The ordinance also provides the City with the ability to monitor the industries' wastewater discharges which enter the City's sewers, and to inspect their facilities.

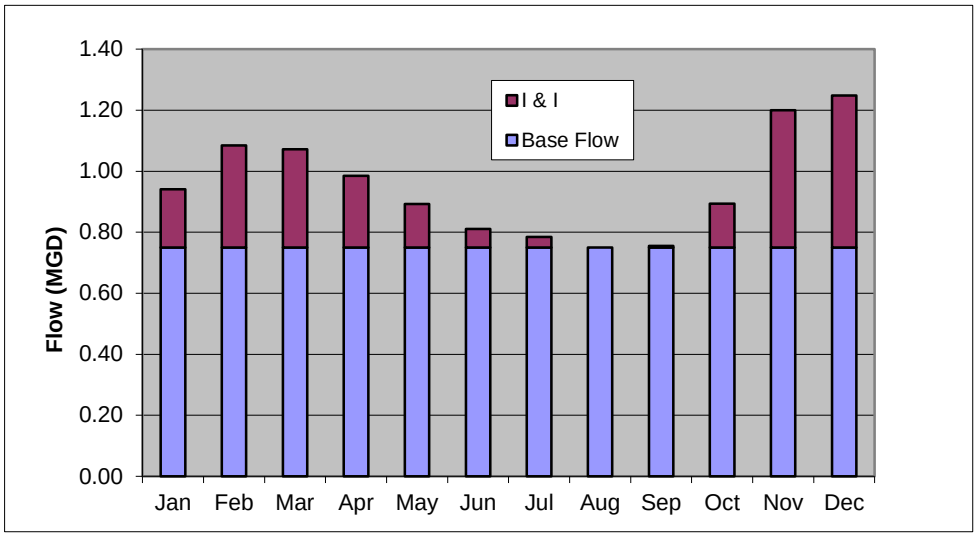
6.6 Infiltration and Inflow (I/I)

Infiltration is defined as subsurface water which enters the wastewater collection system through cracks, joints, or other deficiencies in the collection system. It is directly influenced by the local groundwater table and the structural integrity of the collection system. All collection systems experience some degree of infiltration. Each system must plan and allow for additional capacity to accommodate this flow contribution.

Inflow is the component of I/I that is attributed to surface water, mainly stormwater runoff, entering the system through roof drains, storm drains, manhole covers, and other direct conduits to the sewer system. Inflow is directly influenced by storm events and usually occurs over a short period, during and after a storm event. Inflow is usually preventable by eliminating non-sewerage connections to the system. With older systems, however, identifying illegal sewer connections can be difficult.

A large portion of the wastewater collection system was constructed in the 1960’s using concrete sewer pipe. This pipe is prone to infiltration. In recent years, the City has adopted high quality standards for new sewer main construction and has been diligent in their inspection services. The impact of I/I on Washougal sewage flows is illustrated in the following Figure 6.1.

Figure 6.1: 2014 Average Daily Influent Composition



The City undertook significant corrective measures to identify and reduce the infiltration and inflow sources in 1991. Several significant sources of I/I were identified and eliminated. Based on the EPA Standards listed below, the City currently does not have excessive infiltration and inflow due to these corrective measures.

The following Table 6.3 summarizes the infiltration and inflow related values for the wet months of each year from 1989-1992 and from 2010-2015.

Table 6.3: Infiltration and Inflow Reduction 1989-1992; 2011-2015 (wet weather months)

Year	Wet Month Influent Flows (mgd)			Total Rainfall (inches)
	Daily Average	Peak Month	Peak Day	
1989	0.93	1.09	1.69	34.7
1990	0.95	1.18	1.52	33.1
1991	0.92	1.16	1.56	36.0
1992	0.79	0.89	1.19	35.9
2011	1.10	1.69	2.33	55.4
2012	1.03	1.31	2.22	73.6
2013	0.96	1.14	2.32	50.3
2014	0.95	1.25	1.70	59.4
2015	1.17	1.87	3.13	56.0

The flows for 1992 reveals that the City's 1991 I/I reduction program greatly reduced the wet weather flows as well as the dry weather flows. The large drop in peak day influent flows indicates a reduction in inflow and quick response infiltration sources. The City's flow data from 2011-2015 above, as well as the EPA Evaluation completed in the subsection below, indicate that I/I rates have remained dampened due to the earlier corrective measures.

The weekly average data from 2014 was also analyzed for inflow by correlation of flows and rainfall. The wastewater facility influent and effluent daily flow rates were compared with the average daily rainfall for each week and revealed only a slight rise in flows for wetter weeks.

Excessive Infiltration and Inflow Evaluation

EPA guidelines use 120 gpcd as a threshold value for excessive infiltration, based on the average influent flow of a 7 to 14 day non-rainfall period during the rainy season. One ten day non-rainy period in November 2013 and another non-rainy period in November 2014 were evaluated. Using an equivalent population of 20,281 (2014), the seven day average influent flows were 41 and 52 gpcd, respectively. Both of these weeks followed at least a month of wet weather which would have increased the groundwater levels.

EPA guidelines also recommend 265 gallons per capita per day (gpcd) as a threshold value for excessive inflow. The facility's maximum 24-hour flow in 2014 was 84 gpcd. This value is well below the EPA guidance value for assessing excessive inflow.

6.7 Flows and Wasteload Forecast

Flow Projections

Future per capita waste contributions were estimated based on existing per capita waste contribution and the DOE guidelines. Table 6.4 below contains the per capita average contribution from 2010-2015, the DOE recommended design values for new wastewater treatment facilities [6], and the values used for future population loading.

DOE guidelines use direct population, which assumes a higher per capita flow contribution. The per capita values in Table 6.4 are based upon population equivalents as opposed to direct populations – which would result in lower flow contribution values. The values for future flow and loading rates are equal to the values included in the 2011 Wastewater Treatment Plant Facility Plan [7], which were the basis for design of the recent improvements to the WWTP.

Table 6.4: Per Capita Wastewater Flows and Loadings

		Present	DOE Guideline	Future
Flow (gpcd)	Dry Average	50	n/a	80
	Wet Average	70	n/a	90
	Max Month	80	100	100
Loading (lb/day)	Maximum Monthly TSS/BOD_5	0.14	0.20	0.20
	Average Annual TSS/BOD_5	n/a	n/a	1.37

The equivalent population projections contained in Table 6.1 and per capita rates contained in Table 6.4 were used to project future wastewater flow and loadings. The future flows and loadings are presented in Table 6.5. The increase in flow and loading values between existing and future years was calculated by applying the “future” unit values from Table 6.4 to the difference in existing and future population equivalent values. The calculated increase in flow and loading values was added to the existing flow and loading values (as reported for the year

2015) in order to estimate the future wastewater flow and loading projections shown in Table 6.5.

Table 6.5: Projected Wastewater Flows and Loadings

	Year:	2016	2036
	Population Equivalent:	**20,747**	**30,450**
Flow (mgd)	Dry Average	1.05	1.83
	Wet Average	1.47	2.35
	Maximum Month	1.91	2.88
	Peak Hour [b]	3.68	6.39
Loading (lb/day)	Maximum Monthly TSS/BOD_5	2,533	4,474
	Average Annual TSS/BOD_5	3,470	6,129

Notes

a. Population equivalents include large industry.
b. Peak Hour Flow - The peaking factor is 3.5 times the Dry Weather Flow.
c. Maximum monthly TSS/BOD_5 is calculated based on a peaking factor of 1.37 applied to the average annual TSS/BOD_5 values. This peaking factor was used as the basis for loading projections in the 2011 Wastewater Facility Plan.

Additional future loading values for the full range of years from 2016 to 2036 are presented in Table F1 in Appendix F.

The peak hourly flows projected above were not based on the historical influent peaks presented in Table 6.2. As was discussed earlier, the extremely high peak flows measured at the influent plant over the last few years are due to industrial discharges. The City is currently investigating the source or sources of these peak flows, and will be taking measures to reduce them.

Section 7:
Collection System Evaluation and Improvement Options

7.1 Overview of Evaluation Process

A number of improvements to the sewer system will be necessary to accommodate future growth within Washougal. These improvements were determined based on City input, observed deficiencies, and an evaluation of the collection system. The following steps describe the detailed process of evaluating the system.

1. ***Update of Existing Sewer System.*** As described in Section 4, the service area within the UGA is divided into sewer basins. The basins modeled in the 2006 General Sewer Plan (GSP) have not changed significantly. However, there have been changes to the sewer system since the last GSP, with the construction of new force mains, pump station upgrades, and gravity mains. These changes are reflected in the updated sewer system sewer model.
2. ***Allocation of ERUs.*** ERUs were determined as described in Subsection 6.3 for existing (2016) conditions and future conditions (20-year, or 2036). Existing and future ERUs were allocated to each sewer basin in order to determine the quantity of flows through the system for modelling. Subsection 7.2 describes the basis of these allocations.
3. ***Initial System Evaluation and Plan Development.*** The existing sewer collection system (sewer mains and pump stations) was modeled with existing flows and future flows. Based on the performance of the system in the model, the capacity of each system component could be determined. Where existing sewers lacked capacity for the 20-year future flows, alternative sewer main locations and force main discharge routes which would have capacity were developed and evaluated. A preferred plan for capacity upgrades was developed based on that evaluation.
4. ***Buildout Evaluation.*** ERUs were determined for buildout conditions, and were allocated to each sewer basin according to existing density and anticipated development. Subsection 7.2 describes the basis of buildout allocations.
5. ***Final Evaluation and System Sizing***. As discussed in Section 5, proposed sewer system components were evaluated assuming buildout flows. Those collection system improvements determined during initial system evaluation and plan development were sized for buildout (50 to 60-year) flow projections in accordance with the methodology outlined in Subsection 5.2.

7.2 Basin ERU Allocations

ERUs were allocated to each sewer basin within the existing UGA. Values are presented in Table G1 of Appendix G. It should be noted that the sewer basins previously delineated in the 2006 General Sewer Plan have not substantially changed. Any changes are reflected in Figure G1 in Appendix G, which shows the existing collection system and sewer basins.

For the various flow conditions, ERUs were allocated as discussed in the following paragraphs.

Existing ERU Allocation

During completion of this sewer plan through calendar year 2015, there were a number of large developments in the process of approval. Given this fact, it is important to clearly identify when

"existing" conditions were assumed to have occurred. ERU estimates and flows were assumed to be "existing" as of January 1, 2016.

Existing ERUs were allocated amongst the basins using basin allocation information from the 2006 GSP, zoning, reported industrial ERU values, 2015 aerial photography, and "windshield surveys".

20-year ERU Allocation

20-year ERU estimates were projected as discussed in Section 6. The allocation of the 20-year ERU values amongst each sewer basin was based upon a number of factors, including the existing ERU allocations as discussed above, projected growth rates, zoning, platted undeveloped lots in the basin, and existing topography.

Buildout ERU Allocation

Build-out ERU estimates for each of the basins were estimated in the year 2006 GSP. Those estimates were checked against current zoning, developments processed since the 2006 plan, and data from large industry monitoring. From that effort, it was concluded that build-out ERUs for the basins was the same as in 2006. Build-out ERU estimates are shown in Appendix G.

7.3 Modeling Assumptions

A software evaluation was performed early in the project to identify a software package meeting the criteria identified with City staff, for performance of the collection system evaluation. The software evaluation resulted in selection of InfoSWMM software, by Innovyze. A memorandum summarizing the evaluation process is included in Appendix G.

The model was developed by inputting collection system physical data from the previous spreadsheet model of the City's trunk lines. Sewer mains originally selected for the spreadsheet model were those whose upstream capacity at 20-year design flow conditions exceeded the capacity of an 8-inch main at minimum slope. Additional collection system data was obtained for the current model, which connected individual trunk lines and included system updates constructed after the previous analysis was performed. Several additional/assumed lines were input to the model to convey flow to the modeled trunk system from smaller lines not previously modeled, which serve existing sewered basins, and also to convey future flow from outlying/unsewered basins. Pump station data also was obtained from the City and input to the model. Figure G1 (Appendix G) illustrates the resulting collection system model.

Sanitary and I/I flows were input to the model for existing and 20-year flow scenarios, based on the flow projections identified in Section 6. A diurnal pattern was developed and input to the model that distributes the estimated peak day flow over a 24-hour period and is factored to include the peak hour flow identified in Table 6.5. Model simulations were then performed to simulate peak day flows for the existing and 20-year scenarios. Model results for all scenarios indicate adequate capacity in the existing modeled trunk system and included pump stations. Selected trunk system profiles and projected pump station inflows are included in Appendix G.

7.4 Collection System Overview

The existing facilities were evaluated by estimating existing and 20-year flow conditions within the existing service area, and comparing those flows to the capacity of existing system components.

Appendix G contains information regarding system capacities for the existing mains and projected flows in 20 years. Buildout flow projections are typically used as a basis for sizing 20-year improvements; however, no deficiencies were identified for the 20-year scenario. Therefore, Appendix G does not include the modeling effort for analyzing buildout flow conditions. The scope of this evaluation only addressed the main sewer lines and pump stations in the existing service area, as represented in Figure 4.1.

7.5 Collection System Evaluation

The collection system was evaluated to determine maintenance and capacity deficiencies. The deficiencies are discussed, along with options for correcting them, in the following paragraphs. Because maintenance deficiencies cannot be funded by system development charges, they are listed separately from capacity deficiencies.

The collection system is generally adequate to meet current conditions. Although some portions will surcharge under existing flow conditions, the system has the capacity to accommodate existing flows. Although the majority of the existing collection system has the capacity to accommodate the anticipated 20-year flow conditions, portions will become deficient in capacity.

Maintenance-Related Deficiencies

Pump Station Maintenance Upgrades. A detailed condition assessment of each pump station was completed in the fall of 2015. Assessments were documented in reports included in Appendix C. Following that assessment, City operations staff provided input into recommended improvements. These are summarized as follows:

Pump Station #1. Although information on the pumps installed in this station suggest that they have capacity for peak flows, in practice these pumps cannot keep up with peak flows, which results in frequent overflow alarm conditions. Further investigations are needed to determine the true cause of these alarm conditions. At this point, a conservative assumption is that the pump station wetwell and pumps need replacement, along with other improvements that will be required per City standards. The cost for those improvements is included in the CIP. It is recommended that the improvements be implemented in two phases, with the first phase being the installation of a flow meter and the second phase being the remaining items (wetwell, pumps, and fence).

Pump Station #2. Only two deficiencies were identified for this pump station: 1) improved site lighting, and 2) the installation of cushioned check valves on pump discharge piping to prevent excessive water hammer.

Pump Station #3. The only deficiency noted for this pump station was the absence of a security fence. Given the location of the pump station, this is not deemed to be a priority, but is still included in the CIP.

Pump Station #4 Maintenance Upgrades. When the force main from Pump Station #4 was constructed, chemical addition using bioxide at the pump station was recommended, but not installed due to budget limitations. A bioxide facility at Pump Station #4 is proposed. Addition of a flow meter is also recommended to assist with future maintenance efforts.

Pump Station #5 Maintenance Upgrades. Two improvements to this pump station are recommended: 1) replacement of the existing pump removal rails in the wetwell, and 2) replacement of the aged pump panel.

Pump Station #6 Maintenance Upgrades. Two improvements to this pump station are recommended: 1) replacement of the existing equipment shelter, and 2) installation of a gated security fence.

Pump Station #9 Maintenance Upgrades. Three improvements to this pump station are recommended: 1) replacement of the existing valves and piping in the discharge valve vault, 2) installation of a generator, and 3) installation of a gated security fence. It is important to note that Pump Station #9 is recommended for ultimate replacement, but that said replacement is not anticipated to occur before the end of the planning period. The aforementioned improvements are recommended to provide a serviceable station until such time as it is replaced.

Pump Station #13 Maintenance Upgrades. The only improvement recommended for this pump station is the paving of the site, which currently is unsurfaced and thus requires additional maintenance.

Pump Station #14 Maintenance Upgrades. The only improvement recommended for this pump station is the installation of site illumination.

Pump Station Abandonment Evaluation. The City has an informal policy of providing sewer service by gravity as opposed to utilizing pump stations, except in those cases where pump stations are the only practical alternative. Each of the existing pump stations was evaluated to determine if they could be abandoned. Based upon that evaluation, three pump stations are proposed for abandonment. These include Pump Stations 7, 10 and 11. In order to abandon these stations, the following work will be necessary:

Pump Station #7. An 8-inch diameter gravity sewer main, 800 feet in length, is proposed from the existing pump station south to the existing gravity sewer in 'M' Street. The gravity sewer would be routed through one of two possible routes: 1) a large parcel of City-owned property located south of the pump station or 2) west through developments between 'M' and 'Q' street. If the sewer is routed directly south, the sewer pipe will require an aerial crossing over a small drainageway. The decision between these routes will be based on how soon the parcels between 'M' and 'Q' develop. Detailed surveys will be required to determine exactly where in 'M' Street the existing sewer has dropped sufficiently to provide the opportunity to connect.

Pump Station #10. An 8-inch gravity sewer, approximately 1,600 feet in length, is proposed from the existing pump station southwest to a gravity sewer owned and operated by the City of Camas within Crown Road. The option of routing the gravity main to a sewer line within the City of Washougal was explored, but was deemed not cost effective due to the long distance and easements that would need to be obtained.

Pump Station #11. An 8-inch diameter gravity sewer main, 1,000 feet in length, is proposed from the existing pump station to manhole L49-7 in Sunset Ridge V subdivision. The sewer pipe will require aerial crossings over two small drainageways. The City will need to obtain easements prior to rerouting.

'U' Street Bypass Sewer (Gravity Sewer Between Manhole T7-12 and T7-14). This short section of gravity sewer is located under a home. As such, it is a maintenance concern. City staff has proposed the construction of a directionally drilled gravity main would parallel the existing sewer. That proposed sewer is called the 'U' Street Bypass.

SCADA System Upgrade. The City's SCADA system in outdated and requires updating. Proposed improvements include upgrades to the SCADA computer and telemetry system.

Growth-Related Deficiencies

North Side of Woodburn Hill Sewer Service (Pump Station and Force Main #15 & #16, Trunk T26, Interceptor I8). The area north of the top of Woodburn Hill does not have sewers, nor can existing sewers be extended to it. This area includes Basins W, BB, and CC. There are two options for serving this area:

Option #1 is to extend gravity sewers down to the bottom of the hill to an interceptor sewer which would follow the Little Washougal River to the east, where it would connect to an interceptor located along the Washougal River and discharge south to the existing sewer system.

Option #2 is to extend gravity sewers north to the limits of the UGA, and pump south to the existing collection system installed on the south side of Woodburn Hill. A total of two pump stations would be required for this option.

Due to the significant challenges associated with implementation of Option #1, Option #2 was selected as the preferred option. The pump stations required for this option have been designated as Pump Stations #15 and #16. Pump Station #16 would discharge south and east to a proposed trunk sewer (T26), which would flow to a proposed interceptor sewer (I8) which would continue south to connect to Pump Station #4. Pump Station #15 would discharge southeast into the existing collection system.

Service Area North of Stiles Road and 34th Street (Pump Station & Force Main #17, Interceptors I9 and I10). Stiles Road and its continuation as 34th Street are both located along a ridgetop which falls off to the north and west to the Washougal River drainage. The UGA boundary falls partway down this ridge. In evaluating options to serve this area, a system consisting of a gravity sewer extension traversing along the west slope of the hill and a pump station (Pump Station #17) located on the bottom of the hill was selected as the preferred option.

The "Stiles Road Interceptor" (I9) would commence at near the north end of SE 328th Avenue. The gravity main would flow south to 'R' Street, and then northeast to Pump Station #17 located at the northwest end of 'R' Street. The pump station would discharge into another gravity sewer beginning at the intersection of 'R' Street and 32nd Street, Interceptor 10 (I10). Interceptor 10 would run south and east, discharging into Pump Station #9.

Pump Station #8. Pump Station #8 has insufficient capacity for 20-year flow conditions, and will require a capacity upgrade. Upgrades will involve replacing the two existing pumps with higher capacity pumps. Each new pump will be sized at 550 gpm capacity. The emergency generator installed with the existing station will require replacement. Also, variable speed motors are proposed to help mitigate downstream surges, and to enable continued use of the wetwell, which is undersized if constant speed pumps are utilized.

Pump Station #9. Pump Station #9 has insufficient capacity for 20-year flow conditions and will require a capacity upgrade to accommodate new flows. Upgrades will include replacing the two existing pumps with higher capacity pumps, and replacing the existing undersized wetwell.

27th Street Gravity Main. A small area of approximately 24 acres in Basin F is too low in elevation to be served by the adjacent gravity main (Main A) on 'B' Street. This area is currently undeveloped, and will require sewer service in the future. Based on the existing topography, it appears that the area may be served by either the addition of a pump station discharging into Main A, or by the addition of a gravity sewer main. A gravity sewer main would extend from the low point in this area to the gravity sewer main on S. Ford Street, a distance of approximately 1,600 feet. This gravity main would require crossing under State Highway 14. This improvement could serve one undeveloped property, one developed property currently served elsewhere, and one property containing a dog park with no other facilities. Due to the relatively low public benefit of providing service to these properties at this time, this project is not included in the CIP.

7.6 Proposed Collection System Improvements

As a result of the evaluations of the collection system outlined above, several improvements to the collection system are proposed. These are listed as follows, and are shown in Figure 7.1. A more detailed description of the proposed collection system improvements, including costs and sizes, is included in Section 10.

Proposed Maintenance Upgrades

- Pump Station #1 Upgrade
- Pump Station #2 Upgrade
- Pump Station #3 Upgrade
- Pump Station #4 Upgrade
- Pump Station #5 Upgrade
- Pump Station #6 Upgrade
- Pump Station #9 Upgrade
- Pump Station #13 Upgrade
- Pump Station #14 Upgrade
- Pump Station #7 Abandonment
- Pump Station #10 Abandonment
- Pump Station #11 Abandonment
- 'U' Street Bypass Sewer
- SCADA System Upgrade

Proposed Capacity Upgrades

- Pump Station #15 and Force Main #15
- Pump Station #16 and Force Main #16

- Pump Station #17 and Force Main #17
- Trunk Sewer #T26
- Interceptor I8 (Washougal River North)
- Interceptor I9 (Stiles Road)
- Interceptor I10
- Pump Station #8 Upgrade
- Pump Station #9 Upgrade

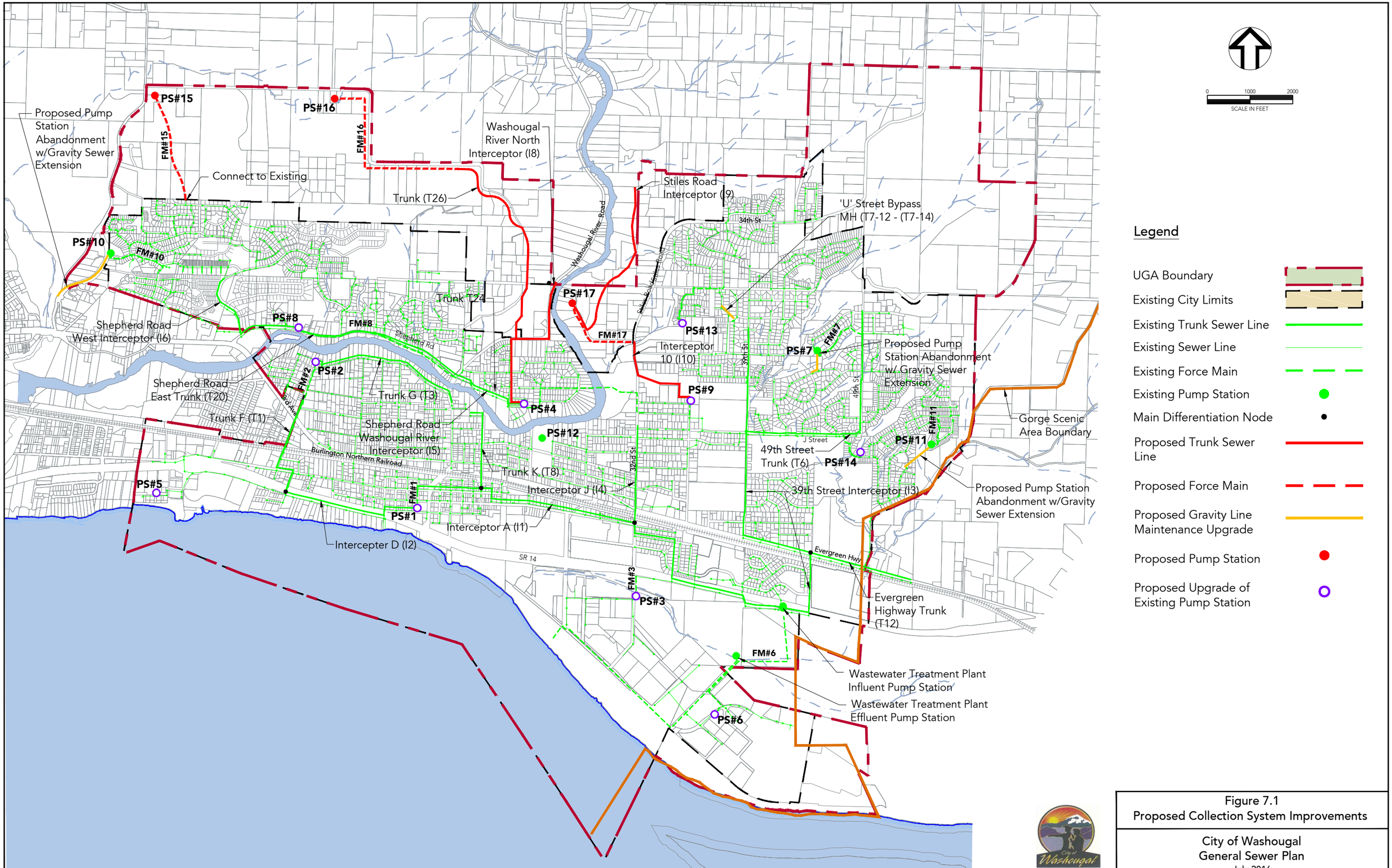


Figure 7.1
Proposed Collection System Improvements

City of Washougal
General Sewer Plan
July 2016

Section 8:
Treatment System Evaluation

8.1 General Overview of Treatment Plant Needs

This section addresses the liquid stream components of the wastewater treatment plant along with support facilities. Section 9 addresses biosolids treatment and disposal facilities.

The existing wastewater treatment plant was constructed in 1998 and is permitted for 2.24 mgd capacity during the maximum wet weather month. The wastewater treatment plant is currently being expanded to improve performance and reliability. These improvements will provide key components, but not necessarily all components, to enable a future capacity increase. Construction of the current expansion is scheduled to be complete in spring of 2016.

A detailed evaluation of the existing treatment plant was completed by Brown and Caldwell in conjunction with their preliminary design efforts. That evaluation is summarized in the Preliminary Design Engineering Report dated December 13, 2013. Included with that document was a "Basis of Design Report". That design information was updated by Brown and Caldwell and incorporated in a Facility Plan Amendment dated May 29, 2014, a copy of which is included in Appendix D. Additional supporting information describing the proposed improvements to the WWTP is also included in Appendix D, including relevant sheets from the plans for the 2014 Wastewater Treatment Plant Improvements.

8.2 Existing Facilities

Existing treatment plant facilities are discussed in detail in the aforementioned Preliminary Design Report. Existing facilities include:

- A headworks building with perforated plate auger screen and grit removal basin
- An influent pump station
- An oxidation ditch
- A clarifier distribution structure
- Two secondary clarifiers
- A scum pump station and RAS/WAS pump station
- Four biosolids storage lagoons
- UV disinfection system
- Effluent pump station

8.3 Facilities Currently Under Construction

There are a number of improvements to the existing treatment plant which are currently under construction under the 2014 Wastewater Treatment Plant Improvements Project. These are described in Brown and Caldwell's Preliminary Design Engineering Report. A schematic showing these improvements in relation to existing facilities is included in Appendix D. Facilities under construction as part of the 2014 Wastewater Treatment Plant Improvements Project include:

- Influent pump station replacement of pumps and controls

- Additional oxidation ditch
- Modification to existing oxidation ditch
- New UV disinfection system within new building
- New effluent pumping system and force main
- New water pumps with variable-frequency drives
- New generator for emergency power
- Stormwater decant facility
- Site improvements, including paving, grading, flood protection, site security, site process piping, erosion and sediment control, and stormwater drainage

8.4 Capacity Evaluation

Although the aforementioned Brown and Caldwell Facility Plan Amendment [8] provided the basis of design for design of the facilities currently under construction, the Amendment did not include any specific recommendations regarding capacity. Instead, it recommended that capacity be evaluated following construction of the proposed oxidation ditch, and process improvements to the existing ditch.

Until such time as that study is completed, the capacity of the treatment plant is established by the Facility Plan completed by Kennedy Jenks in 2011 as updated in 2012 and approved by Ecology in 2013. That facility plan established the capacity in accordance with Ecology's requirements for an engineering report. Additional components of the treatment plant that need to be constructed to provide a maximum month capacity of 4.37 mgd and BOD/SS capacity of 9,547 pounds per day are:

- A third clarifier sized the same as the existing two clarifiers
- A new RAS/WAS building, with RAS/WAS pumps
- A new scum pump station
- An anoxic selector
- Biosolids treatment facilities consisting of an aerobic digester, thickening, and dewatering facilities (as discussed in Section 9)

8.5 Proposed Projects

Facility Plan Amendment

Prior to implementing the capacity upgrades identified in Subsection 8.4, an engineering report or facility plan amendment will have to be prepared and approved by Ecology to satisfy the requirements of WAC 173-240. As a minimum, that report should include two key items of work:

- A Capacity Evaluation. Per the recommendations of Brown and Caldwell's Preliminary Engineering Report, a capacity evaluation should be completed one year following the facilities currently being constructed becoming operational, so as to provide a sound basis for determining capacity of the treatment plant.

- A Biosolids Treatment and Disposal Plan. Section 9 of this Plan consists of an evaluation of existing biosolids conditions and a planning-level study directed at identifying the preferred biosolids facilities needed to meet the City's needs through the planning period. However, a more detailed biosolids treatment and disposal plan is needed to provide a detailed basis of design. That detailed plan should address phasing opportunities and establish a detailed timeline for implementing proposed improvements. In light of concerns expressed by Ecology about groundwater quality, that plan should also include an evaluation of groundwater impacts should any of the lagoons be retained for continued sludge storage, either temporarily or permanently.

Improvement Projects

Locations of proposed facilities are shown in the Facility Plan Amendment in Appendix D. Proposed facilities are described in the following paragraphs.

Anoxic Selector

An anoxic selector was originally proposed for inclusion in the treatment plant expansion currently under construction. It was not included because of budgetary constraints. An anoxic selector is proposed to satisfy that deficiency. Preliminary design information for that selector is included in Appendix D.

Clarifier No. 3

A third clarifier would be constructed, sized the same as the existing two. Unit process design parameters are as follows:

Table 8.1: Clarifier No. 3 Unit Process Design Parameters

Type	Differential Head
Number	3
Diameter, Feet	84
Side Water Depth, Feet	15
Weir Type	Peripheral
Total Weir Length, Feet	732
Flocculation Well Diameter, Feet	30
Flocculation Well Depth, Feet	10
Total Surface Area, SF	16,626
Surface Overflow Rate, GPD/sf:	
@Wet Weather Average Flow	230
@Design Flow	270
@Peak Flow	800
Detention Time (100% RAS), Hours:	
@Design Flow	3.7
@Peak Flow	1.8
Solids Loading Rate (100% RAS), lb/day,sf:	
@Design Flow	14
@Peak Flow	29

Type	Differential Head
Weir Loading Rate, gpd/ft:	
@Design Flow	6,120
@Peak Flow	18,160

RAS/WAS Facility

A RAS/WAS facility would be constructed for the proposed Clarifier No. 3. Unit process design parameters are as follows:

Table 8.2: RAS/WAS Facility Unit Process Design Parameters

Waste Activated Sludge Pumps	
Type	--- Horizontal Non-Clog---
Number	3
Drive	---Constant Speed ---
Capacity per Pump, gpm	600
Pump Controls	PLC controlled as function of influent flow & pump rate

Biosolids Management Facilities

The current 1996 facilities plan calls for a future sludge stabilization facility, but was not specific as to type of process. Waste sludge is currently pumped to the lagoons. At existing loadings, sufficient lagoon volume exists to achieve necessary pathogen and vector attraction reduction in conformance with the EPA 503 regulations based on detention times of nearly two years. Liquid biosolids are periodically land dredged, thickened, and removed by private contractor. Future growth, however, will increase the volume of waste sludge and require the City to examine alternative methods of sludge stabilization and land application. In addition, there are a number of other deficiencies associated with the current management facilities for biosolids, including the fact that the existing lagoons are not lined. Biosolids facility planning issues are addressed in greater detail in Section 9.

Laboratory Staffing Analysis

As part of the Facility Planning efforts associated with the Wastewater Treatment Plant expansion, the City requested that Brown and Caldwell complete an Alternative Net Present Value Analysis to evaluate the cost effectiveness for two alternatives related to providing laboratory services. This information was provided and further evaluated for two alternatives:

Alternative 1 – City Operated Lab

Alternative 2- Lab Analysis shipped to private lab

The analysis considered the cost savings of elimination of the capital costs of laboratory improvements, cost savings for the service, and redirecting staff to perform other duties including collections and new facility maintenance. It found the net present value of Alternative 1 (City Operated Lab) to be $2.12 million and the net present value of Alternative 2 (Lab Analysis shipped to private lab) to be $2.13 million. The City therefore determined that there was no appreciable cost savings, and to maintain laboratory services as City provided.

Section 9:
Biosolids Treatment and Disposal Evaluation

9.1 Overview

The City's current biosolids management facilities include storage of waste solids in three lagoon cells, treatment in the cells through facultative biological treatment, and periodic disposal by a private contractor. Based on our evaluation in this section, these facilities have a number of deficiencies, and should ultimately be abandoned in favor of alternative treatment and disposal methods. A number of alternatives are discussed in this Section, along with facility sizing, process, and cost implications.

9.2 Evaluation of Current Biosolids Facilities

Planning Period

A phased approach with multiple alternatives is proposed for biosolids treatment and disposal. These predesign alternatives are sized for the 20-year planning period (for the year 2036 loadings).

Background

Previous recommendations for biosolids are included in the 2006 Washougal Sewer Plan [1], a Wastewater Biosolids Evaluation completed by Kennedy/Jenks Consultants in May 2007 [11], and recommendations for biosolids treatment in the Wastewater Treatment Plant Facility Plan completed by Kennedy/Jenks in August 2011 [7]. All of these documents recommended improvements to the City's current treatment of biosolids, and provided detailed descriptions and associated costs as to the specific options for stabilization, dewatering, treatment to achieve Class A and Class B biosolids, and disposal.

Biosolids Treatment

As mentioned in Section 4, the current sludge storage/treatment facilities are stabilizing the solids to Class B Standards through anaerobic digestion in the lagoons. The City received a provisional permit for coverage under the Statewide General Permit for Biosolids Management in December 2015 from the Department of Ecology.

There are currently several deficiencies in the existing biosolids treatment program, described in the following paragraphs.

Odor Issues. There have been ongoing odor complaints when the wind shifts north towards the City. This is believed to be a result of the anaerobic digestion process in the lagoon.

Maintenance and Cost Implications. It requires considerably more manpower to operate the lagoons than to complete alternative biosolids treatment processes. In addition, it is a substantial cost to the City when the lagoons periodically reach capacity and the City must hire a contractor to remove the sludge.

Quality and Quantity of Stored Biosolids. The storage of sludge contributes to the generation of volatile fatty acids (VFAs), which in turn increase the biomass of the sludge (as well as oxygen demand). The increased quantity of VFAs ultimately produces a lower quality biosolids.

Lagoon Lining. Although the existing lagoons have functioned as sewage treatment lagoons or biosolids stabilization/storage lagoons for over 50 years without impacting groundwater quality, dredging for biosolids removal over the past decade many be a regulatory concern.

The City has expressed a desire to abandon their current storage/treatment lagoons, contingent upon the proposal of viable alternatives.

Biosolids Disposal

Currently, biosolids are land dredged from the lagoons, thickened, and removed by private contractor on a periodic basis. As discussed, there are significant costs associated with this periodic removal. A review was completed of biosolids management reports and technical memorandum completed for cities similar in size to Washougal with lagoons. These documents recommended abandonment of lagoons for biosolids storage and treatment in favor of other alternatives chiefly because of the substantially greater costs in maintaining the lagoons.

9.3 Biosolids Facility Sizing Considerations

Biosolids Production Estimates

Biosolids projections were made based on the population and ERU projections presented in Section 6. Table 9.1 below includes projections of BOD/SS loadings to the treatment plant, and biosolids production quantities. These projections assume an average annual TSS/BOD production of 0.20 pounds per day per person. The BOD/SS production is assumed to be 80% of the loading, due to reductions from the oxidation ditch.

Table 9.1: Biosolids Dry-Solid Production Estimates

Year	Dry Avg Annual BOD/TSS (lb/dy)	Dry Tons/year
2016	1,406	379
2026	2,121	508
2036	3,014	667

Biosolids Volume Estimates

In evaluating biosolids treatment and disposal facilities, the volume of solids produced is an important consideration. For any given loading, the volume of sludge produced depends upon its moisture content. There are specific moisture contents associated with the various unit processes available for treating and removing moisture from sludge. These contents, and the associated sludge production volumes during incremental design years are summarized in Table 9.2.

Table 9.2: Biosolids Volumetric Production Estimates

Year	1.0 % WAS (gal/dy)	2.5% Lagoon Sludge (gal/dy)	4% Thickened Sludge (gal/dy)	18% Dewatered Sludge (gal/dy)	18% Dewatered Sludge with Lime (gal/dy)
2016	24,907	9,963	6,227	1,384	1,799
2026	33,345	13,338	8,336	1,853	2,408
2036	43,849	17,540	10,962	2,436	3,167

9.4 Overview of Biosolids System Options Development

A biosolids treatment and disposal system is comprised of several unit processes and system components that function together to provide a complete system. In the following sections, alternative unit processes for treatment, thickening, dewatering, storage, and disposal are evaluated. Following that evaluation, principal alternatives which provide a complete treatment and disposal system have been developed and evaluated.

9.5 Unit Process Options for Biosolids Stabilization

The principle purpose of solids stabilization is to make the treated sludge less odorous and reduce the pathogenic organism content. There are several alternative methods by which biosolids can be stabilized, with the choice of disposal method a primary consideration in their selection.

If biosolids are to be land applied, they must be treated to one of two levels of stabilization, Class A or Class B, with the former being the highest level of stabilization and the one which has the least restrictions relative to the land disposal site.

A higher level of treatment known as a Process to Further Reduce Pathogens (PFRP) will permit biosolids to meet Class "A" pathogen reduction requirements. The EPA has approved seven Processes to Further Reduce Pathogens (PFRP) that meet Class A standards: composting, heat drying, heat treatment, thermophilic aerobic digestion, beta ray irradiation, gamma ray irradiation, and pasteurization. Alternative treatment methods to achieve Class A standards are discussed extensively in previous documents, including the 2006 Sewer Plan.

At the direction of the City, Class solids treatment alternatives which yield a Class A biosolid with respect to pathogen were not evaluated. However, the City may decide to produce Class A biosolids in the future, depending on economic factors, changes in biosolids regulations, available disposal options, or the City's desire for more control over the disposal process. The selected solids treatment alternative should be capable of being modified at minimal cost to produce a Class A biosolid.

Class B biosolids must meet one or more of three alternative criteria for pathogen reduction described in 40 CFR Part 503. These unit processes are: 1) aerobic digestion, 2) anaerobic digestion, and 3) alkaline stabilization. These three options are evaluated in the following paragraphs.

Aerobic Digestion (Class B)

Aerobic digestion is the biochemical oxidative stabilization of wastewater sludge in open or closed tanks that are separate from the liquid process system. Aerobic digestion is primarily used in plants with design flows of less than 5 mgd. It typically required a hydraulic retention time of at least 60 days. It has been successfully used in extended aeration activated sludge facilities and in many package-type treatment facilities. The biologically degradable organic component of the sludge is stabilized via oxidation (in the presence of oxygen). Aerobic digestion is thus, in principle, similar to the activated sludge process.

Advantages of aerobic digestion include the following:

- Lower capital costs than for anaerobic plants (under 5 mgd)
- Relatively easy to operate compared with anaerobic systems

- Lower potential for odors
- Production of a high quality, stabilized sludge
- Pathogen reduction
- Production of non-explosive gases

Disadvantages of anaerobic digestion include the following:

- Relatively high power costs to supply oxygen
- Reduced efficiency in cold weather
- Does not produce methane gas
- Possibly poor mechanical dewatering characteristics of the digested sludge

As discussed, the existing treatment/storage lagoons do not efficiently digest sludge. An aerobic digester would stabilize the sludge in order to generate Class B biosolids, and would produce sludge with a greater than 2% solids concentration and a more than 38% volatile solids reduction. All of the previous evaluations of biosolids treatment options recommended the consideration of aerobic digestion.

There are several options for incorporating aerobic digestion into the treatment process. Two of them are the most feasible, and include:

1. ***Convert Cell 3 to a permanent aerobic digester***. This would require dredging the existing solids from the lagoon, lining the lagoon and adding mechanical surface aeration, valve and pumps for decanting the supernatant.
2. ***Construct a new aerobic digester in a concrete tank***. An approximately 350,000-gallon tank would be required, with external blowers and a bubble diffusion system for air distribution. This option would also require a valve and pumps for decanting the supernatant.

Conversion of Cell 3 is a more cost-effective option than construction of a completely new structure. However, over a 20-year period, both options would be equal in cost due to the lower maintenance costs associated with the smaller-footprint concrete digester. Costs for both options are provided in the 2011 Wastewater Treatment Facility Plan.

Anaerobic Digestion (Class B)

Aerobic digestion is a more cost-effective stabilization option for Washougal's wastewater treatment plant given its size and loadings. Anaerobic digestion is a better solution for a larger treatment facility with high solids load, and was therefore not evaluated.

Alkaline Stabilization (Class B)

Alkaline stabilization involves raising the sludge pH using cement kiln dust, lime kiln dust, lime, or alkaline fly ash. Either hydrated lime or quick lime may be used for sludge stabilization. Quick lime is mixed directly with dewatered sludge, and the resulting reaction provides at least some of the temperature increase required for Class A pathogen reduction. In this process, hydrated lime is mixed with water to form a slurry before it is mixed with the sludge or mixed directly with the dewatered sludge cake.

Advantages of using a lime stabilization system include the following:

- Reliability and simple operation and equipment maintenance
- Product is preferred by the local agricultural community because lime is commonly added to the field

Disadvantages of lime stabilization include the following:

- Increase in biosolids volume resulting from the lime addition
- Need for odor control system
- Difficulties associated with conveying either dry lime or lime slurry
- Potential drop in sludge pH generated during storage

9.6 Alternatives for Biosolids Thickening

Gravity Belt Thickener

The equipment used for thickening consists of a gravity belt that moves over rollers driven by a variable-speed unit. The water drains through the belt as the concentrating sludge is carried toward the discharge end of the thickener.

Advantages of gravity belt thickening include the following:

- Relatively small footprint required compared to other gravity thickeners
- Process is less expensive than other mechanical thickening processes
- Process uses less energy than other mechanical processes

Disadvantages of gravity belt thickening include the following:

- Mechanical process that is somewhat complex
- Process is sensitive to the quality of sludge being thickened

Rotary Drum Thickener

A Rotary Drum Thickener (RDT) works in a similar manner to a Gravity Belt Thickener (GBT), in which free water drains through a moving porous media while flocculated solids are retained on the media. However, an RDT uses a rotating screen instead of a belt. An RDT is internally fed with dilute sludge from the head-box after conditioning with polymer. The suspension is distributed into the internal surface of the rotating screening cylinder and physically strained for the separation of free water. The RDT has a built-in spray backwashing system, controlled with programmable timers that can be optimized for each application. For RDTs, about 20 gpm per unit of wash water is required for continuous cleaning of the drum.

GBTs have been used for thickening applications for over 25 years, While RDTs are relatively new pieces of equipment and have no installations for primary sludge thickening. In addition, RDTs may require sole-source procurement. RDTs, however, can be enclosed to control odors. Historically GBTs were not usually enclosed, and therefore had odor issues and were not spill-proof. Ashbrook's GBT, however, can be enclosed and therefore odors can be contained and the cover can also be provide "spill free" operation. Another difference is that one RDT uses much less wash water (20 gpm versus 120 gpm of wash water required for a 2-meter GBT), which translates to hire recycle stream treatment costs.

9.7 Options for Biosolids Dewatering

Dewatering is the removal of water from wastewater treatment solids to achieve a volume reduction greater than that achieved by thickening. Dewatering is primarily done to decrease the capital or operating costs of the subsequent direct sludge disposal. Dewatering sludge from a 4 to a 15-30% percent solids concentration reduces volume by up to three-fourths and results in a non-fluid material. As biosolids volume is directly related to the cost of disposal, dewatering can result in significant cost-savings. A number of dewatering alternatives were evaluated and are discussed in the following paragraphs. Mechanical dewatering alternatives were evaluated. Non-mechanical dewatering alternatives, such as Geotubes have been found to have performance issues.

Rotary Fan Press

A rotary fan press (RFP) rotates sludge and dewaters by gravity, extruding a dewatered cake. The RFP is enclosed, so odors are not a significant issue. It requires minimal operator attention, has low maintenance costs, uses less power, and takes up a smaller footprint than other dewatering equipment. Rotary fan presses achieve solid concentrations of at least 17 percent when dewatering aerobically digested sludge.

Screw Press

The screw press dewaters sludge by conveying solids into a smaller and smaller volume of space using a tapered shaft and screen system. This unit requires minimal operator attention, has low maintenance costs, and has lower power requirements than other dewatering equipment. Like the RFP, the screw press is enclosed, so it has minimal odor. The screw press has the largest physical footprint of the evaluated dewatering technologies.

Typically, screw press dewatering of aerobically digested sludge results in a cake with a minimum of 15% solids concentration.

One screw press manufacturer (FKC) has been evaluated in the 2011 Wastewater Facility Plan. This screw press is capable of being used in conjunction with lime stabilization to produce Class A biosolids.

Centrifuge

The centrifugation process is often used in the dewatering of wastewater sludges. In the solid-bowl machine, sludge is fed at a constant flow rate into the rotating bowl, where it separates into a dense cake containing the solids and a dilute stream called "centrate." The centrate contains fine, low-density solids and is returned to the wastewater treatment system. Solids concentration in the cake varies from 10 to 30 percent.

Advantages of a centrifuge include the following:

- Clean appearance, good odor containment, fast startup and shutdown capabilities
- Produces a very dry (18-22%) sludge cake
- Low capital cost to capacity ratio

Disadvantages of a centrifuge include the following:

- Potentially requires high maintenance
- Skilled maintenance personnel required

- Higher energy requirements
- Moderately high suspended solids content in centrate

The following table is a summary of the anticipated dewatering performance for the evaluated dewatering technologies based on installed units at treatment plants with similar sludge characteristics, as obtained from equipment manufacturer representatives:

Table 9.3: Anticipated Performance of Dewatering Alternatives

Dewatering Equipment	Avg. Solids Loading Rate	Avg. Polymer Dosage	Average Cake Concentration	Estimated Material Cost per Unit
Rotary Fan Press	560-1000 lbs/hr	8-18 lbs/ton	15-20%	$415,000
Screw Press	420-500 lbs/hour	12-18 lbs/ton	15-20%	$559,000
Centrifuge	525-900 lbs/hour	18-25 lbs/ton	18-22%	$455,000

*Average solids capture rates are typically 95% for all the evaluated dewatering technologies

9.8 Solids Disposal Alternatives

There are four alternatives for disposal of biosolids: 1) regional disposal 2) land application, 3) landfilling, and 4) incineration. Each alternative is discussed in the following paragraphs.

Regional Disposal

Regional disposal does not appear to be a feasible option at this time. Preliminary discussions of regional disposal were completed with regional wastewater agencies at City of Vancouver, Clark Regional Wastewater District, and City of Camas.

Land Application

Land application of biosolids is defined as the spreading of biosolids on or just below the soil surface. Biosolids may be applied to agricultural land, forest land, disturbed land, and dedicated land disposal sites. The land application is designed with the objective of providing further biosolids treatment. Sunlight, soil microorganisms, and desiccation combine to destroy pathogens and many toxic organic substances. Trace metals are trapped in the soil matrix and nutrients are taken up by plants and converted to useful biomass. In some cases, a geomembrane liner is installed below a dedicated land disposal area.

To qualify for application to non-agricultural and forested land, biosolids or material derived from biosolids must meet at least the pollutant ceiling concentrations, Class B requirements for pathogens, and vector attraction requirements. Bulk biosolids applied to lawns and home gardens and biosolids that are sold or given away in bags or containers must meet the Class A criteria.

Advantages of land application include the following:

- Relatively low capital cost
- Easy to implement
- City has long-term control over biosolids application
- No local public opposition to using established services

Disadvantages of land application include the following:

- The City has little control over the disposal costs
- A backup disposal option may be needed since long-term cost and viability are somewhat uncertain
- Requires some program administration

In the past the City of Washougal had an established land application program, but discontinued it.

The City is currently planning to have biosolids removed and disposed of by a private contractor. However, if in the future the City elects to directly dispose of biosolids themselves, the following table describes the land area requirements for this method of disposal. Table 9.4 below shows the land application acreage as a function of loading rate for various years through the planning period. As can be seen, the land required for biosolids production is very dependent on the loading rates, and the most conservative amount of land required in 2036 would be 109 acres.

Table 9.4: Biosolid Land-area Requirements

Biosolids Loading Rate (dry tons/acre/yr)	Land Area Requirement for Solids Application in 2016 (Acre)	Land Area Requirement for Solids Application in 2026 (Acre)	Land Area Requirement for Solids Application in 2036 (Acre)
5	76	102	133
15	25	34	44
25	15	20	27
35	11	15	19
45	8	11	15
55	7	9	12

Landfilling

If an acceptable site is convenient, landfilling can be used for disposal of biosolids, grit, screenings, and other solids. Solids concentration is an important factor in determining the acceptability of biosolids in landfills. The sanitary landfill method is most suitable if it is also used for disposal of the other types of solid wastes. In a true sanitary landfill, the wastes are deposited in a designated area, compacted in place with a tractor or roller, and covered with a layer of clean soil. With daily cover of the newly deposited wastes, nuisance conditions, such as odors and flies, are minimized.

Advantages of landfilling include the following:

- Limited time requirement for City
- Cost

Disadvantages of landfilling include the following:

- Public perception
- Environmental implications/requirements

The Department of Ecology and EPA do not encourage disposal by landfilling. In order for this option to be approved, it must be proven that beneficial reuse is not possible. In the case of the

Washougal WWTP, there are land application sites available. Landfilling is also generally viewed unfavorably by the public because valuable landfill space is consumed by material with beneficial reuse potential.

9.9 Principal Alternatives for Treatment and Disposal

In evaluating the various unit process alternatives for treatment, thickening, and dewatering mentioned in the previous paragraphs, three alternatives were developed for biosolids treatment and disposal:

Alternative A: Aerobic digestion with land disposal of 4% Class B biosolids (includes gravity belt thickener).

Alternative B: Aerobic digestion with land disposal of 18% Class B biosolids (includes a gravity belt thickener and screw press).

Alternative C: Lime stabilization with land disposal of 18% Class B biosolids (includes a screw press).

These alternatives are shown in Figure 9.1 on the following page, and described in the following paragraphs.

As discussed in subsection 9.8, regional treatment and disposal alternatives do not appear to be feasible at this time.

Washougal WWTP
Biosolids Management Alternatives

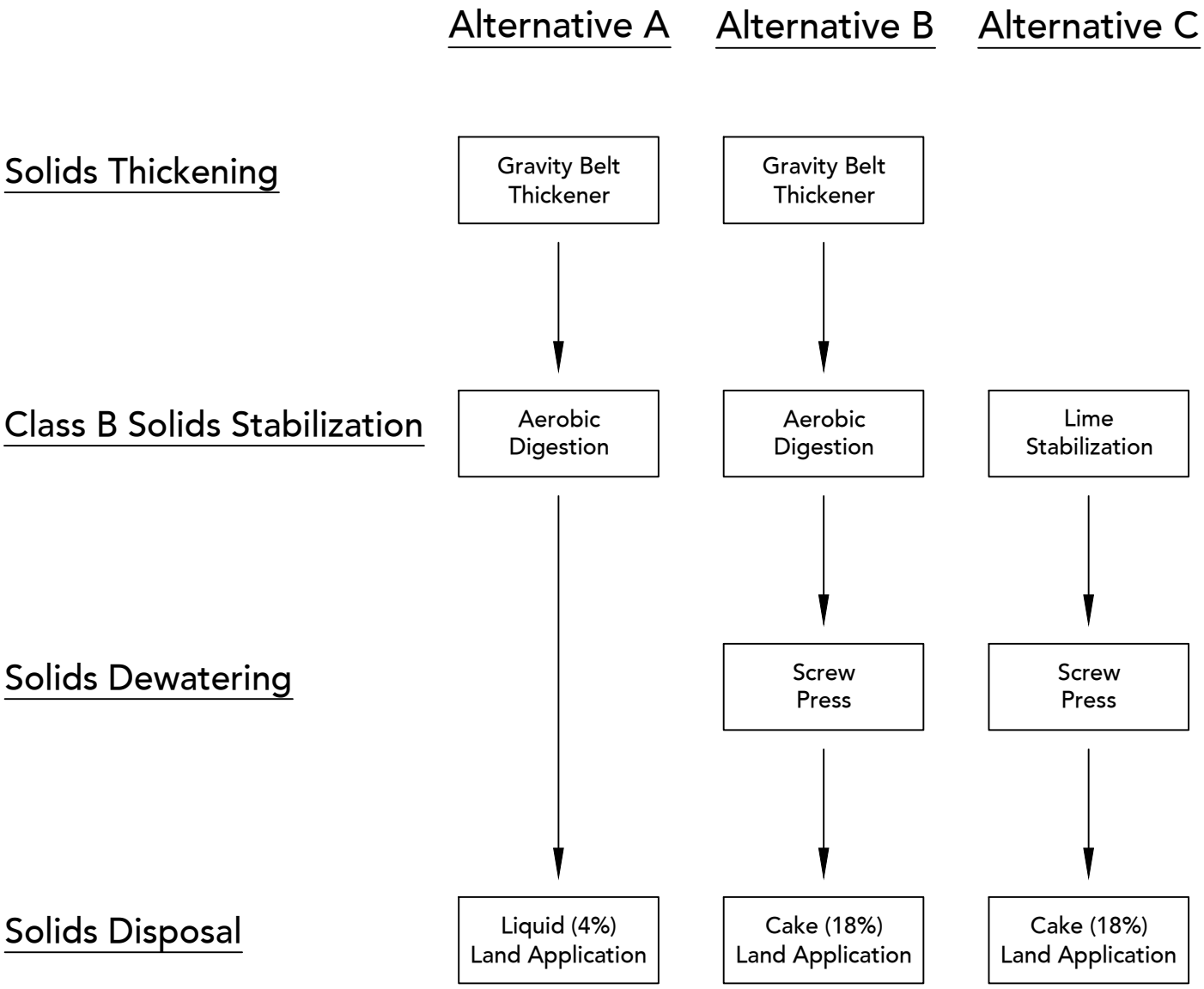


Figure 9.1
Washougal WWTP
Biosolids Management Alternatives

City of Washougal
General Sewer Plan
July 2016

Alternative A: Aerobic Digestion with Land Disposal of 4% Class B Solids (Includes Gravity Belt Thickener)

Alternative A would have the following facilities:

1. An aerobic digester constructed of a 20-foot deep by 66-foot square reinforced tank compartmentalized into four 30-foot cells. Side water depth would be 18 feet. The digester would be sized to hold 60 days of year 2036 biosolids at 4% solids concentration. It would be mixed and aerated with fixed coarse-air diffusers, and would have manual decant facilities. The digester would be covered with an insulated fixed cover.
2. A thickened sludge holding tank constructed of a 150-foot by 125-foot by 21-foot depth reinforced tank. Side water depth would be 19 feet with 17 feet being the sludge depth and 2 feet being for a water cap to mitigate odors. The holding tank would be sized to hold 8 months of biosolids at 4% solids concentration. Sludge removal would be provided by movable mud pump mounted on a floating platform. It would have manual decant facilities.
3. A 3,500 square-foot equipment building housing thickening equipment, polymer feed equipment, and blowers.
4. A 2-meter gravity belt thickener sized for 100 gpm capacity.
5. Three 50 horsepower blowers with variable frequency drives. One of the blowers would be in standby.
6. Polymer feed equipment.
7. An odor control facility consisting of two blowers and an underground biofilter.
8. Sitework including site fill and a paved access road.
9. Two progressing cavity sludge pumps, each sized at 100 gpm.
10. A 3,000 gallon tanker truck for hauling and applying biosolids to land application sites.

Alternative B: Aerobic Digestion with Land Disposal of 18% Class B Biosolids

Alternative B would have the following facilities:

1. An aerobic digester constructed of a 20-foot deep by 66-foot square reinforced tank compartmentalized into four 33-foot cells. Side water depth would be 18 feet. The digester would be sized to hold 60 days of year 2036 biosolids at 4% solids concentration. It would be mixed and aerated with fixed coarse-air diffusers, and would have manual decant facilities. The digester would be covered with an insulated fixed cover.
2. A 4,100 square-foot equipment building housing thickening and dewatering equipment, polymer feed equipment, and blowers.
3. 2-meter gravity belt thickener sized for 100 gpm capacity.
4. One FKC or equal screw press.
5. A pug conveyor to transfer dewatered sludge to a sludge holding facility.

6. Three 50 horsepower blowers with variable frequency drives. One of the blowers would be in standby.
7. Polymer feed equipment.
8. A dewatered sludge storage building consisting of two contiguous reinforced concrete basins each sized at 70-foot by 50-foot by 13-foot depth to hold 11 feet of thickened sludge. The basins are sized to hold 8 months of dewatered biosolids at 18% solids content. Each basin would have a 10-foot wide stop-log gate in the front to allow removal of stored biosolids. A 20-foot concrete pad in front of each basin would be provided for front-end loader operation. The building would be covered with metal roofing. Total footprint would be 140 feet by 70 feet.
9. An odor control facility consisting of two blowers and an underground biofilter.
10. Sitework including site fill and a paved access road.
11. Two progressing cavity sludge transfer pumps, each sized at 100 gpm.
12. A front-end loader and 10-yard dump truck for loading and hauling sludge.

Alternative C: Lime Stabilization with Land Disposal of 18% Class B Biosolids

Alternative C would have the following facilities:

1. A reinforced concrete sludge holding tank sized at 60-foot diameter and 24-foot wall height to hold 10 days of waste activated sludge at 1% solids content.
2. A 3,000 square-foot equipment building housing thickening and dewatering equipment, polymer feed equipment, and pug conveyor, and a 100 gpm capacity progressing cavity sludge transfer pump with variable speed drive.
3. One FKC or equal screw press.
4. A pug conveyor to transfer dewatered sludge to a sludge holding facility.
5. Three 50 horsepower blowers with variable frequency drives. One of the blowers would be in standby.
6. A lime storage silo.
7. Polymer feed equipment.
8. A dewatered sludge storage building consisting of two contiguous reinforced concrete basins each sized at 80-foot by 60-foot by 13-foot depth to hold 11 feet of thickened sludge. The basins are sized to hold 8 months of dewatered, lime-stabilized biosolids at 18% solids content. Each basin would have a 10-foot wide stop-log gate in the front to allow removal of stored biosolids. A 20-foot concrete pad in front of each basin would be provided for front-end loader operation. The building would be covered with a metal roving. Total footprint would be 160 feet by 80 feet.
9. An odor control facility consisting of two blowers and an underground biofilter.
10. Sitework including site fill and a paved access road.
11. Two progressing cavity sludge transfer pumps, each sized at 100 gpm.
12. A front-end loader and 10-yard dump truck for loading and hauling sludge.

9.10 Alternative Comparison and Selection

All alternatives are considered equal from a non-monetary perspective. As such, the alternative with the lowest cost is the preferred alternative. Costs for each alternative are presented in Table 9.5 below.

Table 9.5: Comparative Economic Evaluation of Alternatives

	Alternative A ***Aerobic Digestion with Land Disposal of 4% Class B Solids***	**Alternative B** ***Aerobic Digestion with Land Disposal of 18% Class B Solids***	**Alternative C** ***Lime Stabilization with Land Disposal of 18% Class B Solids***
Capital Cost	$7,800,000	$7,150,000	$6,165,000
Annual O & M Cost	$300,000	$366,000	$416,000

In comparing the benefit as compared to the cost, Alternative B is the preferred alternative. Both the capital and annual O&M costs are moderate compared to other alternatives, but Alternative B still provides the benefits associated with dewatered solids - reduced cost and effort due to a smaller quantity of biosolids.

Section 10:
Recommended Plan

10.1 Plan Summary

A number of collection and wastewater treatment facilities are proposed to meet the sewerage needs of the City for the next 20 years. The schedule for the proposed collection system improvements will depend upon growth within the individual basins. The schedule for the proposed wastewater treatment system improvements will depend upon growth in the entire study area.

10.2 Proposed Collection System Improvements

The recommended collection system improvements are presented in Figure 7.1, and described in the following paragraphs by the subarea in which they are located. Appendix G contains a basin map as Figure G1.

Maintenance Related Upgrades

Maintenance related improvements are those that are required with or without growth. They include the following items, all discussed in Section 7.

- Pump Station #1 Upgrade
- Pump Station #2 Upgrade
- Pump Station #3 Upgrade
- Pump Station #4 Upgrade
- Pump Station #5 Upgrade
- Pump Station #6 Upgrade
- Pump Station #9 Upgrade
- Pump Station #13 Upgrade
- Pump Station #14 Upgrade
- Pump Station #7 Abandonment
- Pump Station #10 Abandonment
- Pump Station #11 Abandonment
- 'U' Street Bypass Sewer
- SCADA System Upgrade

Northwest Subarea Capacity Upgrades

The UGA northwest of the City is an isolated service area, separated from the rest of the UGA by the Washougal River. Wastewater from this area must be pumped across the river in order to be conveyed to the treatment facility. Recommended improvements to this portion of the UGA are:

1. ***Pump Station #15.*** This pump station would serve an isolated basin serving a 20-year estimate of 250 ERUs. The pump station would be a duplex pump station meeting

minimum standards. Each pump would be sized at 150 gpm. It is considered a temporary pump station until such time as the City expands its city limits to the north.

2. ***Force Main #15.*** This force main would be a new 3,100-foot, 4-inch force main. It would discharge into the gravity sewer system on the south side of Woodburn Hill.
3. ***Pump Station #16.*** This pump station would be a duplex pump station meeting minimum standards. Each pump would be sized at 100 gpm (minimum capacity). It is considered a temporary pump station until such time as the City expands its city limits to the north.
4. ***Force Main #16***. This force main would be a new 4,600-foot, 6-inch force main. It would discharge into the proposed Washougal River North Trunk (T26).
5. ***Trunk Sewer #T26***. This 4,300-foot 12-inch gravity line would serve basins W and CC, and the northeastern portion of basin N. This sewer will discharge to the upper end of the Washougal River North Interceptor (I8).
6. ***Interceptor I8 (Washougal River North).*** This interceptor will extend 4,000 feet from PS #4 through existing streets and will terminate where the UGA boundary crosses Washougal River Road. This interceptor will be sized at 36-inch diameter to accommodate basins K, L, J, N, BB, W, and CC at build-out and two-thirds of Basin X plus most of the buildout service area that lies outside of the proposed UGA. This sizing assumes that it will receive flows from two-thirds of Basin X by a sewer extension west across the Washougal River.
7. ***Pump Station #8 Capacity Upgrade.*** The proposed Pump Station #8 upgrade will involve replacing the two existing pumps with higher capacity pumps. Each new pump will be sized at 550 gpm capacity. The emergency generator installed with the existing station will require replacement. Also, variable speed motors are proposed to help mitigate downstream surges, and to enable continued use of the wetwell, which is undersized if constant speed pumps are utilized.

Northeast Subarea Capacity Upgrades

The northeast subarea of the UGA is largely developed. Most of the area that is undeveloped can be served in the future by extending existing sewers uphill. Recommended improvements to this portion of the UGA are:

1. ***Pump Station #17.*** This pump station would serve the area north of Stiles Road and 34th Street. This pump station would be a duplex pump station meeting minimum standards. Each pump would be sized at 100 gpm.
2. ***Force Main #17.*** This force main would be a new 2,000-foot, 4-inch force main. It would discharge into the proposed Interceptor 10 (I10).
3. ***Interceptor I9 (Stiles Road).*** This interceptor will extend 4,500 feet from Pump Station #17 to the north end of SE 328th Avenue. It will be sized at 8-inch to accommodate one third of the flow from basin X. The remainder of the flow from Basin X is assumed to cross the Washougal River and be transmitted south via the Washougal River North Interceptor (I8).
4. ***Interceptor I10.*** This interceptor will extend 2,300 feet from the terminus of Force Main #17 and south and east to Pump Station #9. It will be sized at 8-inch to accommodate one third of the flow from basin X.

5. ***Pump Station #9 Capacity Upgrade.*** The proposed Pump Station #9 upgrade will involve replacing the two existing pumps with higher capacity pumps, and replacement of the existing wetwell.

Cost of Collection System Improvements

Cost estimates have been developed for the collection system improvements as identified previously, and are presented in at the end of this section in Table 10.1. Costs represent construction costs in 2016 dollars plus 40% for engineering, tax and contingency.

10.3 Proposed Wastewater Treatment System Improvements

Proposed wastewater treatment facilities are described in the following paragraphs.

1. ***Facility Plan Amendment.*** A facility plan amendment or engineering report will be necessary to meet the requirements of WAC 173-240. The amendment should include a capacity evaluation of the wastewater treatment plant and a biosolids treatment and disposal plan.
2. ***Anoxic Selector.*** This will improve operation of the biological treatment system.
3. ***Biosolids Management Facilities***. Biosolids management facilities will be constructed, including an aerobic digester to stabilize the biosolids, gravity belt thickener for thickening, screw press for dewatering, biosolids storage building, and appurtenant facilities.
4. ***Clarifier No. 3.*** An additional clarifier will be needed in future years in order to provide additional treatment plant capacity.
5. ***RAS/WAS Facility.*** In conjunction with Clarifier No. 3, a RAS/WAS facility will be necessary in order to provide additional capacity.

10.4 Collection System and Wastewater Treatment Plant Improvements Cost Estimates

Costs summarized in the following table are in 2016 dollars, and include 40% for engineering, tax, administration and contingency. The total cost of all proposed wastewater system improvements is $32,242,000.

Table 10.1: Proposed Collection and WWTP System Improvements Cost Estimates

Item	Cost ($)
6-year Capital Improvements Plan (CIP) (2016 to 2022)	
Collection System Maintenance Upgrades	
1. Pump Station #1 Upgrade	350,000
2. Pump Station #2 Upgrade	25,000
3. Pump Station #3 Upgrade	4,500
4. Pump Station #4 Upgrade	65,000

Item	Cost ($)
5. Pump Station #5 Upgrade	4,200
6. Pump Station #6 Upgrade	7,400
7. Pump Station #9 Upgrade	19,000
8. Pump Station #13 Upgrade	11,000
9. Pump Station #14 Upgrade	14,000
10. SCADA System Upgrade	1,160,900
6-year CIP Collection System Maintenance Improvements Total	**1,661,000**
Collection System Capacity Upgrades	
1. Pump Station #8 Upgrade (550 gpm capacity)	250,000
6-year CIP Collection System Capacity Improvements Total	**250,000**
Treatment Plant Upgrades	
1. Facility Plan Amendment	260,000
2. Anoxic Selector	900,000
6-year CIP Treatment Plant Improvements Total	**1,160,000**
6-YEAR CIP GRAND TOTAL	**3,071,000**
Year 2023 to Year 2036 Capital Improvements Plan (CIP)	
Collection System Maintenance Upgrades	
1. Pump Station 7 Abandonment (800’ of 8” gravity sewer)	440,000
2. Pump Station 10 Abandonment (1,600’ of 8” gravity sewer)	640,000
3. Pump Station 11 Abandonment (1,000’ of 8” gravity sewer)	520,000
4. ‘U’ Street Bypass (1,400’ of 8” sewer)	617,000
Year 2023 to Year 2036 CIP Collection System Maintenance Improvements Total	**2,217,000**
Collection System Capacity Upgrades	
1. Pump Station 15 (150 gpm capacity)	656,000
2. Force Main 15 (3,100’ of 4-inch)	620,000
3. Pump Station 16 (100 gpm capacity)	644,000
4. Force Main 16 (4,600’ of 6-inch)	920,000
5. Trunk Sewer #T26 (4,300’ of 12-inch)	2,197,000
6. Interceptor Sewer I8 (4,000’ of 36-inch)	3,717,000
7. Pump Station #17 (100 gpm capacity)	644,000
8. Force Main #17 (2,000’ of 4-inch)	400,000

Item	Cost ($)
9. Stiles Road Interceptor I9 (4,500' of 8-inch)	2,490,000
10. Interceptor I10 (2,300' of 8-inch)	1,250,000
11. Pump Station #9 Upgrade	650,000
Year 2023 to Year 2036 CIP Collection System Capacity Improvements Total	**14,188,000**
Treatment Plant Upgrades	
1. Biosolids Management Facilities (Alternative B)	7,150,000
2. Clarifier No. 3	3,081,000
3. RAS/WAS Facility	2,535,000
Year 2023 to Year 2036 CIP Treatment Plant Improvement Total	**12,766,000**
YEAR 2023 TO YEAR 2036 CIP GRAND TOTAL	**29,171,000**

Section 11:
System Management and Operation

11.1 Introduction

This Section summarizes the duties and responsibilities of the City's wastewater operations division in operating and maintaining collection system and treatment facility infrastructure. As some preventative maintenance goals for the collection system have not been met due to existing resource limitations, a staffing assessment for those facilities is also presented.

11.2 City Management and Personnel

Washougal's City government includes a Mayor, a 7-person Council, and City Administrator that oversees all governmental departments. Those departments include Finance, Community Development, Public Works, Human Resources, and Police.

The City's Public Works Department currently has 31 approved positions, a few of which are vacant and in the process of being filled. The Public Works Director, Deputy Public Works Director/Engineer, and Senior Analyst provide oversight of four operations divisions: wastewater, water, street/stormwater/fleet, and parks/cemetery/facilities. The four divisions all have an appointed manager and operations staff that perform the necessary operation and maintenance duties associated with their assets.

A City organizational chart is presented in Figure 11.1.

Wastewater Operations Organization

Four operational staff positions are managed by the Wastewater Operations Manager. They include a collection lead, a wastewater treatment plant (WWTP) lead, and two operation and maintenance staff. While the collection and WWTP leads are dedicated to their respective wastewater facilities, they also currently assist with tasks performed on the other's facilities due to institutional knowledge and staffing limitations. The two other staff members are expected to perform duties both within the collection system and at the WWTP, as needed and prioritized.

A general position summary for each of the four departmental positions is summarized as follows:

Wastewater Operations Manager

- Plans and directs the activities and personnel of the Wastewater Operations Division.
- Responsible for the effective and efficient utilization of equipment, materials, and personnel to complete wastewater utility maintenance programs in a timely and cost effective manner.
- Ensures compliance with federal and state regulations and prepares various official reports for federal and state agencies.

Wastewater Collection Lead (Currently Vacant)

- Responsible for the specialized maintenance, repair, and upkeep of the City of Washougal's sanitary sewer collection system. This includes regular and non-routine work in the maintenance and operation of the wastewater collection system and lift stations as well as various other sewer related programs.

- Knowledgeable in all aspects of collections system. Prepares reports, able to effectively use and operate the City's electronic work management software, memorandums or narratives as required or assigned to ensure the effective maintenance and operation of the wastewater utility.
- May have limited supervisory authority over subordinate utility maintenance workers, and may make budgetary recommendations.
- Interfaces with the Wastewater Operations Manager daily about system quality, needed maintenance and repairs.
- Works collaboratively with the Manager and Lead Wastewater Treatment Operator to establish work plans and follow through on maintenance and repair projects as needed.
- Performs lift station checks and maintenance; operates high velocity sewer cleaner/vactor truck to flush, rod and repair collection system mainline, laterals and manholes.
- May supervise, train and mentor division personnel; provides input on evaluations.
- Completes special projects independently.

WWTP Lead and Wastewater Staff – Maintenance III

- Responsible for the specialized maintenance and upkeep of the grounds, facilities, and/or equipment of the department. Compiles routine reports; maintains various department records. May have limited supervisory authority over lower level maintenance workers and may make budgetary recommendations.
- Knowledgeable in all aspects of WWTP operation. Completes maintenance and testing projects of a regular and recurring nature, including various lab tests on wastewater samples from specific points of the treatment process to track water quality flowing from Wastewater Treatment Plant.
- Completes sewer maintenance projects of a regular and recurring nature involving the installation and operation of various pumps, valves, pipes, and motors, and the computer operated telemetry system. Supervises daily activities of assigned personnel; assigns projects and provides input on evaluations. Makes budgetary recommendations; maintains records.
- Completes special projects independently.

Wastewater Staff – Maintenance II

- Responsible for the regular and routine maintenance and upkeep of the grounds, facilities, and equipment of the department.
- Completes work projects as assigned by supervisors; compiles routine reports for supervisors.
- Operates department equipment and machinery to complete work projects.
- Inventories equipment and supplies.
- Performs various lab tests independently on water samples from specific points of the treatment process to track water quality flowing to and from the Publicly Owned Treatment Works (POTW); enters data and maintains records of sample collection and lab analysis.

- Maintains and repairs process equipment, facilities, and grounds. Performs lift station checks and maintenance; flushes/cleans and repairs collection system mainline, laterals, and manholes. Takes water samples for water quality testing.
- Interacts with citizens regarding requests or complaints.

Certification, Training, and Specialized Skills

The City encourages its employees to obtain certification and training for skills relevant to operating and maintaining the sewer system. All staff must, at a minimum, have the following:

- A high school education or equivalent
- A driver's license

In addition, the City provides employees with opportunities for training and certification relative to their position function. Operator training is an important component in maintaining a safe and reliable wastewater collection and treatment system. Depending on job description and managerial duties, the following certifications, training, and specialized skills are needed by some or all of the wastewater utility staff:

Certifications/Licenses

- Washington State Department of Ecology Wastewater Treatment Plant Operator – Group I, II, or III
- Washington State Class A commercial driver's license with or w/o tanker endorsement
- First Aid/CPR
- Washington State flagging and traffic control
- OSHA forklift

Training

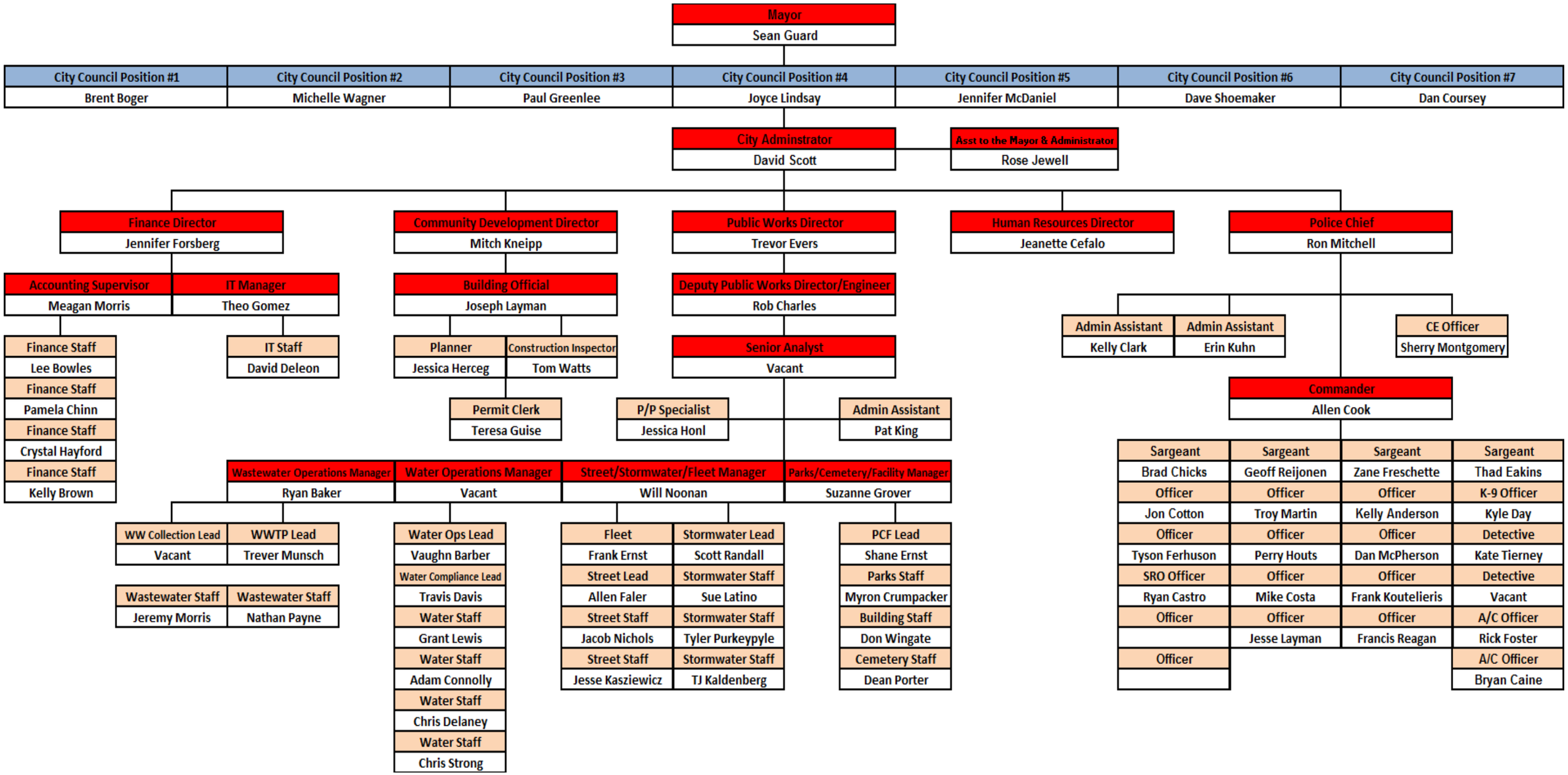
- Blood borne pathogens
- Confined space
- Defensive driving
- Basic electrical
- Heavy equipment operator
- Trenching and shoring
- Lock out/tag out

Specialized Skills

- Telemetry and SCADA systems
- State and federal wastewater regulations
- Wastewater biology, chemistry and laboratory analysis/equipment
- Microsoft Office products
- Operation of CCTV equipment for pipeline video inspections
- Pump repair and maintenance

- Vactor truck operation
- Sewer pipeline cleaning, including high velocity flushing, rodding/pigging
- Manhole inspection
- Lift station inspection
- Wastewater treatment process and monitoring equipment
- Operation and Maintenance Management System (OMMS), including Cartegraph or other software
- Use of hand or power tools
- Ability to push, pull, lift and carry up to 100 pounds
- Training assistance and mentorship
- Emergency and after hour service

Figure 11.1 City of Washougal Organization Chart



11.3 Operations and Maintenance Activities

This section presents an evaluation of the operations and maintenance activities, including preventive and corrective routines that the wastewater utility has incorporated within their collection system goals. Evaluation of the WWTP activities is beyond the intended scope of this document, but a summary is provided that includes recent City efforts to assess their staffing levels specific to that facility. This section makes reference to other documentation that was developed internally by City wastewater utility and operations managers; this information is kept on file by the wastewater department.

WWTP Operation and Maintenance Summary

As summarized in Section 4, the primary facilities at the WWTP include the headworks, two oxidation ditches (one under construction), secondary clarifiers, UV disinfection channels, three solids storage lagoons, pumping and flow distribution facilities, and the administration building.

The plant operates as a secondary treatment facility and reports the following parameters within daily monitoring reports (DMRs) submitted to Ecology:

Table 11.1: WWTP Monitoring Parameters

Parameter	NPDES Permit Limit
Flow (in mgd)	2.24 mgd (max month)
Influent BOD	N/A (used for % removal calculations)
Influent TSS	N/A (used for % removal calculations)
Effluent BOD	30 mg/l monthly max, 45 mg/l weekly max
Effluent TSS	30 mg/l monthly max, 45 mg/l weekly max
pH	between 6 and 9 units
Fecal Coliform	200/100 ml monthly max, 400/100 ml weekly max
Total Ammonia	21.1 mg/l monthly max, 42.3 mg/l daily max
Sludge Volume Index	N/A (indicator for making process modifications)
Effluent Temperature	N/A (informational)
Rainfall	N/A (used to trend collection system I/I)

Typical Staff Duties

This document does not include a detailed assessment of staffing levels and needs, but a summary of general duties and previous staffing analysis performed, as follows:

Currently, two full time employees (FTEs) are dedicated by job description to WWTP operation and maintenance. However, due to staffing limitations and the institutional knowledge of these operators, they are sometimes asked to respond to collection system issues.

The highest staffing priority at the WWTP is providing operational oversight and control of the treatment processes to ensure that NPDES permit limits are met for the effluent discharged to the Columbia River. This oversight typically involves monitoring plant performance through SCADA control software, completing required reporting, coordinating sampling and analysis of raw and treated wastewater for important compliance parameters, and making process adjustments (flow, aeration, mixing, amount of recycled and wasted solids, etc.) to maintain acceptable operations. Due to the time required to provide this critical oversight, a separate staff

member is typically designated to conduct the required sampling and laboratory analysis for a facility of this size and complexity. In addition to the sampling and testing, those duties include calibration, cleaning and maintenance of the sampling and monitoring equipment within the facility (as well as the laboratory testing equipment), and coordination of samples that must be sent to an outside laboratory for testing of parameters not supported at the WWTP.

Extensive maintenance of facilities is also necessary to promote trouble-free operations at the WWTP. These activities can include draining and cleaning of basins, cleaning and grit removal of headworks, performing maintenance on pumps and other mechanical equipment, minor equipment and plumbing repair, inspection and monitoring of biosolids storage lagoons, inventory of assets within OMMS software, and general yard work.

For all WWTP employees, additional obligations commonly include construction participation, public education and interface, coordination with consultants, internal/external reporting and training.

Staffing Self-Assessment Efforts

Beginning in 2010, when commitments by WWTP staff became necessary to respond to collection system sanitary sewer overflow (SSO) events, wastewater utility managers began evaluating staffing levels to determine the need for additional staff. Specific to WWTP staffing levels, a primary resource document within the industry remains the 1973 US EPA document *Estimating Staffing for Municipal Wastewater Treatment Facilities*. In 2008, the New England Interstate Water Pollution Control Commission (NEIWPCC) used the estimating framework of this document to update a guide and spreadsheet-based estimating tool. Generally, these tools use the number, size and complexity of WWTP facilities to estimate the process operation, maintenance, laboratory, solids handling, and yardwork/general maintenance needs of a facility.

These materials were reviewed and drawn from by the City wastewater managers, who in 2010 estimated the staffing level needed at the WWTP to be between 3.5 and 4 FTEs. Concurrent with these internal evaluations, research was conducted to determine if contracting full laboratory testing services was an option alleviate some staffing commitments. A summary of this evaluation is included in Subsection 8.4 of Section 8 of this Plan. With the plant currently under construction to add major new facilities, a total of 4 FTEs could likely be justified through these industry-accepted estimating methodologies.

An evaluation was made of WWTP staffing structure for similar facilities, confirming a minimum of 1 FTE prioritized to plant operation, 1 FTE prioritized to plant maintenance, 1 FTE dedicated to laboratory testing and analysis, and other general supervisory, clerical, or maintenance tasks handled by other public works staff with multiple facility obligations, as necessary. This amounts to a 3.5 to 4 FTE WWTP staffing level estimated by utility managers to be necessary, using the industry tools discussed in the previous paragraphs of this section.

Collection System Operation and Maintenance

Capacity, Management, Operation, and Maintenance (CMOM)

As mentioned in the previous section, collection system SSO events several years ago brought attention to the wastewater utility's staffing limitations. These events highlighted not only the lack of staffing necessary to respond to them, but also the need for staffing levels able to provide sufficient preventative maintenance on collection system infrastructure to avoid these events entirely. Subsequent staffing level analyses by the City's public works managers began to

document current operations and maintenance activities that were being deferred due to the lack of staff, and set goals for implementing new preventative maintenance program elements.

In 2005, the USEPA released the resource document *Guide for Evaluating Capacity, Management, Operation, and Maintenance (CMOM) Programs at Sanitary Sewer Collection Systems*. The name served to define the four main elements of a representative comprehensive collection system program recommended by USEPA. At the time of its release, the document was intended to define procedures by collection system operators and managers that might result in the reduction of SSO events. For utilities with habitual SSO occurrence, implementing a CMOM evaluation was considered for potential regulatory compliance, though this has never been discussed with the City of Washougal. Nonetheless, many US wastewater utilities have used this guidance document to develop their wastewater collection system programs, from adding elements within defined personnel job descriptions to incorporating the equipment necessary to execute program elements within CIP budgets.

The evaluation within this document relies on CMOM-recommended activities to assess the City's existing wastewater utility collection system staffing levels. These activities incorporate practices already being employed and benchmarked by Washougal, as well as new recommended elements that have commonly been adopted within the industry.

Collection System Program Goals and Duties

Between 2012 and 2014, public works managers used CMOM recommendations and methodologies as the basis for developing department goals and a Sewer Collection System Inspection and Maintenance Repair Plan. The plan included establishing acceptable levels of service for emergency response, as well as department policies regarding employee safety, reporting, and certification and training requirements. Collection system facility inspection and maintenance goals are summarized below in Table 11.2.

Table 11.2: Washougal Collection System Inspection and Maintenance Goals

Action	Target	Resulting Baseline
Sewer Main Inspections (CCTV)	10% of system annually	Approx. 6 miles
Sewer Main Cleaning (jet flushing/rodding)	10% of system annually	Approx. 6 miles
Fats, Oils and Grease (FOG) Inspections	100% of City installations/grease traps semi-annually	Approx. 30 installations
Manhole Inspections	33% of system annually	Approx. 500 manholes
Lift Station Wetwell Cleaning	semi-annually	28 wetwells
Lift Station Valve Cleaning/Inspection	annually	14 stations
Lift Station Pump Maintenance	semi-annually	14 stations
Lift Station Building and Site Cleanup	annually	14 stations

Staffing Assessment

A workshop was held with City engineering and wastewater operations staff to review current utility collection system operation and maintenance goals, other desired CMOM program

elements, and labor efforts associated with each desired function. For functions already being performed, labor efforts were estimated to reflect operations staff experience in performing the work. For new program elements, discussions were held to establish how each task would be staffed, the equipment that would be necessary, and the durations that would be involved, drawing from other industry information available when appropriate. The new elements include:

- Closed Circuit Television Inspections: Perform sewer line inspections using wastewater utility resources, rather than contracting these services. This transition will make adopted annual inspection goals more attainable, but will require additional labor to perform field work and evaluate video, as well as investment in a CCTV truck and equipment.
- Root Intrusion: Most problematic with side sewer connections, root intrusion is a large contributor to groundwater infiltration issues that increase collection system conveyance flows, thereby limiting the system's capacity to transmit municipal wastewater.
- Flow Monitoring: Installation of flow data loggers at various locations within the collection system's basins allows utilities to diagnose areas most susceptible to I/I through recorded dry/wet weather peak flow patterns. I/I reduction is the single largest measure that utilities use to maximize and prolong their collection system capacity. When problematic areas have been identified, pipeline/manhole rehabilitation, or other capacity enhancement capital improvements, can be executed.
- Smoke Testing: The City will continue to contract services to conduct smoke testing, but has established a goal to complete this activity annually and provide the operations staff the support that is needed to assist the contractor. Smoke testing most commonly provides clear visual detection of sources of system inflow, whether through unsealed manhole lids or illicit connections of private roof drains and surface water drainage systems.

In assigning labor estimates, it is important to note that most field operation and maintenance assignments require and necessitate a 2-person crew. In addition to many tasks with discrete needs for each staff to complete the work, there are also safety policies in place that require two people when working with certain equipment or within confined spaces.

A summary of the sewer collection system recommended CMOM program established by this workshop is detailed within Table 11.3. The total estimated labor supports the addition of a third FTE to the City's wastewater operations staff to perform collection system activities.

Table 11.3: Labor Estimates for Desired Operation and Maintenance Duties

Collection System O&M Program Action	Target	Total System Quantity	Unit	Frequency	Yearly Labor Hours	Labor Estimate Assumptions	CIP component
System Operations							
Pump Station Flow/Motor Data		14	number	daily	360	daily morning check in, adjustments via SCADA	
System Maintenance, Pipeline							
Sewer Main Cleaning	10%	63	miles	yearly	253	based on 6 miles/year, 2000 LF/8hrs/2 FTE (2 person crew)	
Sewer Main Inspections (TV)	10%	63	miles	yearly	507	based on 6 miles/year, 1000 LF/8hrs/2 FTEs (2 person crew)	City purchase of CCTV truck required
Sewer Main Inspections Data Assessment		63	miles	yearly	127	based on 6 miles/year, 1 FTE 4 hrs review of 1000 LF	
Sewer System Sliplining/Point Repairs	1%		number	annually		repairs contracted, City staff involvement included with construction participation	consider yearly rehabilitation allocation
System Maintenance, Lift Stations/Force Mains							
Lift Station Inspections	100%	14	number	weekly	832	based on 1 day/wk to inspect, 2 FTEs	
Lift Station Wet Well Cleaning	100%	14	number	semi-annual	336	based on 4 hrs/station, 3 FTEs	
Lift Station and Force Main PMs	100%	14	number	semi-annual	448	based on 8 hrs/station, two FTEs to change seals, oil, flush FM, exercise/clean valves	
Lift Station Building and Site Cleanup	100%	14	number	annually	56	based on 4 hrs/station, one FTE	
System Infrastructure Response Maintenance	100%		hours	weekly	416	based on 2 FTEs at 4 hrs per week	
System Maintenance, Manholes							
Inspections/Cleaning	33%	1,445	number	annually	477	based on 0.5 hr/MH 2 FTE crew	
Maintenance Programs, Source Control							
FOG	100%	30	number	semi-annually	240	based on 1 FTE 4 hrs each	
Corrosion Control					0	assume included with inspections	
Odor Control/H2S Monitoring						minimal historical issues, doesn't warrant additional investment at this time	
Root Intrusion	1%	5,000	connections	annually	300	based on 2 FTEs, 3 hours per side sewer connection	
I/I Flow Monitoring	10%	29	basins	annually	240	1 FTE 40 hrs/installation to monitor/analyze data, 6 yearly installs	procure 2 flow monitors
Smoke Testing				annually	60	based on 60 hrs/year smoke test support to contracted company	
Emergency/SSO response						staff defers other maintenance tasks to prioritize	
Construction Participation			months	weekly	90	1 FTE to provide 3 hrs/week observation/progress mtgs for 7 month-construction season	
System Information Management				weekly	260	based on weekly allocation for 1 FTE 5 hrs populating software with facility data	
Training/Safety					90	30 hrs/year per FTE, includes monthly staff safety meetings - 3 FTEs assumed	
Holidays					264	11 days/year per FTE - 3 FTEs assumed	
Vacation					360	based on 3 weeks vacation/year per FTE - 3 FTEs assumed	
			TOTAL ESTIMATED LABOR HOURS		**5,716**	**(EQUAL TO APPROX. 3 FTEs)**	

Comparative Wastewater Utility Benchmarking

Support for assessed and recommended staffing levels can be offered through benchmarking surveys conducted with other demographically similar state wastewater utilities. One of the most common parameters used to compare collection system staffing is the unit measure of miles of collection system pipeline per collection system operator (FTE). This information has been summarized in Table 11.4 for a number of Washington cities and sewer districts. Based on this common unit of measurement, the recommended staffing level summarized in the previous section generally aligns with the average levels being employed by other state wastewater utilities.

Table 11.4: Collections System Staffing Comparison

Jurisdiction	Miles of Mainline	FTE's for Collections	Miles of Pipe/FTE
Battle Ground	58.08	2.00	29.04
Vancouver	662.00	26.00	25.46
CRWWD	315.00	16.00	19.69
Longview	152.00	11.00	13.82
Monroe	42.35	4.00	10.59
Bellevue	526.00	22.00	23.91
Enumclaw	47.00	2.00	23.50
Kent	200.00	9.00	22.22
Kirkland	120.00	5.50	21.82
Lacey	170.00	6.00	28.33
Mercer Island	134.00	4.00	33.50
Poulsbo	42.31	2.50	16.92
Southwest Suburban Sewer District	343.12	33.00	10.40
Valley View Sewer District	130.38	14.50	8.99
Average			**20.59**
Washougal	**63.00**	**2.00**	**Needed FTE's from Avg = Approx. 3**

11.4 Overall Staffing Needs

Based on the assessments performed in Section 11.3, it appears that the Washougal wastewater utility is understaffed, with a minimum additional 1 FTE necessary for both the WWTP and the collection system (two additional FTEs total). Justification for these staffing levels is offered by various industry accepted publications and guidance documents that detail the necessary and generally accepted operation and maintenance practices of a well-maintained wastewater utility within the marketplace today. Further justification is provided through benchmarking of utility staffing levels in place at other comparable Washington State municipalities and sewer districts. It is recommended that plans be made to add these staff members to effectively support the desired wastewater utility program and level of service. The addition of a seventh FTE (a third new hire), which this section indicates could be necessary to fully perform WWTP duties, could be deferred and reevaluated after the abilities of the staff of six can be assessed in more detail.

Section 12
Implementation and Financing

12.1 General

The implementation of the General Sewer Plan is necessary to accommodate projected growth. In making the necessary expansions, financing will be a critical issue. Because of that, detailed financial planning is necessary. This section provides an overview of financing issues, but is not meant to be a substitute for the financial planning that will be necessary to implement the plan.

12.2 Institutional Responsibility

The City of Washougal owns and operates the collection system serving the area within the Washougal UGA. The City has sole responsibility for the operation, maintenance and improvement activities associated with the collection system and transmission system. It is logical to assume that the City will continue to own and be responsible for the sewer system and its growth throughout the 20-year planning period. The only reasonable alternative to that would be a merger with the City of Camas, which would be a challenge due to the fact Washougal utilizes gravity sewers while Camas utilizes pressure sewers. Monthly sewer service charges and sewer connection fees are established and collected by the City.

12.3 Implementation Schedule

Proposed maintenance related improvements are dependent primarily upon the availability of funding. Proposed capacity related improvements are dependent upon the rate of growth. Both maintenance and capacity improvements were scheduled into two categories; 1) those required in the next six years, and 2) those required in the 14-year period following the initial six year period. That schedule is included as Table 10.1 in Section 10. The schedule was based on the growth rates projected in Section 6. The schedule was estimated by comparing the capacity of the proposed improvements with the growth rate in their respective basins. Most of the proposed collection system improvements are needed to serve residential growth in areas with large subdivisions scheduled for, or under construction. Due to uncertainties regarding the time it will take for homes to build and connect, close monitoring of the growth in the various basins is recommended.

12.4 Funding Options for Capital Improvements

Funding issues regarding the City's sewerage facilities have historically been addressed in an independent rate study. Connection fees have been utilized to fund new capital improvements that increase system capacity, while monthly rate revenues have been utilized to fund operation and maintenance costs. While this funding structure will likely continue, additional funding options are summarized in the following paragraphs.

Local Improvement District (LID)

For wastewater collection system expansions, a local improvement district (LID) can be formed for the area to be served. In the LID method of financing, a benefit area is established, and those parcels of property within that area share the cost of improvements constructed to serve the area. Revenue bonds finance the improvements, and property owners within the LID benefit area share in the cost of bond retirement.

Bonds

Large wastewater collection and treatment system expansions or upgrades that require a large one-time expenditure are frequently funded by a general obligation or revenue bond that is repaid during the life of the new facility. The bond is normally repaid from revenues derived from monthly service charges. Normally, all customers share in the bond repayment. If bond payments are made from monthly utility charges, the existing citizens effectively finance a proportionate share of the growth. If bond payments are made from future impact fees, then growth pays for itself. Where system development charges are used to retire the bond, these charges should be set sufficiently high to also pay for other system capacity upgrades that will be needed to restore the capacity lost as a result of that development.

Connection Charges

Revenues have historically been generated for utility system improvements through the collection of connection charges. As connections to the system are made, a connection fee is charged. Although some of the connection fee may be used to recover costs associated with making the service connection, most of the fee is used to finance capacity upgrades. The rationale behind these fees is that the existing system has a limited amount of excess capacity and that new demands upon the system should pay the cost of providing new capacity. In Washougal, connection fees that are used to finance system upgrades associated with growth are classified as System Development Charges (SDCs). When charging SDCs, it is important that they be used exclusively for capacity expansions, as opposed to maintenance upgrades.

Revolving Loan Fund Program

The State of Washington has a program whereby the City can obtain low interest loans to finance utility system improvements. The loan could be paid back with a funding program similar to that used to retire bonds.

Developer Financing

Utility distribution, collection, or even treatment facility improvements could be developer financed. This method of financing for utility line extensions is often used in conjunction with system development charges, whereby the developer is reimbursed for expenditures from future SDCs.

State and Federal Funding Programs

There are a number of State and Federal funding programs available to finance sewerage facility expansions. The nature of these programs varies with the political climate. The recent trend has been for the availability of funds from these programs to decrease. Another recent trend has been for the funds to be limited to current needs and environmental improvement projects, rather than to finance expansions for future growth.

12.5 Policy Issues Associated With Financing

Historically, federal and state funds have been utilized to finance major sewer system expansions. The recent trend has been towards a decreasing availability of federal and state funds. When federal and state grants were utilized for sewer system expansions, the end result was that existing residents helped to finance growth. Often, given the nature of the tax structure, people were unaware that they were financing growth. In many cases, the issue was viewed as

one of "water quality" rather than "paying for growth." Now that state and federal funds are limited, there is sensitivity to the question of who pays for growth. It is becoming very important to address sewer funding issues so that the public can distinguish between those expenditures which benefit all citizens equally, and those expenditures that exclusively serve new growth.

Operation and maintenance costs clearly benefit all ratepayers, as do capital expenditures for repairs and replacement of existing facilities. The benefit of capital expenditures for collection system expansions into new service areas is clearly limited to the new ratepayers being served by those expansions. The issue of who pays for growth is clearly a "policy" issue. Although policies vary from one community to next, the most common one is to have growth pay for itself. In such cases, revenue from monthly sewer bills is used to pay for operation and maintenance costs, and utility extensions are paid by new development.

As stated previously, for sewer planning purposes, implementation of the proposed facilities will be dependent upon financing. The method of financing selected by the City largely depends upon two fundamental policy issues associated with the City's role in financing growth: 1) how much, if any, should existing ratepayers pay for the cost of growth; and 2) if a policy of growth paying for itself is adopted by the City, how much risk are existing ratepayers willing to take regarding debt financing?

If elected officials adopt the policy of having growth pay for itself, the issues are simplified. If elected officials adopt a policy of having existing ratepayers finance growth, the issue becomes more complicated when considering the question of the share existing ratepayers should pay.

The method by which existing ratepayers pay for the cost of growth is quite simple – through monthly service charges. Capital improvements are either funded directly through accumulated revenue from service charges, or debt financed with debt retirement from monthly service charges.

Funding programs meeting the requirements of a policy of having growth pay for itself are much more complicated, particularly for collection system improvements. The simplest method of having growth pay for itself is to calculate the improvements necessary to accommodate growth, to calculate the growth in terms of equivalent residential units, and to set a system development fee equal to the cost divided by the ERUs. If other methods of financing such as LID or developer financing are utilized, the developer can be credited the proportional amount of system development charge.

Where a policy of growth paying for itself using system development charges is adopted, and a community is faced with a very rapid rate of growth, the issue of risk becomes important. High growth rates often mean that major expenditures must be made for capital improvements, which results in significant debt; debt that must be paid for by future system development fees. This may present a community with the situation of being dependent upon growth to retire debt. In such cases, it is often difficult for a community to impose strict development standards. This is why the issue of risk is an important policy issue. If a community adopts a policy of having growth pay for itself, said policy should also address the debt load a community is willing to accept.

12.6 Funding Capital Facilities

General Financing Program

Currently, Washougal finances capital improvements associated with capacity expansion with SDC revenue. This General Sewer Plan, once adopted, will be the basis for a revised calculation of the SDCs based upon the Capital Facilities Plan component of the Comprehensive Plan.

The current SDC (adopted in June 2006) for the collection system is $5,620 per ERU inside the city limits, and $8,430 per ERU outside the city limits.

12.7 Financing System Operation and Maintenance

Washougal relies upon periodic rate studies to determine the adequacy of rates. Historically, Washougal has increased rates annually to reflect inflation. The current monthly sewer charge is $113.20/2 months per ERU. The most recent rate study was completed in early 2014 by FCS Group.

Section 13
Environmental Assessment

13.1 General

The environmental impacts associated with the Sewer Plan will primarily be those related to construction of the proposed collection system and treatment plant improvements as identified in this Plan. The proposed treatment plant improvements will increase the performance and efficiency of the plant resulting in improved effluent water quality.

13.2 NPDES Requirements

The requirements of the National Environmental Policy Act (NEPA) have been fulfilled. An environmental checklist has been prepared along with related figures and sent to the proper governmental agencies. A copy of the NEPA information is included in Appendix E.

APPENDIX A
Cited Documents and References

Appendix A:
Cited Documents and References

Cited Documents

The following documents are referred to in brackets ([1], i.e.) in the text of this General Sewer Plan Update. They are listed in the order in which they appear in the Plan.

1. City of Washougal General Sewer Plan. Wallis Engineering. December 2006.
2. City of Washougal Comprehensive Plan for Growth Management Act Compliance. The Benkendorf Associates Corp., Kittelson & Associates, Inc. December 1994.
3. City of Washougal Updated Comprehensive Plan. February 2003.
4. City of Washougal Water System Plan Update. Murray Smith & Associates. June 2012.
5. City of Washougal, Washington Preliminary Design Engineering Report prepared for the 2014 WWTP Improvements. Brown and Caldwell. December 13, 2013.
6. Criteria for Sewage Works Design. State of Washington, Department of Ecology. Revised August 2008.
7. City of Washougal Washington Wastewater Treatment Plant Facility Plan Revised Regulatory Review Copy. Kennedy/Jenks Consultants. August 11, 2011.
8. City of Washougal, Washington Facility Plan Amendment for Wastewater Treatment Plant Expansion Project. Brown and Caldwell. May 29, 2014.
9. Biosolids Management Guidelines for Washington State, Publication #93-80. State of Washington, Department of Ecology. Revised July 2000.
10. Clark County Comprehensive Plan 2016 Update, Planning for growth 2015 – 2035: Preferred Alternative – Urban VBLM and Rural Capacity Estimates – Issue Paper 7, Clark County WA.
11. Wastewater Biosolids Evaluation, City of Washougal, Washington. Kennedy/Jenks Consultants. May 7, 2007.

References

The following documents were used in the preparation of this General Sewer Plan Update.

1. Wastewater Engineering Treatment and Resource Recovery. Metcalf & Eddy, Inc. Fifth Edition, 2013.
2. Design Manual for Municipal Wastewater Stabilization Ponds. USEPA. EPA-625/1-83-015. October 1983.
3. Design of Municipal Wastewater Treatment Plants, Volumes I and II. WEF Manual of Practice No. 8, ASCE Manual and Report on Engineering Practice No. 76. Fifth Edition, 2009.
4. City of Washougal, Wastewater Treatment Facility Engineering Report for Interim Operations. Wallis Engineering. May 1994.
5. City of Washougal Capital Facility Plan. Wallis Engineering. July 2006.
6. City of Washougal Wastewater Treatment Plant Improvements. Brown and Caldwell. August 2014.
7. City of Washougal, Washington Facility Plan Amendment. Kennedy/Jenks Consultants. May 29, 2014.
8. City of Washougal Wastewater Treatment Plant Expansion, Design Memoranda. Wallis Engineering. February 1997.

APPENDIX B
Existing Collection System Map

PS#10
FM#10
Shepherds Road
East Main
Shepherds Road
West Main
PS#8
FM#8
Shepherds Road
Washougal River Main
PS#13
PS#7
FM#7
PS#2
FM#2
Main G
PS#4
FM#4
PS#9
FM#9
Main F
PS#12
PS#5
FM#1
PS#1
Main K
Main J
49th Street Main
PS#14
PS#11
FM#11
Main D
Main A
39th Street
Main
PS#3
FM#3
Evergreen
Highway Main
FM#6
Wastewater Treatment Plant
Influent Pump Station
Wastewater Treatment Plant
Effluent Pump Station
PS#6

0 500 1000
SCALE IN FEET

Figure B1
Existing Collection System Map
Draft April 2016

Legend

- UGA Boundary
- Existing City Limits
- Existing Sewer Line (size noted) — 8"
- Existing Force Main
- Existing Pump Station — PS5-2
- Existing Manhole (ID noted) — T4-2
- Main Differentiation Node

Note: Lots shown are those platted or preliminary platted as of December 2015.

wallis engineering

APPENDIX C
Pump Station Assessments

Completed by Wallis Engineering, December 2015

Pump Station Name: Pump Station No. 1, Fire Station
Address: 1401 A Street
Date Constructed: 2006

Condition: 1 - Very Good 3 - Needs significant maintenance 5 - Requires Replacement
2 - Slightly degraded 4 - Requires rehabilitation

General

Flow Meter Records	*Present?*	No
Pump Run Time Records	*Present?*	Yes
Operation and Maintenance Manual	*Present?*	Yes

Site

Visual Appearance	*Condition:*	1
Fence and Gate	*Condition:*	NA
Surfacing	*Type:*	Asphalt
	Condition:	1
Parking Adequacy	*Condition:*	1
Washdown Hose Bibb	*Present?*	Yes
Backflow Prevention	*Present?*	No
	Type:	N/A
Site Lighting	Adequate	
Ease of Pump Access	Good	

Overall Comments: Overall condition good, but public visibility and exposure are 100%.

Structure

Wet Well	*Structure Materials:*	Precast Concrete
	Dimensions:	6' dia., 18'-21' operating depth
	Condition:	2
Valve Vault	*Structure Materials:*	Precast Concrete
	Depth:	6'
	Condition:	2
Access Lid Fall Prevention	*Present?*	Yes
Vault Drain Discharge	*Present?*	Yes

Overall Comments: No ladder or steps in valve vault. Operator noted substantial aggregate and grit routinely cleaned from wet well, suggesting upstream corrosion and possibly explaining, in part, performance issues with Pump 2.

Pump Station Name: Pump Station No. 1, Fire Station

Condition: 1 - Very Good 3 - Needs significant maintenance 5 - Requires Replacement
2 - Slightly degraded 4 - Requires rehabilitation

Pumps & Motors

Pumps
No. Pumps: 2
Make/Model: Flygt NP3127.090
Capacity: 675 GPM
HP: 7.5 HP

Rail
Material: SS
Condition: 5

Control Panel
Type: Shelter
Seal-off Location: NA - Disconnect panel w/Meltric plugs

Overall Comments: "The problem station," per operator; gives frequent HW alarms. Pump 2 runs over far more hours and delivers lower shutoff head, indicating inefficiency and warranting investigation.

Discharge Forcemain

Discharge Piping
Material: Ductile iron
Diameter: 8"
Condition: 2

Force Main Length 500'

Check Valve
Present? Yes (2)
Type: Ball
Condition: 2

Check Valve Flow Indicator
Present? No
Condition: NA

Isolation Valve
Present? Yes (2)
Type: Gate
Condition: 2

Pigging Station
Present? No, but could be performed through wye
Type: N/A
Condition: N/A

Pressure Gauge *Present?* Yes (2)

Overall Comments: Note wye on manifold for bypass, possible pigging.

Pump Station Name: Pump Station No. 1, Fire Station

Condition: 1 - Very Good 3 - Needs significant maintenance 5 - Requires Replacement
2 - Slightly degraded 4 - Requires rehabilitation

Instrumentation

Flow Meter
Present? Yes, but meter is installed without connections
Location: Separate vault downstream of manifold
Type: Mag
Condition: 1

Primary Level Indicator *Type:* Float

Backup Level Indicator *Type:* Float

Overall Comments: Connecting the flow meter that has been installed would be uninvolved and would dramatically simplify investigation of ongoing pump issues.

Alarms/Telemetry

Communications *Type:* Mission cellular system

Alarms
High Water
Low Water

Overall Comments: None

General Electric

Primary Power *Type:* Electric, Clark County PUD

Backup Power
Type: Gas-Powered Generator
Make/Model: Cummins Power Generation
Fuel supply: Natural Gas

Overall Comments: None

Completed by Wallis Engineering, December 2015

Pump Station Name: Pump Station No. 2, Martell's
Address: 607 K Street
Date Constructed: 2013

Condition: 1 - Very Good 3 - Needs significant maintenance 5 - Requires Replacement
2 - Slightly degraded 4 - Requires rehabilitation

General

Flow Meter Records	*Present?*	No
Pump Run Time Records	*Present?*	Yes
Operation and Maintenance Manual	*Present?*	Yes

Site

Visual Appearance	*Condition:*	1
Fence and Gate	*Condition:*	1
Surfacing	*Type:*	Asphalt
	Condition:	1
Parking Adequacy	*Condition:*	1
Washdown Hose Bibb	*Present?*	Yes
Backflow Prevention	*Present?*	Yes
	Type:	RBPA
Site Lighting	Deficient	
Ease of Pump Access	Good	

Overall Comments: Parking and access entirely by long, narrow drive. A flood light near the wet well would improve nighttime work and safety.

Structure

Wet Well	*Structure Materials:*	Precast Concrete
	Dimensions:	6' dia., 12'-14' operating depth
	Condition:	1
Valve Vault	*Structure Materials:*	Precast Concrete
	Depth:	Approx. 6'
	Condition:	1
Access Lid Fall Prevention	*Present?*	Yes
Vault Drain Discharge	*Present?*	Yes

Overall Comments: None

Pump Station Name: Pump Station No. 2, Martell's

Condition: 1 - Very Good 3 - Needs significant maintenance 5 - Requires Replacement
2 - Slightly degraded 4 - Requires rehabilitation

Pumps & Motors

Pumps
No. Pumps: 2
Make/Model: Flygt NP3127.090
Capacity: 282 GPM
HP: 7.5 HP

Rail
Material: SS
Condition: 1

Control Panel
Type: Sheltered with lighting
Seal-off Location: NA - Disconnect panel w/Meltric plugs

Overall Comments: Water hammer occurs when Pump 2 is shut off (observed), and pressure gauge on Pump 2 riser shows fluctuation of 10-20 psi. Measured flow from each pump is identical: 170 gpm.

Discharge Forcemain

Discharge Piping
Material: Ductile iron
Diameter: 6"
Condition: 1

Force Main Length 900'

Check Valve
Present? Yes (2)
Type: Ball
Condition: 1

Check Valve Flow Indicator
Present? No
Condition: NA

Isolation Valve
Present? Yes (2)
Type: Gate
Condition: 1

Pigging Station
Present? No, but could be performed through wye
Type: N/A
Condition: N/A

Pressure Gauge
Present? Yes (2)

Overall Comments: Note wye on manifold for bypass, possible pigging. Check Valves, need replacement to prevent slamming

Pump Station Name: Pump Station No. 2, Martell's

Condition: 1 - Very Good 3 - Needs significant maintenance 5 - Requires Replacement
2 - Slightly degraded 4 - Requires rehabilitation

Instrumentation

Flow Meter	*Present?*	Yes
	Location:	Valve Vault
	Type:	Mag
	Condition:	1
Primary Level Indicator	*Type:*	Multitrode
Backup Level Indicator	*Type:*	Float

Overall Comments: Per operator, flow meter has not calibrated since installation.

Alarms/Telemetry

Communications	*Type:*	Mission cellular system
Alarms	High Water	
	Low Water	

Overall Comments: None

General Electric

Primary Power	*Type:*	Electric, Clark County PUD
Backup Power	*Type:*	Gas-Powered Generator
	Make/Model:	Cummins Power Generation
	Fuel supply:	Natural Gas

Overall Comments: None

Completed by Wallis Engineering, December 2015

Pump Station Name: Pump Station No. 3, West Industrial Park
Address: 625 South 32nd Street
Date Constructed: 2013

Condition: 1 - Very Good 3 - Needs significant maintenance 5 - Requires Replacement
2 - Slightly degraded 4 - Requires rehabilitation

General

Flow Meter Records	*Present?*	No
Pump Run Time Records	*Present?*	Yes
Operation and Maintenance Manual	*Present?*	Yes

Site

Visual Appearance	*Condition:*	1
Fence and Gate	*Condition:*	NA
Surfacing	*Type:*	Asphalt
	Condition:	1
Parking Adequacy	*Condition:*	1
Washdown Hose Bibb	*Present?*	Yes
Backflow Prevention	*Present?*	No
	Type:	NA
Ease of Pump Access	Good	

Overall Comments: Visibility and exposure are 100%. This is an industrial area and the station need not be hidden, but graffiti noted on control enclosure.

Structure

Wet Well	*Structure Materials:*	Precast Concrete
	Dimensions:	6' dia., 13'-15.5' operating depth
	Condition:	1
Valve Vault	*Structure Materials:*	Precast Concrete
	Depth:	Approx. 6'
	Condition:	1
Access Lid Fall Prevention	*Present?*	Yes
Vault Drain Discharge	*Present?*	Yes

Overall Comments: None

Pump Station Name: Pump Station No. 3, West Industrial Park

Condition: 1 - Very Good 3 - Needs significant maintenance 5 - Requires Replacement
2 - Slightly degraded 4 - Requires rehabilitation

Pumps & Motors

Pumps
No. Pumps: 2
Make/Model: Flygt NP3127.090
Capacity: 282 GPM
HP: 10 HP

Rail
Material: SS
Condition: 1

Control Panel
Type: Sheltered with lighting
Seal-off Location: NA - Disconnect panel w/Meltric plugs

Overall Comments: Slight water hammer (i.e., a single report) was exhibited as each pump was shut off. Measured flow from each pump is identical: 525 gpm.

Discharge Forcemain

Discharge Piping
Material: Ductile iron
Diameter: 6"
Condition: 1

Force Main Length 500'

Check Valve
Present? Yes
Type: Ball
Condition: 1

Check Valve Flow Indicator
Present? No
Condition: NA

Isolation Valve
Present? Yes (2)
Type: Gate
Condition: 1

Pigging Station
Present? No, but could be performed through wye
Type: N/A
Condition: N/A

Pressure Gauge
Present? Yes

Overall Comments: Note wye on manifold for bypass, possible pigging. ARV and blind flange with small (~1") fitting on manifold.

Pump Station Name: Pump Station No. 3, West Industrial Park

Condition: 1 - Very Good 3 - Needs significant maintenance 5 - Requires Replacement
2 - Slightly degraded 4 - Requires rehabilitation

Instrumentation

Flow Meter	*Present?*	Yes
	Location:	Valve Vault
	Type:	Mag
	Condition:	1
Primary Level Indicator	*Type:*	Multitrode
Backup Level Indicator	*Type:*	Float

Overall Comments: None

Alarms/Telemetry

Communications	*Type:*	Mission cellular system
Alarms	High Water Low Water	

Overall Comments: None

General Electric

Primary Power	*Type:*	Electric, Clark County PUD
Backup Power	*Type:*	Gas-Powered Generator
	Make/Model:	Cummins Power Generation
	Fuel supply:	Natural Gas

Overall Comments: None

Completed by Wallis Engineering, December 2015

Pump Station Name: Pump Station No. 4, Turtle Terrace
Address: 2395 North L Street
Date Constructed:

Condition: 1 - Very Good 3 - Needs significant maintenance 5 - Requires Replacement
2 - Slightly degraded 4 - Requires rehabilitation

General

Flow Meter Records	*Present?*	NA
Pump Run Time Records	*Present?*	Yes
Operation and Maintenance Manual	*Present?*	Yes

Site

Visual Appearance	*Condition:*	2
Fence and Gate	*Condition:*	2
Surfacing	*Type:*	Crushed Rock
	Condition:	3
Parking Adequacy	*Condition:*	2
Washdown Hose Bibb	*Present?*	Yes
Backflow Prevention	*Present?*	No
	Type:	N/A
Ease of Pump Access	Fair	

Overall Comments: Crushed rock coverage is uneven. Paving the station and parking area would be far better for hosedown and general appearance. Needs lighting; currently there is none.

Structure

Wet Well	*Structure Materials:*	Precast Concrete
	Dimensions:	12' dia., 29.5'-31.5' operating depth
	Condition:	2
Valve Vault	*Structure Materials:*	Precast Concrete
	Depth:	6'
	Condition:	2
Access Lid Fall Prevention	*Present?*	Yes
Vault Drain Discharge	*Present?*	Yes

Overall Comments: A homeowner to the northwest frequently registers odor complaints. Partly in response, each of the three force mains (two in service) has been tapped for chemical feed equipment, currently not installed on site. Light encrustation on wet well.

Pump Station Name: Pump Station No. 4, Turtle Terrace

Condition: 1 - Very Good 3 - Needs significant maintenance 5 - Requires Replacement
2 - Slightly degraded 4 - Requires rehabilitation

Pumps & Motors

Pumps
No. Pumps: 2
Make/Model: Flygt 3201.090
Capacity: 1000 GPM
HP: 47 HP

Rail
Material: SS
Condition: 2

Control Panel
Type: Enclosure
Seal-off Location: Vault

Overall Comments: Station is equipped to accept a third pump but, per operator, is virtually never plugged (1-2 times in the past 10 years) or over capacity.

Discharge Forcemain

Discharge Piping
Material: Ductile iron
Diameter: 8"
Condition: 2

Force Main Length 3600'

Check Valve
Present? Swing
Type: Sprung
Condition: 2

Check Valve Flow Indicator
Present? Yes
Condition: Arm

Isolation Valve
Present? Yes (2)
Type: Gate valve
Condition: 2

Pigging Station
Present? No, but could be performed through wye
Type: N/A
Condition: N/A

Pressure Gauge *Present?* No

Overall Comments: Discharge main observed as 8" DI; sewer plan shows 12" DI/16" HDPE.

Pump Station Name: Pump Station No. 4, Turtle Terrace

Condition: 1 - Very Good 3 - Needs significant maintenance 5 - Requires Replacement
2 - Slightly degraded 4 - Requires rehabilitation

Instrumentation

Flow Meter	*Present?*	No
	Location:	NA
	Type:	NA
	Condition:	NA
Primary Level Indicator	*Type:*	Float
Backup Level Indicator	*Type:*	Float
Overall Comments:	None	

Alarms/Telemetry

Communications	*Type:*	Mission cellular system
Alarms	High Water Low Water	
Overall Comments:	None	

General Electric

Primary Power	*Type:*	Electric, Clark County PUD
Backup Power	*Type:*	Gas-Powered Generator
	Make/Model:	Cummins Onan GenSet
	Fuel supply:	Natural Gas
Overall Comments:	None	

Completed by Wallis Engineering, December 2015

Pump Station Name: Pump Station No. 5, The Marina
Address: 34 South A Street
Date Constructed:

Condition: 1 - Very Good 3 - Needs significant maintenance 5 - Requires Replacement
2 - Slightly degraded 4 - Requires rehabilitation

General

Flow Meter Records	*Present?*	NA
Pump Run Time Records	*Present?*	Yes
Operation and Maintenance Manual	*Present?*	Yes

Site

Visual Appearance	*Condition:*	3
Fence and Gate	*Condition:*	NA
Surfacing	*Type:*	Crushed Rock
	Condition:	Grass
Parking Adequacy	*Condition:*	1
Washdown Hose Bibb	*Present?*	Yes
Backflow Prevention	*Present?*	No
	Type:	N/A

Ease of Pump Access Poor

Overall Comments: Grass surface poor for hosedown and work. Wet well access fair (bollards all around), but pump access poor due to crowding of equipment in wet well.

Structure

Wet Well	*Structure Materials:*	Precast Concrete
	Dimensions:	4' dia., 16.5'-18' operating depth
	Condition:	3
Valve Vault	*Structure Materials:*	NA
	Depth:	NA
	Condition:	NA
Access Lid Fall Prevention	*Present?*	Yes
Vault Drain Discharge	*Present?*	NA

Overall Comments: All equipment (valves, seal offs, force main manifold, etc.) is crowded into the 4' diameter wet well. Apparent evidence of infiltration. Hatch opening corroded. Note apparently stalled development nearby.

Pump Station Name: Pump Station No. 5, The Marina

Condition: 1 - Very Good 3 - Needs significant maintenance 5 - Requires Replacement
2 - Slightly degraded 4 - Requires rehabilitation

Pumps & Motors

Pumps
No. Pumps: 2
Make/Model: Flygt 3085
Capacity: 220 GPM
HP: 2.2 HP

Rail
Material: Galvanized
Condition: 5

Control Panel
Type: Enclosure

Seal-off Location: Wet Well

Overall Comments: Pump control panel needs to be replaced.

Discharge Forcemain

Discharge Piping
Material: Ductile iron
Diameter: 4"
Condition: 3

Force Main Length

Check Valve
Present? Unclear
Type: NA
Condition: NA

Check Valve Flow Indicator
Present? NA
Condition: NA

Isolation Valve
Present? Yes (2)
Type: Gate valve
Condition: 3

Pigging Station
Present? No
Type: N/A
Condition: N/A

Pressure Gauge
Present? No

Overall Comments: Discharge is inaccessible and severely corroded. Rails and rail mounts are encrusted and corroded.

Pump Station Name: Pump Station No. 5, The Marina

Condition: 1 - Very Good 3 - Needs significant maintenance 5 - Requires Replacement
2 - Slightly degraded 4 - Requires rehabilitation

Instrumentation

Flow Meter	*Present?*	No
	Location:	NA
	Type:	NA
	Condition:	NA
Primary Level Indicator	*Type:*	Float
Backup Level Indicator	*Type:*	Float

Overall Comments: None

Alarms/Telemetry

Communications *Type:* Mission cellular system

Alarms High Water
Low Water

Overall Comments: None

General Electric

Primary Power *Type:* Electric, Clark County PUD

Backup Power	*Type:*	None
	Make/Model:	NA
	Fuel supply:	NA

Overall Comments: Station lacks any on-site backup power.

Completed by Wallis Engineering, December 2015

Pump Station Name: Pump Station No. 6, East Industrial Park
Address: 628 South 37th Street
Date Constructed: 2000

Condition: 1 - Very Good 3 - Needs significant maintenance 5 - Requires Replacement
2 - Slightly degraded 4 - Requires rehabilitation

General

Flow Meter Records	*Present?*	No
Pump Run Time Records	*Present?*	Yes
Operation and Maintenance Manual	*Present?*	Yes

Site

Visual Appearance	*Condition:*	2
Fence and Gate	*Condition:*	NA
Surfacing	*Type:*	Crushed Rock
	Condition:	2
Parking Adequacy	*Condition:*	1
Washdown Hose Bibb	*Present?*	Yes, in shed
Backflow Prevention	*Present?*	No
	Type:	N/A
Ease of Pump Access	Good	

Overall Comments: Pavement would improve access, work and washdown. Grading around site has apparently deteriorated.

Structure

Wet Well	*Structure Materials:*	Precast Concrete
	Dimensions:	4' dia., 20'-23' operating depth
	Condition:	2
Valve Vault	*Structure Materials:*	Precast Concrete
	Depth:	Approx. 5'
	Condition:	2
Access Lid Fall Prevention	*Present?*	Yes
Vault Drain Discharge	*Present?*	Yes

Overall Comments: No ladder or steps in valve vault. Wet well is slightly gassy, with light encrustation but no scaling.

Pump Station Name: Pump Station No. 6, East Industrial Park

Condition: 1 - Very Good 3 - Needs significant maintenance 5 - Requires Replacement
2 - Slightly degraded 4 - Requires rehabilitation

Pumps & Motors

Pumps	*No. Pumps:*	2
	Make/Model:	Flygt 3127.090
	Capacity:	315 GPM
	HP:	7.5 HP
Rail	*Material:*	SS
	Condition:	2
Control Panel	*Type:*	Shed
	Seal-off Location:	Vault

Overall Comments: Control panel shelter requires replacement.

Discharge Forcemain

Discharge Piping	*Material:*	Ductile iron
	Diameter:	6"
	Condition:	2
Force Main Length	4000'	
Check Valve	*Present?*	Yes (2)
	Type:	Swing
	Condition:	2
Check Valve Flow Indicator	*Present?*	No
	Condition:	NA
Isolation Valve	*Present?*	Yes (2)
	Type:	Plug
	Condition:	2
Pigging Station	*Present?*	Yes
	Type:	Port
	Condition:	N/A
Pressure Gauge	*Present?*	No

Overall Comments: Note that discharge piping is 6", force main is 12" per original plans. Parallel pipes in valve vault are saddle-tapped just inside of the downstream vault wall and capped.

Pump Station Name: Pump Station No. 6, East Industrial Park

Condition: 1 - Very Good 3 - Needs significant maintenance 5 - Requires Replacement
2 - Slightly degraded 4 - Requires rehabilitation

Instrumentation

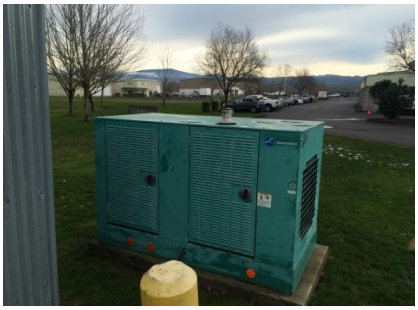
Flow Meter	*Present?*	No
	Location:	NA
	Type:	NA
	Condition:	NA
Primary Level Indicator	*Type:*	Float
Backup Level Indicator	*Type:*	Float
Overall Comments:	None	

Alarms/Telemetry

Communications	*Type:*	Mission cellular system
Alarms	High Water Low Water	
Overall Comments:	None	

General Electric

Primary Power	*Type:*	Electric, Clark County PUD
Backup Power	*Type:*	Gas-Powered Generator
	Make/Model:	Cummins Power Generation
	Fuel supply:	Natural Gas
Overall Comments:	None	



Completed by Wallis Engineering, December 2015

Pump Station Name: Pump Station No. 7, Eldridge
Address: 4621 Dr. Eldridge Drive
Date Constructed:

Condition: 1 - Very Good 3 - Needs significant maintenance 5 - Requires Replacement
2 - Slightly degraded 4 - Requires rehabilitation

General

Flow Meter Records	*Present?*	No
Pump Run Time Records	*Present?*	Yes
Operation and Maintenance Manual	*Present?*	Yes

Site

Visual Appearance	*Condition:*	1
Fence and Gate	*Condition:*	2
Surfacing	*Type:*	Grass
	Condition:	2
Parking Adequacy	*Condition:*	1
Washdown Hose Bibb	*Present?*	Yes
Backflow Prevention	*Present?*	No
	Type:	N/A

Ease of Pump Access Fair

Overall Comments: Pavement around well and vaults would improve work and hosedown. A gate at the entrance might mitigate recurring litter issues (beer cans).

Structure

Wet Well	*Structure Materials:*	Precast Concrete
	Dimensions:	6' dia., 18'-19' operating depth
	Condition:	2
Valve Vault	*Structure Materials:*	Precast Concrete
	Depth:	Approx. 4'
	Condition:	2
Access Lid Fall Prevention	*Present?*	Yes
Vault Drain Discharge	*Present?*	Not clear

Overall Comments: Significant water (~1') in valve vault. Drain may be plugged.

Pump Station Name: Pump Station No. 7, Eldridge

Condition: 1 - Very Good 3 - Needs significant maintenance 5 - Requires Replacement
2 - Slightly degraded 4 - Requires rehabilitation

Pumps & Motors

Pumps	*No. Pumps:*	2
	Make/Model:	Flygt 3127.090
	Capacity:	100 GPM
	HP:	10 HP
Rail	*Material:*	SS
	Condition:	2
Control Panel	*Type:*	Shelter
	Seal-off Location:	Vault

Overall Comments: None

Discharge Forcemain

Discharge Piping	*Material:*	Ductile iron
	Diameter:	4"
	Condition:	2
Force Main Length	1400'	
Check Valve	*Present?*	Yes (2)
	Type:	Swing
	Condition:	2
Check Valve Flow Indicator	*Present?*	Yes
	Condition:	2
Isolation Valve	*Present?*	Yes (3)
	Type:	Gate
	Condition:	2
Pigging Station	*Present?*	No
	Type:	NA
	Condition:	NA
Pressure Gauge	*Present?*	No

Overall Comments: Note wye with camlok and valve for bypass.

Pump Station Name: Pump Station No. 7, Eldridge

Condition: 1 - Very Good 3 - Needs significant maintenance 5 - Requires Replacement
2 - Slightly degraded 4 - Requires rehabilitation

Instrumentation

Flow Meter
Present? No
Location: NA
Type: NA
Condition: NA

Primary Level Indicator *Type:* Float

Backup Level Indicator *Type:* Float

Overall Comments: None

Alarms/Telemetry

Communications *Type:* Mission cellular system

Alarms High Water
Low Water

Overall Comments: None

General Electric

Primary Power *Type:* Electric, Clark County PUD

Backup Power *Type:* Gas-Powered Generator
Make/Model: Cummins Onan GenSet
Fuel supply: Natural Gas

Overall Comments: None

Completed by Wallis Engineering, December 2015

Pump Station Name: Pump Station No. 8, Shepherd Road
Address: 465 North Shepherd Road
Date Constructed: 1997

Condition: 1 - Very Good 3 - Needs significant maintenance 5 - Requires Replacement
2 - Slightly degraded 4 - Requires rehabilitation

General

Flow Meter Records	*Present?*	No
Pump Run Time Records	*Present?*	Yes
Operation and Maintenance Manual	*Present?*	Yes

Site

Visual Appearance	*Condition:*	1
Fence and Gate	*Condition:*	NA
Surfacing	*Type:*	Cement Concrete
	Condition:	1
Parking Adequacy	*Condition:*	2
Washdown Hose Bibb	*Present?*	Yes
Backflow Prevention	*Present?*	No
	Type:	N/A
Ease of Pump Access	Good	

Overall Comments: Landscaping effectively obscures station. Station surface good but parking area very muddy, with parking next to station routinely filled.

Structure

Wet Well	*Structure Materials:*	Precast Concrete
	Dimensions:	9' dia., 29.5'-31.5' operating depth
	Condition:	2
Valve Vault	*Structure Materials:*	Precast Concrete
	Depth:	Approx. 6'
	Condition:	2
Access Lid Fall Prevention	*Present?*	Yes
Vault Drain Discharge	*Present?*	Yes

Overall Comments: Wet well is slightly gassy with light encrustation, in good condition but was rehabilitated on at least one occasion using chemical grout. No lighting on site.

Pump Station Name: Pump Station No. 8, Shepherd Road

Condition: 1 - Very Good 3 - Needs significant maintenance 5 - Requires Replacement
2 - Slightly degraded 4 - Requires rehabilitation

Pumps & Motors

Pumps
No. Pumps: 2
Make/Model: Flygt 3127.090
Capacity: 725 GPM
HP: 10 HP

Rail
Material: SS
Condition: 2

Control Panel
Type: Enclosure

Seal-off Location: Vault

Overall Comments: No lighting at control panel.

Discharge Forcemain

Discharge Piping
Material: Ductile iron
Diameter: 8"
Condition: 2

Force Main Length 4000'

Check Valve
Present? Yes (2)
Type: Swing
Condition: 2

Check Valve Flow Indicator
Present? Yes
Condition: 2

Isolation Valve
Present? Yes (3)
Type: Gate
Condition: 2

Pigging Station
Present? No
Type: NA
Condition: NA

Pressure Gauge
Present? No

Overall Comments: Note wye with camlok and valve for bypass.

Pump Station Name: Pump Station No. 8, Shepherd Road

Condition: 1 - Very Good 3 - Needs significant maintenance 5 - Requires Replacement
2 - Slightly degraded 4 - Requires rehabilitation

Instrumentation

Flow Meter	*Present?*	No
	Location:	NA
	Type:	NA
	Condition:	NA
Primary Level Indicator	*Type:*	Float
Backup Level Indicator	*Type:*	Float
Overall Comments:	None	

Alarms/Telemetry

Communications	*Type:*	Mission cellular system
Alarms	High Water Low Water	
Overall Comments:	None	

General Electric

Primary Power	*Type:*	Electric, Clark County PUD
Backup Power	*Type:*	Gas-Powered Generator
	Make/Model:	Cummins Onan GenSet
	Fuel supply:	Natural Gas
Overall Comments:	Note that generator is off site but nearby, possibly due to natural gas service proximity.	

Completed by Wallis Engineering, December 2015

Pump Station Name: Pump Station No. 9, Gause
Address: 3400 L Street
Date Constructed:

Condition: 1 - Very Good 3 - Needs significant maintenance 5 - Requires Replacement
2 - Slightly degraded 4 - Requires rehabilitation

General

Flow Meter Records	*Present?*	No
Pump Run Time Records	*Present?*	Yes
Operation and Maintenance Manual	*Present?*	Yes

Site

Visual Appearance	*Condition:*	2
Fence and Gate	*Condition:*	NA
Surfacing	*Type:*	Asphalt
	Condition:	2
Parking Adequacy	*Condition:*	1
Washdown Hose Bibb	*Present?*	Yes
Backflow Prevention	*Present?*	No
	Type:	N/A
Ease of Pump Access		1

Overall Comments: Station is located next to a school and has been vandalized in the past; the cellular antenna was broken off. No vandalism since a low-profile antenna was installed.

Structure

Wet Well	*Structure Materials:*	Precast Concrete
	Dimensions:	4' dia., 8.5'-10.5' operating depth
	Condition:	2
Valve Vault	*Structure Materials:*	Precast Concrete
	Depth:	Approx. 4'
	Condition:	2
Access Lid Fall Prevention	*Present?*	Yes
Vault Drain Discharge	*Present?*	Yes

Overall Comments: Structures are visibly aging but appear to be functioning well.

Pump Station Name: Pump Station No. 9, Gause

Condition: 1 - Very Good 3 - Needs significant maintenance 5 - Requires Replacement
2 - Slightly degraded 4 - Requires rehabilitation

Pumps & Motors

Pumps	*No. Pumps:*	2
	Make/Model:	Flygt 3057.181
	Capacity:	85 GPM
	HP:	2.7 HP
Rail	*Material:*	SS
	Condition:	2
Control Panel	*Type:*	Enclosure
	Seal-off Location:	Vault

Overall Comments: None

Discharge Forcemain

Discharge Piping	*Material:*	Ductile iron
	Diameter:	2"
	Condition:	2
Force Main Length	300'	
Check Valve	*Present?*	Yes (2)
	Type:	Swing
	Condition:	5
Check Valve Flow Indicator	*Present?*	No
	Condition:	2
Isolation Valve	*Present?*	Yes (2)
	Type:	Ball
	Condition:	4
Pigging Station	*Present?*	No
	Type:	NA
	Condition:	NA
Pressure Gauge	*Present?*	No

Overall Comments: All piping corroded. Swing check valves severly corroded. Handles on isolation valves appear as though they might fail in service. Note bypass from manifold.

Pump Station Name: Pump Station No. 9, Gause

Condition: 1 - Very Good 3 - Needs significant maintenance 5 - Requires Replacement
2 - Slightly degraded 4 - Requires rehabilitation

Instrumentation

Flow Meter *Present?* No
Location: NA
Type: NA
Condition: NA

Primary Level Indicator *Type:* Float

Backup Level Indicator *Type:* Float

Overall Comments: None

Alarms/Telemetry

Communications *Type:* Mission cellular system

Alarms High Water
Low Water

Overall Comments: None

General Electric

Primary Power *Type:* Electric, Clark County PUD

Backup Power *Type:* None
Make/Model: NA

Fuel supply: NA

Overall Comments: Station has no backup power.

Completed by Wallis Engineering, December 2015

Pump Station Name: Pump Station No. 10, Lookout Ridge
Address: 1095 West Lookout Ridge Drive
Date Constructed:

Condition: 1 - Very Good 3 - Needs significant maintenance 5 - Requires Replacement
2 - Slightly degraded 4 - Requires rehabilitation

General

Flow Meter Records	*Present?*	No
Pump Run Time Records	*Present?*	Yes
Operation and Maintenance Manual	*Present?*	Yes

Site

Visual Appearance	*Condition:*	2
Fence and Gate	*Condition:*	1
Surfacing	*Type:*	Asphalt
	Condition:	2
Parking Adequacy	*Condition:*	1
Washdown Hose Bibb	*Present?*	Yes
Backflow Prevention	*Present?*	No
	Type:	N/A

Ease of Pump Access 1

Overall Comments: Station is discretely located off road, at a low elevation relative to its surroundings. Heavy moss on pavement, apparently scraped away in places.

Structure

Wet Well
Structure Materials: Precast Concrete
Dimensions: 4' dia., 8.5'-10.5' operating depth
Condition: 2

Valve Vault
Structure Materials: Precast Concrete
Depth: Approx. 8'
Condition: 2

Access Lid Fall Prevention *Present?* Yes

Vault Drain Discharge *Present?* Yes

Overall Comments: Scum on the well water's surface suggests that a mix flush valve would be a worthwhile upgrade. Vault ladder is not mounted to the structure. Operator noted that wipes were once a frequent problem, but the issue has subsided. Rags 1-2 times per year. Inadequate lighting overall.

Pump Station Name: Pump Station No. 10, Lookout Ridge

Condition: 1 - Very Good 3 - Needs significant maintenance 5 - Requires Replacement
2 - Slightly degraded 4 - Requires rehabilitation

Pumps & Motors

Pumps	*No. Pumps:*	2
	Make/Model:	Flygt 3127.090
	Capacity:	75 GPM
	HP:	10 HP
Rail	*Material:*	SS
	Condition:	2
Control Panel	*Type:*	Sheltered
	Seal-off Location:	Vault

Overall Comments: None

Discharge Forcemain

Discharge Piping	*Material:*	Ductile iron
	Diameter:	4"
	Condition:	2
Force Main Length	1400'	
Check Valve	*Present?*	Yes (2)
	Type:	Swing
	Condition:	5
Check Valve Flow Indicator	*Present?*	Yes
	Condition:	2
Isolation Valve	*Present?*	Yes (3)
	Type:	Gate
	Condition:	2
Pigging Station	*Present?*	No
	Type:	NA
	Condition:	NA
Pressure Gauge	*Present?*	No

Overall Comments: Note that force main is laterally braced to vault walls.

Pump Station Name: Pump Station No. 10, Lookout Ridge

Condition: 1 - Very Good 3 - Needs significant maintenance 5 - Requires Replacement
2 - Slightly degraded 4 - Requires rehabilitation

Instrumentation

Flow Meter	*Present?*	No
	Location:	NA
	Type:	NA
	Condition:	NA
Primary Level Indicator	*Type:*	Float
Backup Level Indicator	*Type:*	Float
Overall Comments:	None	

Alarms/Telemetry

Communications	*Type:*	Mission cellular system
Alarms	High Water Low Water	
Overall Comments:	None	

General Electric

Primary Power	*Type:*	Electric, Clark County PUD
Backup Power	*Type:*	Gas-Powered Generator
	Make/Model:	Kohler Power System Fast Response
	Fuel supply:	Natural Gas
Overall Comments:	None	

Completed by Wallis Engineering, December 2015

Pump Station Name: Pump Station No. 11, Sunset Ridge
Address: 5510 I Street
Date Constructed:

Condition: 1 - Very Good 3 - Needs significant maintenance 5 - Requires Replacement
2 - Slightly degraded 4 - Requires rehabilitation

General

Flow Meter Records	*Present?*	No
Pump Run Time Records	*Present?*	Yes
Operation and Maintenance Manual	*Present?*	Yes

Site

Visual Appearance	*Condition:*	1
Fence and Gate	*Condition:*	1
Surfacing	*Type:*	Asphalt
	Condition:	1
Parking Adequacy	*Condition:*	1
Washdown Hose Bibb	*Present?*	Yes
Backflow Prevention	*Present?*	No
	Type:	N/A

Ease of Pump Access 1

Overall Comments: Station is well maintained and landscaped.

Structure

Wet Well	*Structure Materials:*	Precast Concrete
	Dimensions:	6' dia., 15'-17.5' operating depth
	Condition:	2
Valve Vault	*Structure Materials:*	Precast Concrete
	Depth:	6.7'
	Condition:	2

Access Lid Fall Prevention	*Present?*	Yes
Vault Drain Discharge	*Present?*	Yes

Overall Comments: Per operator and visual inspection, grease buildup is an issue at this station.

Pump Station Name: Pump Station No. 11, Sunset Ridge

Condition: 1 - Very Good 3 - Needs significant maintenance 5 - Requires Replacement
2 - Slightly degraded 4 - Requires rehabilitation

Pumps & Motors

Pumps	*No. Pumps:*	2
	Make/Model:	Flygt 3127.090
	Capacity:	150 GPM
	HP:	7.4 HP
Rail	*Material:*	SS
	Condition:	2
Control Panel	*Type:*	Sheltered
	Seal-off Location:	Vault

Overall Comments: None

Discharge Forcemain

Discharge Piping	*Material:*	Ductile iron
	Diameter:	4"
	Condition:	2
Force Main Length	800'	
Check Valve	*Present?*	Yes (2)
	Type:	Swing
	Condition:	5
Check Valve Flow Indicator	*Present?*	Yes
	Condition:	2
Isolation Valve	*Present?*	Yes (3)
	Type:	Gate
	Condition:	2
Pigging Station	*Present?*	No
	Type:	NA
	Condition:	NA
Pressure Gauge	*Present?*	No

Overall Comments: Vault ladder not secured to vault wall - hardware to fasten ladder in place appears to be lying on the vault floor.

Pump Station Name: Pump Station No. 11, Sunset Ridge

Condition: 1 - Very Good 3 - Needs significant maintenance 5 - Requires Replacement
2 - Slightly degraded 4 - Requires rehabilitation

Instrumentation

Flow Meter
Present? No
Location: NA
Type: NA
Condition: NA

Primary Level Indicator *Type:* Float

Backup Level Indicator *Type:* Float

Overall Comments: None

Alarms/Telemetry

Communications *Type:* Mission cellular system

Alarms
High Water
Low Water

Overall Comments: None

General Electric

Primary Power *Type:* Electric, Clark County PUD

Backup Power
Type: Gas-Powered Generator
Make/Model: Cummins Onan GenSet
Fuel supply: Natural Gas

Overall Comments: Station has no alarm for generator, which is checked weekly.

Completed by Wallis Engineering, December 2015

Pump Station Name: Pump Station No. 12, Hathaway Park
Address: 799 25th Street
Date Constructed:

Condition: 1 - Very Good 3 - Needs significant maintenance 5 - Requires Replacement
2 - Slightly degraded 4 - Requires rehabilitation

General

Flow Meter Records	*Present?*	No
Pump Run Time Records	*Present?*	Yes
Operation and Maintenance Manual	*Present?*	No

Site

Visual Appearance	*Condition:*	2
Fence and Gate	*Condition:*	NA
Surfacing	*Type:*	Asphalt and Gravel
	Condition:	2
Parking Adequacy	*Condition:*	1
Washdown Hose Bibb	*Present?*	No
Backflow Prevention	*Present?*	No
	Type:	N/A

Ease of Pump Access 1

Overall Comments: This is a very small station in terms of footprint, barely noticeable.

Structure

Wet Well	*Structure Materials:*	Precast Concrete
	Dimensions:	~3' dia., 4.5'-6.5' operating depth
	Condition:	2
Valve Vault	*Structure Materials:*	Precast Concrete
	Depth:	Approx. 4'
	Condition:	2
Access Lid Fall Prevention	*Present?*	Yes
Vault Drain Discharge	*Present?*	Yes

Overall Comments: Two very small cylindrical vaults connect to the wet well to provide additional detention capacity. The vault furthest from the wet well typically collects significant solids.

Pump Station Name: Pump Station No. 12, Hathaway Park

Condition: 1 - Very Good 3 - Needs significant maintenance 5 - Requires Replacement
2 - Slightly degraded 4 - Requires rehabilitation

Pumps & Motors

Pumps	*No. Pumps:*	1
	Make/Model:	Paco PIP 503 B
	Capacity:	100 GPM
	HP:	1 HP
Rail	*Material:*	SS
	Condition:	2
Control Panel	*Type:*	None
	Seal-off Location:	Wet Well
Overall Comments:	None	

Discharge Forcemain

Discharge Piping	*Material:*	PVC
	Diameter:	3"
	Condition:	1
Force Main Length	Not known	
Check Valve	*Present?*	Not Confirmed
	Type:	
	Condition:	
Check Valve Flow Indicator	*Present?*	Not Confirmed
	Condition:	
Isolation Valve	*Present?*	Not Confirmed
	Type:	
	Condition:	
Pigging Station	*Present?*	No
	Type:	NA
	Condition:	NA
Pressure Gauge	*Present?*	No
Overall Comments:	None	

Pump Station Name: Pump Station No. 12, Hathaway Park

Condition: 1 - Very Good 3 - Needs significant maintenance 5 - Requires Replacement
2 - Slightly degraded 4 - Requires rehabilitation

Instrumentation

Flow Meter
Present? No
Location: NA
Type: NA
Condition: NA

Primary Level Indicator *Type:* None

Backup Level Indicator *Type:* NA

Overall Comments: Pump is run manually and periodically to pump down bathroom waste. Waste volume is typically low except in warmer months.

Alarms/Telemetry

Communications *Type:* None

Alarms None

Overall Comments: See Instrumentation above; telemetry is not necessarily required at this station.

General Electric

Primary Power *Type:* Electric, Clark County PUD

Backup Power
Type: None
Make/Model: NA
Fuel supply: NA

Overall Comments: Station has no backup power.

Completed by Wallis Engineering, December 2015

Pump Station Name: Pump Station No. 13, Daniel Park
Address: 1968 34th Street
Date Constructed:

Condition: 1 - Very Good 3 - Needs significant maintenance 5 - Requires Replacement
2 - Slightly degraded 4 - Requires rehabilitation

General

Flow Meter Records	*Present?*	No
Pump Run Time Records	*Present?*	Yes
Operation and Maintenance Manual	*Present?*	Yes

Site

Visual Appearance	*Condition:*	1
Fence and Gate	*Condition:*	1
Surfacing	*Type:*	Crushed Rock
	Condition:	3
Parking Adequacy	*Condition:*	1
Washdown Hose Bibb	*Present?*	Yes
Backflow Prevention	*Present?*	No
	Type:	N/A

Ease of Pump Access Poor

Overall Comments: Pump access is rated as poor due to low quality of surface grading and safe access by vehicle or appurtenant machinery. Site needs surfacing.

Structure

Wet Well	*Structure Materials:*	Precast Concrete
	Dimensions:	6' dia., 10'-11" operating depth
	Condition:	1
Valve Vault	*Structure Materials:*	Precast Concrete
	Depth:	Approx. 8'
	Condition:	2
Access Lid Fall Prevention	*Present?*	Yes
Vault Drain Discharge	*Present?*	Yes

Overall Comments: Evidence of significant infiltration in valve vault and possibly a plugged vault drain.

Pump Station Name: Pump Station No. 13, Daniel Park

Condition: 1 - Very Good 3 - Needs significant maintenance 5 - Requires Replacement
2 - Slightly degraded 4 - Requires rehabilitation

Pumps & Motors

Pumps
No. Pumps: 2
Make/Model: Flygt 3153.090
Capacity: 135 GPM
HP: 2.3 HP

Rail
Material: SS
Condition: 2

Control Panel
Type: Shelter
Seal-off Location: NA - Disconnect panel w/Meltric plugs.

Overall Comments: No on-site lighting.

Discharge Forcemain

Discharge Piping
Material: Ductile iron
Diameter: 4"
Condition: 2

Force Main Length 1500'

Check Valve
Present? Yes (2)
Type: Ball
Condition: 2

Check Valve Flow Indicator
Present? No
Condition: NA

Isolation Valve
Present? Yes (3)
Type: Plug
Condition: 2

Pigging Station
Present? No
Type: NA
Condition: NA

Pressure Gauge
Present? No

Overall Comments: Note bypass with camlock and unusual pipe support mounted laterally across vault.

Pump Station Name: Pump Station No. 13, Daniel Park

Condition: 1 - Very Good 3 - Needs significant maintenance 5 - Requires Replacement
2 - Slightly degraded 4 - Requires rehabilitation

Instrumentation

Flow Meter	*Present?*	No
	Location:	NA
	Type:	NA
	Condition:	NA
Primary Level Indicator	*Type:*	Multritrode
Backup Level Indicator	*Type:*	Multritrode
Overall Comments:	None	

Alarms/Telemetry

Communications	*Type:*	Mission cellular system
Alarms	High Water Low Water	
Overall Comments:	Note that, as the City's standard telemetry provider, the Mission cellular system is the assumed provider. However, Mission's stock label was absent from the control panel.	

General Electric

Primary Power	*Type:*	Electric, Clark County PUD
Backup Power	*Type:*	Gas-Powered Generator
	Make/Model:	Cummins Quiet Site
	Fuel supply:	Natural Gas
Overall Comments:	None	

Completed by Wallis Engineering, December 2015

Pump Station Name: Pump Station No. 14, Orchard View
Address: 4920 G Street
Date Constructed:

Condition: 1 - Very Good 3 - Needs significant maintenance 5 - Requires Replacement
2 - Slightly degraded 4 - Requires rehabilitation

General

Flow Meter Records	*Present?*	No
Pump Run Time Records	*Present?*	Yes
Operation and Maintenance Manual	*Present?*	Yes

Site

Visual Appearance	*Condition:*	1
Fence and Gate	*Condition:*	1
Surfacing	*Type:*	Asphalt Concrete
	Condition:	2
Parking Adequacy	*Condition:*	1
Washdown Hose Bibb	*Present?*	Yes
Backflow Prevention	*Present?*	No
	Type:	N/A
Site Lighting	Deficient	
Ease of Pump Access	Poor	

Overall Comments: Station is well maintained and discrete in visibility. No direct lighting to wet well. Site needs lighting.

Structure

Wet Well	*Structure Materials:*	Precast Concrete
	Dimensions:	6' dia., 14'-16" operating depth
	Condition:	1
Valve Vault	*Structure Materials:*	Precast Concrete
	Depth:	6.8'
	Condition:	1
Access Lid Fall Prevention	*Present?*	Yes
Vault Drain Discharge	*Present?*	Yes

Overall Comments: Wet well has mild grease issues; has mix flush valve.

Pump Station Name: Pump Station No. 14, Orchard View

Condition: 1 - Very Good 3 - Needs significant maintenance 5 - Requires Replacement
2 - Slightly degraded 4 - Requires rehabilitation

Pumps & Motors

Pumps
No. Pumps: 2
Make/Model: Flygt 3102.090
Capacity: 170 GPM
HP: 6.5 HP

Rail
Material: SS
Condition: 2

Control Panel
Type: Shelter
Seal-off Location: NA - Disconnect panel w/Meltric plugs.

Overall Comments: No on-site lighting.

Discharge Forcemain

Discharge Piping
Material: Ductile iron
Diameter: 4"
Condition: 1

Force Main Length 800'

Check Valve
Present? Yes (2)
Type: Ball
Condition: 1

Check Valve Flow Indicator
Present? No
Condition: NA

Isolation Valve
Present? Yes (3)
Type: Plug
Condition: 1

Pigging Station
Present? No
Type: NA
Condition: NA

Pressure Gauge
Present? No

Overall Comments: Note ARV and bypass with camlock. ARV not on maintenance schedule.

Pump Station Name: Pump Station No. 14, Orchard View

Condition: 1 - Very Good 3 - Needs significant maintenance 5 - Requires Replacement
2 - Slightly degraded 4 - Requires rehabilitation

Instrumentation

Flow Meter
Present? No
Location: NA
Type: NA
Condition: NA

Primary Level Indicator *Type:* Multritrode

Backup Level Indicator *Type:* Multritrode

Overall Comments: None

Alarms/Telemetry

Communications *Type:* Mission cellular system

Alarms
High Water
Low Water

Overall Comments: Control panel readout is unintelligible, and alarm disable (AD) key does not work properly. AD key issues should be addressed by an electrician and/or EE.

General Electric

Primary Power *Type:* Electric, Clark County PUD

Backup Power
Type: Gas-Powered Generator
Make/Model: Cummins Power Generation
Fuel supply: Natural Gas

Overall Comments: None

APPENDIX D
Wastewater Treatment Plant Design Data

CITY OF WASHOUGAL, WASHINGTON

FACILITY PLAN AMENDMENT

FINAL | **REPORT**

Wastewater Treatment Plant Expansion Project

Prepared by:

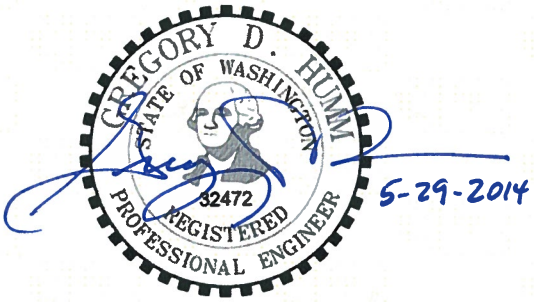
Brown and Caldwell

May 29, 2014

Brown AND Caldwell

Wastewater Treatment Plant Expansion Project: Facility Plan Amendment

Prepared for
City of Washougal, Washington
May 29, 2014



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Section 1

Introduction

The City of Washougal (City) is currently proceeding with implementation of recommendations outlined in the 2011 Wastewater Treatment Plant (WWTP) Facility Plan (Facility Plan), which was approved by the Washington State Department of Ecology in June 2013. The Facility Plan recommends and describes a phased approach to constructing plant improvements that are needed to accommodate future influent flow and loading conditions while continuing to comply with water quality requirements defined by the City's National Pollutant Discharge Elimination System (NPDES) permit.

The City has started preparing design documents for the Phase 2 expansion defined in the Facility Plan. The design, which is currently at a 60 percent level of completion, is being developed by Brown and Caldwell. Advancing the design from the planning level to the detailed design level has resulted in refinement of the general concepts described by the Facility Plan for the addition and/or expansion of unit processes within Phase 2. Additionally, a detailed evaluation of recent treatment plant performance has revealed process issues that may require alternative approaches and/or additional improvements not envisioned by the Facility Plan.

As such, this Facility Plan Amendment (Amendment) describes and documents various changes to the approved Facility Plan. The Amendment has been prepared as a stand-alone document. Cross-references to the Facility Plan are provided to facilitate coordination between the two documents. Portions of the Facility Plan that are not modified by this amendment remain unchanged.

Section 2

Study Area Characteristics and Existing Wastewater Treatment Plant

Section 2 of the Facility Plan presents an overview of the study area (climate, air, land, socioeconomic environment, etc.). A description of the existing wastewater treatment plant is provided beginning in Section 2.9. Topics discussed include evaluations of the mechanical process equipment at each unit process and electrical/control systems (Sections 2.10 and 2.12, respectively), along with a discussion of historical plant performance in Section 2.11.

This Amendment updates the description of plant performance in Section 2.11. All other portions of Section 2 of the Facility Plan remain unchanged.

2.11 Historical WWTP Performance

Section 2.11 of the Facility Plan provides an overview of effluent water quality limits specified in the National Pollutant Discharge Elimination System (NPDES) permit and describes the City of Washougal's record of compliance with the effluent water quality limits. This Amendment adds information to Section 2.11 by providing an analysis of WWTP performance between 2010 and 2013 as Section 2.11.1. Topics that are addressed in added Section 2.11.1 are as follows:

- variation in solids retention time (SRT)
- mixed liquor settleability data
- secondary clarification performance

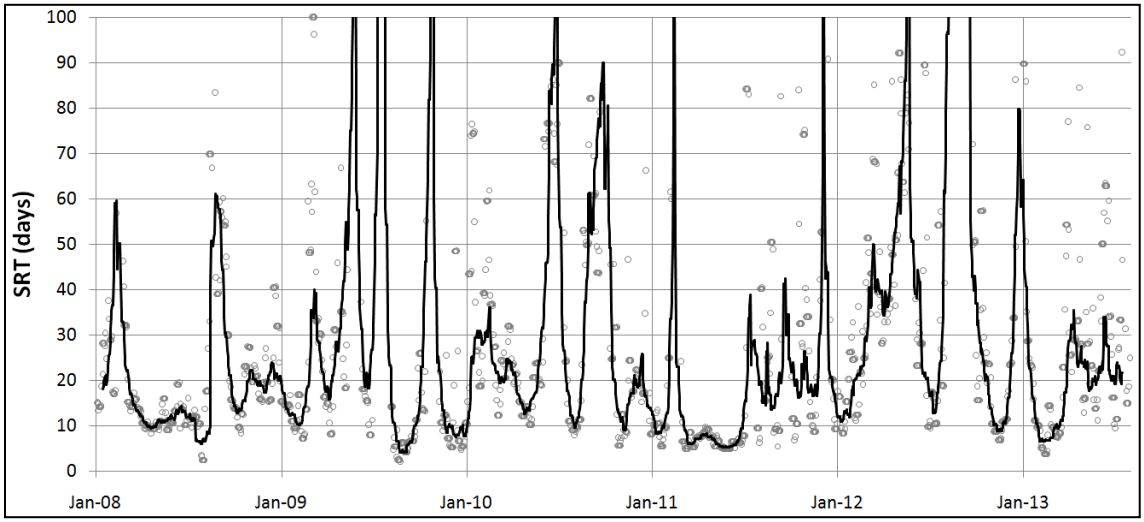
2.11.1 Secondary Treatment Performance, 2010 to 2013

Plant data from 2010 to 2013 were analyzed and used for the purposes of process modeling and to establish process design conditions. Findings and conclusions derived from that effort are provided in this section of the Amendment to supplement the information presented in the Facility Plan.

Solids Retention Time

An oxidation ditch is an extended aeration treatment system. Oxidation ditches are designed to operate at long solids retention times (SRTs). The operations and maintenance manual for the plant recommends operation of the ditch at between 15 and 25 days SRT. The Water Environment Federation (WEF) *Manual of Practice* suggests a range of 20 to 30 days. Operation within the targeted SRT range is expected to result in development of a stable, healthy microbiological population and well-settling solids in the mixed liquor.

Historical SRT data from 2008 through 2013 are plotted in Amendment Figure 2-1. The plot shows both the 7-day moving average (data points) and the 30-day moving average (line).



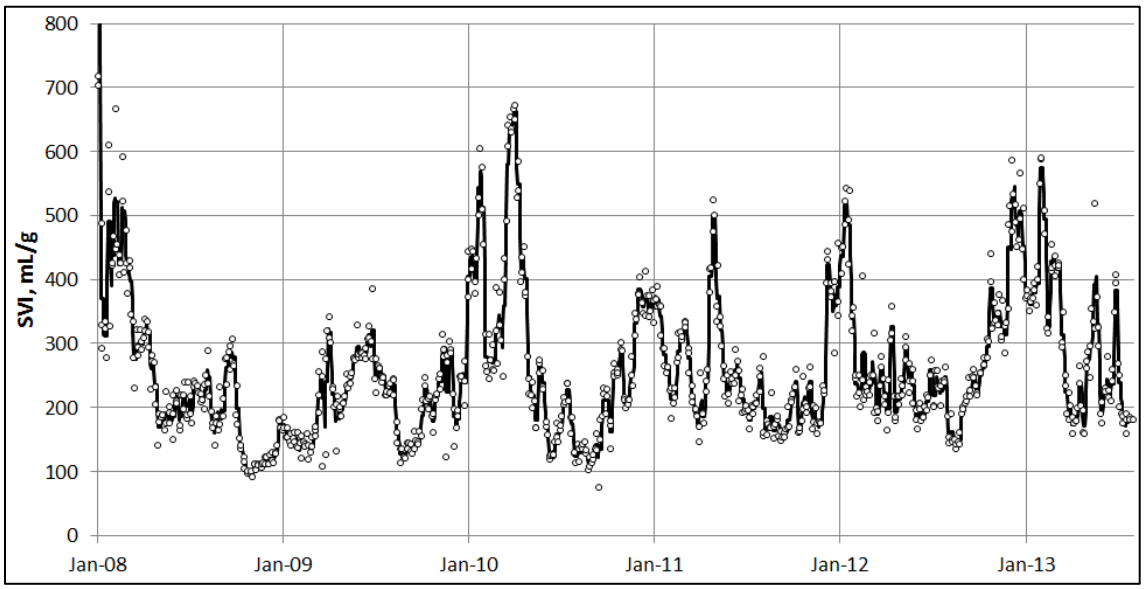
Amendment Figure 2-1. Plant SRT, 7-day moving average (points) and 30-day moving average (lines)

The SRT has varied widely through the period of record, shifting from a minimum of less than 7 days, to peaks that exceed 100 days. Under such conditions, a stable, healthy microbial community is difficult to maintain.

Settleability of Mixed Liquor Solids

Mixed liquor settleability is often represented by the sludge volume index (SVI), which is measured by allowing a sample of mixed liquor of known solids concentration to settle in a 2-liter container. Mixed liquor with an SVI of between 100 and 200 milliliters per gram (mL/g) is generally considered to be well settling, whereas higher SVI values indicate poor settling characteristics. Poor settleability of the mixed liquor suspended solids (MLSS) increases the risk of high suspended solids concentrations in the final effluent.

Analysis of plant data shows that historical SVI values are typically higher than the range of values generally desired in extended aeration systems. The plant operated with an SVI of between 100 and 200 mL/g relatively infrequently and periodically experiences SVI values that exceed 400 mL/g. SVI data between 2010 and 2013 indicate the plant's 90th and 95th percentile SVIs are 418 mL/g and 490 mL/g, respectively. A plot of the plant's historical SVI is provided in Amendment Figure 2-2.



Amendment Figure 2-2. Historical SVI, with 7-day moving average

Stabilizing the SRT is expected to result in a well-acclimated microbial community which will reduce the likelihood of poor settleability. This could be achieved by improved control of the sludge wasting process. Recommended changes to the waste sludge process to support operation within the recommended SRT range are presented in Section 5.3.11 of this Amendment.

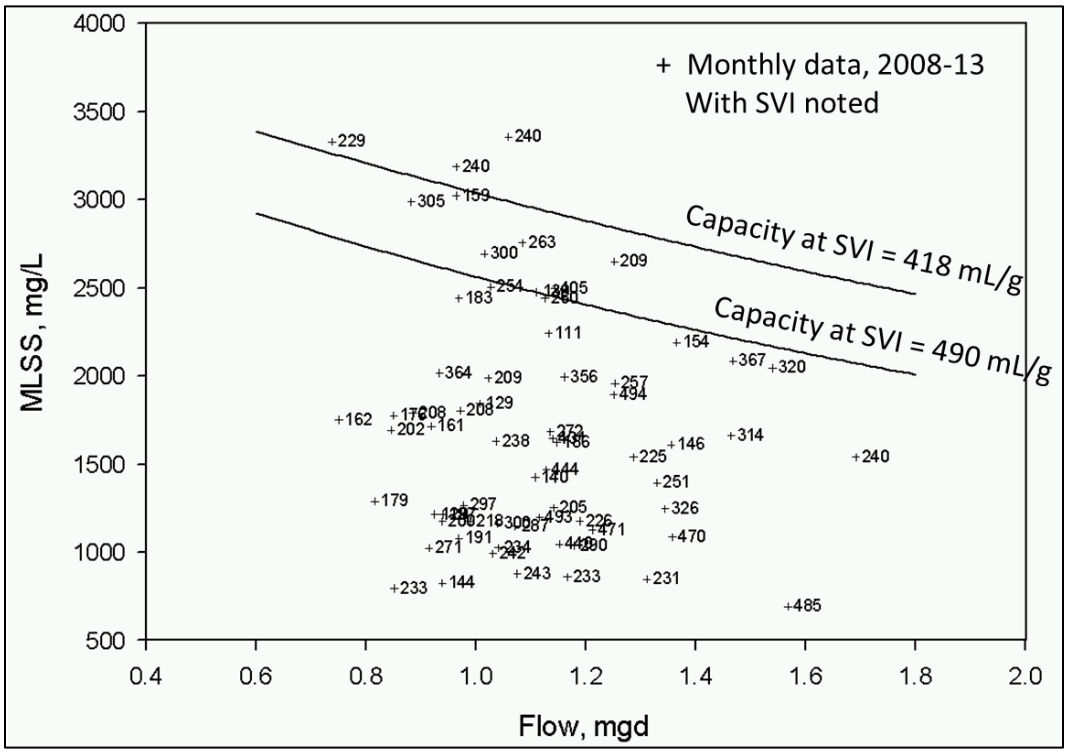
Secondary Clarification Performance

To understand the potential effects of poor SVI, the treatment performance of the secondary clarifiers requires analysis. The secondary clarifiers take oxidation ditch effluent and allow solids to settle out, discharging supernatant as effluent, and removing settled solids for recycling (return activated sludge [RAS]) or wasting (waste activated sludge [WAS]). Clarifier performance and capacity are based on the following three factors: flow, MLSS concentration, and settleability.

Clarifiers can handle a high flow, provided that the MLSS is low and the settleability is good. Likewise, clarifiers can handle poor settleability, provided that flow and/or MLSS concentrations are low. Capacity is a combination of all three parameters.

In spite of the poor sludge settleability, clarifier performance between 2008 and 2013 has been good. This is partially because flows and MLSS concentrations have been low enough to allow the clarifiers to settle solids effectively such that final effluent solids concentrations are well below the permit limits.

When rating clarifier capacity, an acceptable level of risk is considered. Capacity is typically assessed on the basis of either the 90th or 95th percentile risk levels. Amendment Figure 2-3 plots 66 months of data (January 2008 through September 2013). These months are plotted based on flow (X-axis) and MLSS concentration (Y-axis). Each month is labeled by the average SVI during that month. Two lines were superimposed on these data; they reflect the projected capacity of a single secondary clarifier operating at an SVI of 418 mL/g and 490 mL/g, respectively. The capacity projection is based on state point analysis, calibrated using 5 years of operational data.



Amendment Figure 2-3. Clarifier capacity versus monthly loadings

Note that while several months have exceeded SVI values of 418 and 490 mL/g, none of those months had average flows or MLSS concentrations that would place them above the two capacity lines on the figure.

Section 3

Existing and Future Wastewater Characteristics

Section 3 of the Wastewater Treatment Plant Facility Plan (Facility Plan) describes the existing and projected influent wastewater characteristics for the treatment facility. The Facility Plan projects wastewater flows through the year 2030 based on service area growth projected by the City of Washougal's (City) current General Sewer Plan (GSP) and a detailed analysis of wastewater flows and loads using data from 2003 through 2007.

This portion of the Facility Plan Amendment (Amendment) provides a summary of wastewater characteristics based on data from 2008 through 2013. A detailed analysis of flow and load data will be undertaken by the City as part of a planned GSP update which will be prepared in 2016.

3.3 Existing Flow and Waste Load

Section 3.3 of the Facility Plan summarizes plant influent flows and loads based on Daily Monitoring Reports from January 1, 2003 through December 31, 2007. This section of the Amendment expands the summary by adding new Sections 3.3.2 and 3.3.3, which describe influent flow and loading characteristics based on data from 2008 to 2012 and provides a comparison to the Facility Plan projections. New Section 3.3.4 describes the plan for establishing updated future flow and load projections.

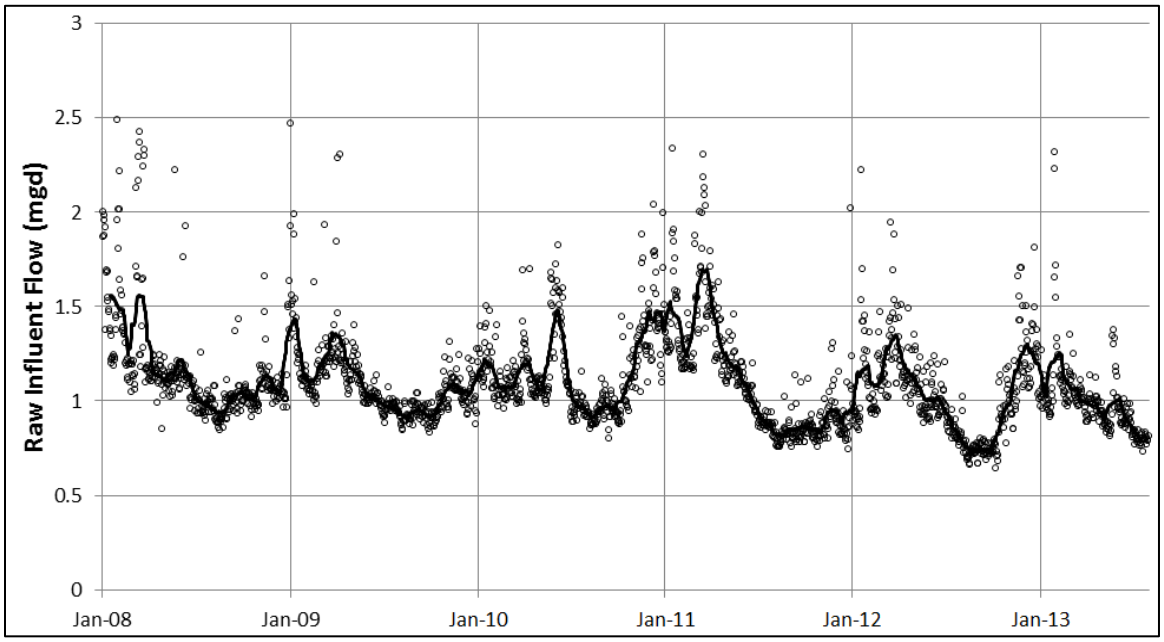
3.3.2 Plant Influent Data 2008 to 2012

Plant influent data for this time period are listed in Amendment Table 3-1.

Amendment Table 3-1. Plant Influent Flow and Loading History

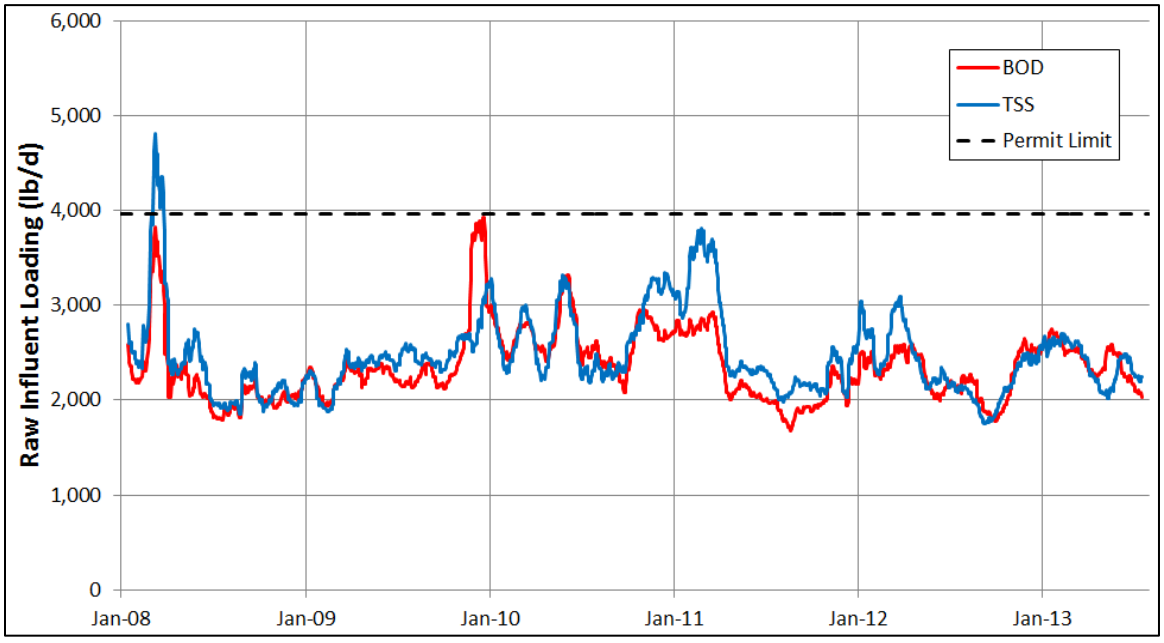
Parameter	2008	2009	2010	2011	2012
Flow, mgd[a]					
Average	1.17	1.09	1.15	1.10	1.03
Base sanitary	0.88	0.88	0.88	0.76	0.69
Dry weather	1.04	0.99	1.08	0.94	0.88
Wet weather	1.31	1.19	1.23	1.27	1.18
Maximum 30-day	1.56	1.37	1.52	1.70	1.35
Maximum day	2.48	2.47	2.04	2.33	2.22
BOD[b], ppd[c]					
Average	2,223	2,404	2,647	2,227	2,255
Maximum 30-day	3,825	3,926	3,320	2,920	2,682
Dry weather	1,987	2,255	2,595	1,962	2,066
Wet weather	2,458	2,553	2,700	2,493	2,455
TSS[d], ppd					
Average	2,420	2,439	2,692	2,555	2,316
Maximum 30-day	4,806	3,274	3,339	3,815	3,086
Dry weather	2,140	2,442	2,575	2,197	2,074
Wet weather	2,700	2,436	2,810	2,912	2,571
NH_4N, ppd					
Average	353	393	398	407	294
Maximum 30-day	450	525	548	558	337
Dry weather	351	421	419	372	302
Wet weather	355	365	377	445	286

Influent flow data from Amendment Table 1 are plotted in Amendment Figure 3-1.

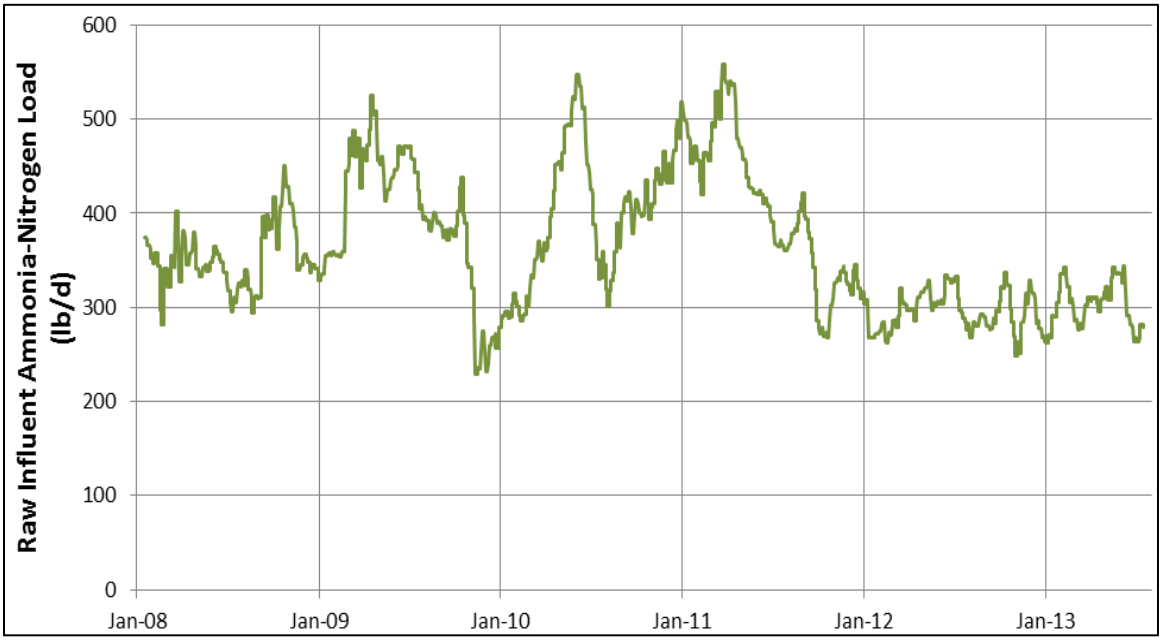


Amendment Figure 3-1. Influent BOD and TSS loading rates, 30-day moving average

Influent BOD and TSS loading data from Amendment Table 3-1 are shown in Amendment Figure 3-2 and influent ammonia data are plotted in Amendment Figure 3-3.



Amendment Figure 3-2. Influent BOD and TSS loading rates, 30-day moving average



Amendment Figure 3-3. Influent ammonia-nitrogen loading rate, 30-day moving average

3.3.3 Comparison Between Facility Plan Projections and Actual Conditions

Section 3.4 of the Facility Plan provides estimates of future flow and loading conditions based on growth rate projections defined in the GSP and industrial growth. The GSP was prepared at a time when the city was rapidly developing. Soon after its publication, the rate of development slowed and there has been very little growth since that time. Plant flows and loadings have been decreasing over the past 5 years. A comparison of projections from the Facility Plan and projections based on data collected from 2008 to 2012 are listed in Amendment Table 3-2.

Amendment Table 3-2. Comparison between Facility Plan Projections for 2012 and Actual Data

Parameter	Projection	Actual	Difference, percent
Flow, mgd			
Average day	2.24	1.03	-54
Maximum month	2.54	2.22	-12
Dry weather	2.15	0.88	-59
Wet weather	2.34	1.18	-49
BOD, ppd			
Average day	3,241	2,255	-30
Maximum month	4,424	2,682	-39
Maximum week	6,151	3,563	-42
Maximum day	7,946	4,526	-43
TSS, lb/d			
Average day	3,748	2,316	-38
Maximum month	4,957	3,086	-38
Maximum week	7,060	3,975	-44
Maximum day	10,676	4,817	-55
NH_4N, lb/d			
Average day	455	294	-35
Maximum month	621	337	-46
Maximum day	1,116	414	-63

3.3.4 Plan for Defining Future Influent Conditions

The future influent flow and load conditions will be refined as part of the GSP update that the City will undertake in 2016. Refining future influent conditions will involve analysis of the latest influent data, population growth projections defined by the City's Comprehensive Plan, per capita flow and load information, and projected increases in commercial and industrial wastewater discharges.

When completed, the GSP update will be submitted for approval by the Washington State Department of Ecology and will then serve as the basis of design for future plant improvements beyond Phase 2.

Section 4

Regulatory Requirements

This Amendment does not modify Section 4.

Section 5

Future Wastewater Treatment Plant Improvements

Section 5 of the Wastewater Treatment Plant Facility Plan (Facility Plan) describes the recommended improvements to the WWTP based on the projected influent flow and loading conditions, the capacity of the existing unit processes, and effluent water quality requirements. A phasing plan and opinion of probable cost for construction of the recommended improvements are described also.

Section 5 of the Facility Plan also provides recommendations for solids processing. Solids processing improvements will be undertaken as part of Phase 3; improvements that will be implemented under Phase 3 are not modified by this Amendment. The City of Washougal (City) intends to re-assess solids stream processing options including de-commissioning of the biosolids treatment lagoons prior to beginning the Phase 3 design and will produce a separate Facility Plan Amendment (Amendment) for the Washington State Department of Ecology (Ecology) approval that specifically addresses those improvements.

This portion of the Amendment updates and refines the recommended liquid stream improvements that will be addressed during Phase 2. Refinement has been achieved by virtue of advancing the planning-level concepts described in the Facility Plan through a preliminary design phase.

5.3 Unit Process Evaluation for Meeting Future Requirements–Liquid Stream

Section 5.3 of the Facility Plan describes either how each unit process meets future requirements or what upgrades are required. Amendment Figure 5-1 presents a process flow schematic for the expanded WWTP. Existing treatment structures, structures that will be constructed under Phase 2, and structures that will be constructed under Phase 3 are identified.

The hydraulic profile for the Phase 2 expanded plant is provided in Amendment Figures 5-2a and 5-2b.

The following sections of this Amendment describe design recommendations associated with the unit processes to be modified during Phase 2.

5.3.2 Influent Pump Station (IPS)

Section 5.3.2 of the Facility Plan describes the recommended improvements to the influent pumping system. The planning-level recommendation described in the Facility Plan is to replace the existing IPS pumps with larger units to provide adequate pumping capacity to handle the projected peak hour flow rate, and to undertake an evaluation during preliminary design to verify the existing manhole is large enough to accommodate larger pumps.

5.3.2.1 Preliminary Design Evaluations and Approach

During preliminary design, two options for increasing pumping capacity were evaluated. Option 1 entails replacing the existing influent pumps with new pumps located in the existing wet well. Option 2 consists of constructing a new facility that would operate in parallel with the existing pump station. These two options are described below.

- Option 1. Replace pumps in existing wet well: Replacement pumps for this option were found that would fit physically within the existing 144-inch manhole wet well. However, the separation between the pumps would be inadequate and would not meet commonly-accepted criteria. Moreover, the flow velocity of the wastewater entering the manhole is 5 feet per second (fps), which is considered to be excessive and results in potentially damaging hydraulic currents within the wet well. In addition, the velocities through the existing 12-inch-diameter discharge piping and 16-inch-diameter force main would be 9.8 fps and 11.2 fps, respectively. These high velocities would require replacement of the force main with a larger diameter pipeline and would also require consideration to be given to replacing the 12-inch-diameter discharge lines.

- **Option 2. Construct parallel IPS**: Construction of a parallel IPS (IPS-2) would involve intercepting the influent flow downstream of the headworks and upstream of the existing IPS (IPS-1), and directing the flow to a new pumping facility. The new facility would consist of a precast concrete manhole containing two new submersible pumps controlled by variable-frequency drives (VFDs). This option also would connect the force main from IPS-1 and the force main from IPS-2 together so that there would be a single discharge point at the new Oxidation Ditch Flow Distribution Structure (ODFDS). Implementation of this option would result in a total of five influent pumps that together would provide coverage for the expected range of flows.

When comparing both options, it is clear that implementation of Option 1 would result in very large pumps relative to the expected range of flows. It is also clear that the approach to the wet well would result in high velocities and turbulent flow that likely would impact the performance of the pumps and could have service life implications as well. As a result of these large, negative impacts to the performance and operation of the IPS-1, Option 2 was selected as the preferred approach for increasing influent pumping capacity to match the projected peak hour influent flow rate defined in the Facility Plan. Therefore, this Amendment refines the planning-level arrangement only for increasing influent pumping capacity as described in the Facility Plan.

Amendment Figure 5-3 illustrates the layout of the influent pumping system. As indicated in this figure, return flows will not be introduced prior to the sampling point.

5.3.2.2 Flow Metering

A new flow meter will be installed on the 20-inch force main from the IPSs to the ODFDS. The meter is located downstream of the point where the discharge pipes from each IPS are tied together, thus, flow from both pumping stations will be captured by the meter. The flow meter is the same size as the conveyance pipe, 20 inches in diameter, and is located in a straight run of pipe that provides at least four pipe diameters from the nearest bend or pipe appurtenance.

5.3.2.3 Influent Sampling

A flow-paced composite sampler is currently located at the headworks. The sampler collects samples of screened and de-gritted wastewater. Construction of a parallel IPS as described in Option 2 will not impact sample collection; wastewater samples will continue to be collected in compliance with the NPDES permit in terms of frequency and location. The signal from the new flow meter in the pump discharge pipe will be routed to the sampler.

5.3.2.4 Pumping System Operational Narrative

The two influent pumping stations will operate in parallel to achieve the firm pumping capacity of 11.0 million gallons per day (mgd). Under most flow conditions, only IPS-2 will be operational and IPS-1 will be kept in reserve until the incoming flow exceeds the capacity of IPS-2. Following is a brief description of how the two facilities operate together:

1. Wastewater flows from the headworks east through an existing 36-inch-diameter pipe to new manhole (MH) 31.
2. The flow drops vertically several feet in MH 31 and then flows south through a new 36-inch-diameter pipe to IPS-2.
3. The flow is conveyed to the ODFDS through the new 20-inch-diameter force main by one of two new submersible pumps in IPS-2.
4. When the incoming flow rate exceeds the capacity of a single pump, the second pump in IPS-2 is called to run.
5. When the incoming flow rate exceeds the capacity of both pumps, the water level in MH 31 rises until it flows into the existing 36-inch-diameter pipe to IPS-1.
6. Pumps in IPS-1 are called to run as needed up to the firm capacity of 11.0 mgd.
7. As the influent flow rate drops, the water level recedes to a point where wastewater no longer flows to IPS-1 and the pumps in IPS-1 shut off on low level.

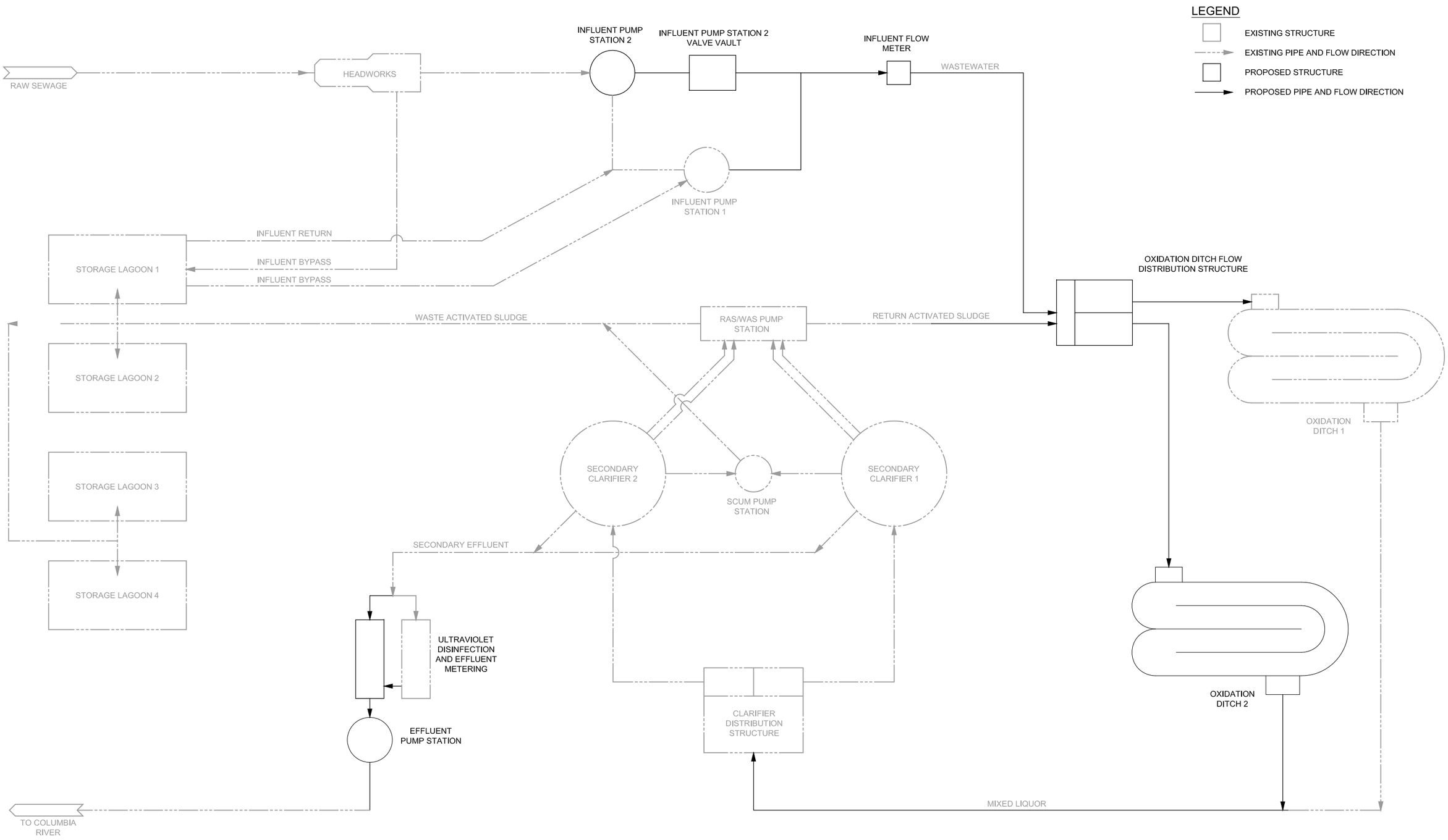


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FIGURE 5-1
PROCESS FLOW SCHEMATIC

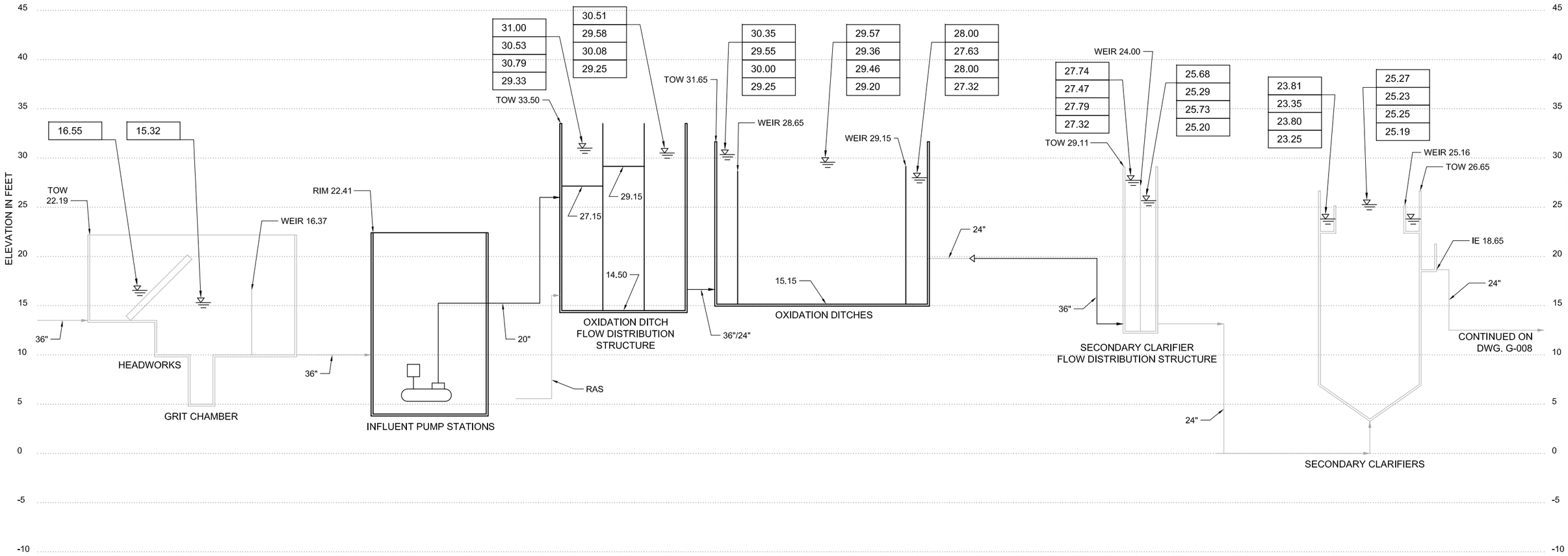
YEAR 2030 FLOWS (MGD) AND COLUMBIA RIVER STAGES (FT)		
	RAW WASTEWATER FLOW	RIVER STAGE
MDF	0.25	4.5 (7Q-10 LOW FLOW)
ADWF	3.64	4.5 (7Q-10 LOW FLOW)
MMWW	4.00	30.5 (25-YR FLOOD)
PHF	11.00	30.5 (25-YR FLOOD)

RAS FLOW RATE ASSUMPTIONS		
	FLOW	UNITS IN SERVICE
MDF	0.8 MGD	1 OXIDATION DITCH/1 SECONDARY CLARIFIER
ADWF	3.64 MGD	1 OXIDATION DITCH/1 SECONDARY CLARIFIER
MMWW	4.0 MGD	2 OXIDATION DITCHES/2 SECONDARY CLARIFIERS
PHF	10.0 MGD	2 OXIDATION DITCHES/2 SECONDARY CLARIFIERS

LEGEND

- EXISTING STRUCTURE
- EXISTING PIPE AND FLOW DIRECTION
- PROPOSED STRUCTURE
- PROPOSED PIPE AND FLOW DIRECTION
- EXISTING GROUND

22.10	2030 WATER SURFACE AT PEAK HOUR FLOW (PHF)
22.00	2030 WATER SURFACE AT MAX MONTH WET WEATHER FLOW (MMWW)
21.95	2030 WATER SURFACE AT AVERAGE DRY WEATHER FLOW (ADWF)
21.90	2030 WATER SURFACE AT MINIMUM DIURNAL FLOW (MDF)



HYDRAULIC PROFILE

SCALE: HORIZ NO SCALE, VERT 1" = 10'

GENERAL NOTES:

1. FLOWS INCLUDE RAS FLOWS PER DATA TABLE THIS DWG.
2. COLUMBIA RIVER STAGE AS SHOWN ON DATA TABLE THIS DWG.
3. FOR UV DISINFECTION, HYDRAULIC PROFILE FOR PEAK FLOW BASED ON 5.6 MGD CAPACITY PER CHANNEL. USE OF NEW UV CHANNEL ASSUMED AT FLOWS LESS THAN 5.6 MGD.
4. PIPES ARE SHOWN AS SINGLE LINES AT INVERT ELEVATIONS.
5. WATER SURFACE ELEVATIONS UPSTREAM OF INFLUENT PUMP STATION HAVE BEEN ESTABLISHED THROUGH PRIOR WORK PERFORMED BY OTHERS.
6. COLUMBIA RIVER STAGE DATA BASED ON USGS INFORMATION. 7Q-10 FLOW/STAGE IS DEFINED AS THE SEVEN CONSECUTIVE DAY LOW FLOW WITH A 10-YR RECURRENCE FREQUENCY.

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FIGURE 5-2a
HYDRAULIC PROFILE - PART 1

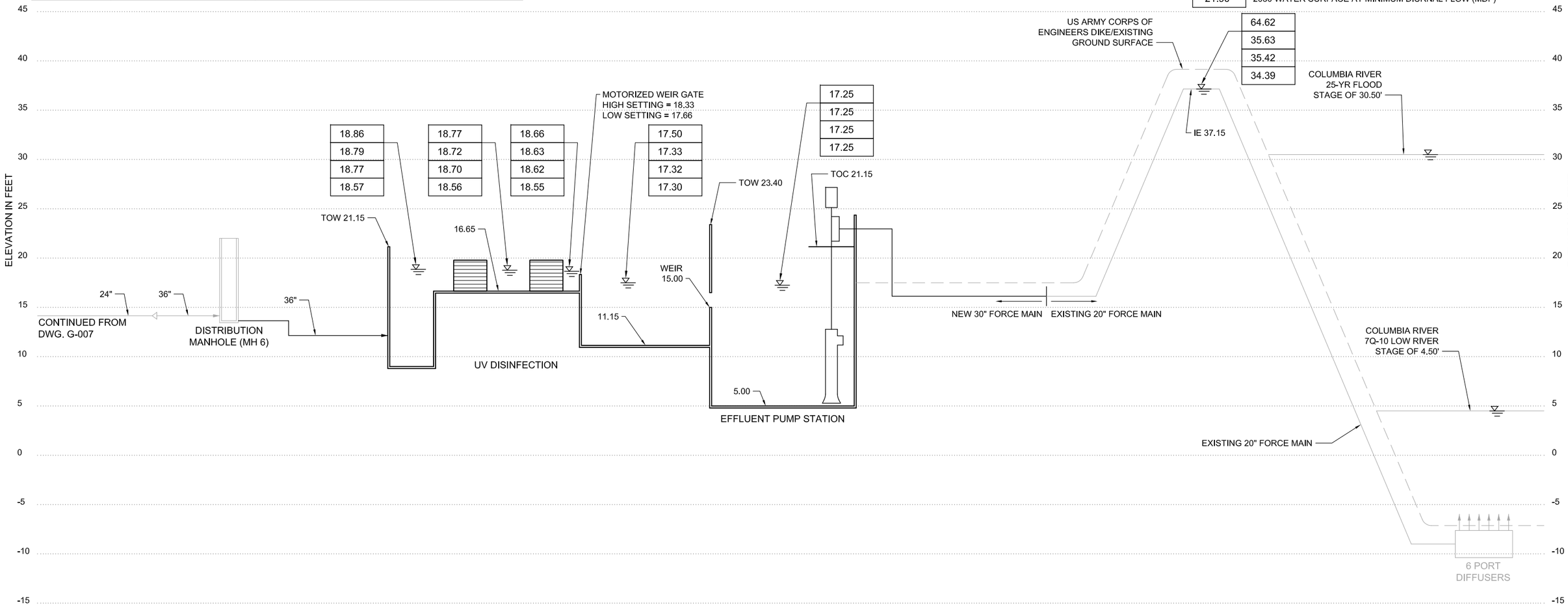
YEAR 2030 FLOWS (MGD) AND COLUMBIA RIVER STAGES (FT)		
	RAW WASTEWATER FLOW	RIVER STAGE
MDF	0.25	4.5 (7Q-10 LOW FLOW)
ADWF	3.64	4.5 (7Q-10 LOW FLOW)
MMWW	4.00	30.5 (25-YR FLOOD)
PHF	11.00	30.5 (25-YR FLOOD)

RAS FLOW RATE ASSUMPTIONS		
	FLOW	UNITS IN SERVICE
MDF	0.8 MGD	1 OXIDATION DITCH/1 SECONDARY CLARIFIER
ADWF	3.64 MGD	1 OXIDATION DITCH/1 SECONDARY CLARIFIER
MMWW	4.0 MGD	2 OXIDATION DITCHES/2 SECONDARY CLARIFIERS
PHF	10.0 MGD	2 OXIDATION DITCHES/2 SECONDARY CLARIFIERS

LEGEND

- EXISTING STRUCTURE
- EXISTING PIPE AND FLOW DIRECTION
- PROPOSED STRUCTURE
- PROPOSED PIPE AND FLOW DIRECTION
- EXISTING GROUND

22.10	2030 WATER SURFACE AT PEAK HOUR FLOW (PHF)
22.00	2030 WATER SURFACE AT MAX MONTH WET WEATHER FLOW (MMWW)
21.95	2030 WATER SURFACE AT AVERAGE DRY WEATHER FLOW (ADWF)
21.90	2030 WATER SURFACE AT MINIMUM DIURNAL FLOW (MDF)



GENERAL NOTES:

1. FLOWS INCLUDE RAS FLOWS PER DATA TABLE THIS DWG.
2. COLUMBIA RIVER STAGE AS SHOWN ON DATA TABLE THIS DWG.
3. FOR UV DISINFECTION, HYDRAULIC PROFILE FOR PEAK FLOW BASED ON 5.6 MGD CAPACITY PER CHANNEL. USE OF NEW UV CHANNEL ASSUMED AT FLOWS LESS THAN 5.6 MGD.
4. PIPES ARE SHOWN AS SINGLE LINES AT INVERT ELEVATIONS.
5. WATER SURFACE ELEVATIONS UPSTREAM OF INFLUENT PUMP STATION HAVE BEEN ESTABLISHED THROUGH PRIOR WORK PERFORMED BY OTHERS.
6. COLUMBIA RIVER STAGE DATA BASED ON USGS INFORMATION. 7Q-10 FLOW/STAGE IS DEFINED AS THE SEVEN CONSECUTIVE DAY LOW FLOW WITH A 10-YR RECURRENCE FREQUENCY.

HYDRAULIC PROFILE

SCALE: HORIZ NO SCALE, VERT 1" = 10'

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FIGURE 5-2b
HYDRAULIC PROFILE - PART 2

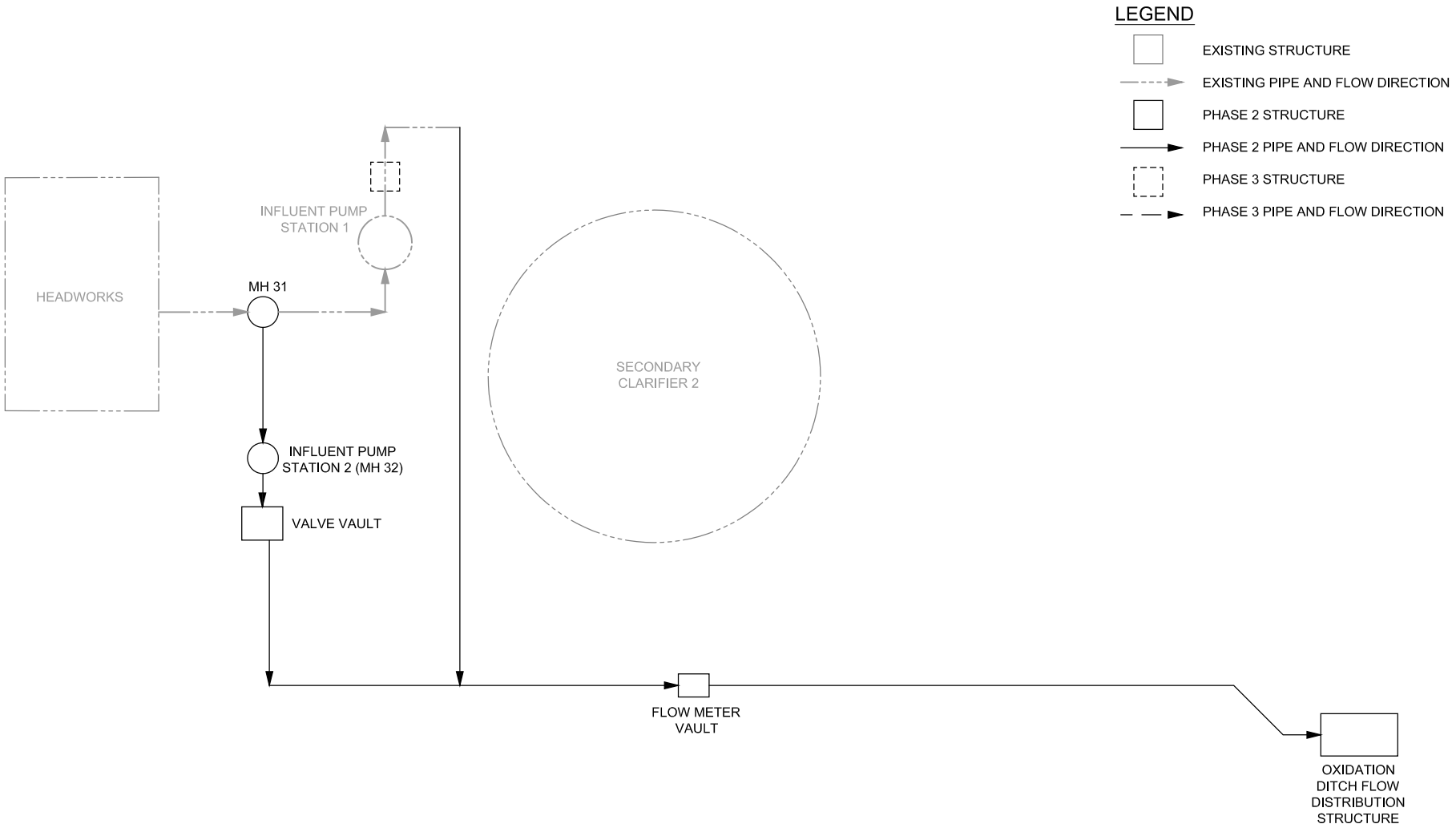

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FIGURE 5-3
INFLUENT PUMPING SYSTEM LAYOUT

5.3.4 Secondary Treatment Expansion

Section 5.3.4 of the Facility Plan describes process criteria and expansion requirements for the secondary treatment process. This section of the Amendment replaces Section 5.3.4 in its entirety.

5.3.4.1 Overview

Secondary treatment components include a bioselector basin, ODFDS, oxidation ditches, secondary clarifiers, RAS/WAS pumping facilities, and secondary scum pumping facilities. Expansion of the secondary treatment facilities are consistent with recommendations made in the General Sewer Plan.

5.3.4.2 Biological Process Evaluation and Calibration

The biological process within the oxidation ditch was modeled using the BioWin 4.0 simulator (EnviroSim Associates, Ltd., Hamilton, Ontario, Canada). The purpose of biological process modeling is to improve the understanding of existing ditch operation and to project performance against future flows and loadings. The model was used to assess ditch capacity, define and/or validate design criteria and assumptions, and suggest operational or structural refinements to optimize plant performance. The model was calibrated using historical data from 2012 to 2013 and data collected in September 2013 as part of a wastewater characterization effort. The model uses the following process parameters:

- Flow and load projections per Table 3-11 of the Facility Plan
- Volume of the new oxidation ditch to match existing ditch in terms of volume (1.8 million gallons [MG]), layout (serpentine), and equipment arrangement (aerators and mixers)
- Clarifier 3 to match existing clarifier dimensions (84 feet in diameter, 15 feet side water depth, suction header type sludge removal system)
- Design solids retention time (SRT) of 20 days
- Chemical oxygen demand (COD) concentration/biochemical oxygen demand (BOD) concentration = 1.73
- NH_4N concentration/total Kjeldahl nitrogen concentration = 0.828
- COD concentration/total phosphorus concentration = 72.89

The existing oxidation ditch has a rated capacity of 2.24 mgd. According to the Facility Plan, the expanded secondary treatment process will need to handle the projected 2030 BOD, total suspended solids (TSS), and ammonia loads listed in Table 3-11 of the Facility Plan, which are reproduced in Amendment Table 5-1.

Amendment Table 5-1. Projected Wastewater Loads[a]

	Annual average, ppd[b]	Maximum month, ppd	Maximum week, ppd	Peak day, ppd
BOD_5[c]	6,696	9,142	12,710	16,419
TSS	7,219	9,547	13,596	20,561
Ammonia	857	1,170	1,626	2,101

[a]*Values listed are as reported in Table 3-11 of the Facility Plan*

[b]*ppd = pounds per day*

[c]*BOD_5 = 5-day BOD*

5.3.4.3 Bioselector Basin

It may be necessary to incorporate a bioselector into the secondary treatment process to promote denitrification and improve sludge settling by providing anoxic conditions which would inhibit growth of filamentous bacteria. A bioselector would be needed if sludge settleability cannot be improved through operational changes. The bioselector would be constructed as a separate basin located upstream of the oxidation ditches.

5.3.4.3.1 Process Overview

Bioselectors reduce bulking and foaming potential by creating an environment that dis-favors filamentous microorganisms. Bioselectors, whether aerobic, anaerobic, or anoxic, act by removing readily biodegradable chemical oxygen demand (RBCOD) from the influent. Filamentous bacteria use RBCOD for growth, so by removing it, the selector removes their principal source of food.

Anoxic selectors promote denitrification, where denitrifying bacteria use RBCOD to drive the reaction from nitrate to nitrogen gas. This allows for nitrogen removal and also promotes the growth of denitrifying bacteria, which are floc-forming (good-settling).

Anaerobic selectors promote the growth of phosphorus-accumulating organisms (PAOs), which uptake and store RBCOD within the selector and use it for cell growth in the downstream aerated zones. PAOs have a high cell density which promotes good settling.

Whether a bioselector is anoxic or anaerobic depends on the amount of nitrate present in the selector. Although the Washougal WWTP typically nitrifies, much of the nitrate is reduced to nitrogen gas within the oxidation ditch, resulting in a low nitrate concentration in the RAS. As a result, a bioselector at the WWTP is expected to be primarily anaerobic.

5.3.4.3.2 Relationship Between Sludge Settleability Issues and Lack of SRT Control

Poor sludge settleability has been a chronic operating condition at the Washougal WWTP as documented in Section 2.11.1 in this Amendment. As discussed in that section, poor sludge settleability appears to be tied closely to the lack of maintaining a stable SRT. Adding a bioselector basin into the secondary treatment process may reduce the likelihood of filamentous growth and bulking, however without stabilizing SRT, poor settleability is likely to persist. Therefore, the principal approach to resolving settleability issues is to improve SRT control by implementing operational changes, which may include pumping improvements by replacing the existing WAS pumps and improving control of the wasting process by adding a solids density meter to allow real-time control. These changes are more completely discussed in Section 5.3.11 of this Amendment.

Implementing operational changes to improve SRT control is expected to promote the development of a stable microbial community that will have more consistent settling characteristics. This is a cost-effective first step that the City can take, with approval from Ecology, before investing in construction of a bioselector basin.

5.3.4.3.3 Bioselector Design Criteria, Conceptual Layout, and Process Schematic

Ecology has published design criteria for wastewater treatment facilities in Washington. The publication, *Criteria for Sewage Works Design* (*Orange Book*) provides fundamental design criteria for bioselector basins as follows:

- Selectors are a means of controlling SVI in the biological treatment of wastewater, particularly treatment using a suspended growth process (oxidation ditches are a suspended growth process).
- Design should include provisions for returning a portion of the RAS to the influent of the selector. The return flow to the selector should be set by the operator from approximately 30 percent to 100 percent of the total RAS flow.
- Hydraulic detention times range from 10 to 45 minutes. Typical sizing is 30 minutes at the design flow with detention times of no less than 10 minutes under peak flow conditions.
- The basin should be compartmentalized into three or more tanks with the third tank double the size of the first two tanks.
- A mixer should be provided in each tank.
- The food-to-microorganism (F/M) ratio should be as high as possible in the first tank; typical values range from 6 to 30.

Amendment Table 5-2 summarizes design values for the bioselector based on the design criteria listed above.

Amendment Table 5-2. Design Values for Bioselector

Parameter	Design values
Minimum volume[a]	90,000 gallons
Depth	15 feet
Hydraulic retention time	30 minutes

[a]*Volume listed is minimum value required by Ecology guidelines. Actual volume may be larger and will be established in Phase 3.*

A conceptual layout of a three-tank bioselector that complies with Ecology's design criteria outlined above is shown in Amendment Figure 5-4. As shown in the process schematic in Amendment Figure 5-5, influent wastewater would be routed into the bioselector basin and RAS would be added in a controlled manner by positioning valves that would control the distribution of RAS that is blended with the incoming wastewater versus being routed directly to the oxidation ditch. The mixture would then flow to the ODFDS. A site plan that identifies the bioselector location on the plant site is shown in Amendment Figure 5-6.

5.3.4.3.4 Determining Need for Bioselector

Operational improvements and physical upgrades to the waste sludge process are described in Section 5.3.11 of the Amendment. These measures are intended to improve sludge settleability and result in SVI values that are consistently within the range of typical values for treatment plants using oxidation ditch technology.

Following implementation of the improvements noted in Section 5.3.11, SVI values and other pertinent data will be recorded over a 12 month assessment period. If the 95th percentile SVI value over the 12 month period is less than or equal to 160 mL/g, the bioselector basin will not need to be added into the treatment process. Conversely, if the 95th percentile SVI value over the 12 month period is greater than 160 mL/g, the City has the following options:

1. Construct the bioselector basin in Phase 3.
2. Undertake an assessment of clarifier capacity to determine whether clarifier capacity is sufficient for the projected 2030 flows and solids loading.

The City should not utilize chemicals to enhance settleability.

Clarifier capacity can be determined by stress testing one of the clarifiers to establish secondary clarification capacity as a function of sludge settleability. A computational fluid dynamic model of the clarifier is developed, calibrated against sludge setting data obtained during the stress test, and validated against historical conditions. Using the SVI data recorded over the 12 month assessment period, an estimate of clarifier capacity is derived by applying the dynamic model. In the event settleability has not improved such that the estimated secondary clarifier capacity is adequate to handle the design influent flow and load conditions, the City will need to construct the bioselector as part of Phase 3.

5.3.4.4 Oxidation Ditch Flow Distribution Structure

This section describes the Oxidation Ditch Flow Distribution Structure.

5.3.4.4.1 Background and Facility Plan Recommendations

The addition of a second oxidation ditch requires a means of distributing flow between the two. The ODFDS accomplishes this flow split. Flow distribution between the two basins will be accomplished by using flumes that are symmetrical, set at the same elevation, and operate in parallel with each other such that the flow is split equally between the two flumes.

RAS will be introduced at the ODFDS in lieu of providing separate feed points at each oxidation ditch. This arrangement will provide mixing of the RAS with the wastewater and will result in an even distribution of the RAS between the two oxidation ditches. It also eliminates the need for numerous and expensive valving and piping.

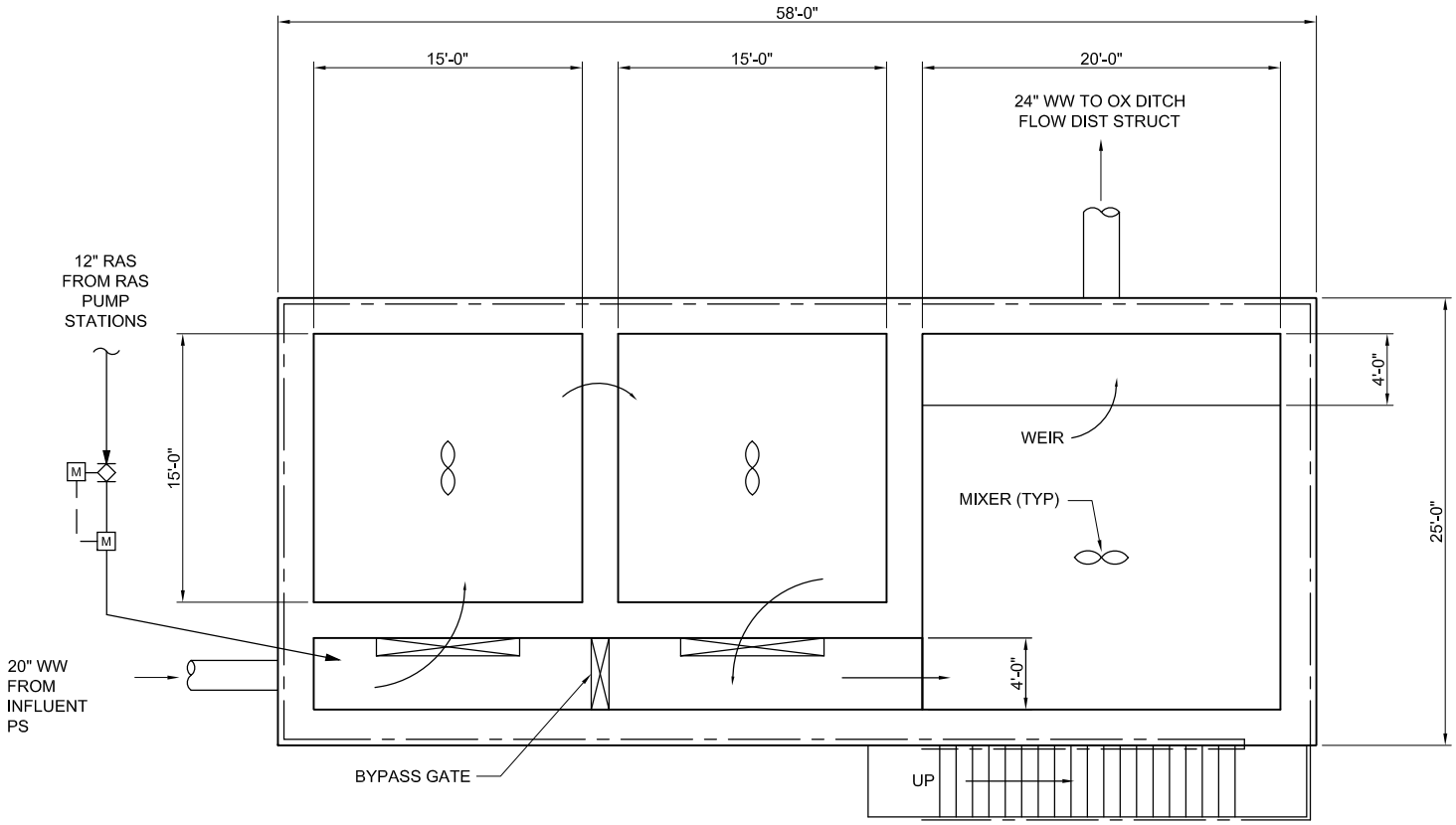

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FIGURE 5-4
CONCEPTUAL LAYOUT OF BIOSELECTOR BASIN

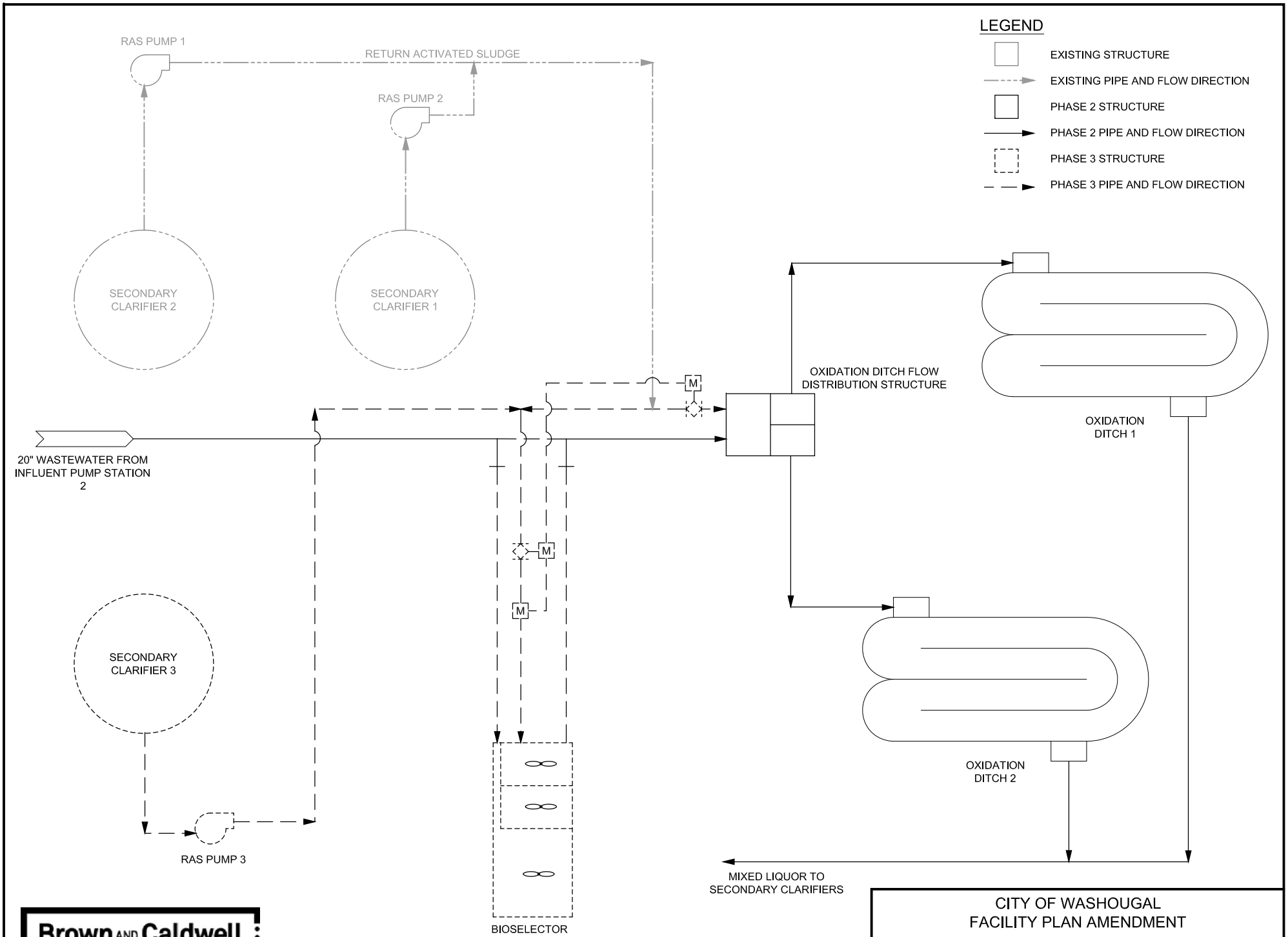
LEGEND
EXISTING STRUCTURE
EXISTING PIPE AND FLOW DIRECTION
PHASE 2 STRUCTURE
PHASE 2 PIPE AND FLOW DIRECTION
PHASE 3 STRUCTURE
PHASE 3 PIPE AND FLOW DIRECTION
RAS PUMP 1
RETURN ACTIVATED SLUDGE
RAS PUMP 2
SECONDARY CLARIFIER 2
SECONDARY CLARIFIER 1
SECONDARY CLARIFIER 3
OXIDATION DITCH FLOW DISTRIBUTION STRUCTURE
OXIDATION DITCH 1
OXIDATION DITCH 2
20" WASTEWATER FROM INFLUENT PUMP STATION 2
M
M
M
RAS PUMP 3
BIOSELECTOR
MIXED LIQUOR TO SECONDARY CLARIFIERS
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FIGURE 5-5
SECONDARY PROCESS FLOW SCHEMATIC WITH BIOSELECTOR

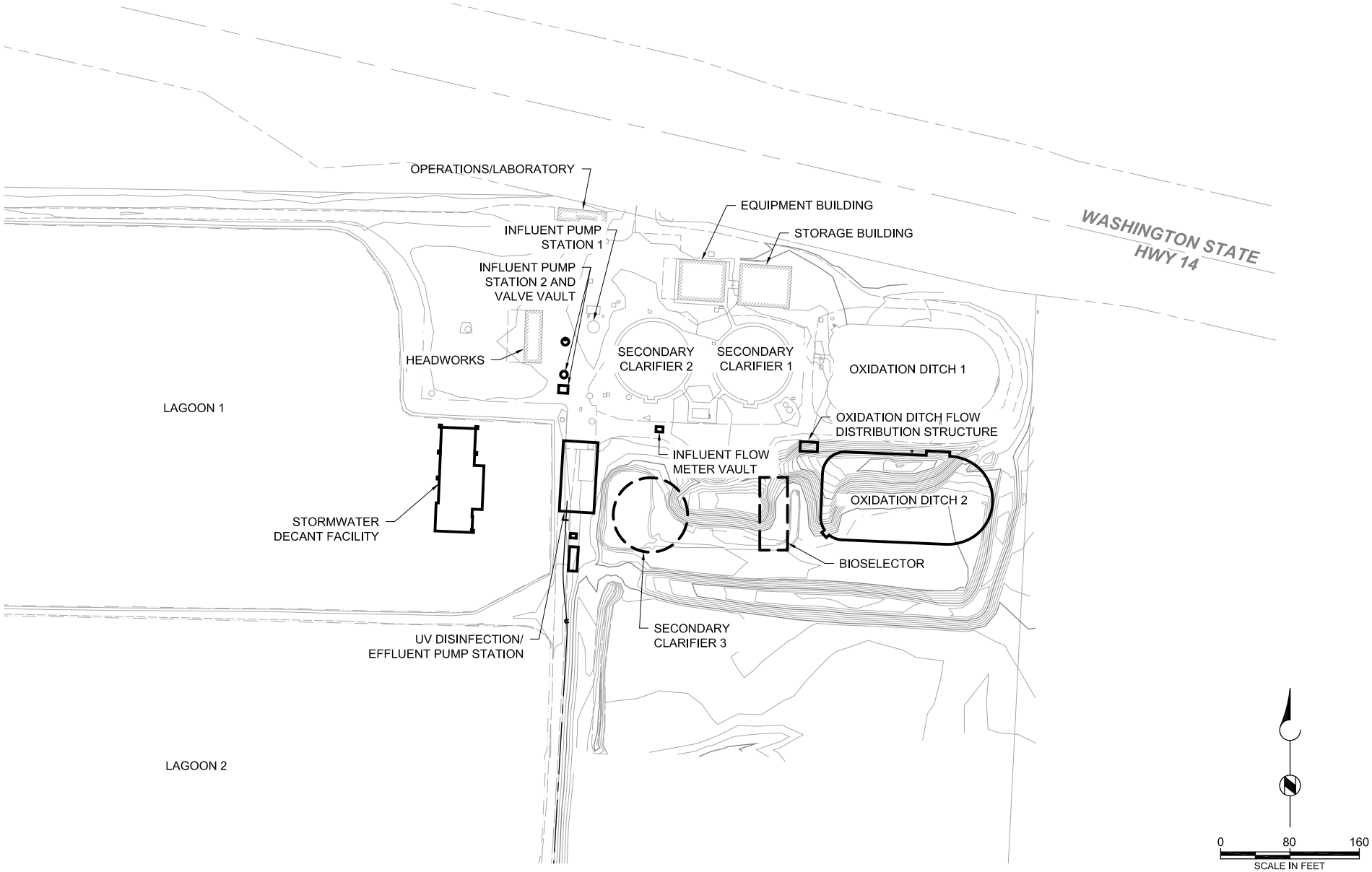

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FIGURE 5-6
SITE PLAN WITH BIOSELECTOR

5.3.4.4.2 Design Criteria

The projected 2030 peak hour flow reported by the Facility Plan is 11.0 mgd. Assuming the addition of the 10.1 mgd maximum capacity of the existing and future RAS pumps, the ODFDS is designed for a maximum flow rate of 21.1 mgd.

5.3.4.4.3 Configuration and Equipment

The ODFDS is a concrete structure that consists of an inlet box, two slide gates for flow control and isolation, two cutthroat flumes, and two separate outlet boxes, one for each oxidation ditch. The ODFDS rises approximately 13 feet above the surrounding grade to contain a water surface elevation that is approximately 1 foot above the oxidation ditches. A stairway will provide access to the top of the structure.

Flow from the influent pumping system enters the ODFDS through a pipe that rises vertically into the inlet box. RAS also enters the inlet box from a pipe discharging from above, causing intense mixing. Two stainless-steel slide gates, one dedicated to each oxidation ditch, are provided to isolate flow to the oxidation ditch when one of them is out of service. These gates are manually-operated, and will be either fully open or fully closed, depending on the operational status (in service or out of service) of each oxidation ditch.

Each slide gate leads directly to one of two cutthroat flumes. To ensure an equal split of wastewater to each ditch, both flumes will be identical in size and set at the same elevation. When both oxidation ditches are in operation, the cutthroat flumes will divide flows evenly between them. Downstream of the flumes, the two outlet boxes will keep the flows separate but allow velocities to decrease, preventing air entrainment as the contents travel back underground to the oxidation ditches.

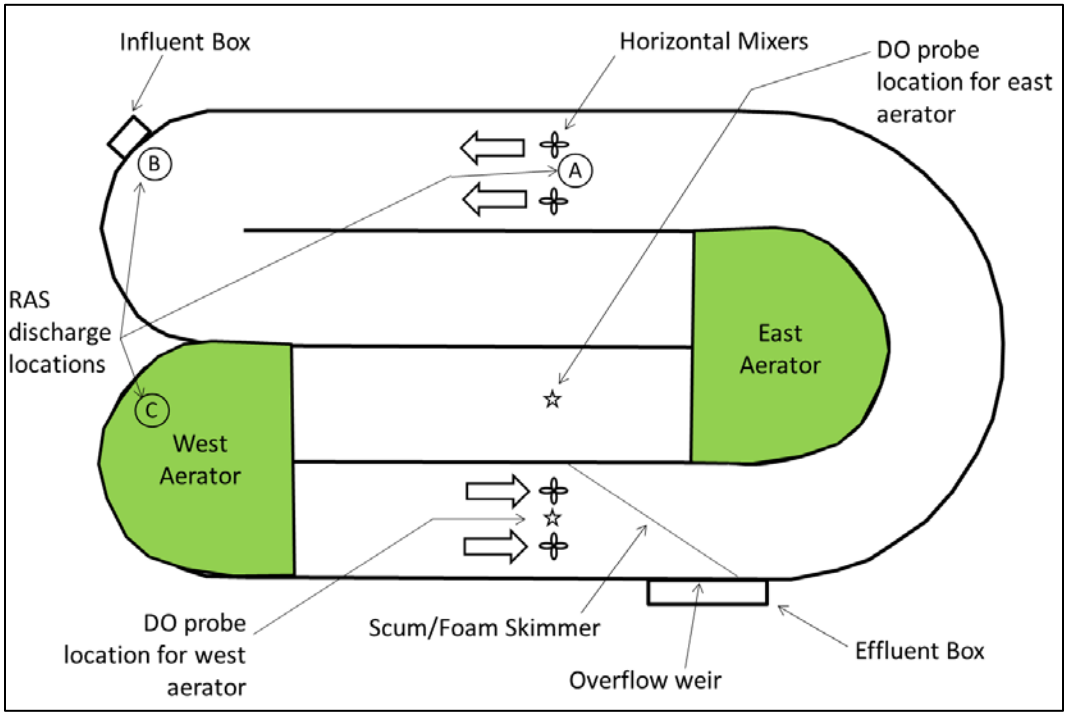
5.3.4.5 Oxidation Ditch

The following paragraphs describe the oxidation ditch configuration and operation.

5.3.4.5.1 Existing Arrangement

Secondary treatment is currently accomplished by use of an existing oxidation ditch and two existing secondary clarifiers. The oxidation ditch provides aeration and biological oxidation, while the clarifiers settle and remove the sludge that is created in the process.

Wastewater from the IPS enters the existing oxidation ditch at the bottom of a small forebay. The wastewater overflows a weir in the forebay and enters the ditch's main channel, where it is mixed with the rest of the ditch's contents. Surface aerators and mixers located along the serpentine path of the ditch's main channel circulate the contents and provide oxygen for biological consumption. An effluent weir allows the mixed liquor to leave the oxidation ditch through an afterbay. The existing oxidation ditch is shown schematically in Amendment Figure 5-7.



Amendment Figure 5-7. Existing oxidation ditch configuration

The new oxidation ditch will be nearly identical to the existing ditch and will be located south of the existing ditch.

5.3.4.5.2 Process Design Criteria

Amendment Table 5-3 summarizes the process design criteria for the existing oxidation ditch as well as the expanded plant (two oxidation ditches). Based on analysis that indicates that simultaneous nitrification-denitrification (SND) will occur in the ditches, a separate denitrification zone within the oxidation ditch will not be necessary.

Amendment Table 5-3. Process Design Parameters for Oxidation Ditch[a]

Parameter	Design Value
Raw wastewater influent characteristics	
Peak hour flow rate	11.0 mgd
Maximum month flow rate	4.36 mgd
Maximum month influent BOD	9,140 ppd
Maximum month influent TSS	9,600 ppd
Process criteria	
Target SRT	20 days
SRT range	15 - 25 days
Design SVI	160 mL/g[b]
MLSS[c] concentration	2,500 – 3,500 mg/L[d, g]
MLVSS:MLSS ratio	78%
RAS return rate	4.36 mgd
F/M ratio	0.09 pound TSS/pound BOD
Oxidation ditch	
Ditch volume	3.6 MG
Depth	14 feet
Hydraulic retention time at 100% RAS	
Maximum month wet weather flow	19.8 hours
Peak hour flow	7.9 hours
Maximum month oxygen demand	4,100 ppd
Peak day oxygen demand	4,850 ppd
Aerator efficiency	3.5 lb/hp[f]/hour
Maximum month power demand	73.5 hp
Peak day power demand	86.8 hp

[a]*Process criteria are calculated at the maximum month condition– flow of 4.36 mgd, influent BOD load of 9,140 ppd. Calculations are carried out for the winter condition, with a mixed liquor temperature of 12 degrees Celsius at an SRT of 15 days. The winter condition is more limiting than the summer condition, due to higher flows and loadings.*

[b]*mL/g = milliliters per gram*

[c]*MLSS = mixed liquor suspended solids*

[d]*mg/L = milligrams per liter*

[e]*MLVSS = mixed liquor volatile suspended solids*

[f]*hp = horsepower*

[g]*MLSS range as per Orange Book*

5.3.4.5.3 Configuration, Equipment, and Details

The new oxidation ditch will be the same size as Oxidation Ditch 1 to provide equivalent capacity. This eliminates the need to proportion flow appropriately between basins when both are in service and provides full redundancy. The two basins will be similar in other respects as well as in terms of number and capacity of aerators, mixers, and other equipment as listed in Amendment Table 5-4. The orientation of the incoming and outgoing pipes will differ slightly between the two ditches, but each basin will operate and function in the same manner.

Amendment Table 5-4. Oxidation Ditch Equipment

Equipment	Quantity	Type	Capacity rating, hp
Surface aerators	2	Platform-mounted, vertical impeller, variable-speed	100
Horizontal mixers	4	Low-speed, submersible, variable-speed	7.5
Vertical mixers	1	Platform-mounted, right angle, constant-speed	10

The primary difference between the two oxidation ditches will be in regard to RAS distribution points. The existing oxidation ditch has three alternative locations for discharging RAS into the ditch. Because RAS will be introduced into the ODFDS upstream of the oxidation ditches (or at a future bioselector), multiple RAS distribution points in the oxidation ditches are no longer needed. The new ditch will not have RAS distribution provisions, and the provisions in the existing ditch will be decommissioned permanently during Phase 2.

5.3.4.5.4 Operational Narrative

Two conditions must be controlled in the oxidation ditch: aeration to meet dissolved oxygen (DO) demand and mixing to keep solids in suspension in the mixed liquor.

- **Aeration:** The two surface aerators will be controlled on the basis of DO concentration in the mixed liquor. Each aerator will be controlled by a DO meter located approximately 50 feet downstream, with a setpoint of 1.2 to 1.5 mg/L. As flows or loads change, the setpoint may require adjustment. A secondary point of control would be a DO meter located just upstream of the aerators. The DO at this location should be less than 0.50 mg/L to optimize SND performance.
- **Mixing**: Horizontal mixers are needed to maintain the biological solids in suspension when the aerators are operating at reduced speeds. A minimum horizontal velocity of 1 foot per second is required. According to the current Operations and Maintenance Manual, this flow velocity can be met when total hp draw is 70, with either or both of the aerators in operation. When total aerator hp draw goes below this rate, horizontal mixer operation is required to maintain the velocity of the mixed liquor in the oxidation ditch aeration basin. Power requirements will be confirmed during commissioning of the Phase 2 improvements.

The horizontal mixers should be operated to make up the deficit between the total aerator hp that is provided by the aerators and the total hp required for full mixing. Controls will adjust the operating speed of the mixers automatically every 5 minutes based on total aerator hp draw averaged over the previous 5 minutes. The applicable formula is as follows:

Formula:

hp deficit = 70 hp – total aerator hp

If hp deficit is <0, the aerators are providing ample mixing energy and the mixers do not need to operate

If hp deficit is >0, the horizontal mixer hp setting = hp deficit to be supplied by the mixers

Example:

average aerator hp draw during the previous 5 minutes = 40 hp

hp deficit = 70 - 40 = 30 hp of mixing energy must be provided by the horizontal mixers

speed setting for each of four mixers in operation= speed needed to draw 7.5 hp per mixer

The vertical mixer ensures adequate mixing of the incoming wastewater with the ditch contents. This mixer will operate independently of the aerators and horizontal mixers, with only ON/OFF functionality.

5.3.4.6 Secondary Treatment Process Capacity Analysis

Secondary clarifier capacity is dependent upon several factors, including settleability of the mixed liquor. Improved sludge settleability will increase clarifier capacity. Treatment capacity should be determined under the improved settleability conditions and full-scale stress testing and more advanced modeling should be undertaken to establish clarifier capacity. This effort should be completed prior to Phase 3 to fully define the need for expansion and to optimize the design of the new clarifier.

5.3.5 Ultraviolet (UV) Disinfection

This section of the Amendment presents the background and Facility Plan recommendations, design criteria, and an operational narrative for the UV disinfection system.

5.3.5.3 Background and Facility Plan Recommendations

The existing UV disinfection system consists of a single-channel medium-pressure lamp unit with two banks of lamps in an enclosed reactor. This UV4000 Low Flow (UV4000LF) product, manufactured by Trojan Technologies, Inc. of London, Ontario, Canada, has been in service for about 12 years. The UV4000LF unit uses medium-pressure lamps, which use 2,800 watts (W) each. There are two banks of eight lamps each in series, with expansion capability of one additional two-lamp module per bank. The current system has a total of 16 lamps and draws approximately 45 kilowatts (kW) of power at full load operation.

The existing UV disinfection system has a peak flow capacity of 5.6 mgd that provides a delivered UV dose of 24,000 microwatts per second per square centimeter (mW-sec/cm^2) at 65 percent UV transmittance. It is designed to achieve a disinfection limit of less than 400 fecal coliform per 100 milliliters (mL) on a 7-day geometric mean basis and 200 fecal coliform per 100 mL on a 30-day geometric mean basis. The UV4000LF system has controls that are capable of flow-pacing the number of lamps in operation, but little other instrumentation. Moreover, control through supervisory control and data acquisition (SCADA) is not available, nor is control of UV dose based on transmittance. The manufacturer developed and marketed the UV4000LF for smaller installations and for minimal instrumented control. The UV4000LF product is no longer marketed and may have limited future product support.

The Facility Plan recommended that a second parallel UV channel with a capacity of 5.6 mgd be added to provide a total flow capacity of 11.2 mgd. This would be adequate for the projected 11.0-mgd year 2030 flow rate. The Phase 2 design is consistent with this approach.

The new UV system uses a low-pressure, high-output (LPHO) lamp system with two banks of lamps in series. The new lamps are 250 W and are dimmable to about 60 percent of full light output. The system will have UV intensity monitors in each lamp bank and a single UV transmittance monitoring system. The total draw at full power is about 15 kW. A new building will be constructed for the new and existing UV systems' weather protection and ease of operation.

5.3.5.4 Design Criteria

Ecology's *Orange Book* allows UV disinfection as an alternative to chlorine disinfection and provides design guidelines for these systems. The guidelines are narrative in nature covering UV dose, UV transmittance, hydraulic conditions, flow rate, water depth control, and instrumentation.

The UV disinfection system will consist of the existing and new UV systems, each with a flow capacity of 5.6 mgd, providing a total capacity of 11.2 mgd. The system will be based on a UV transmittance value of 65 percent. Transmittance data obtained during September 2013 indicate that UV transmittance is typically in the range of 62 to 73 percent. The average of 54 values measured was 67.2 percent. Design criteria and permit requirements are summarized in Tables 5-5 and 5-6, respectively. Design criteria selected for this new UV system comply with *Orange Book* requirements.

Amendment Table 5-5. Disinfection-Related Permit Conditions

Parameter	Units	Value
Fecal coliform: weekly geometric mean	cfu per 100 mL	<400
Fecal coliform: monthly geometric mean	cfu per 100 mL	<200

Amendment Table 5-6. UV Disinfection Design Criteria

Parameter	Unit	Existing UV channel	New UV channel[a]
Lamp technology	-	Medium-pressure	LPHO
Channels	number	1	1
Peak flow capacity[b]	mgd	5.6	5.6
UV transmittance at 253.7 nanometers	percent	>65	>65
Channel width	inches	45	40[c]
Channel depth	inches	97	54
Straight channel length	feet	32	32
Banks per channel	number	2	2
Lamps	number	16	60
Lamp power	W	2,800	250
UV total power draw	kW	45	15
UV dose	mW-sec/cm^2	24	30

[a]*New UV channel parameters based on the Trojan technologies UV3000+. Other competing systems may vary somewhat from these values.*

[b]*Total disinfection capacity will be 11.2 mgd.*

[c]*Channel width is based on potential future expansion of the new system to 11.2 mgd.*

5.3.5.5 Operational Narrative

The UV disinfection system will have two parallel channels to provide a total flow capacity of 11.2 mgd at the peak hour flow rate in 2030. The new LPHO system will be the base load system operating at all flows between 0 and 5.6 mgd. The existing UV4000LF system will be the high-flow backup system and will be brought online when flow rates exceed 5.6 mgd. This normally occurs during wet weather conditions. The following is a brief description of how the facility is designed to operate:

1. Secondary effluent from the clarifiers flows to a manhole outside of the UV disinfection/effluent pump station (EPS) building. Normally, flows of up to 5.6 mgd are routed to the new UV channel and the existing UV channel is not in operation.
2. Flow rate is measured by a level instrument and weir at the effluent end of the new UV channel.
3. When total flow rate in the new UV channel exceeds 5.6 mgd, the motorized slide gate at the inlet end of the existing UV channel is opened and the UV equipment is energized.
4. Flow is split between the two channels based on hydraulic conditions in the channels.
5. Flow rate through the existing UV channel is measured by a level sensor and fixed weir at the outlet end of the UV channel.
6. When total flow summed between the two parallel channels drops below 5.6 mgd for a preset period of time, the inlet gate to the existing UV channel is closed and the equipment in the channel is de-energized.
7. The number of lamps in operation in the existing UV channel is paced by flow rate, but the control is limited to operation of one or both banks of lamps.
8. The number of lamps in operation in the new UV channel is paced by both flow rate and UV transmittance. One or both lamp banks can be operated and the individual lamps can be dimmed to about 60 percent of peak output. Control of UV dose will be provided through the SCADA system.
9. Alarms will indicate when operating conditions are outside of pre-selected limits. Alarms will be transmitted through the SCADA system.

UV intensity monitors in both channels determine when lamp sleeves require automatic cleaning and initiate the cleaning process from the control panel. The SCADA system will prevent more than one bank of lamps from being cleaned at a time.

5.3.6 Effluent Pumping System

This section of the Amendment describes recommendations, design criteria, the preliminary design evaluations and approach, the pump selection, and an operational narrative for the effluent pumping system.

5.3.6.3 Existing Facility and Facility Plan Recommendations

The existing EPS consists of a 144-inch manhole wet well containing two 60-hp vertical-turbine pumps controlled by VFDs. The pump motors are located outside without protection from the weather. The EPS is located to the southwest of lagoon 4 and conveys final effluent to the discharge point in the Columbia River through a 20-inch-diameter force main. The firm capacity of the EPS with one of the pumps out of service is 2,000 gallons per minute (gpm) or 2.9 mgd. Each of the pumps discharges through a 10-inch-diameter pipe to a valve vault where each line has check and isolation valves. Downstream of the isolation valves, the discharge lines combine into a single 20-inch-diameter force main. Between the valve vault and the discharge point, the force main contains a flow meter that records the flow rate discharging to the Columbia River.

The Facility Plan recommended replacing the two existing EPS pumps with larger units to provide capacity for the 2030 peak hourly flow rate of 11.0 mgd. Although the Facility Plan provided preliminary pump sizing, the specific number of pumps and pump capacity was left to be determined during preliminary design. The Facility Plan suggested two options for the system: install three, 75-hp pumps plus one standby pump; or install two, 125-hp pumps plus one standby pump. In addition, the Facility Plan recommended that consideration be given to sheltering the pumps.

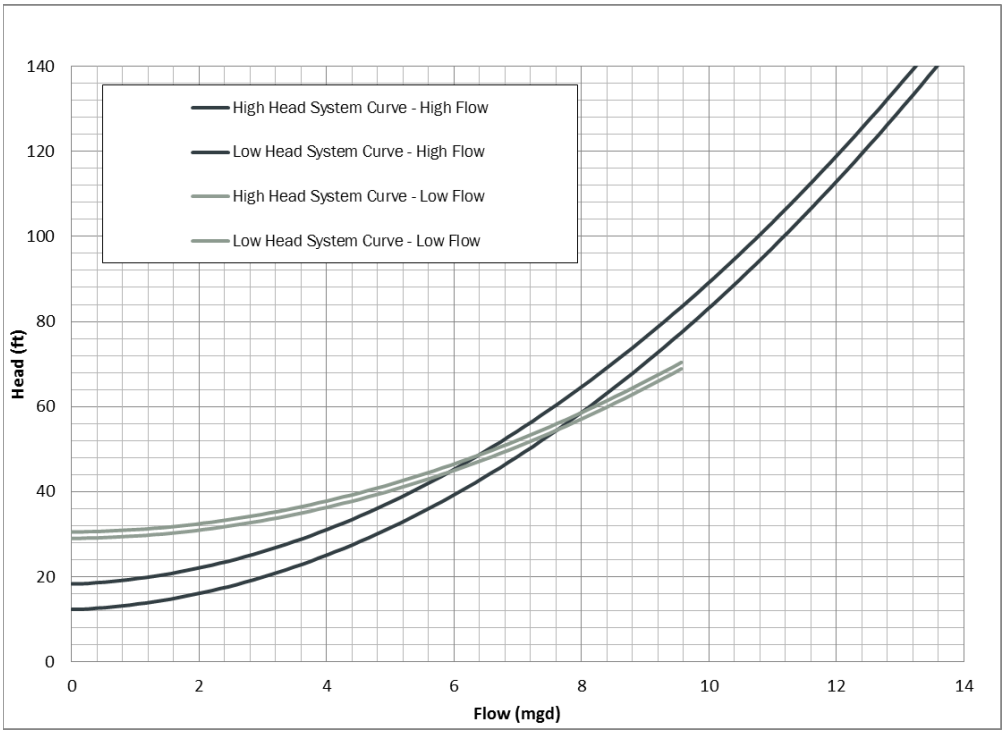
5.3.6.4 Preliminary Design Evaluations and Approach

At the start of the upgrades project, the City requested that consideration be given to locating the replacement effluent pumps in the same building at the expanded UV disinfection system. This move requires the effluent force main to be extended approximately 1,600 feet, bringing the total length of the pipeline to approximately 8,400 feet, not including the diffuser section.

The diffuser section is approximately 100-feet-long and has six, 4-inch discharge ports with duckbill-type check valves. The ports are oriented to direct the flow downstream.

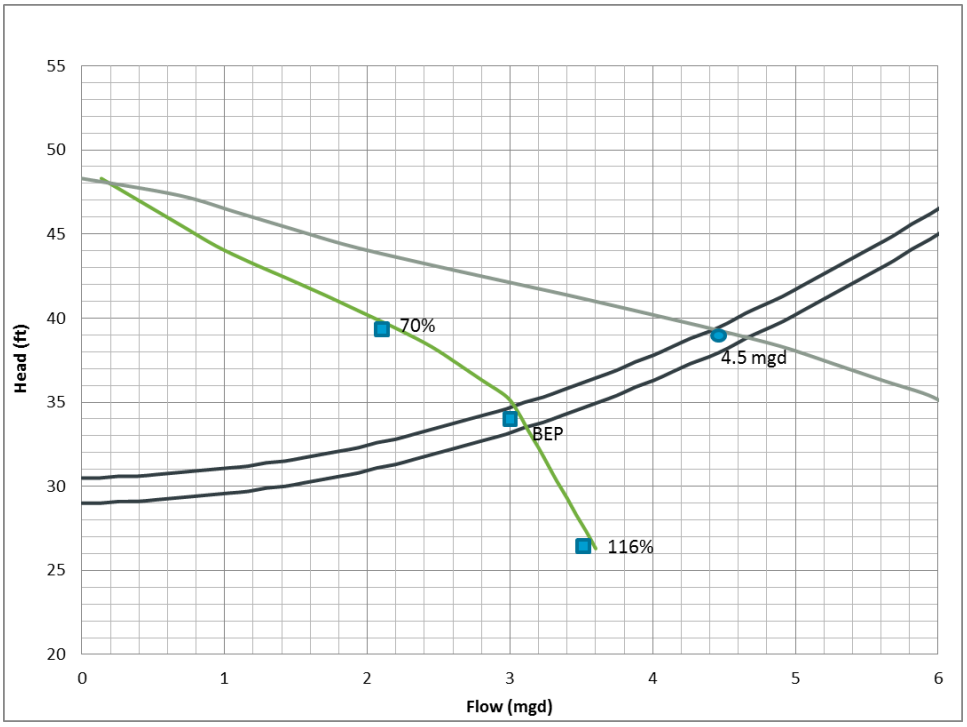
The effluent pipeline runs from the proposed UV disinfection/EPS building south along the eastern edge of lagoons 2, 3, and 4, and then turns west along the southern edge of Lagoon 4. At the southwestern corner of Lagoon 4, which is the site of the current EPS, the pipeline heads roughly southwest toward the Columbia River. Then the pipeline turns roughly northwest to follow the alignment of Index Street, which runs parallel to the Columbia River levee. At roughly the intersection of Index Street and South 27th Street, the pipeline turns back southwest, crosses through the levee, and enters the Columbia River. The levee crossing contains the high point of the alignment and has an air release valve installed.

Because the geometry of the effluent pipeline has the intermediate high point at the levee, during lower flow periods, the pumping system pressurizes the line to that point only and the static lift is the difference between the high point and the wet well level. Downstream from the high point, the pipeline runs by gravity to the river. As flows increase, the capacity of the gravity section is taken up until the entire effluent pipeline is pressurized and the static lift becomes the difference between the river and wetwell levels. This difference in system curves is illustrated in Amendment Figure 5-8.



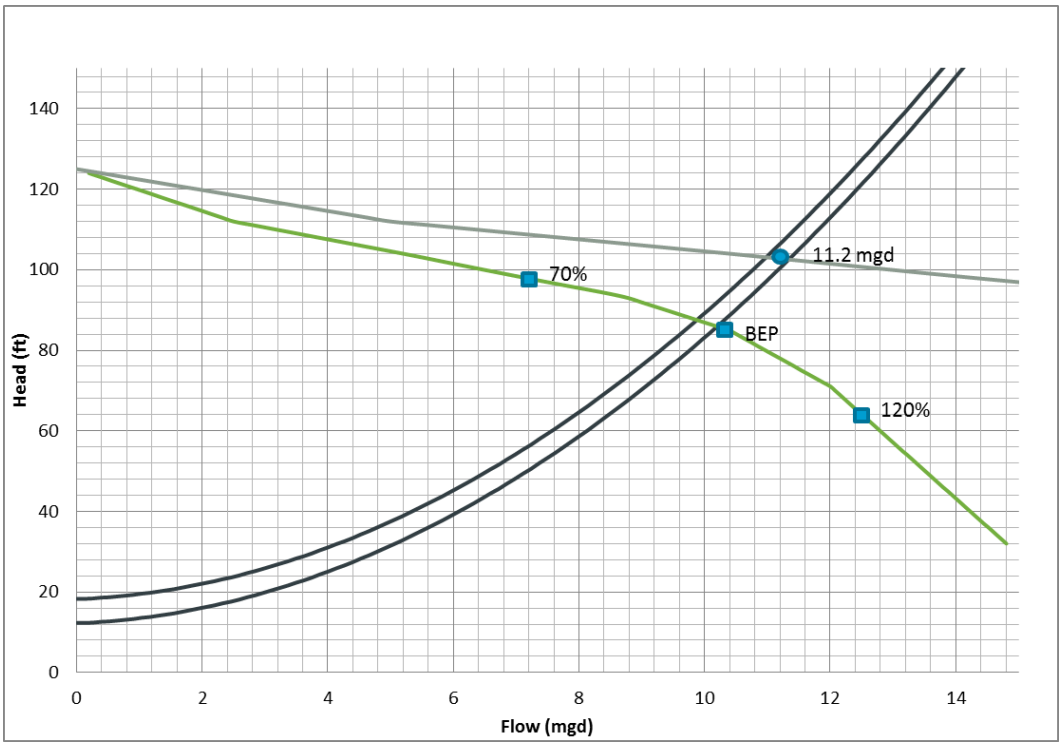
Amendment Figure 5-8. Effluent pipeline system curves

To accommodate the range of flow and discharge conditions, pumps of two different sizes are required. Two smaller pumps provide capacity at lower flows when the effluent pipeline is not fully pressurized. In this scenario, the flow is pumped to the high spot in the pipeline within the Columbia River levee and the flow then goes by gravity to the river through the diffuser. Pump curves for this scenario are provided in Amendment Figure 5-9.



Amendment Figure 5-9. Small effluent pump curves

Three larger pumps provide firm capacity for the 11-mgd design flow when the pipeline becomes fully pressurized. This scenario occurs when the portion of the pipeline on the river side of the levee reaches its gravity flow capacity and the pumps are required to push the increased flow through the diffuser. Pump curves for this scenario are provided in Amendment Figure 5-10.



Amendment Figure 5-10. Large effluent pump curves

5.3.6.5 Pump Selection

As described above, the pumps installed at the EPS will need to move final effluent from the Washougal WWTP to the Columbia River during both low- and high-flow scenarios. The pumps selected during preliminary design for these two scenarios are listed in Amendment Table 5-7.

Amendment Table 5-7. Effluent Pump Station Pumps Design Criteria

Parameter	Design criteria	
Pump size	Small	Large
Number of pumps	2	3
Type	Vertical-turbine	Vertical-turbine
Manufacturer	Patterson	Patterson
Model number	17JHC	24RHC
Pump speed, revolutions per minute	1,150	880
Maximum efficiency, percent	81	85
Suction-specific speed, dimensionless	6,660	8,180
Motor hp, each	25	200
Drive type	Variable-frequency	Variable-frequency
Single pump capacity, mgd	3.1	10.2
Two pump capacity, mgd	4.5	11.2
Firm capacity of effluent pumping system, mgd	11.0	

5.3.6.6 Operational Narrative

The EPS contains two sets of pumps, large and small, that together cover the range of expected flows up to a firm capacity of 11.0 mgd. However, under most flow conditions, only the small pumps will be running and the large pumps will be kept in reserve until the flow from the UV channels exceeds the capacity of the small pumps. The following is a brief description of how the facility is intended to operate:

1. Flow passes through the UV system over control weirs and collects in a channel upstream of the effluent pumps.
2. The water level in the collection channel is maintained at a constant level by the VFDs that control the small effluent pumps.
3. When the incoming flow rate exceeds the capacity of a single small pump, the second small pump is called to run and both pumps are controlled by the VFDs to maintain a constant level.
4. When the incoming flow rate exceeds the capacity of both small pumps, the pumps are ramped down and a large pump is called to run.
5. The water level in the collection channel is maintained at a constant level by the VFDs that control the large effluent pumps.
6. When the incoming flow rate exceeds the capacity of a single large pump, the second large pump is called to run and both pumps are controlled by the VFDs to maintain a constant level up to the 11.0 mgd firm capacity of the pumping system.
7. As the flow rate drops, the large pumps will no longer be required and the small pumps will be placed back into service.

It is important to note that the air/vacuum relief valve located at the high point of the effluent pipeline in the levee must be maintained in good working order for the pipeline to operate effectively.

5.3.8 Auxiliary Processes

This section of the Amendment discusses upgrades to auxiliary systems within the WWTP.

5.3.8.1 Plant Water Pumps

Two plant water pumps are provided at the UV facility. These pump disinfected final effluent into the plant water system for use at hose bibs, spray nozzles, etc. The existing pumps will be relocated to the new effluent flow channel and re-connected to the distribution system. A new hydropneumatic tank will be installed in the UV disinfection/EPS building.

5.3.8.2 Electrical Power Distribution

Electrical power service to the plant that is provided by Clark Public Utilities (CPU). CPU delivers electric power service to the site via an overhead 12.47 kilovolt (kV) line that runs along Washington State Route (SR) 14. Three utility power services are brought to the WWTP. The first serves the operations building and is routed overhead from three 75–kilovolt-ampere (kVA) pole-mounted transformers. The second serves the process loads at the plant and is routed underground from a pole drop on SR 14 to an existing 1,000 kVA pad-mounted utility transformer at the north end of the site. The third service is provided for the effluent pump station.

Upgrades to the existing electrical service and power distribution system are summarized as follows:

- An expansion of the existing 12.47- kV utility power service to supply an additional 480-volt (V), three-phase utility transformer. This transformer will be located south of the new UV disinfection/EPS building and will serve new and existing loads. The existing 480-V, three-phase, 1,000-kVA utility transformer located at the north of the existing equipment building will remain to serve existing loads that are not transferred over to the new transformer.
- A new electrical room at the UV disinfection/EPS building with a double-ended 480-V switchboard and motor control center (MCC) to serve as the power distribution hub for new and existing plant process areas.
- Demolition of major items of the existing electrical equipment in the existing operations building. This includes an existing 480-V, three-phase, 600-amp MCC and panelboards.

- Installation of 480-V, three-phase diesel engine-generator sets to serve as a standby source of power during utility outages for essential plant loads. The existing 350-kW generator and existing automatic transfer switch (ATS) will remain in service to be used for backing up existing essential loads that remain connected to the existing ATS. A new 1,000-kW generator will be installed in an outdoor enclosure south of the new UV disinfection/EPS building. This unit will back up new essential loads and existing essential loads that are transferred over to the new switchboard, including the existing operations building.

5.3.8.3 Standby Power

Standby power will be provided by two engine-generator sets located at the WWTP site. One generator is existing and the second generator will be installed as part of the Phase 2 project. Each generator is connected through an ATS to power all essential plant loads, including lighting and ventilation systems. The generators will provide power automatically during utility outages.

The existing 350-kW engine-generator set is located at the north end of the existing equipment building. It is connected through an ATS to the existing switchboard for the plant. This generator is not sufficiently large to provide adequate standby power capacity for the current essential loads at the plant and does not provide standby power to the operations building.

A new 1,000-kW engine-generator set will be installed to serve the new essential loads that will be added during the upgrade and to serve existing essential loads that cannot be handled by the existing generator due to its capacity constraint. The new generator will also provide standby power to the operations building.

The combined capacity of the existing and new generators is sufficient to provide standby power to all essential loads at the plant after completion of the current upgrade as well as future loads associated with Secondary Clarifier 3, RAS/WAS pump station, secondary scum pump station, and bioselector basin. Future loads associated with solids processing facilities have not been included in the sizing of the new generator.

5.3.8.4 Stormwater Solids Decant/Septage Processing Facility

A decant facility for unloading and dewatering street sweepings, debris removed from the stormwater system during cleaning operations, and septage will be constructed as part of Phase 2. The decant facility is described in Section 5.3.8 of the Facility Plan.

Street sweepings and stormwater solids will be discharged from trucks and street sweepers in a large bay in the middle of the facility. The sloping receiving slab will allow gravity separation of the material and entrained water such that the material dewaters. The dewatered material will then be moved off the slab and into a storage zone. The stockpiled material will be periodically trucked offsite for disposal.

A dumping pit for septage is also integrated into the design along with processing equipment. Septage is strictly material from municipal sources, not from RVs or commercial septic tank cleaners. The material has been removed by a Vactor truck from pump station wet wells and sewer line cleaning operations. It generally consists of grease, grit, plastics, floatable items, etc., that tends to accumulate in collection system facilities. Septage processing equipment will remove and compact solid material and liquid will be discharged to the influent pump station.

5.3.10 Potential Class A Effluent Reuse Opportunities

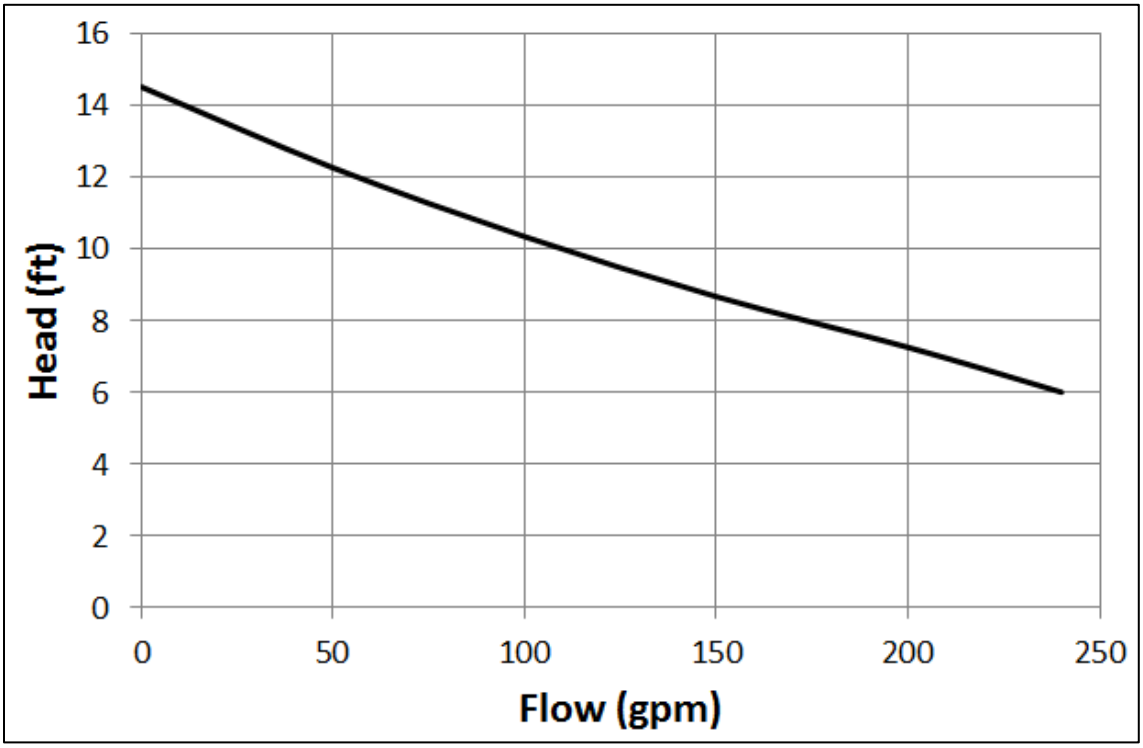
Section 5.3.10 of the Facility Plan describes opportunities for using plant effluent for reuse water. The City has not advanced an effluent reuse program and changes to Section 5.3.10 of the Facility Plan are not necessary. Therefore, this Amendment does not modify any portion of Section 5.3.10.

5.3.11 Waste Activated Sludge Pumping System

The existing RAS/WAS Pump Building contains two WAS pumps that pump sludge from the bottom of the secondary clarifiers to the sludge storage lagoons. WAS Pump 1 is dedicated to Secondary Clarifier 1 and WAS Pump 2 is dedicated to Secondary Clarifier 2.

WAS is currently pumped intermittently, approximately 6 to 10 times per day. When in use, the WAS pumps operate for approximately 10 to 30 minutes at a time, then pumping is stopped. Under normal operation, WAS is pumped for a total of 180 to 220 minutes per day.

Both WAS pumps are centrifugal-type pumps. The pumping rate of centrifugal pumps is sensitive to the fluid thickness being pumped. As the concentration of the WAS changes, the friction loss through the system also changes, which then affects the actual pumping rate. The pump performance curve, reproduced in Amendment Figure 5-11, shows the degree of sensitivity: a 4-foot change in discharge head results in a change in pumping rate of about 150 gpm.



Amendment Figure 5-11. Existing WAS pump curve

These pumping issues often result in difficulty in controlling the wasting process, leading to difficulty in meeting the daily target for wasting sludge. Over-shooting and under-shooting wasting targets has been a chronic problem at the plant and appears to be the primary reason why SRT varies widely. Poor control of SRT in turn results in poor sludge settleability.

Operational changes to the waste sludge pumping process are recommended as outlined below. If poor performance of the system continues, physical changes to the system should be made, also outlined below.

Recommended Operational Changes

1. On a daily basis, calculate the volume of sludge that needs to be removed from the system based on a target SRT of 20 days.
2. Waste sludge on a daily basis starting mid-morning when the sludge blanket in the clarifier is the deepest. Run the WAS pump continuously until the target volume of sludge has been pumped to the lagoons as measured by the WAS flow meter. Stop the WAS pump when the WAS flow meter indicator reaches the target sludge volume for the day.
3. Monitor the sludge blanket during the course of the pumping to confirm there is adequate blanket depth throughout the pumping duration.

Recommended Physical Changes to WAS System

In the event that operational changes do not fully resolve the settleability issues, the City can consider making physical changes and implementing automated SRT control. The following modifications, which would be added under Phase 3 if deemed necessary, would be made:

1. Replace the existing centrifugal WAS pumps with positive displacement (PD) type pumps. In contrast to centrifugal pumps, the output of PD type pumps is not susceptible to change with changes in thickness of the pumped medium. Making this change would remove one variable from the system operation.
2. Install a solids density meter on the pump discharge line to obtain real-time data on the solids content of the sludge being pumped to the lagoons. This change would eliminate wasting based on the results of a single grab sample from the WAS flow stream, which currently results in wasting an unknown mass of solids.
3. Provide automatic control of the sludge wasting process based on a target SRT setpoint. The system would be programmed to operate the WAS pump to discharge a known amount of solids as measured by the WAS flow meter and WAS density meter such that the SRT target is achieved using the following calculation:

$$\text{Wastage (lb/d)} = \text{WAS flow (gal/d)} \times \text{WAS solids (mg/L)} \times \frac{8.34}{1{,}000{,}000} = \frac{\text{MLSS (mg/L)} \times 1.81 \text{ Mgal} \times 8.34}{\text{SRT (days)}}$$

$$\text{WAS flow (gal/d)} = \frac{\text{MLSS (mg/L)} \times 1{,}810{,}000 \text{ gallons}}{\text{WAS solids (mg/L)} \times \text{SRT (days)}}$$

where

8.34 is the conversion between mg-Mgal/L and pounds, and 1.81 Mgal is the volume of the oxidation ditch (with two ditches, the 1.81 Mgal term would be replaced with 3.62 Mgal).

5.4 Recommended Plan

WWTP improvements will be constructed in a phased manner. Phase 1 improvements, which were primarily for maintenance, consisted of dredging lagoons 2 and 3 and construction of an expanded shop and storage building. This work has been completed.

Phase 2 Improvements

Phase 2 improvements, which are slated to be complete in 2016, is currently under design. Phase 2 improvements consist of the following elements:

1. Influent pumping system expansion (construction of IPS-2)
2. Infrastructure needed for future construction of a bioselector basin
3. Oxidation ditch flow distribution structure
4. Oxidation ditch 2
5. Concrete repair and updating of existing equipment and controls at oxidation ditch 1
6. Expansion of UV disinfection system
7. Effluent pumping system expansion
8. Stormwater decant facility
9. Electrical and instrumentation and control (I&C) system improvements including new standby power generator
10. Yard piping and site improvements

Phase 3 Improvements

Phase 3 improvements consist of the following elements:

1. Secondary clarifier 3 and secondary scum pump station
2. RAS/WAS pump facility 2
3. Bioselector basin, if needed
4. Operations and laboratory building
5. Biosolids processing modifications
6. Lagoon assessment

7. WAS system improvements, if needed
8. Expansion of electrical and I&C systems to serve new facilities
9. Yard piping and site improvements

Solids processing options will be re-evaluated prior to beginning Phase 3. Re-evaluation will consider possibilities for leveraging local partnership with the City of Camas to process biosolids from the Washougal WWTP. Additionally, updated operating conditions, opportunities for reuse of Class A biosolids, and regulatory changes that have occurred since the Facility Plan recommendations were developed should be considered in the re-evaluation.

Lagoon assessment generally involves determining whether the lagoons require upgrading or whether they should be decommissioned. Upgrading possibilities include installation of a geomembrane liner in each lagoon and installing groundwater monitoring wells around the lagoon complex. It may be desirable to take lagoon 1 out of service and the area used for stormwater treatment or a constructed wetlands.

Improving Sludge Settleability

The action plan for improving sludge settleability and for determining whether a bioselector basin is needed is as follows:

1. Make operational changes associated with the waste sludge process to begin addressing sludge settleability problems. These include the following:
   - Waste sludge to meet a target SRT of 20 days.
   - Waste sludge on a daily basis starting mid-morning when the sludge blanket in the clarifier is the deepest.
   - Run the WAS pump continuously until the target volume of sludge has been pumped to the lagoons as measured by the WAS flow meter.
   - Monitor the sludge blanket during the course of the pumping to confirm there is adequate blanket depth throughout the pumping duration.
2. Make physical improvements to the WAS systems, including the following:
   - If deemed necessary, replace the existing centrifugal pumps with positive displacement-type pumps.
   - If deemed necessary, install a solids density meter on the pump discharge line to obtain real-time data on the solids content of the sludge being pumped to the lagoons. Continuously monitoring the solids concentration of the waste sludge flow stream vastly improves the accuracy of the sludge mass removed from the activated sludge process.
   - If deemed necessary, provide automatic control of the sludge wasting process based on a target SRT setpoint. The SRT setpoint (typically 20 days), is established by the operator. A programmable logic controller (PLC) would automatically turn the WAS Pump on and off based on the signal from the density meter to achieve the target SRT setpoint.
3. Determine the need for a bioselector basin:
   - Collect settleability data and analyze to determine the 12-month, 95th percentile SVI value.
   - If the 95th percentile SVI value is 160 mL/g or greater, consider conducting a clarifier stress test, and developing a CFD model to establish clarifier capacity as a function of SVI.
   - Determine whether a bioselector basin is required to improve sludge settleability such that the design flow rate can be handled by the secondary clarifier.
   - The need for a bioselector basin will be determined prior to scoping of Phase 3. If deemed necessary, the bioselector basin could be constructed as a separate structure or integrated into the design of the RAS/WAS pump facility 2 to take advantage of common wall construction.

5.5 Construction Cost Estimates

Section 5.5.1 of the Facility Plan presents an estimate of probable construction cost for all three project phases based on the recommendations and planning-level concepts presented in the Facility Plan.

Phase 1 of the plant expansion project, which included improvements to the operations building, expansion of the utility shop and dredging sludge from lagoons 2 and 3, has been completed. An updated cost estimate for Phase 3 has not been prepared and would be dependent upon the sludge processing technology that the City selects when the options are reconsidered prior to beginning Phase 3.

An updated estimate of probable construction cost has been prepared for Phase 2. The estimate is based on information developed during the preliminary design phase, including 60 percent complete design drawings, budgetary quotations received from equipment manufacturers, unit costs for materials, and cost information used for similar elements.

The estimated probable construction cost is $12.6 million. The estimate includes markups on labor, materials, and equipment; subcontractor markups; insurance premiums; a construction contingency; and escalation to the midpoint of construction. The construction contingency assumed for this stage in the project is 20 percent. A summary of the component costs from the detailed estimate are provided in Amendment Table 5-8.

Amendment Table 5-8. Project Component Cost Breakdown

Component	Cost, dollars
Demolition	108,000
Site civil improvements	1,827,000
Yard piping	1,056,000
Oxidation ditch flow distribution structure	437,000
Oxidation ditch	3,521,000
UV system and building	1,050,000
Effluent pumps	1,751,000
Plant water pumping system	58,000
Decant facility	732,000
Influent pumps	242,000
Electrical and instrumentation	1,421,000
Standby generator	396,000
Total	**$12,597,000**

Section 6

Biosolids Treatment Evaluation and Recommendations

Section 6 of the Facility Plan describes and evaluates options for biosolids processing and recommends implementing composting to produce Class A biosolids. Biosolids processing improvements are included in Phase 3. Prior to beginning Phase 3, the City will re-evaluate solids processing options, considering updated operating conditions, opportunities for reuse of Class A biosolids, and any regulatory changes that have occurred since the Facility Plan recommendations were developed. In addition, the City intends to further evaluate opportunities for leveraging local partnership with the City of Camas to process biosolids. If a change in approach is determined to provide advantages, a new amendment to the Facility Plan will be prepared and submitted for Ecology approval.

As a result, updates to Section 6 are not needed at this time and this Amendment does not amend any portion of Section 6.

Section 7

Overview of Funding Sources, Funding Strategy, and Rate Increases

In 2012, the City engaged FCS Group to prepare a financial plan for the City's water and wastewater systems. As of the date of this Facility Plan Amendment (April 2014), the financial plan for funding improvements to the water system has been completed. The financial plan for funding improvements to the wastewater system, including the Phase 2 improvements at the WWTP, remains under development with completion expected by December 2014. Upon completion, this plan will be provided to Ecology for review and comment.

The City has applied for funding for the Phase 2 project through the State Revolving Fund program. The project was deemed ineligible for funding because the revised planning documents (this Facility Plan Amendment) have not been approved by Ecology and the State Environmental Review Process has not been completed.

The City will be applying for Public Works Trust Fund assistance in the May 2014 application cycle.

Section 8

Environmental Assessment

Various permitting documents have been prepared and submitted to jurisdictional agencies for review and approval. These include the following:

- Type II Site Plan Application (including attachments)
- Fish and Wildlife Habitat Permit
- Wetland Permit
- Shoreline Substantial Development Permit
- Archaeological Predetermination Report

Section 9

Limitations

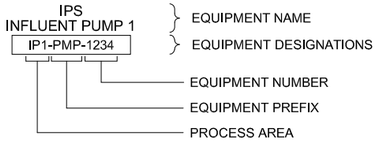
This document was prepared solely for the City of Washougal, Washington (City), in accordance with professional standards at the time the services were performed and in accordance with the contract between the City and Brown and Caldwell dated June 18, 2013. This document is governed by the specific scope of work authorized by the City; it is not intended to be relied upon by any other party except for regulatory authorities contemplated by the scope of work. We have relied on information or instructions provided by the City and other parties and, unless otherwise expressly indicated, have made no independent investigation as to the validity, completeness, or accuracy of such information.

City of Washougal 2014 WWTP Improvements

Selected Plan Sheets

PIPING DESIGNATIONS

NEW EQUIPMENT

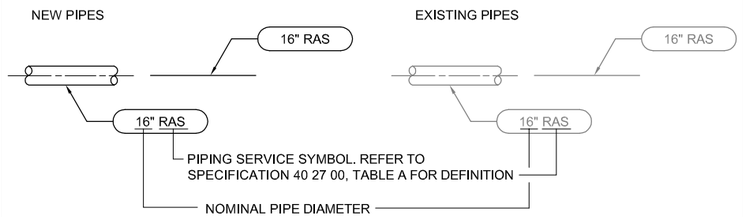


EXISTING EQUIPMENT

IP1-PMP-1234

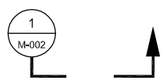
FUTURE EQUIPMENT

IP1-PMP-1234



SECTION AND DETAIL DESIGNATIONS

(1) SECTION CUT ON DWG. M-001:

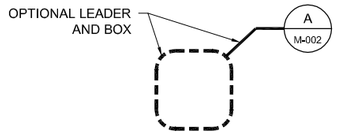


(2) ON DWG. M-002 THIS SECTION IS IDENTIFIED AS:

SECTION 1 / M-001

SCALE: 3/8" = 1'-0"

(1) DETAIL CALLOUT ON DWG. M-001:



(2) ON DWG. M-002 THIS DETAIL IS IDENTIFIED AS:

DETAIL A / M-001

SCALE: 3/8" = 1'-0"

DRAWING DESIGNATIONS

1. DRAWINGS ARE SUBDIVIDED BY DISCIPLINE AS FOLLOWS:
   - G - GENERAL
   - D - DEMOLITION
   - C - CIVIL
   - P - PROCESS
   - A - ARCHITECTURAL
   - S - STRUCTURAL
   - M - MECHANICAL
   - H - HVAC
   - E - ELECTRICAL
   - I - INSTRUMENTATION

MASS BALANCE FOR YEAR 2030 PROJECTED LOADING CONDITIONS:

RAW INFLUENT	AVG DAY	MAX MONTH
FLOW, MGD	3.82	4.37
TSS, LB/D	7,365	10,055
BOD, LB/D	6,695	9,141
TKN, LB/D	1,155	1,576

OXIDATION DITCHES	AVG DAY	MAX MONTH
FLOW, MGD	7.64	8.74
VOLUME, Mgal	3	3.62
SRT, DAYS	15	15
INVENTORY, LB	71,026	104,715
MLSS, mg/L	2,353	3,468

OXIDATION DITCH EFFLUENT	AVG DAY	MAX MONTH
FLOW, MGD	7.64	8.74
TSS, LB/D	150,063	252,919
BOD, LB/D	162	258
TIN, LB/D	112	343

SECONDARY CLARIFIERS	
NUMBER	3
DIAMETER , FT	84

FINAL EFFLUENT	AVG DAY	MAX MONTH
FLOW, MGD	3.70	4.25
TSS, LB/D	148	249
cBOD, LB/D	78	126
TKN, LB/D	55	167

LAGOON RETURN	AVG DAY	MAX MONTH
FLOW, MGD	VARIES	VARIES
TSS, LB/D	NEGLIGIBLE	NEGLIGIBLE
BOD, LB/D	NEGLIGIBLE	NEGLIGIBLE
TKN, LB/D	NEGLIGIBLE	NEGLIGIBLE

LAGOON	AVG DAY	MAX MONTH
VOLUME, Mgal	24	24.7

RAS	AVG DAY	MAX MONTH
FLOW, MGD	3.82	4.37
TSS, mg/L	4,561	6,748
TSS, LB/D	145,366	246,025

WAS	AVG DAY	MAX MONTH
FLOW, MGD	0.12	0.12
TSS, mg/L	4,561	6,748
TSS, LB/D	4,549	6,645

NOTES:
1. THE MASS BALANCE IS CALCULATED USING THE PROCESSES THAT WILL BE IN PLACE UPON EXECUTION OF THE UPGRADES DESCRIBED BY THESE CONTRACT DOCUMENTS. FUTURE MODIFICATIONS MADE PRIOR TO YEAR 2030 WILL REQUIRE REVISION OF THE MASS BALANCE.

Brown AND Caldwell

PORTLAND, OREGON

SUBMITTED: _____ DATE: _____ (PROJECT MANAGER)

APPROVED: _____ DATE: _____ (BROWN AND CALDWELL)

LINE IS 2 INCHES AT FULL SIZE (IF NOT 2" - SCALE ACCORDINGLY)

DESIGNED: DWL
DRAWN: NSW
CHECKED: DWL
CHECKED: RMG
APPROVED: DWL

EXTERNAL REFERENCE FILES

REVISIONS			
ZONE	REV.	DESCRIPTION	DATE

CONFORMED DOCUMENT

FOR SIGNATURE AND SEAL
SEE CONTRACT DOCUMENTS

CITY OF WASHOUGAL
2014 WWTP IMPROVEMENTS
GENERAL

DESIGNATION SYSTEMS AND MASS BALANCE

FILENAME	144581-SF-G-005.DWG
BC PROJECT NUMBER	144581
SCALE	NONE
DRAWING NUMBER	G-005
SHEET NUMBER	5 OF 213

Plot Date/Time: 9/16/2014 1:17 PM CAD: whirby, nate

Path: P:\144581 Washougal WWTP Phase 2\CAD\2-Sheets\G-General

DESIGN DATA

DESIGN CONDITIONS	
DESIGN YEAR	2030
PROJECTED POPULATION	33,151
POPULATION EQUIVALENTS	36,687

DESIGN FLOWS AND LOADINGS	
AVERAGE DRY WEATHER, MGD	3.64
AVERAGE WET WEATHER, MGD	4.00
MAXIMUM MONTH (DESIGN FLOW), MGD	4.37
PEAK HOUR (PEAK FLOW), MGD	11.00
BOD ANNUAL AVERAGE, PPD	6696
BOD MAXIMUM MONTH AVERAGE, PPD	9142
TSS ANNUAL AVERAGE, PPD	7219
NH3-N ANNUAL AVERAGE, PPD	857
EPA RELIABILITY CLASS	II

EFFLUENT REQUIREMENTS	
CBOD, MONTHLY AVERAGE	30 MG/L (560 LBS/DAY)
CBOD, WEEKLY AVERAGE	45 MG/L (840 LBS/DAY)
BOD, PERCENT REMOVAL	85% MONTHLY AVERAGE
TSS, MONTHLY AVERAGE	30 MG/L (560 LBS/DAY)
TSS, WEEKLY AVERAGE	45 MG/L (840 LBS/DAY)
TSS, PERCENT REMOVAL	85% MONTHLY AVERAGE
FECAL COLIFORM, MONTHLY AVERAGE	200/100 ML
FECAL COLIFORM, WEEKLY AVERAGE	400/100 ML
NH3 -N, MONTHLY AVERAGE	21.1 MG/L
NH3 -N, DAILY MAXIMUM	42.3 MG/L

INFLUENT FLOW MEASUREMENT	EXISTING	REPLACEMENT
TYPE	MAGNETIC FLOW METER	MAGNETIC FLOW METER
SIZE, INCHES	12	20

INFLUENT/EFFLUENT SAMPLERS	EXISTING	REPLACEMENT
TYPE	FLOW PROPORTIONAL	FLOW PROPORTIONAL
SAMPLE PACING	INFLUENT FLOW METER	INFLUENT FLOW METER
LOCATION	HEADWORKS	MH 31

INFLUENT PUMPS	EXISTING	NEW
TYPE	NON-CLOG SUBMERSIBLE	NON-CLOG SUBMERSIBLE
QUANTITY	3	2
DRIVE	VARIABLE SPEED	CONSTANT SPEED
SIZE, HP	35	12
CAPACITY PER PUMP, MGD	4.0	2.0

HEADWORKS	EXISTING
INFLUENT SCREEN	
TYPE	ROTARY
QUANTITY	1
DRUM SIZE, INCHES	47"
MESH DIAMETER, INCHES	1/4"
CAPACITY PER UNIT, MGD @ PEAK FLOW	6.4

GRIT CHAMBER	EXISTING
TYPE	SPIRAL
QUANTITY	1
DIAMETER	12'
GRIT PUMP HP	5
CAPACITY, MGD @ PEAK FLOW	12

OXIDATION DITCH	EXISTING	NEW
VOLUME, MG	1.80	1.80
SIDE WATER DEPTH, FEET	14	14
AERATORS		VERTICAL
TYPE	VERTICAL TURBINE	TURBINE
QUANTITY	2	2
SIZE, HP	100	100
DRIVE	VARIABLE SPEED	VARIABLE SPEED
VERTICAL MIXERS		
QUANTITY	1	1
SIZE, HP	10	10
DRIVE	CONSTANT SPEED	CONSTANT SPEED
HORIZONTAL MIXERS		
QUANTITY	4	4
SIZE, HP	7.5	7.5
DRIVE	VARIABLE SPEED	VARIABLE SPEED
DETENTION TIME (100% RAS), HOURS		
@ AVERAGE DRY WEATHER FLOW	13.5	13.5
@ DESIGN FLOW	9.7	9.7
F/M, ASSUMING MLSS = 3,000 MG/L, 1/DAY		
@ AVERAGE ANNUAL BOD LOAD	0.07	0.07
@ MAXIMUM MONTH BOD LOAD	0.09	0.09
SLUDGE AGE, DAYS		
@AVERAGE ANNUAL LOAD	15	15
@ MAXIMUM MONTH LOAD	12.5	12.5
EFFLUENT WEIR LENGTH, FEET	20	20

SECONDARY CLARIFIERS	EXISTING
TYPE	DIFFERENTIAL HEAD
NUMBER	2
DIAMETER, FEET	84
SIDE WATER DEPTH, FEET	15
WEIR TYPE	PERIPHERAL
WEIR LENGTH, FEET	244
FLOCCULATION WELL DIAMETER, FEET	35
FLOCCULATION WELL DEPTH, FEET	9
TOTAL SURFACE AREA, SF	5542
SURFACE OVERFLOW RATE, GPD/SF	
@ WET WEATHER AVERAGE FLOW	340
@ DESIGN FLOW	400
@ PEAK FLOW	1200
DETENTION TIME (100% WWADF RAS), HOURS	
@ DESIGN FLOW	3.6
@ PEAK FLOW	1.75
SOLIDS LOADING RATE (100% WWADF RAS), PPD/SF	
@ DESIGN FLOW	22
@ PEAK FLOW	45
WEIR LOADING RATE (GPD/FT)	
@ DESIGN FLOW	9180
@ PEAK FLOW	27250

RETURN ACTIVATED SLUDGE PUMPS	EXISTING
TYPE	HORIZONTAL SCREW CENTRIFUGAL
QUANTITY	3
DRIVE	VARIABLE SPEED
SIZE, HP	20
CAPACITY PER PUMP, GPM	780 - 2,330

WASTE ACTIVATED SLUDGE PUMPS	EXISTING
TYPE	VERTICAL SCREW CENTRIFUGAL
QUANTITY	2
DRIVE	CONSTANT SPEED
SIZE, HP	3
CAPACITY PER PUMP, GPM	200

CLARIFIER SCUM PUMP	EXISTING
TYPE	NON-CLOG SUBMERSIBLE
QUANTITY	1
DRIVE	CONSTANT SPEED
SIZE, HP	1.9
CAPACITY PER PUMP, GPM	150

SLUDGE METERING	EXISTING
RAS	2 10" MAGNETIC FLOW METERS
WAS	4" MAGNETIC FLOW METER

EFFLUENT DISINFECTION	EXISTING	NEW
TYPE	MEDIUM PRESSURE ULTRAVIOLET	LOW PRESSURE ULTRAVIOLET
NUMBER OF CHANNELS	1	1
PEAK FLOW CAPACITY, MGD	5.6	5.6
CHANNEL WIDTH, INCHES	45	40
CHANNEL DEPTH, INCHES	97	54
STRAIGHT CHANNEL LENGTH, FEET	32	32
NUMBER OF BANKS	2	2
UV TRANSMITTANCE @ 253.7 NM	65%	65%
NUMBER OF LAMPS	16	60
POWER PER LAMP, W	2,800	250

EFFLUENT PUMPS	NEW (SMALL)	NEW (LARGE)
TYPE	VERTICAL TURBINE	VERTICAL TURBINE
QUANTITY	2	3
CAPACITY PER PUMP, MGD	2.3	5.6

OUTFALL	EXISTING
FORCE MAIN DIAMETER, INCH	20
LENGTH, FEET	8,400
DIFFUSER	
TYPE	SIX PORT WITH DUCKBILL CHECK VALVES
LENGTH IN RIVER, FEET	200
SUBMERGENCE	VARIES

NON-POTABLE WATER SYSTEM	EXISTING
PUMPS	
TYPE	VERTICAL TURBINE
QUANTITY	2
DRIVE	CONSTANT SPEED
SIZE, HP	10
CAPACITY PER PUMP, GPM	100
HYDROPNEUMATIC TANK, GAL	528

STANDBY GENERATOR	EXISTING	NEW
TYPE	DIESEL	DIESEL
NUMBER	1	1
CAPACITY, KW	350	800

Brown AND Caldwell
PORTLAND, OREGON

SUBMITTED: _____ DATE: _____ (PROJECT MANAGER)
APPROVED: _____ DATE: _____ (BROWN AND CALDWELL)

LINE IS 2 INCHES AT FULL SIZE (IF NOT 2" - SCALE ACCORDINGLY)

DESIGNED: DWL
DRAWN: NSW
CHECKED: DWL
CHECKED: RMG
APPROVED: DWL

EXTERNAL REFERENCE FILES

REVISIONS			
ZONE	REV.	DESCRIPTION	DATE

CONFORMED DOCUMENT

FOR SIGNATURE AND SEAL
SEE CONTRACT DOCUMENTS

CITY OF WASHOUGAL
2014 WWTP IMPROVEMENTS
GENERAL

DESIGN DATA

FILENAME 144581-SF-G-009.DWG
BC PROJECT NUMBER 144581
SCALE NONE
DRAWING NUMBER G-009
SHEET NUMBER 9 OF 213

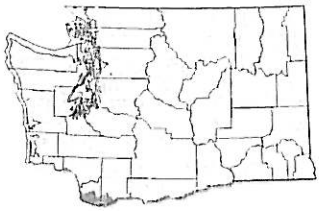
Plot Date/Time: 9/16/2014 1:17 PM
CAD: whitty; rate
Path:P:\144581 Washougal WWTP Phase 2\CAD\2-Sheets\G-General

APPENDIX E
NPDES Permit

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY
PO Box 47775 • Olympia, Washington 98504-7775 • (360) 407-6300

November 16, 2011

CERTIFIED MAIL: 7010 0780 0002 3400 8259



Your address is in the **Salmon-Washougal** watershed

The Honorable Sean Guard
Mayor of Washougal
1701 C Street
Washougal, WA 98671

Re: National Pollutant Discharge Elimination System (NPDES) Permit for NPDES Permit Number WA0037427, City of Washougal Wastewater Treatment Plant

Dear Mayor Guard:

Enclosed is a National Pollutant Discharge Elimination System (NPDES) Permit No. WA0037427 for the city of Washougal Wastewater Treatment Plant. The permit is issued by the Department of Ecology (Ecology) in conformance with the Water Pollution Control Law [Chapter 90.48 Revised Code of Washington (RCW)], and as authorized by the U.S. Environmental Protection Agency (EPA) acting under the Federal Clean Water Act.

Submission of an application for permit renewal or continued discharge must be received by Ecology the date indicated in the permit [Washington Administrative Code (WAC) 173-220-180]. Please contact Carey Cholski, Permit Administrator, at 360-407-6279 or carey.cholski@ecy.wa.gov for an application form.

You have the right to appeal this permit within thirty (30) days upon receipt of this document. Pursuant to chapter 43.21B RCW, your appeal must be filed with the Pollution Control Hearings Board, and served on the Department of Ecology, within thirty (30) days of the date of your receipt of this document.

If you choose to appeal this decision, your notice of appeal must contain: (1) a copy of the permit you are appealing, and (2) a copy of the application for the permit/modification.

Any appeal must contain the following in accordance with the rules of the hearing board:

a. The appellant's name and address;
b. The coverage date and number of the permit appealed;
c. A description of the substance within the permit that is the subject of the appeal;
d. A clear, separate, and concise statement of every error alleged to have been committed;
e. A clear and concise statement of the facts which the requester relies to sustain his or her statements of error; and
f. A statement setting forth the relief sought.

You must file your appeal with The Pollution Control Hearing Board.

Mail your appeal to:

The Pollution Control Hearings Board
P.O. Box 40903
Olympia, Washington 98504-0903

OR

Deliver your appeal in person to:

The Pollution Control Hearings Board
1111 Israel Road Southwest, Suite 301
Tumwater, Washington 98501

Your appeal must also be served on:

The Department of Ecology
Appeals Coordinator
P.O. Box 47608
Olympia, Washington 98504-7608

In addition, please send a copy of your appeal to:

David Knight, P.E.
Department of Ecology
Southwest Regional Office
P.O. Box 47775
Olympia, Washington 98504-7775

For additional information: Environmental Hearings Office Website: http://www.eho.wa.gov

If you have any questions on this action, please contact Dave Knight at 360-407-6277, or by e-mail at david.j.knight@ecy.wa.gov.

Sincerely,

Robert W. Bergquist, LEED© AP
Southwest Region Manager
Water Quality Program

RWB:CC(0037427)
Enclosures

cc: Ryan Baker, Wastewater Supervisor, City of Washougal
Trevor Evers, Public Works Director, City of Washougal

DEPARTMENT OF
ECOLOGY
State of Washington

Issuance Date: November 16, 2011
Effective Date: December 1, 2011
Expiration Date: November 30, 2016

NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM
WASTE DISCHARGE PERMIT NO. WA0037427

State of Washington
DEPARTMENT OF ECOLOGY
Olympia, Washington 98504-7775

In compliance with the provisions of
The State of Washington Water Pollution Control Law
Chapter 90.48 Revised Code of Washington
and
The Federal Water Pollution Control Act
(The Clean Water Act)
Title 33 United States Code, Section 1251 et seq.

City of Washougal

1701 "C" Street

Washougal, WA 98671

Plant Location: 54 Second Street Washougal, Washington 98671	Receiving Water: Columbia River @ RM 123.5
Water Body I.D. No.: WA-CR-1010	Discharge Location: Latitude: 45.56971 Longitude: -122.34585
Plant Type: Extended air activated sludge (oxidation ditch)	

is authorized to discharge in accordance with the special and general conditions that follow.

Robert W. Bergquist, LEED© AP
Southwest Region Manager
Water Quality Program
Washington State Department of Ecology

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SUMMARY OF PERMIT REPORT SUBMITTALS

Refer to the Special and General Conditions of this permit for additional submittal requirements.

Permit Section	Submittal	Frequency	First Submittal Date
S3.	Discharge Monitoring Report	Monthly	January 15, 2012
S3.E	Reporting Permit Violations	As necessary	
S4.B.	Plans for Maintaining Adequate Capacity	As necessary	
S4.C.	Notification of New or Altered Sources	As necessary	
S4.D.	Infiltration and Inflow Evaluation	Annually	May 15, 2012
S4.E.	Wasteload Assessment	Annually	May 15, 2012
S6.D.	Industrial User Survey	1/permit cycle	August 30, 2013
S8.	Outfall Evaluation	1/permit cycle	August 30, 2013
G1.	Notice of Change in Authorization	As necessary	
G4.	Permit Application for Substantive Changes to the Discharge	As necessary	
G5.	Engineering Report for Construction or Modification Activities	As necessary	
G7.	Application for permit renewal	1/permit cycle	June 1, 2016

SPECIAL CONDITIONS

S1. DISCHARGE LIMITS

A. Effluent Limits

All discharges and activities authorized by this permit shall be consistent with the terms and conditions of this permit. The discharge of any of the following pollutants more frequently than, or at a concentration in excess of, that authorized by this permit shall constitute a violation of the terms and conditions of this permit.

Beginning on the effective date of this permit and lasting through the expiration date the Permittee is authorized to discharge municipal wastewater at the permitted location subject to the following limitations:

EFFLUENT LIMITS[a]		
Parameter	**Average Monthly**	**Average Weekly**
Biochemical Oxygen Demand[b] (5 day)	30.0 mg/L, 560 lbs/day 85% minimum removal	45.0 mg/L, 840 lbs/day
Total Suspended Solids[b]	30.0 mg/L, 560 lbs/day 85% minimum removal	45.0 mg/L, 840 lbs/day
Fecal Coliform Bacteria	200/100 mL	400/100 mL
pH[c]	Daily minimum is equal to or greater than 6.0 and the daily maximum is less than or equal to 9.0	
Parameter	**Average Monthly**	**Maximum Daily[d]**
Total Ammonia (as NH3-N)	21.1 mg/L	42.3 mg/L

[a]The average monthly and weekly effluent limitations are based on the arithmetic mean of the samples taken with the exception of fecal coliform, which is based on the geometric mean.

[b]The average monthly effluent concentration for BOD5 and Total Suspended Solids shall not exceed 30 mg/L or 15 percent of the respective monthly average influent concentrations, whichever is more stringent.

[c]Indicates the range of permitted values. When pH is continuously monitored excursions between 5.0 and 6.0, or 9.0, and 10.0 shall not be considered violations provided no single excursion exceeds 60 minutes in length and total excursions do not exceed 7 hours and 30 minutes per month. Any excursions below 5.0 and above 10.0 are violations. The instantaneous maximum and minimum pH shall be reported monthly.

[d]The maximum daily effluent limitation is defined as the highest allowable daily discharge. The daily discharge means the discharge of a pollutant measured during a calendar day. For pollutants with limitations expressed in units of mass, the daily discharge is calculated as the total mass of the pollutant discharged over the day. For other units of measurement, the daily discharge is the average measurement of the pollutant over the day.

B. Mixing Zone Descriptions

The maximum boundaries of the mixing zones are defined as follows:

Chronic Dilution Zone -- In rivers and streams, mixing zones, singularly or in combination with other mixing zones, shall comply with the most restrictive combination of the following:

1. Not extend in a downstream direction for a distance from the discharge port(s) greater than three hundred feet plus the depth of water over the discharge port(s), or extend upstream for a distance of over 100;

2. Not utilize greater than 25 percent of the flow; and

3. Not occupy greater than 25 percent of the width of the water body.

Chronic dilution factor was determined to be 63:1 for the existing outfall diffuser configuration.

Acute Dilution Zone -- In rivers and streams, a zone where acute criteria may be exceeded shall comply with the most restrictive combination of the following (this size limitation may also be applied to estuaries having flow characteristics resembling rivers):

1. Not extend beyond ten percent of the distance towards the upstream and downstream boundaries of an authorized mixing zone, as measured independently from the discharge port(s);

2. Not utilize greater than two and one-half percent of the flow; and

3. Not occupy greater than twenty-five percent of the width of the water body.

Acute dilution factor was determined to be 17.5:1 for the existing outfall diffuser configuration.

S2. MONITORING REQUIREMENTS

A. Monitoring Schedule

Category	Parameter	Units	Sample Point	Minimum Sampling Frequency	Sample Type
	Rainfall	Inches/day	WWTP Site	Daily	Reading
Wastewater Influent	Flow	MGD	Influent Meter	Continuous	Measurement
Wastewater Influent	BOD5	mg/L lbs/day	Headworks	3/week	24-hour Composite

Category	Parameter	Units	Sample Point	Minimum Sampling Frequency	Sample Type
Wastewater Influent	TSS	mg/L lbs/day	Headworks	3/week	24-hour Composite
Wastewater Effluent	Flow	MGD	Effluent Meter	Continuous	Measurement
Wastewater Effluent	Temperature	°C	UV Effluent	Daily	Measurement
Wastewater Effluent	BOD5	mg/L lbs/day % Removal	UV Effluent	3/week	24-hour Composite
Wastewater Effluent	TSS	mg/L lbs/day % Removal	UV Effluent	3/week	24-hour Composite
Wastewater Effluent	pH	Standard Units	UV Effluent	Daily	Grab
Wastewater Effluent	Fecal Coliform	#/100 ml	UV Effluent	3/week	Grab
Wastewater Effluent	Ammonia (as N)	mg/L	UV Effluent	1/week	Grab
Wastewater Effluent	Nitrite as N	mg/L	UV Effluent	Quarterly[a]	Grab
Wastewater Effluent	Nitrate as N	mg/L	UV Effluent	Quarterly[a]	Grab
Wastewater Effluent	TKN	mg/L	UV Effluent	Quarterly[a]	Grab
Wastewater Effluent	Ortho-phosphate (PO_4)	mg/L	UV Effluent	Quarterly[a]	Grab
Wastewater Effluent	Total Phosphorus	mg/L	UV Effluent	Quarterly[a]	Grab

[a] Quarterly is defined as: January - March, report with March DMR
April – June, report with June DMR
July – September, report with September DMR
October – December, report with December DMR

B. Sampling and Analytical Procedures

Samples and measurements taken to meet the requirements of this permit shall be representative of the volume and nature of the monitored parameters, including

representative sampling of any unusual discharge or discharge condition, including bypasses, upsets and maintenance-related conditions affecting effluent quality.

Sampling and analytical methods used to meet the water and wastewater monitoring requirements specified in this permit shall conform to the latest revision of the *Guidelines Establishing Test Procedures for the Analysis of Pollutants* contained in 40 CFR Part 136 or to the latest revision of *Standard Methods for the Examination of Water and Wastewater* (APHA), unless otherwise specified in this permit or approved in writing by the Department of Ecology (Ecology).

C. Flow Measurement

Appropriate flow measurement devices and methods consistent with accepted scientific practices shall be selected and used to ensure the accuracy and reliability of measurements of the quantity of monitored flows. The devices shall be installed, calibrated, and maintained to ensure that the accuracy of the measurements are consistent with the accepted industry standard for that type of device. Frequency of calibration shall be in conformance with manufacturer's recommendations and at a minimum frequency of at least one calibration per year. Calibration records shall be maintained for at least three years.

D. Laboratory Accreditation

All monitoring data required by Ecology shall be prepared by a laboratory registered or accredited under the provisions of, *Accreditation of Environmental Laboratories*, Chapter 173-50 Washington Administrative Code (WAC). Flow, temperature, settleable solids, conductivity, pH, and internal process control parameters are exempt from this requirement. Conductivity and pH shall be accredited if the laboratory must otherwise be registered or accredited. Crops, soils and hazardous waste data are exempted from this requirement pending accreditation of laboratories for analysis of these media by Ecology.

S3. REPORTING AND RECORDKEEPING REQUIREMENTS

The Permittee must monitor and report in accordance with the following conditions. Falsification of information submitted to Ecology is a violation of the terms and conditions of this permit.

A. Reporting

The first monitoring period begins on the effective date of the permit. The Permittee must:

1. Submit monitoring results each month.

2. Summarize, report, and submit monitoring data obtained during each monitoring period on a Discharge Monitoring Report (DMR) form provided, or otherwise approved, by Ecology.

3. Submit DMR forms monthly whether or not the facility was discharging. If the facility did not discharge during a given monitoring period, submit the form as required with the words "NO DISCHARGE" entered in place of the monitoring results.

4. Ensure that DMR forms are postmarked or received by Ecology no later than the 15th day of the month following the completed monitoring period, unless otherwise specified in this permit.

5. Send report(s) to Ecology at:

Water Quality Permit Coordinator
Department of Ecology
Southwest Regional Office
P.O. Box 47775
Olympia, WA 98504-7775

All laboratory reports providing data for organic and metal parameters must include the following information: sampling date, sample location, date of analysis, parameter name, CAS number, analytical method/number, method detection limit (MDL), laboratory practical quantitation limit (PQL), reporting units, and concentration detected. Analytical results from samples sent to a contract laboratory must include information on the chain of custody, the analytical method, QA/QC results, and documentation of accreditation for the parameter.

B. Records Retention

The Permittee must retain records of all monitoring information for a minimum of three years. Such information must include all calibration and maintenance records and all original recordings for continuous monitoring instrumentation, copies of all reports required by this permit, and records of all data used to complete the application for this permit. The Permittee must extend this period of retention during the course of any unresolved litigation regarding the discharge of pollutants by the Permittee or when requested by Ecology.

C. Recording of Results

For each measurement or sample taken, the Permittee must record the following information:

1. The date, exact place, method, and time of sampling or measurement.

2. The individual who performed the sampling or measurement.

3. The dates the analyses were performed.

4. The individual who performed the analyses.

5. The analytical techniques or methods used.

6. The results of all analyses.

D. Additional Monitoring by the Permittee

If the Permittee monitors any pollutant more frequently than required by Condition S2 of this permit, then the Permittee must include the results of such monitoring in the calculation and reporting of the data submitted in the Permittee's DMR.

E. Reporting Permit Violations

The Permittee must take the following actions when it violates or is unable to comply with any permit condition:

- Immediately take action to stop, contain, and cleanup unauthorized discharges or otherwise stop the noncompliance and correct the problem.
- If applicable, immediately repeat sampling and analysis. Submit the results of any repeat sampling to Ecology within 30 days of sampling.

1. Immediate Reporting

The Permittee must report any failure of the disinfection system immediately to the Department of Ecology's Regional Office 24-hour number listed below:

Southwest Regional Office	360-407-6300

The Permittee must report any failure of the disinfection system, any collection system overflows, or any plant bypass discharging to a waterbody used as a source of drinking water immediately to the Department of Ecology and the Department of Health, Drinking Water Program at the numbers listed below:

Southwest Regional Office	360-407-6300
Department of Health Drinking Water Program	360-521-0323 (business hours) 360-789-8962 (after business hours)

2. Twenty-Four (24)-Hour Reporting

The Permittee must report the following occurrences of noncompliance by telephone, to Ecology at 360-407-6300, within 24 hours from the time the Permittee becomes aware of any of the following circumstances:

a. Any noncompliance that may endanger health or the environment, unless previously reported under subpart 1, above.

b. Any unanticipated **bypass** that exceeds any effluent limitation in the permit (See Part S4.B., "Bypass Procedures").

c. Any **upset** that exceeds any effluent limitation in the permit (See G.15, "Upset").

d. Any violation of a maximum daily or instantaneous maximum discharge limitation for any of the pollutants in Section S1.A of this permit.

e. Any overflow prior to the treatment works, whether or not such overflow endangers health or the environment or exceeds any effluent limitation in the permit.

3. Report Within Five Days

The Permittee must also provide a written submission within five days of the time that the Permittee becomes aware of any event required to be reported under subparts 1 or 2, above. The written submission must contain:

a. A description of the noncompliance and its cause.

b. The period of noncompliance, including exact dates and times.

c. The estimated time noncompliance is expected to continue if it has not been corrected.

d. Steps taken or planned to reduce, eliminate, and prevent recurrence of the noncompliance.

e. If the noncompliance involves an overflow prior to the treatment works, an estimate of the quantity (in gallons) of untreated overflow.

4. Waiver of Written Reports

Ecology may waive the written report required in subpart 3, above, on a case-by-case basis upon request if a timely oral report has been received.

5. All Other Permit Violation Reporting

The Permittee must report all permit violations, which do not require immediate or within 24 hours reporting, when it submits monitoring reports for S3.A ("Reporting"). The reports must contain the information listed in paragraph E.3, above. Compliance with these requirements does not relieve the Permittee from responsibility to maintain continuous compliance with the terms and conditions of this permit or the resulting liability for failure to comply.

6. Report Submittal

The Permittee must submit reports to the address listed in S3.

F. Other Reporting

The Permittee must report a spill of oil or hazardous materials in accordance with the requirements of RCW 90.56.280 and chapter 173-303-145. You can obtain further instructions at the following website:
http://www.ecy.wa.gov/programs/spills/other/reportaspill.htm.

Where the Permittee becomes aware that it failed to submit any relevant facts in a permit application, or submitted incorrect information in a permit application, or in any report to Ecology, it must submit such facts or information promptly.

The Permittee must submit a new application or supplement at least 180 days prior to commencement of discharges, resulting from the activities listed below, which may result in permit violations. These activities include: any facility expansions, production increases, or other planned changes, such as process modifications, in the permitted facility.

G. Maintaining a Copy of This Permit

The Permittee must keep a copy of this permit at the facility and make it available upon request to Ecology inspectors.

S4. FACILITY LOADING

A. Design Criteria

Flows or waste loadings of the following design criteria for the permitted treatment facility shall not be exceeded:

Average flow for the maximum month:	2.24 MGD
BOD_5 loading for maximum month:	3,960 lbs/day
TSS loading for maximum month:	3,960 lbs/day

B. Plans for Maintaining Adequate Capacity

When the actual flow or wasteload reaches 85 percent of any one of the design criteria in S4.A for three consecutive months, or when the projected increases would reach design capacity within five years, whichever occurs first, the Permittee shall submit to Ecology, a plan and a schedule for continuing to maintain capacity at the facility sufficient to achieve the effluent limitations and other conditions of this permit. This plan shall address any of the following actions or any others necessary to meet this objective.

1. Analysis of the present design including the introduction of any process modifications that would establish the ability of the existing facility to achieve the effluent limits and other requirements of this permit at specific levels in excess of the existing design criteria specified in paragraph A above.

2. Reduction or elimination of excessive infiltration and inflow of uncontaminated ground and surface water into the sewer system.

3. Limitation on future sewer extensions or connections or additional wasteloads.

4. Modification or expansion of facilities necessary to accommodate increased flow or wasteload.

5. Reductions of industrial or commercial flows or waste loads to allow for increasing sanitary flow or wasteload.

Engineering documents associated with the plan must meet the requirements of WAC 173-240-060, "Engineering Report," and be approved by Ecology prior to any construction. The plan shall specify any contracts, ordinances, methods for financing, or other arrangements necessary to achieve this objective.

C. Notification of New or Altered Sources

The Permittee shall submit written notice to Ecology whenever any new discharge or increase in volume or change in character of an existing discharge into the sewer is proposed which: (1) would interfere with the operation of, or exceed the design capacity of, any portion of the collection or treatment system; (2) is not part of an approved general sewer plan or approved plans and specifications; or would be subject to pretreatment standards under 40 Code of Federal Regulations (CFR) Part 403 and Section 307(b) of the Clean Water Act. This notice shall include an evaluation of the system's ability to adequately transport and treat the added flow and/or wasteload.

D. Infiltration and Inflow Evaluation

1. The Permittee shall conduct an infiltration and inflow evaluation. Refer to the U.S.EPA publication, *I/I Analysis and Project Certification*, available as Publication No. 97-03 at: Publications Office, Department of Ecology, P.O. Box 47600, Olympia, Washington 98504-7600. Plant monitoring records may be used to assess measurable infiltration and inflow.

2. A report shall be prepared which summarizes any measurable infiltration and inflow. If infiltration and inflow have increased by more than 15 percent from that found in the first report based on equivalent rainfall, the report shall contain a plan and a schedule for: (1) locating the sources of infiltration and inflow; and (2) correcting the problem.

3. The report shall be submitted by **May 15, 2012**, and **annually** thereafter.

E. Wasteload Assessment

The Permittee shall conduct an annual assessment of their flow and waste load and submit a report to Ecology by **May 15, 2012**, and **annually** thereafter. The report shall contain the following: an indication of compliance or noncompliance with the permit effluent limitations; a comparison between the existing and design monthly average dry weather and wet weather flows, peak flows, BOD, and total suspended solids loadings; and (except for the first report) the percentage increase in these parameters since the last annual report. The report shall also state the present and design population or population equivalent, projected population growth rate, and the estimated date upon which the design capacity is projected to be reached, according to the most restrictive of the parameters above. The interval for review and reporting may be modified if Ecology determines that a different frequency is sufficient.

S5. OPERATION AND MAINTENANCE

The Permittee shall at all times be responsible for the proper operation and maintenance of any facilities or systems of control installed to achieve compliance with the terms and conditions of the permit.

A. Certified Operator

An operator certified for at least a Class II plant by the state of Washington shall be in responsible charge of the day-to-day operation of the wastewater treatment plant. An operator certified for at least a Class I plant shall be in charge during all regularly scheduled shifts.

B. O & M Program

The Permittee shall institute an adequate operation and maintenance program for their entire sewage system. Maintenance records shall be maintained on all major electrical and mechanical components of the treatment plant, as well as the sewage system and pumping stations. Such records shall clearly specify the frequency and type of maintenance recommended by the manufacturer and shall show the frequency and type of maintenance performed. These maintenance records shall be available for inspection at all times.

C. Short-term Reduction

If a Permittee contemplates a reduction in the level of treatment that would cause a violation of permit discharge limitations on a short-term basis for any reason, and such reduction cannot be avoided, the Permittee shall give written notification to Ecology, if possible, 30 days prior to such activities, detailing the reasons for, length of time of, and the potential effects of the reduced level of treatment. This notification does not relieve the Permittee of their obligations under this permit.

D. Electrical Power Failure

The Permittee is responsible for maintaining adequate safeguards to prevent the discharge of untreated wastes or wastes not treated in accordance with the requirements of this permit during electrical power failure at the treatment plant and/or sewage lift stations either by means of alternate power sources, standby generator, or retention of inadequately treated wastes. The Permittee shall maintain Reliability Class II (EPA 430-99-74-001) at the wastewater treatment plant, which requires primary sedimentation and disinfection.

E. Prevent Connection of Inflow

The Permittee shall strictly enforce their sewer ordinances and not allow the connection of inflow (roof drains, foundation drains, etc.) to the sanitary sewer system.

F. Bypass Procedures

The Permittee shall immediately notify Ecology of any spill, overflow, or bypass from any portion of the collection or treatment system.

The bypass of wastes from any portion of the treatment system is prohibited unless one of the following conditions (1, 2, or 3) applies:

1. Unavoidable Bypass -- Bypass is unavoidable to prevent loss of life, personal injury, or severe property damage. "Severe property damage" means substantial physical damage to property, damage to the treatment facilities which would cause them to become inoperable, or substantial and permanent loss of natural resources which can reasonably be expected to occur in the absence of a bypass.

   If the resulting bypass from any portion of the treatment system results in noncompliance with this permit the Permittee shall notify Ecology in accordance with Condition S3.E "Noncompliance Notification."

2. Anticipated Bypass That Has the Potential to Violate Permit Limits or Conditions -- Bypass is authorized by an administrative order issued by Ecology. The Permittee shall notify Ecology at least 30 days before the planned date of bypass. The notice shall contain (1) a description of the bypass and its cause; (2) an analysis of all known alternatives which would eliminate, reduce, or mitigate the need for bypassing; (3) a cost-effectiveness analysis of alternatives including comparative resource damage assessment; (4) the minimum and maximum duration of bypass under each alternative; (5) a recommendation as to the preferred alternative for conducting the bypass; (6) the projected date of bypass initiation; (7) a statement of compliance with State Environmental Policy Act (SEPA); (8) if a water quality criteria exceedance is unavoidable, a request for modification of water quality standards as provided for in WAC 173-201A-110, and (9) steps taken or planned to reduce, eliminate, and prevent reoccurrence of the bypass.

   For probable construction bypasses, the need to bypass is to be identified as early in the planning process as possible. The analysis required above shall be considered during preparation of the engineering report or facilities plan and plans and specifications and shall be included to the extent practical. In cases where the probable need to bypass is determined early, continued analysis is necessary up to and including the construction period in an effort to minimize or eliminate the bypass.

   Ecology will consider the following prior to issuing an administrative order:

   a. If the bypass is necessary to perform construction or maintenance-related activities essential to meet the requirements of the permit.

   b. If there are feasible alternatives to bypass, such as the use of auxiliary treatment facilities, retention of untreated wastes, maintenance during normal periods of equipment down time, or transport of untreated wastes to another treatment facility.

   c. If the bypass is planned and scheduled to minimize adverse effects on the public and the environment.

   After consideration of the above and the adverse effects of the proposed bypass and any other relevant factors, Ecology will approve or deny the request. The public shall be notified and given an opportunity to comment on bypass incidents of significant duration, to the extent feasible. Approval of a request to bypass

will be by administrative order issued by Ecology under Revised Code of Washington (RCW) 90.48.120.

3. Bypass For Essential Maintenance Without the Potential to Cause Violation of Permit Limits or Conditions -- Bypass is authorized if it is for essential maintenance and does not have the potential to cause violations of limitations or other conditions of the permit, or adversely impact public health as determined by Ecology prior to the bypass.

G. Operations and Maintenance Manual

The approved Operations and Maintenance (O&M) Manual shall be kept available at the treatment plant and all operators shall follow the instructions and procedures of this Manual. The operator shall take particular attention to the process control requirements identified in the O&M Manual. These requirements are important in the proper operation of an activated sludge treatment facility.

S6. PRETREATMENT

A. General Requirements

The Permittee shall work with Ecology to ensure that all commercial and industrial users of the publicly owned treatment works (POTW) are in compliance with the pretreatment regulations promulgated in 40 CFR Part 403 and any additional regulations that may be promulgated under Section 307(b) (pretreatment) and 308 (reporting) of the Federal Clean Water Act.

B. Wastewater Discharge Permit Required

The Permittee shall not allow significant industrial users (SIUs) to discharge wastewater to the Permittee's sewerage system until such user has received a wastewater discharge permit from Ecology in accordance with Chapter 90.48 RCW and Chapter 173-216 WAC, as amended.

C. Identification and Reporting of Existing, New, and Proposed Industrial Users

1. The Permittee shall take continuous, routine measures to identify all existing, new, and proposed SIUs and potential significant industrial users (PSIUs) discharging or proposing to discharge to the Permittee's sewerage system (see Appendix B of Fact Sheet for definitions).

2. Within 30 days of becoming aware of an unpermitted existing, new, or proposed industrial user who may be an SIU, the Permittee shall notify such user by registered mail that, if classified as an SIU, they shall be required to apply to Ecology and obtain a State Waste Discharge Permit. A copy of this notification letter shall also be sent to Ecology within this same 30-day period.

3. The Permittee shall also notify all PSIUs, as they are identified, that if their classification should change to an SIU, they shall be required to apply to Ecology for a State Waste Discharge Permit within 30 days of such change.

D. Industrial User Survey

1. The Permittee shall complete and submit to Ecology an Industrial User Survey listing all SIUs and PSIUs discharging to the POTW. The survey shall be received by Ecology by **August 30, 2013**. At a minimum, the list of SIUs and PSIUs shall be developed by means of a telephone book search, a water utility billing records search, and a physical reconnaissance of the service area. Information on PSIUs shall at least include: the business name, telephone number, address, description of the industrial process(es), and the known wastewater volumes and characteristics. For assistance with the development of the Industrial User Survey, the Permittee shall refer to Ecology's guidance document entitled "Performing an Industrial User Survey".

E. Duty to Enforce Discharge Prohibitions

1. In accordance with 40 CFR 403.5(a), the Permittee shall not authorize or knowingly allow the discharge of any pollutants into its POTW which cause pass through or interference, or which otherwise violates general or specific discharge prohibitions contained in 40 CFR Part 403.5 or WAC-173-216-060.

2. The Permittee shall not authorize or knowingly allow the introduction of any of the following into its POTW:

   a. Pollutants which create a fire or explosion hazard in the POTW (including, but not limited to waste streams with a closed cup flashpoint of less than 140 degrees Fahrenheit or 60 degrees Centigrade using the test methods specified in 40 CFR 261.21).

   b. Pollutants which will cause corrosive structural damage to the POTW, but in no case discharges with pH lower than 5.0, or greater than 11.0 standard units, unless the works are specifically designed to accommodate such discharges.

   c. Solid or viscous pollutants in amounts that could cause obstruction to the flow in sewers or otherwise interfere with the operation of the POTW.

   d. Any pollutant, including oxygen demanding pollutants, (BOD, etc.) released in a discharge at a flow rate and/or pollutant concentration which will cause interference with the POTW.

   e. Petroleum oil, nonbiodegradable cutting oil, or products of mineral origin in amounts that will cause interference or pass through.

   f. Pollutants which result in the presence of toxic gases, vapors, or fumes within the POTW in a quantity which may cause acute worker health and safety problems.

g. Heat in amounts that will inhibit biological activity in the POTW resulting in interference but in no case heat in such quantities such that the temperature at the POTW headworks exceeds 40°C (104°F) unless Ecology, upon request of the Permittee, approves, in writing, alternate temperature limits.

h. Any trucked or hauled pollutants, except at discharge points designated by the Permittee.

i. Wastewaters prohibited to be discharged to the POTW by the Dangerous Waste Regulations (Chapter 173-303 WAC), unless authorized under the Domestic Sewage Exclusion (WAC 173-303-071).

3. All of the following are prohibited from discharge to the POTW unless approved in writing by Ecology under extraordinary circumstances (such as a lack of direct discharge alternatives due to combined sewer service or the need to augment sewage flows due to septic conditions):

a. Noncontact cooling water in significant volumes.

b. Stormwater, and other direct inflow sources.

c. Wastewaters significantly affecting system hydraulic loading, which do not require treatment, or would not be afforded a significant degree of treatment by the system.

4. The Permittee shall notify Ecology if any industrial user violates the prohibitions listed in this section.

S7. RESIDUAL SOLIDS

Residual solids include screenings, grit, scum, primary sludge, waste activated sludge and other solid waste. The Permittee shall store and handle all residual solids in such a manner so as to prevent their entry into state ground or surface waters. The Permittee shall not discharge leachate from residual solids to state surface or ground waters.

S8. OUTFALL EVALUATION

The Permittee shall inspect the submerged portion of the outfall line and diffuser to document its integrity and continued function. If conditions allow for a photographic verification, it shall be included in the report. The inspection report shall be submitted to Ecology by **August 30, 2013**.

GENERAL CONDITIONS

G1. SIGNATORY REQUIREMENTS

All applications, reports, or information submitted to Ecology shall be signed and certified.

A. All permit applications shall be signed by either a principal executive officer or a ranking elected official.

B. All reports required by this permit and other information requested by Ecology shall be signed by a person described above or by a duly authorized representative of that person. A person is a duly authorized representative only if:

1. The authorization is made in writing by a person described above and submitted to Ecology, and

2. The authorization specifies either an individual or a position having responsibility for the overall operation of the regulated facility, such as the position of plant manager, superintendent, position of equivalent responsibility, or an individual or position having overall responsibility for environmental matters. (A duly authorized representative may thus be either a named individual or any individual occupying a named position.)

C. Changes to authorization. If an authorization under paragraph B.2. above is no longer accurate because a different individual or position has responsibility for the overall operation of the facility, a new authorization satisfying the requirements of B.2. must be submitted to Ecology prior to or together with any reports, information, or applications to be signed by an authorized representative.

D. Certification. Any person signing a document under this section shall make the following certification:

> "I certify under penalty of law, that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system or those persons directly responsible for gathering information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

G2. RIGHT OF ENTRY

The Permittee shall allow an authorized representative of Ecology, upon the presentation of credentials and such other documents as may be required by law:

A. To enter upon the premises where a discharge is located or where any records must be kept under the terms and conditions of this permit;

B. To have access to and copy at reasonable times any records that must be kept under the terms of the permit;

C. To inspect at reasonable times any monitoring equipment or method of monitoring required in the permit;

D. To inspect at reasonable times any collection, treatment, pollution management, or discharge facilities; and

E. To sample at reasonable times any discharge of pollutants.

G3. PERMIT ACTIONS

This permit shall be subject to modification, suspension, or termination, in whole or in part by Ecology for any of the following causes:

A. Violation of any permit term or condition;

B. Obtaining a permit by misrepresentation or failure to disclose all relevant facts;

C. A material change in quantity or type of waste disposal;

D. A material change in the condition of the waters of the state; or

E. Nonpayment of fees assessed pursuant to RCW 90.48.465.

Ecology may also modify this permit, including the schedule of compliance or other conditions, if it determines good and valid cause exists, including promulgation or revisions of regulations or new information.

G4. REPORTING A CAUSE FOR MODIFICATION

The Permittee shall submit a new application, or a supplement to the previous application, along with required engineering plans and reports, whenever a material change in the quantity or type of discharge is anticipated which is not specifically authorized by this permit. This application shall be submitted at least 60 days prior to any proposed changes. Submission of this application does not relieve the Permittee of the duty to comply with the existing permit until it is modified or reissued.

G5. PLAN REVIEW REQUIRED

Prior to constructing or modifying any wastewater control facilities, an engineering report and detailed plans and specifications shall be submitted to Ecology for approval in accordance with Chapter 173-240 WAC. Engineering reports, plans, and specifications should be submitted at least 180 days prior to the planned start of construction. Facilities shall be constructed and operated in accordance with the approved plans.

G6. COMPLIANCE WITH OTHER LAWS AND STATUTES

Nothing in the permit shall be construed as excusing the Permittee from compliance with any applicable federal, state, or local statutes, ordinances, or regulations.

G7. DUTY TO REAPPLY

The Permittee must apply for permit renewal by **June 1, 2016**.

G8. REMOVED SUBSTANCES

Collected screenings, grit, solids, sludges, filter backwash, or other pollutants removed in the course of treatment or control of wastewaters shall not be resuspended or reintroduced to the final effluent stream for discharge to state waters.

G9. TOXIC POLLUTANTS

If any applicable toxic effluent standard or prohibition (including any schedule of compliance specified in such effluent standard or prohibition) is established under Section 307(a) of the Clean Water Act for a toxic pollutant and that standard or prohibition is more stringent than any limitation upon such pollutant in the permit, Ecology shall institute proceedings to modify or revoke and reissue the permit to conform to the new toxic effluent standard or prohibition.

G10. OTHER REQUIREMENTS OF 40 CFR

All other requirements of 40 CFR 122.41 and 122.42 are incorporated in this permit by reference.

G11. ADDITIONAL MONITORING

Ecology may establish specific monitoring requirements in addition to those contained in this permit by administrative order or permit modification.

G12. PAYMENT OF FEES

The Permittee shall submit payment of fees associated with this permit as assessed by Ecology. Ecology may revoke this permit if the permit fees established under Chapter 173-224 WAC are not paid.

G13. PENALTIES FOR VIOLATING PERMIT CONDITIONS

Any person who is found guilty of willfully violating the terms and conditions of this permit shall be deemed guilty of a crime, and upon conviction thereof shall be punished by a fine of up to $10,000 and costs of prosecution, or by imprisonment in the discretion of the court. Each day upon which a willful violation occurs may be deemed a separate and additional violation.

Any person who violates the terms and conditions of a waste discharge permit shall incur, in addition to any other penalty as provided by law, a civil penalty in the amount of up to $10,000 for every such violation. Each and every such violation shall be a separate and distinct offense, and in case of a continuing violation, every day's continuance shall be and be deemed to be a separate and distinct violation.

APPENDIX A

LIST OF POLLUTANTS WITH ANALYTICAL METHODS, DETECTION LIMITS AND QUANTITATION LEVELS

The Permittee must use the specified analytical methods, detection limits (DLs) and quantitation levels (QLs) in the following table for permit and application required monitoring unless:

- Another permit condition specifies other methods, detection levels, or quantitation levels.
- The method used produces measurable results in the sample and EPA has listed it as an EPA-approved method in 40 CFR Part 136.

If the Permittee uses an alternative method, not specified in the permit and as allowed above, it must report the test method, DL, and QL on the discharge monitoring report or in the required report.

When the permit requires the Permittee to measure the base neutral compounds in the list of priority pollutants, it must measure all of the base neutral pollutants listed in the table below. The list includes EPA required base neutral priority pollutants and several additional polynuclear aromatic hydrocarbons (PAHs). The Water Quality Program added several PAHs to the list of base neutrals below from Ecology's Persistent Bioaccumulative Toxics (PBT) List. It only added those PBT parameters of interest to Appendix A that did not increase the overall cost of analysis unreasonably.

Ecology added this appendix to the permit in order to reduce the number of analytical "non-detects" in permit-required monitoring and to measure effluent concentrations near or below criteria values where possible at a reasonable cost.

CONVENTIONAL PARAMETERS

Pollutant & CAS No. ***(if available)***	**Recommended Analytical Protocol**	**Detection (DL)[1]** ***µg/L unless specified***	**Quantitation Level (QL)[2]** ***µg/L unless specified***
Biochemical Oxygen Demand	SM5210-B		2 mg/L
Chemical Oxygen Demand	SM5220-D		10 mg/L
Total Organic Carbon	SM5310-B/C/D		1 mg/L
Total Suspended Solids	SM2540-D		5 mg/L
Total Ammonia (as N)	SM4500-NH3-GH		0.3 mg/L
Flow	Calibrated device		
Dissolved oxygen	SM4500-OC/OG		0.2 mg/L
Temperature (max. 7-day avg.)	Analog recorder or Use micro-recording devices known as thermistors		0.2° C

Pollutant & CAS No. *(if available)*	Recommended Analytical Protocol	Detection (DL)[1] *µg/L unless specified*	Quantitation Level (QL)[2] *µg/L unless specified*
pH	SM4500-H^+ B	N/A	N/A

NONCONVENTIONAL PARAMETERS

Pollutant & CAS No. *(if available)*	Recommended Analytical Protocol	Detection (DL)[1] *µg/L unless specified*	Quantitation Level (QL)[2] *µg/L unless specified*
Total Alkalinity	SM2320-B		5 mg/L as CaCO3
Chlorine, Total Residual	SM4500 Cl G		50.0
Color	SM2120 B/C/E		10 color units
Fecal Coliform	SM 9221D/E,9222	N/A	N/A
Fluoride (16984-48-8)	SM4500-F E	25	100
Nitrate-Nitrite (as N)	SM4500-NO3-E/F/H		100
Nitrogen, Total Kjeldahl (as N)	SM4500-NH3-C/E/FG		300
Ortho-Phosphate (PO_4 as P)	SM4500- PE/PF	3	10
Phosphorus, Total (as P)	SM4500-PE/PF	3	10
Oil and Grease (HEM)	1664A	1,400	5,000
Salinity	SM2520-B		3 PSS
Settleable Solids	SM2540 -F		100
Sulfate (as mg/L SO_4)	SM4110-B		200
Sulfide (as mg/L S)	SM4500-S^2F/D/E/G		200
Sulfite (as mg/L SO_3)	SM4500-SO3B		2000
Total Coliform	SM 9221B, 9222B, 9223B	N/A	N/A
Total dissolved solids	SM2540 C		20 mg/L
Total Hardness	SM2340B		200 as CaCO3
Aluminum, Total (7429-90-5)	200.8	2.0	10

Pollutant & CAS No. *(if available)*	Recommended Analytical Protocol	Detection (DL)[1] *µg/L unless specified*	Quantitation Level (QL)[2] *µg/L unless specified*
Barium Total (7440-39-3)	200.8	0.5	2.0
BTEX (benzene +toluene + ethylbenzene + m,o,p xylenes)	EPA SW 846 8021/8260	1	2
Boron Total (7440-42-8)	200.8	2.0	10.0
Cobalt, Total (7440-48-4)	200.8	0.05	0.25
Iron, Total (7439-89-6)	200.7	12.5	50
Magnesium, Total (7439-95-4)	200.7	10	50
Molybdenum, Total (7439-98-7)	200.8	0.1	0.5
Manganese, Total (7439-96-5)	200.8	0.1	0.5
NWTPH Dx	Ecology NWTPH Dx	250	250
NWTPH Gx	Ecology NWTPH Gx	250	250
Tin, Total (7440-31-5)	200.8	0.3	1.5
Titanium, Total (7440-32-6)	200.8	0.5	2.5

PRIORITY POLLUTANTS

Pollutant & CAS No. *(if available)*	Recommended Analytical Protocol	Detection (DL)[1] *µg/L unless specified*	Quantitation Level (QL)[2] *µg/L unless specified*
METALS, CYANIDE & TOTAL PHENOLS			
Antimony, Total (7440-36-0)	200.8	0.3	1.0
Arsenic, Total (7440-38-2)	200.8	0.1	0.5
Beryllium, Total (7440-41-7)	200.8	0.1	0.5
Cadmium, Total (7440-43-9)	200.8	0.05	0.25
Chromium (hex) dissolved (18540-29-9)	SM3500-Cr EC	0.3	1.2
Chromium, Total (7440-47-3)	200.8	0.2	1.0
Copper, Total (7440-50-8)	200.8	0.4	2.0
Lead, Total (7439-92-1)	200.8	0.1	0.5

Pollutant & CAS No. *(if available)*	Recommended Analytical Protocol	Detection (DL)[1] *µg/L unless specified*	Quantitation Level (QL)[2] *µg/L unless specified*
METALS, CYANIDE & TOTAL PHENOLS			
Mercury, Total (7439-97-6)	1631E	0.0002	0.0005
Nickel, Total (7440-02-0)	200.8	0.1	0.5
Selenium, Total (7782-49-2)	200.8	1.0	1.0
Silver, Total (7440-22-4)	200.8	0.04	0.2
Thallium, Total (7440-28-0)	200.8	0.09	0.36
Zinc, Total (7440-66-6)	200.8	0.5	2.5
Cyanide, Total (57-12-5)	335.4	5	10
Cyanide, Weak Acid Dissociable	SM4500-CN I	5	10
Phenols, Total	EPA 420.1		50
ACID COMPOUNDS			
2-Chlorophenol (95-57-8)	625	1.0	2.0
2,4-Dichlorophenol (120-83-2)	625	0.5	1.0
2,4-Dimethylphenol (105-67-9)	625	0.5	1.0
4,6-dinitro-o-cresol (534-52-1) (2-methyl-4,6,-dinitrophenol)	625/1625B	1.0	2.0
2,4 dinitrophenol (51-28-5)	625	1.0	2.0
2-Nitrophenol (88-75-5)	625	0.5	1.0
4-nitrophenol (100-02-7)	625	0.5	1.0
Parachlorometa cresol (59-50-7) (4-chloro-3-methylphenol)	625	1.0	2.0
Pentachlorophenol (87-86-5)	625	0.5	1.0
Phenol (108-95-2)	625	2.0	4.0
2,4,6-Trichlorophenol (88-06-2)	625	2.0	4.0
Pollutant & CAS No. *(if available)*	**Recommended Analytical Protocol**	**Detection (DL)[1] *µg/L unless specified***	**Quantitation Level (QL)[2] *µg/L unless specified***
VOLATILE COMPOUNDS			
Acrolein (107-02-8)	624	5	10

Pollutant & CAS No. *(if available)*	Recommended Analytical Protocol	Detection (DL)[1] *µg/L unless specified*	Quantitation Level (QL)[2] *µg/L unless specified*
METALS, CYANIDE & TOTAL PHENOLS			
Acrylonitrile (107-13-1)	624	1.0	2.0
Benzene (71-43-2)	624	1.0	2.0
Bromoform (75-25-2)	624	1.0	2.0
Carbon tetrachloride (56-23-5)	624/601 or SM6230B	1.0	2.0
Chlorobenzene (108-90-7)	624	1.0	2.0
Chloroethane (75-00-3)	624/601	1.0	2.0
2-Chloroethylvinyl Ether (110-75-8)	624	1.0	2.0
Chloroform (67-66-3)	624 or SM6210B	1.0	2.0
Dibromochloromethane (124-48-1)	624	1.0	2.0
1,2-Dichlorobenzene (95-50-1)	624	1.9	7.6
1,3-Dichlorobenzene (541-73-1)	624	1.9	7.6
1,4-Dichlorobenzene (106-46-7)	624	4.4	17.6
Dichlorobromomethane (75-27-4)	624	1.0	2.0
1,1-Dichloroethane (75-34-3)	624	1.0	2.0
1,2-Dichloroethane (107-06-2)	624	1.0	2.0
1,1-Dichloroethylene (75-35-4)	624	1.0	2.0
1,2-Dichloropropane (78-87-5)	624	1.0	2.0
1,3-dichloropropene (mixed isomers) (1,2-dichloropropylene) (542-75-6)[3]	624	1.0	2.0
Ethylbenzene (100-41-4)	624	1.0	2.0
Methyl bromide (74-83-9) (Bromomethane)	624/601	5.0	10.0
Methyl chloride (74-87-3) (Chloromethane)	624	1.0	2.0

Pollutant & CAS No. *(if available)*	Recommended Analytical Protocol	Detection (DL)[1] *µg/L unless specified*	Quantitation Level (QL)[2] *µg/L unless specified*
METALS, CYANIDE & TOTAL PHENOLS			
Methylene chloride (75-09-2)	624	5.0	10.0
1,1,2,2-Tetrachloroethane (79-34-5)	624	1.9	2.0
Tetrachloroethylene (127-18-4)	624	1.0	2.0
Toluene (108-88-3)	624	1.0	2.0
1,2-Trans-Dichloroethylene (156-60-5) (Ethylene dichloride)	624	1.0	2.0
1,1,1-Trichloroethane (71-55-6)	624	1.0	2.0
1,1,2-Trichloroethane (79-00-5)	624	1.0	2.0
Trichloroethylene (79-01-6)	624	1.0	2.0
Vinyl chloride (75-01-4)	624/SM6200B	1.0	2.0
BASE/NEUTRAL COMPOUNDS (compounds in bold are Ecology PBTs)			
Acenaphthene (83-32-9)	625	0.2	0.4
Acenaphthylene (208-96-8)	625	0.3	0.6
Anthracene (120-12-7)	625	0.3	0.6
Benzidine (92-87-5)	625	12	24
Benzyl butyl phthalate (85-68-7)	625	0.3	0.6
Benzo(*a*)anthracene (56-55-3)	625	0.3	0.6
Benzo(b)fluoranthene (3,4-benzofluoranthene) (205-99-2)[4]	610/625	0.8	1.6
Benzo(j)fluoranthene (205-82-3)[4]	625	0.5	1.0
Benzo(k)fluoranthene (11,12-benzofluoranthene) (207-08-9)[4]	610/625	0.8	1.6
Benzo(r,s,t)pentaphene (189-55-9)	625	0.5	1.0
Benzo(*a*)pyrene (50-32-8)	610/625	0.5	1.0

Pollutant & CAS No. *(if available)*	Recommended Analytical Protocol	Detection (DL)[1] *µg/L unless specified*	Quantitation Level (QL)[2] *µg/L unless specified*
METALS, CYANIDE & TOTAL PHENOLS			
Benzo(*ghi*)Perylene (191-24-2)	610/625	0.5	1.0
Bis(*2-chloroethoxy)*methane (111-91-1)	625	5.3	21.2
Bis(*2-chloroethyl*)ether (111-44-4)	611/625	0.3	1.0
Bis(*2-chloroisopropyl*)ether (39638-32-9)	625	0.3	0.6
Bis(*2-ethylhexyl*)phthalate (117-81-7)	625	0.1	0.5
4-Bromophenyl phenyl ether (101-55-3)	625	0.2	0.4
2-Chloronaphthalene (91-58-7)	625	0.3	0.6
4-Chlorophenyl phenyl ether (7005-72-3)	625	0.3	0.5
Chrysene (218-01-9)	610/625	0.3	0.6
Dibenzo (a,j)acridine (224-42-0)	610M/625M	2.5	10.0
Dibenzo (a,h)acridine (226-36-8)	610M/625M	2.5	10.0
Dibenzo(a-*h*)anthracene (53-70-3)(1,2,5,6-dibenzanthracene)	625	0.8	1.6
Dibenzo(a,e)pyrene (192-65-4)	610M/625M	2.5	10.0
Dibenzo(a,h)pyrene (189-64-0)	625M	2.5	10.0
3,3-Dichlorobenzidine (91-94-1)	605/625	0.5	1.0
Diethyl phthalate (84-66-2)	625	1.9	7.6
Dimethyl phthalate (131-11-3)	625	1.6	6.4
Di-n-butyl phthalate (84-74-2)	625	0.5	1.0
2,4-dinitrotoluene (121-14-2)	609/625	0.2	0.4
2,6-dinitrotoluene (606-20-2)	609/625	0.2	0.4

Pollutant & CAS No. *(if available)*	Recommended Analytical Protocol	Detection (DL)[1] *µg/L unless specified*	Quantitation Level (QL)[2] *µg/L unless specified*
BASE/NEUTRAL COMPOUNDS (compounds in bold are Ecology PBTs)			
Di-n-octyl phthalate (117-84-0)	625	0.3	0.6
1,2-Diphenylhydrazine (*as Azobenzene*) (122-66-7)	1625B	5.0	20
Fluoranthene (206-44-0)	625	0.3	0.6
Fluorene (86-73-7)	625	0.3	0.6
Hexachlorobenzene (118-74-1)	612/625	0.3	0.6
Hexachlorobutadiene (87-68-3)	625	0.5	1.0
Hexachlorocyclopentadiene (77-47-4)	1625B/625	0.5	1.0
Hexachloroethane (67-72-1)	625	0.5	1.0
Indeno(*1,2,3-cd*)Pyrene (193-39-5)	610/625	0.5	1.0
Isophorone (78-59-1)	625	0.5	1.0
3-Methyl cholanthrene (56-49-5)	625	2.0	8.0
Naphthalene (91-20-3)	625	0.3	0.6
Nitrobenzene (98-95-3)	625	0.5	1.0
N-Nitrosodimethylamine (62-75-9)	607/625	2.0	4.0
N-Nitrosodi-n-propylamine (621-64-7)	607/625	0.5	1.0
N-Nitrosodiphenylamine (86-30-6)	625	0.5	1.0
Perylene (198-55-0)	625	1.9	7.6
Phenanthrene (85-01-8)	625	0.3	0.6
Pyrene (129-00-0)	625	0.3	0.6
1,2,4-Trichlorobenzene (120-82-1)	625	0.3	0.6
DIOXIN			
2,3,7,8-Tetra-Chlorodibenzo-P-Dioxin (176-40-16)	1613B	1.3 pg/L	5 pg/L

PESTICIDES/PCBs			
Aldrin (309-00-2)	608	0.025	0.05
alpha-BHC (319-84-6)	608	0.025	0.05
beta-BHC (319-85-7)	608	0.025	0.05
gamma-BHC (58-89-9)	608	0.025	0.05
delta-BHC (319-86-8)	608	0.025	0.05
Chlordane (57-74-9) [5]	608	0.025	0.05
4,4'-DDT (50-29-3)	608	0.025	0.05
4,4'-DDE (72-55-9)	608	0.025	0.05[10]
4,4' DDD (72-54-8)	608	0.025	0.05
Dieldrin (60-57-1)	608	0.025	0.05
alpha-Endosulfan (959-98-8)	608	0.025	0.05
beta-Endosulfan (33213-65-9)	608	0.025	0.05
Endosulfan Sulfate (1031-07-8)	608	0.025	0.05
Endrin (72-20-8)	608	0.025	0.05
Endrin Aldehyde (7421-93-4)	608	0.025	0.05
Heptachlor (76-44-8)	608	0.025	0.05
Heptachlor Epoxide (1024-57-3)	608	0.025	0.05
PCB-1242 (53469-21-9) [6]	608	0.25	0.5
PCB-1254 (11097-69-1)	608	0.25	0.5
PCB-1221 (11104-28-2)	608	0.25	0.5
PCB-1232 (11141-16-5)	608	0.25	0.5
PCB-1248 (12672-29-6)	608	0.25	0.5
PCB-1260 (11096-82-5)	608	0.13	0.5
PCB-1016 (12674-11-2) [6]	608	0.13	0.5
Toxaphene (8001-35-2)	608	0.24	0.5

1. Detection level (DL) or detection limit means the minimum concentration of an analyte (substance) that can be measured and reported with a 99percent confidence that the analyte concentration is greater than zero as determined by the procedure given in 40 CFR part 136, Appendix B.

2. 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).

3. 1, 3-dichloroproylene (mixed isomers) You may report this parameter as two separate parameters: cis-1, 3-dichlorpropropene (10061-01-5) and trans-1, 3-dichloropropene (10061-02-6).

4. Total Benzofluoranthenes - Because Benzo(b)fluoranthene, Benzo(j)fluoranthene and Benzo(k)fluoranthene co-elute you may report these three isomers as total benzofluoranthenes.

5. Chlordane – You may report alpha-chlordane (5103-71-9) and gamma-chlordane (5103-74-2) in place of chlordane (57-74-9). If you report alpha and gamma-chlordane, the DL/PQLs that apply are 0.025/0.050.

6. PCB 1016 & PCB 1242 – You may report these two PCB compounds as one parameter called PCB 1016/1242.

ADDENDUM TO THE FACT SHEET
FOR NATIONAL POLLUTANT DISCHARGE
ELIMINATION SYSTEM (NPDES)
PERMIT NO. WA0037427

DECEMBER 2011

I. GENERAL INFORMATION

Facility: City of Washougal Wastewater Treatment Plant
54 Second Street
Washougal, WA 98671

II. APPLICATION REVIEW

The city of Washougal submitted an application to Ecology on April 13, 2009, and October 26, 2009, for permit reissuance, and Ecology accepted it on October 6, 2010. Ecology has sufficiently reviewed the application, discharge monitoring reports, and other facility information in enough detail to ensure that:

- The city of Washougal has complied with all of the terms, conditions, requirements and schedules of compliance of the expired permit.
- Ecology has up-to date information on the waste treatment practices and the nature, content, volume, and frequency of its discharge.
- The discharge meets applicable effluent standards and limits, water quality standards, and other legally applicable requirements.

III. PERMIT REAUTHORIZATION

When Ecology reauthorizes a discharge permit it essentially reissues the permit with the existing limits, terms and conditions. Alternatively, when Ecology renews a permit it re-evaluates the impact of the discharge on the receiving water which may lead to changes in the limits, terms and conditions of the permit.

This fact sheet addendum accompanies the permit, which Ecology proposes to reauthorize for the discharge of wastewater to the Columbia River. The previous fact sheet explains the basis for the discharge limitations and conditions of the reauthorized permit and remains as part of the administrative record.

Ecology determined it does not need to change the existing permit requirements, including discharge limits and monitoring, to protect the receiving water receiving quality. The previous fact sheet addressed conditions and issues at the facility at the time when Ecology issued the previous permit in 1998. Since the issuance of the current

permit, Ecology has not received any additional information which indicates that environmental impacts from the discharge warrant a complete renewal of the permit. The reauthorized permit is virtually identical to the previous permit issued on September 30, 2004. The effluent sampling location acknowledges replacement of chlorine disinfection with UV disinfection.

Ecology reviewed inspections and assessed compliance of the The city of Washougal discharge with the terms and conditions in the previous permit and determined that it should not rank the facility as a high priority for permit renewal. Ecology assigns a high priority for permit renewals in situations where water quality would benefit from a more stringent permit during the next five-year cycle.

The permit reauthorization process, along with the renewal of high priority permits, allows Ecology to reissue permits in a timely manner and minimize the number of active permits that have passed their expiration dates. For permit reissuance planning purposes, Ecology follows a system of ranking that considers the benefit gained by renewing a permit rather than reauthorizing a permit during its annual permit planning process. Ecology assesses each permit that is expiring and due for reissuance and compares it with other permits due for reissuance. Ecology notifies the public and seeks input after it has tentatively established the initial draft ranking of the permits it plans to renew and those it plans to reauthorize. Ecology considers all relevant comments and suggestions before it makes a final decision.

Ecology carried over the discharge limits and conditions in effect at the time of expiration of the previous permit to this reauthorized permit. Ecology only changed the submittal dates for reports from those in the previous permit. Ecology removed the completed report requirements that do not require additional or continued assessment. It adjusted the dates for the other standard compliance and submittal requirements that it carried over from the past permit into this reauthorized permit. Ecology considered these reports necessary in the previous permit and no information has come forward to cause it to reconsider.

Ecology must public notice the availability of the draft reauthorized permit at least 30 days before it reissues the permit [Washington Administrative Code (WAC) 173-220-050]. Ecology invites you to review and comment on its decision to reauthorize the permit (see Appendix A-Public Involvement for more detail on the Public Notice procedures).

After the public comment period has closed, Ecology will prepare a response to comments document that it will attach to this fact sheet addendum. The response to comments will include the resultant changes to the permit and either address each comment individually or summarize the substantive comments and respond. Ecology sends a copy of the response to comments to all parties who submitted comments. Ecology will include the response to comments in this fact sheet addendum.

IV. RECOMMENDATION FOR PERMIT ISSUANCE

Ecology proposes to reissue this permit for five years.

APPENDIX A--PUBLIC INVOLVEMENT INFORMATION

Ecology proposes to reissue a permit to the city of Washougal. The permit includes wastewater discharge limits and other conditions. This fact sheet addendum describes the facility and Ecology's reasons for reauthorizing the permit conditions.

Ecology placed a Public Notice of Application on June 4, 2009; June 11, 2009; June 16, 2010, and June 23, 2010; in the *Columbian* to inform the public about the submitted application and to invite comment on the reissuance of this permit.

Ecology will place a Public Notice of Draft on June 15, 2011, in the *Columbian* to inform the public and to invite comment on the proposed draft National Pollutant Discharge Elimination System permit and fact sheet addendum.

The Notice –

- Tells where copies of the draft Permit and Fact Sheet are available for public evaluation (a local public library, the closest Regional or Field Office, posted on our website.).
- Offers to provide the documents in an alternate format to accommodate special needs.
- Urges people to submit their comments, in writing, before the end of the Comment Period
- Tells how to request a public hearing of comments about the proposed NPDES Permit.
- Explains the next step(s) in the permitting process.

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

You may obtain further information from Ecology by telephone, 360-407-6279, or by writing to the permit writer at the address listed below.

Water Quality Permit Coordinator
Department of Ecology
Southwest Regional Office
P.O. Box 47775
Olympia, WA 98504-7775

The primary author of this permit and fact sheet is Carey Cholski.

WASTEWATER TREATMENT PLANT MONITORING REPORT

Permit No. WA0037427 Month Year

Facility Name City of Washougal County Clark

Receiving Water Columbia River Plant Operator

Plant Type Oxidation Ditch with UV Disinfection Population

	INFLUENT						EFFLUENT									
Frequency	CONT	3/WEEK	3/WEEK	3/WEEK	3/WEEK		CONT	3/WEEK	3/WEEK	3/WEEK	3/WEEK	3/WEEK	3/WEEK	DAILY	3/WEEK	1/WEEK
Date	FLOW MGD	BOD 5-DAY MG/L	BOD 5-DAY LBS/DAY	TSS MG/L	TSS LBS/DAY		FLOW MGD	BOD 5-DAY MG/L	BOD 5-DAY % REMOVAL	BOD 5-DAY LBS/DAY	TSS MG/L	TSS % REMOVAL	TSS LBS/DAY	pH STANDARD UNITS	FECAL COLIFORM #/100 ML	AMMONIA AS N MG/L
1																
2																
3																
4																
5																
6																
7																
8																
9																
10																
11																
12																
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22																
23																
24																
25																
26																
27																
28																
29																
30																
31																
Total																
	AVG	AVG	AVG	AVG	AVG		AVG	AVG	AVG	AVG	AVG	AVG	AVG	MIN	GEM	AVG
Permit	**2.24**		**3960**		**3960**			**30**	**85**	**560**	**30**	**85**	**560**	**6.0**	**200**	**21.1**
	MAX	MAX	MAX	MAX	MAX		MAX	AVW		AVW	AVW		AVW	MAX	GM7	MXD
Limits								**45**		**840**	**45**		**840**	**9.0**	**400**	**42.3**

Please Circle ALL Permit Violations **Mail to P.O. Box 47775, Olympia WA 98504-7775**

AVG=Average **AVW** =Highest Weekly Average **GEM**=Geometric Mean **MAX**=Maximum **MIN**=Minimum
GM7=highest 7-day Geometric Mean

I certify under penalty of law, that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system or those persons directly responsible for gathering information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Name and Title

Signature

WASTEWATER TREATMENT PLANT MONITORING REPORT

Permit No. WA0037427 Month Year

Facility Name City of Washougal County Clark

Receiving Water Columbia River Plant Operator

Plant Type Oxidation Ditch with UV Disinfection Population

EFFLUENT

Frequency	DAILY	DAILY													
Date	TEMPERATURE DEG. C	RAIN INCHES/DAY													
1															
2															
3															
4															
5															
6															
7															
8															
9															
10															
11															
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24															
25															
26															
27															
28															
29															
30															
31															
Total															
	AVG	AVG													
Permit															
	MXD	MXD													
Limits															

Please Circle ALL Permit Violations **Mail to P.O. Box 47775, Olympia WA 98504-7775**

AVG=Average **AVW** =Highest Weekly Average **GEM**=Geometric Mean **MAX**=Maximum **MIN**=Minimum
GM7=highest 7-day Geometric Mean

I certify under penalty of law, that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system or those persons directly responsible for gathering information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Name and Title

Signature

WASTEWATER TREATMENT PLANT MONITORING REPORT

Permit No.	WA0037427	Month	Year
Facility Name	City of Washougal	County	Clark
Receiving Water	Columbia River	Plant Operator	
Plant Type	Oxidation Ditch with UV Disinfection	Population	

QUARTERLY MONITORING

PARAMETER	UNITS	EFFLUENT
NITRITE AS N	MG/L	
NITRATE AS N	MG/L	
TKN	MG/L	
ORTHO PHOSPHATE (PO_4)	MG/L	
TOTAL PHOSPHORUS	MG/L	

DATE SAMPLED _____

REPORT WITH MARCH, JUNE, SEPTEMBER, & DECEMBER DMRS

I certify under penalty of law, that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system or those persons directly responsible for gathering information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Name and Title _____ Signature _____

APPENDIX F
Flow and Loading Projections

Appendix F:
Flow and Loading Projections

Table F.1: Future Wastewater Flow and Loading Values

Year	Dry Average Flow *(mgd)*	Wet Average Flow *(mgd)*	Maximum Monthly Flow *(mgd)*	Peak Hour Flow *(mgd)*	Avg Annual TSS/BOD *(lb/day)*	Maximum Monthly TSS/BOD *(lb/day)*
2016	20,747	1.05	1.47	1.91	3.68	2,533
2017	21,141	1.08	1.51	1.95	3.79	2,612
2018	21,543	1.11	1.55	1.99	3.90	2,692
2019	21,953	1.15	1.58	2.03	4.02	2,774
2020	22,372	1.18	1.62	2.07	4.13	2,858
2021	22,799	1.22	1.66	2.11	4.25	2,944
2022	23,235	1.25	1.70	2.16	4.37	3,031
2023	23,680	1.29	1.74	2.20	4.50	3,120
2024	24,135	1.32	1.78	2.25	4.63	3,211
2025	24,598	1.36	1.82	2.29	4.76	3,303
2026	25,072	1.40	1.86	2.34	4.89	3,398
2027	25,555	1.44	1.91	2.39	5.02	3,495
2028	26,048	1.47	1.95	2.44	5.16	3,593
2029	26,552	1.52	2.00	2.49	5.30	3,694
2030	27,066	1.56	2.04	2.54	5.45	3,797
2031	27,591	1.60	2.09	2.59	5.59	3,902
2032	28,127	1.64	2.14	2.65	5.74	4,009
2033	28,674	1.69	2.19	2.70	5.90	4,119
2034	29,233	1.73	2.24	2.76	6.05	4,230
2035	29,866	1.78	2.30	2.82	6.23	4,357
2036	30,450	1.83	2.35	2.88	6.39	4,474

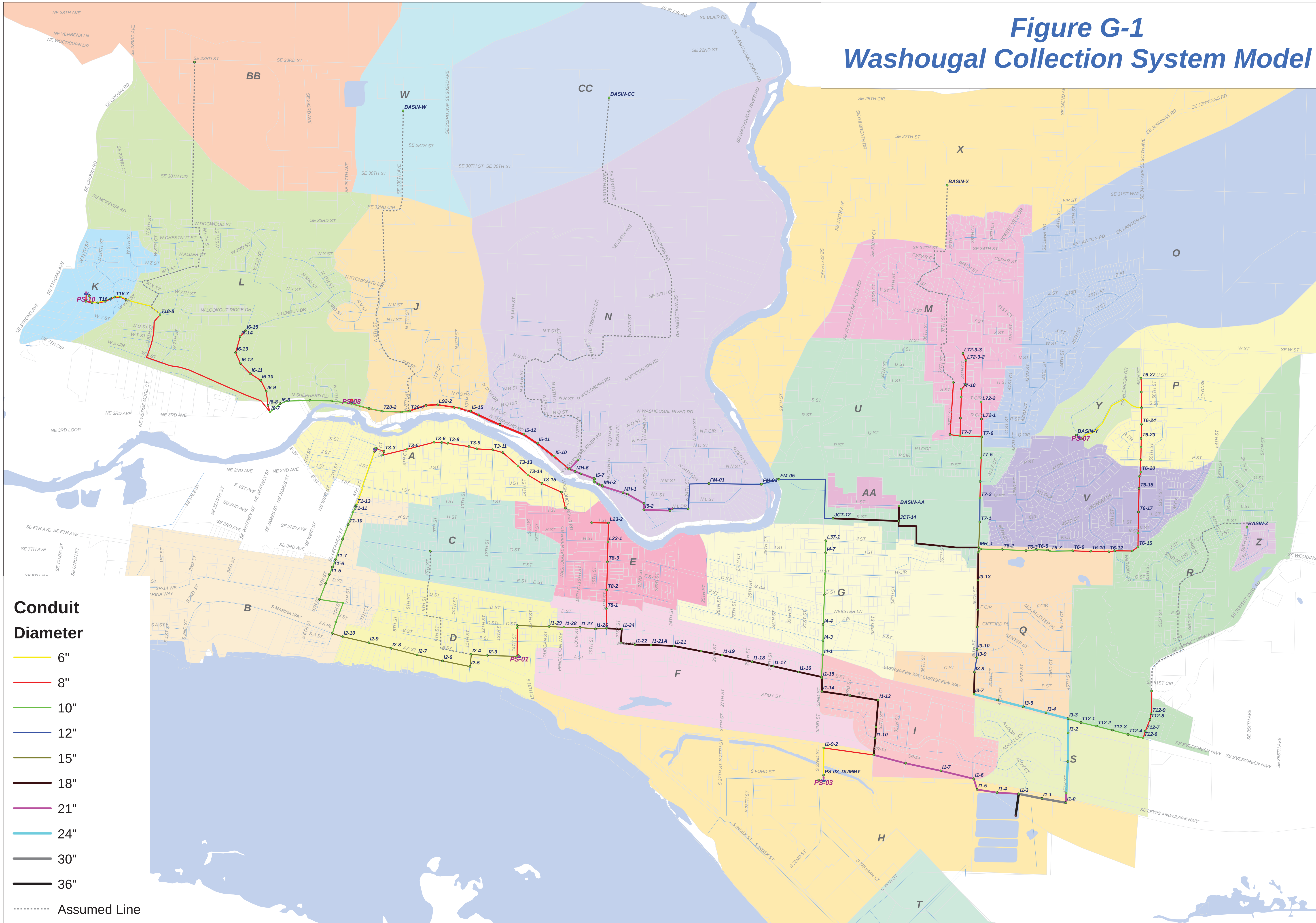
APPENDIX G
Collection System Evaluation

Appendix G:
Collection System Evaluation

Table G.1: ERU Allocation by Basin

Basin	Total Acreage	Existing ERUs	20-Year ERUs	Buildout ERUs
A	113	280	320	453
B	196	60	307	1,063
C	94	287	354	445
D	126	206	313	668
E	83	285	352	500
F	184	125	190	997
G	206	377	572	1,339
H	377	800	986	1,748
I	91	245	349	640
J	166	186	265	636
K	53	111	148	170
L	378	428	719	1,332
M	172	368	454	654
N	451	461	802	2,452
O	383	200	667	1,780
P	168	92	202	600
Q	129	240	342	442
R	237	377	537	899
S	82	246	350	587
T	270	612	755	1,397
U	210	280	399	1,042
V	117	325	401	499
W	85	-	161	720
X	291	-	258	1,070
Y	34	52	74	85
Z	9	65	70	75
AA	11	22	28	36
BB	144	-	199	750
CC	25	-	264	865
Total	4,882	6,730	10,838	23,944

Figure G-1
Washougal Collection System Model



MEMORANDUM

Date: August 26, 2015

To: Chris Kelsey, Adam Crafts

From: Dave Harms

CC:

Subject: **Washougal General Sewer Plan Update**
Sanitary Sewer Modeling Software Evaluation

An evaluation of sewer modeling software was performed to develop a recommendation for the Washougal General Sewer Plan (GSP) analysis. Many factors were considered in making the recommendation. Each hydraulic modeling application has unique requirements, depending on the utilities available data, specific analysis needs, long term goals, etc. The overall goal of this evaluation is to select an appropriate software application that will facilitate efficient development of a hydraulic model of the City's collection system, perform an accurate analysis and result in an effective CIP. More accurate diagnostic capabilities will allow for quicker diagnosis of deficiencies and necessary improvements and a more effective CIP, potentially saving money over the more conservative and limited spreadsheet method.

As part of this evaluation, the City's data was reviewed, together with the previous spreadsheet model of the collection system and County data, available in GIS format. An evaluation matrix was developed to summarize key criteria in the selection process and compare/contrast software characteristics, capabilities in meeting those criteria and for comparison with the previous spreadsheet process. The criteria listed in the matrix are tailored to address Washougal's specific characteristics and needs. The resulting matrix is attached.

Many software choices exist that simulate sanitary collection systems. This evaluation is limited to three for expediency, license availability, familiarity and the capability to successfully model the City's collection system. The three software packages evaluated are all considered industry standards. Other software packages were not selected for consideration if they required

purchase of a license, familiarization/training or were not considered to possess all the criteria listed in the evaluation matrix. Software purchase costs are included for comparison, for each of the three packages included in the evaluation. These costs are based on the specific configuration that BHC previously purchased from each vendor and are intended to illustrate the range of costs, if the City decided to purchase a license. The cost to the City would vary, depending on the specific configuration chosen (i.e. single seat vs network license and the number of pipes simulated).

The three software packages evaluated have a number of common capabilities, including those listed below. As a result, none is clearly superior, based on the listed criteria.

- Fully dynamic hydraulic routing, required to accurately simulate potential surcharge conditions in the collection system.
- The ability to operate within a GIS environment.
- The ability to export collection system data to a standard format, if the City decided to change software products in the future.
- Flexible pump simulation and control capabilities.
- Multiple data import options and efficient model development.
- I/I generation capabilities.
- Extensive capabilities for reviewing results, identifying deficiencies and the effectiveness of alternative solutions.

Recommendation

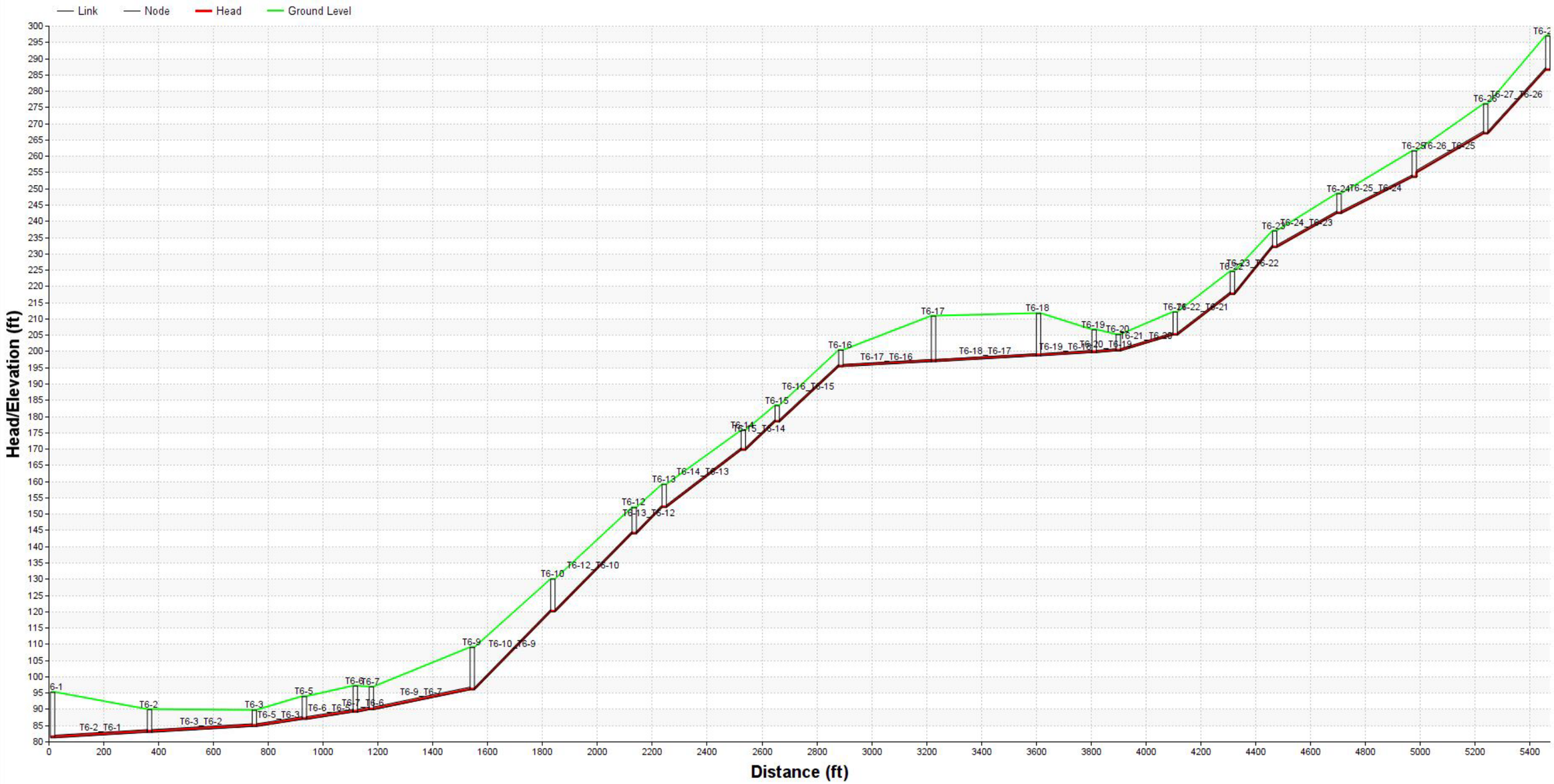
Based on our evaluation of the software packages and past experience performing collection system modeling analyses, it is apparent that all three can successfully model the City's collection system. InfoSWWM software appears to best meet the overall criteria identified in this evaluation. We are, therefore, recommending InfoSWMM software for this analysis.

Category	Description	Spreadsheet	INFOSWMM (Innovyze)	MIKE Urban (DHI)	XPSWMM (XPSolutions)
Ability to leverage/import existing spreadsheet data		yes	yes	yes	yes
GIS interface?	Can the software interact directly with GIS, importing/exporting data & generating graphics?	no	yes	yes	yes
BHC familiarity		yes	yes	yes	yes
License Cost	Software purchase price plus annual maintenance fee – based on the configuration already purchased by BHC	n/a	Software Cost = $10,000 Annual Maint.. Fee = $1,500 Total = $11,000 4,000 pipe single-seat license	Software Cost = $28,000 Annual Maint.. Fee = $3,640 Total = $31,640 unlimited pipe double-seat network license	Software Cost = $9,865 Annual Maint.. Fee = $1,510 Total = $11,375 500 pipe single-seat license
License availability	Does BHC have a current software license?	yes	Yes	Yes	yes
Ease of use	Is the software easy to use – i.e. characterize the time needed to perform an analysis	easy	More complicated because of the capability to manage data/multiple scenarios & perform detailed analysis	More complicated because of the capability to manage data/multiple scenarios & perform detailed analysis. Somewhat more complicated/time consuming than InfoSWMM	Data management is somewhat cumbersome. Easier than MU; more complicated than InfoSWMM
Ability to diagnose system deficiencies	Capability to identify system deficiencies for multiple scenarios & effectively identify efficient improvements to resolve deficiencies	Limited to pass/fail for capacity, cannot simulate surcharging & account for system storage volume. No graphical capabilities	Extensive diagnostic capabilities. Can color code multiple output types (i.e. flow depth, velocity, etc.) in plan and profile view. Dynamic computational engine allows for realistic simulation of surcharging	Extensive diagnostic capabilities. Can color code multiple output types (i.e. flow depth, velocity, etc.) in plan and profile view. Dynamic computational engine allows for realistic simulation of surcharging	Diagnostic capabilities are similar to MU & InfoSWMM
Fully dynamic hydraulic engine	Does the software include fully dynamic hydraulic computational engine, capable of realistic simulation of surcharging and volume vs time in the collection system?	No – does not account for hydraulic attenuation of pipe flow	Innovyze relies on SWMM5, but is more explicit than other sewer modeling packages. The user can define/taylor the calculations if desirable.	User defines which computation engine to use (MOUSE or SWMM5). Data requirements for pipes, manholes, structures, etc. are specific to each engine, but typically can be exported from one to the other.	Yes – SWMM5.
Force main vs gravity flow computations	How does the software compute pressurized flow in a force main vs gravity pipe flow?	Defined by user-input equations	Force mains are specified by the user and always calculated as force mains during the simulation. "Normal" gravity pipes are able to switch between gravity flow and pressure flow. Preisman slot approximation is not used.	Force mains are specified by the user and always calculated as force mains during the simulation. "Normal" gravity pipes are able to switch between gravity flow and pressure flow using the Preisman slot approximation.	Force mains are specified by the user and always calculated as force mains during the simulation. "Normal" gravity pipes are able to switch between gravity flow and pressure flow. Preisman slot approximation is not used.
Pump station simulation	Does the software simulate pump station operations?	No	Yes	Yes	Hydraulic calcs similar to InfoSWMM
Sanitary flow generation options	How are sanitary flows “loaded” into the model? Can the software load/track separate categories, such as for SF, MF and commercial properties?	Manual flow input – does not distinguish between separate loading categories or I/I vs sanitary loading	Several loading methods are available. The polygon intersection method is one method for loading or modifying flow scenarios (without having to go back into the GIS database).	Loads may be stored in the model database as point or polygon features. Subbasins can be associated with person equivalents, which can in turn be associated with loading rates (gpcd). Geocoding tools for	Loads can be generated for sub-areas in the network manually or from pre-defined residential, commercial, and industrial urban areas. The total study area loads can be automatically corrected for

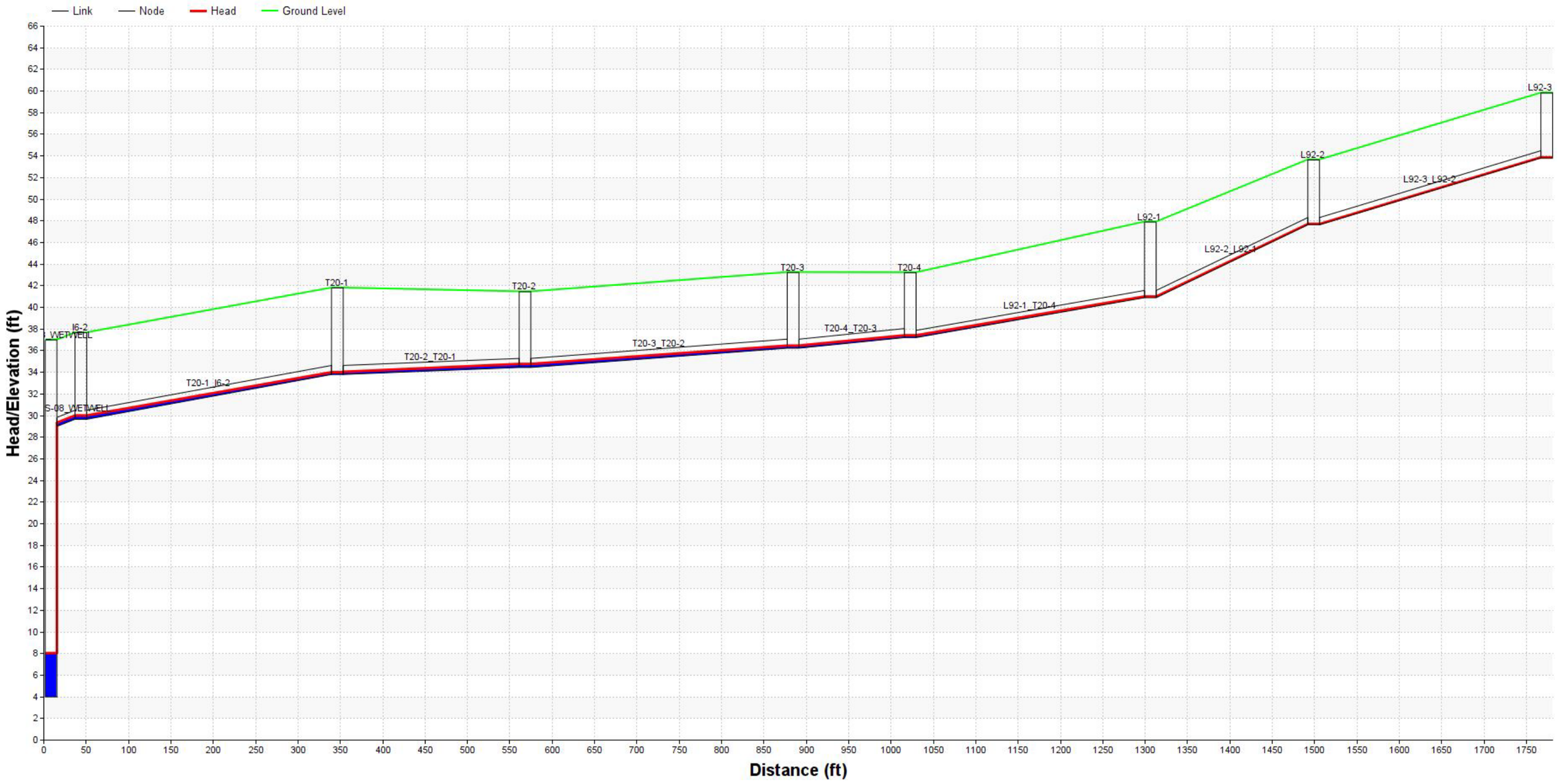
Category	Description	Spreadsheet	INFOSWMM (Innovyze)	MIKE Urban (DHI)	XPSWMM (XPSolutions)
				connecting point or subbasin-based loads to the model network are available.	personal income variations, degree of commercial use, garbage grinder usage, and population.
I/I simulation options	What options are available for generating and simulating I/I?	Manual flow input – does not distinguish between separate loading categories or I/I vs sanitary loading	Multiple methods, including RDII module	Multiple methods, including RDII module	Multiple methods, including RDII module. Estimates infiltration in a sewer system based upon existing information about the sewer, its surrounding soil and groundwater, and precipitation
Loading assignment options	Allocate sanitary loading to manholes. Can the parcel to node assignments be changed?	No	DWF allocator provides numerous methods and flexibility in sanitary loading. Loading can be assigned to closest node, closest pipe (up or downstream end). Initial allocations can be performed automatically according to criteria you specify. It can be parcel-by-parcel based, or you can intersect a load area with a parcel layer. Usage can be assigned based on how the parcels are defined, too. You can graphically manipulate the allocations so that flows assigned to one node can be shifted to another.	Multiple options, similar to InfoSWMM	Sewage inflow estimates are made at discrete locations along the trunk sewers of any specified drainage basin. These estimates are calculated from data describing drainage basin subdivisions (referred to as sub-areas) under which the trunk sewer passes.
Extended period/diurnal simulation?	Does the software utilize diurnal patterns and perform extended period simulations?	No	Many diurnal patterns can be created.	Unlimited diurnal patterns can be created.	Many diurnal patterns can be created.
Scenarios	Simulate multiple scenarios	No	The dry weather flow (DWF) module can handle up to eight different scenarios.	All of the Alternatives of the Child scenarios are automatically updated with the changes from the Parent scenarios. An unlimited number of child and parent scenarios can be developed. Can set the current Alternative as the Base Data Group Alternative for the active scenario, removing all other Alternatives of the Data Group and keeps all Child Alternatives of the current Alternative.	Up to 50 scenarios can be maintained and compared. Scenarios can be defined as modifications to the base model such as changes to piping or population.
How is growth added?		Manual input of externally processed flows	Growth can be input as a new scenario.	Growth can be incorporated as a new scenario and additional pipes, manholes, loads and catchments data would need to be imported from the design data, or manually digitized inside MIKE URBAN.	Growth can be incorporated as a new scenario.
Graphical capabilities	What capabilities does the software have, for generating graphics of model input/output, including plan and profile views?	Limited to excel graphing capabilities. No plan or profile graphical capabilities	Graphs, maps and animations are available for reviewing, analyzing and presenting model results. Multiple scenarios can be graphically compared to each other.	Graphs, maps and animations are available for reviewing, analyzing and presenting model results. Multiple scenarios can be graphically compared to each other.	Graphs, maps and animations are available for reviewing, analyzing and presenting model results. Multiple scenarios can be graphically compared to each other.

Sewer Trunk Profiles

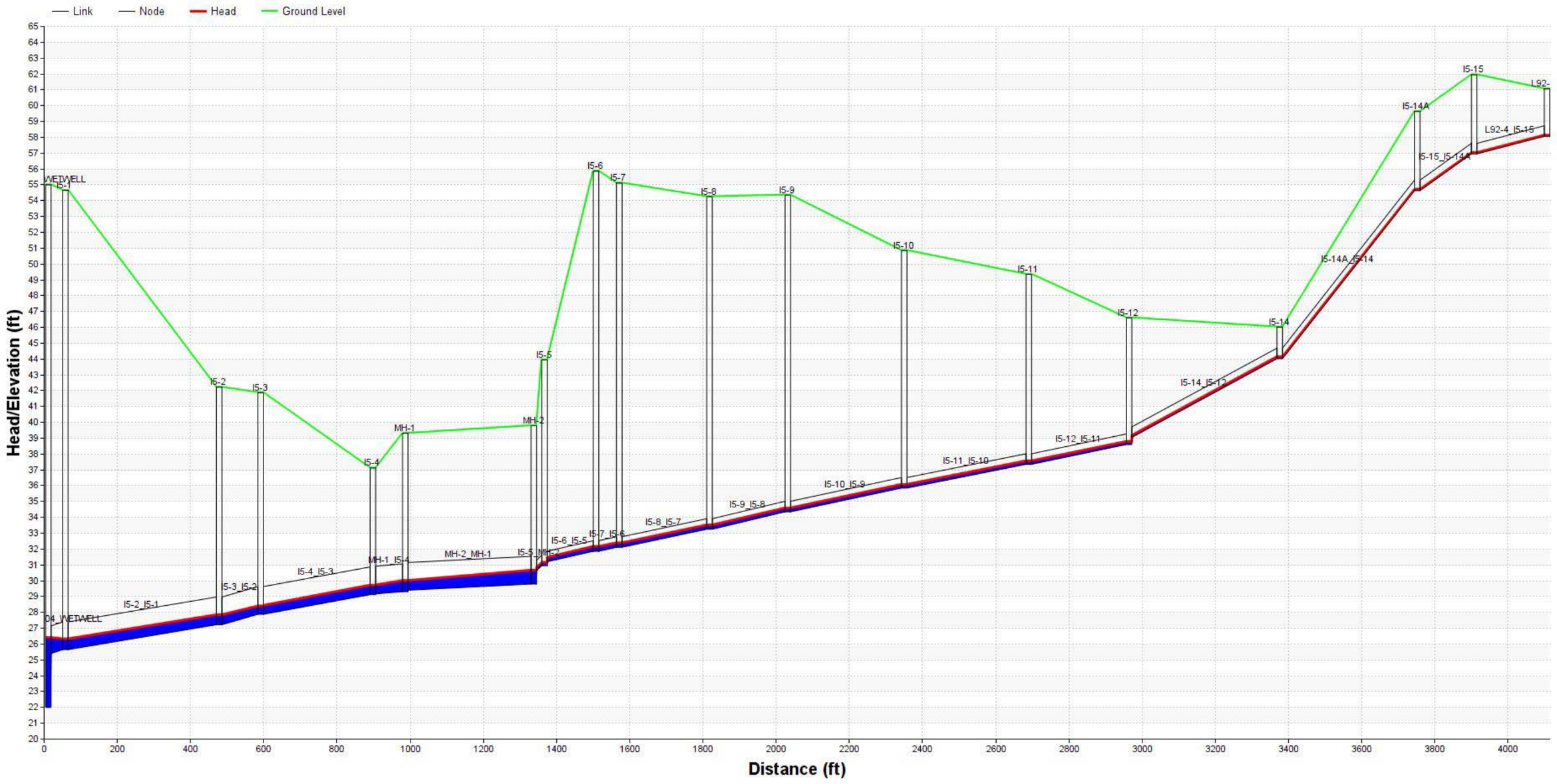
20-Year Peak Hour Flow: 49th Street Main



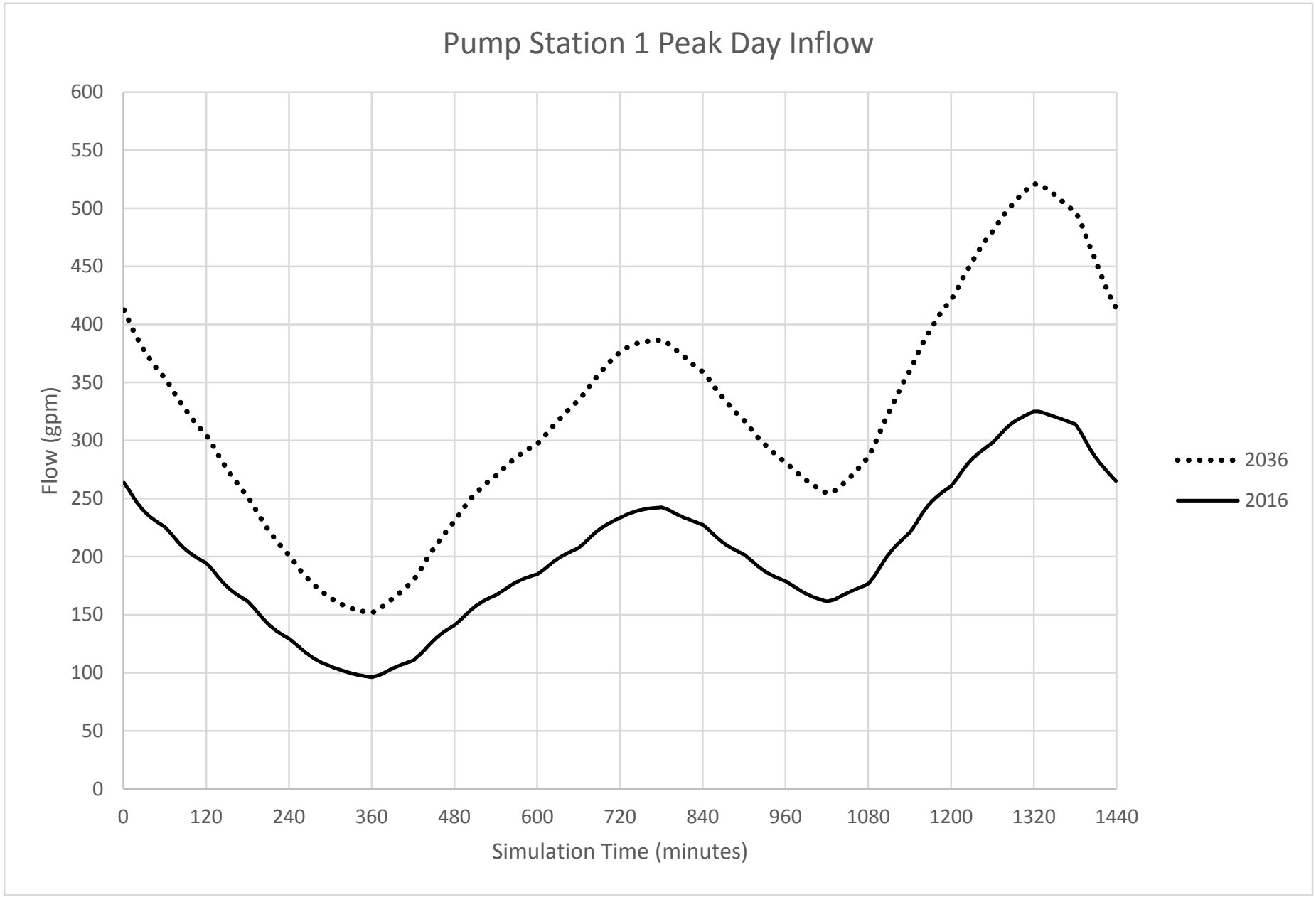
20-Year Peak Hour Flow: Shepherd Road East of Pump Station 8

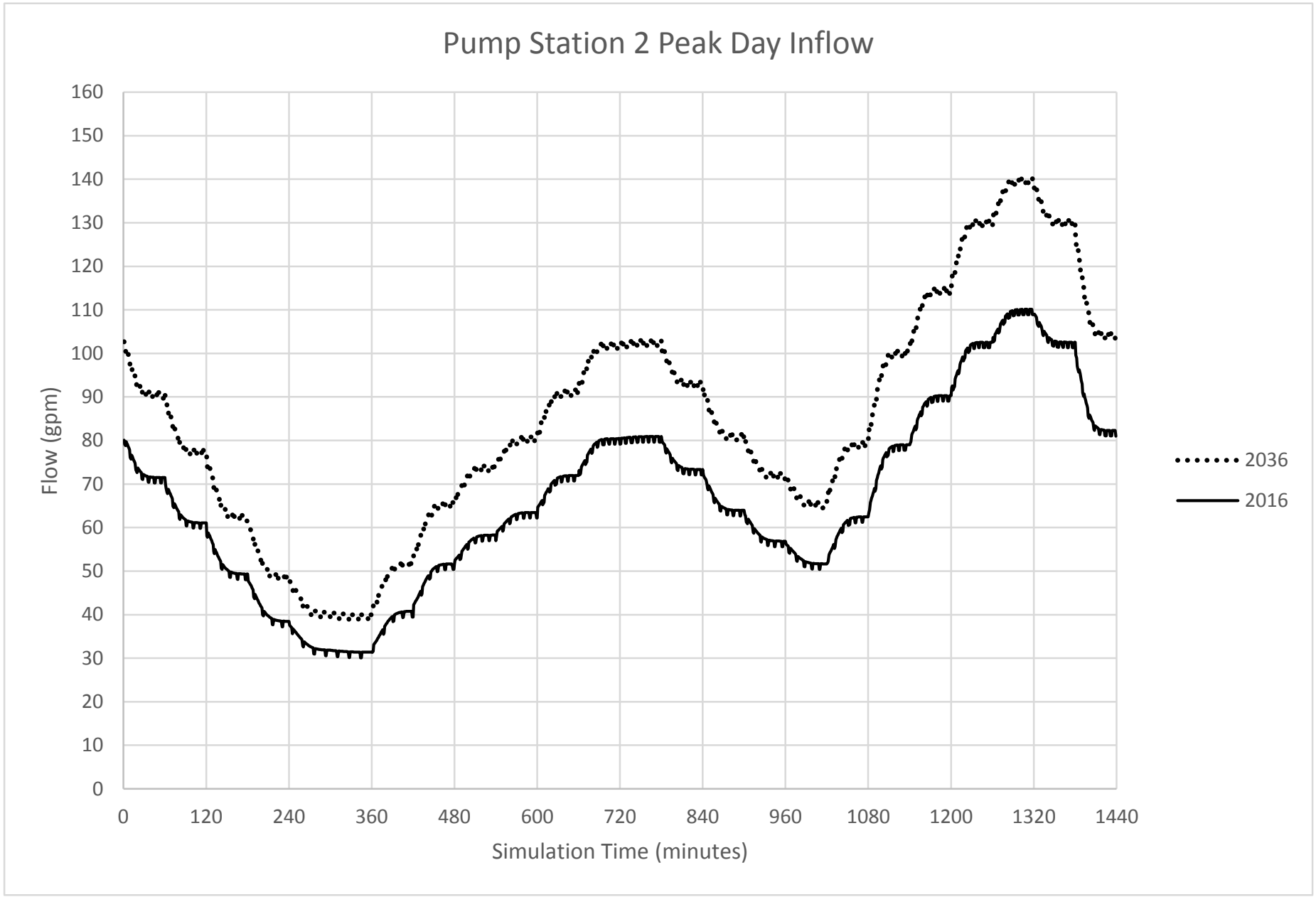


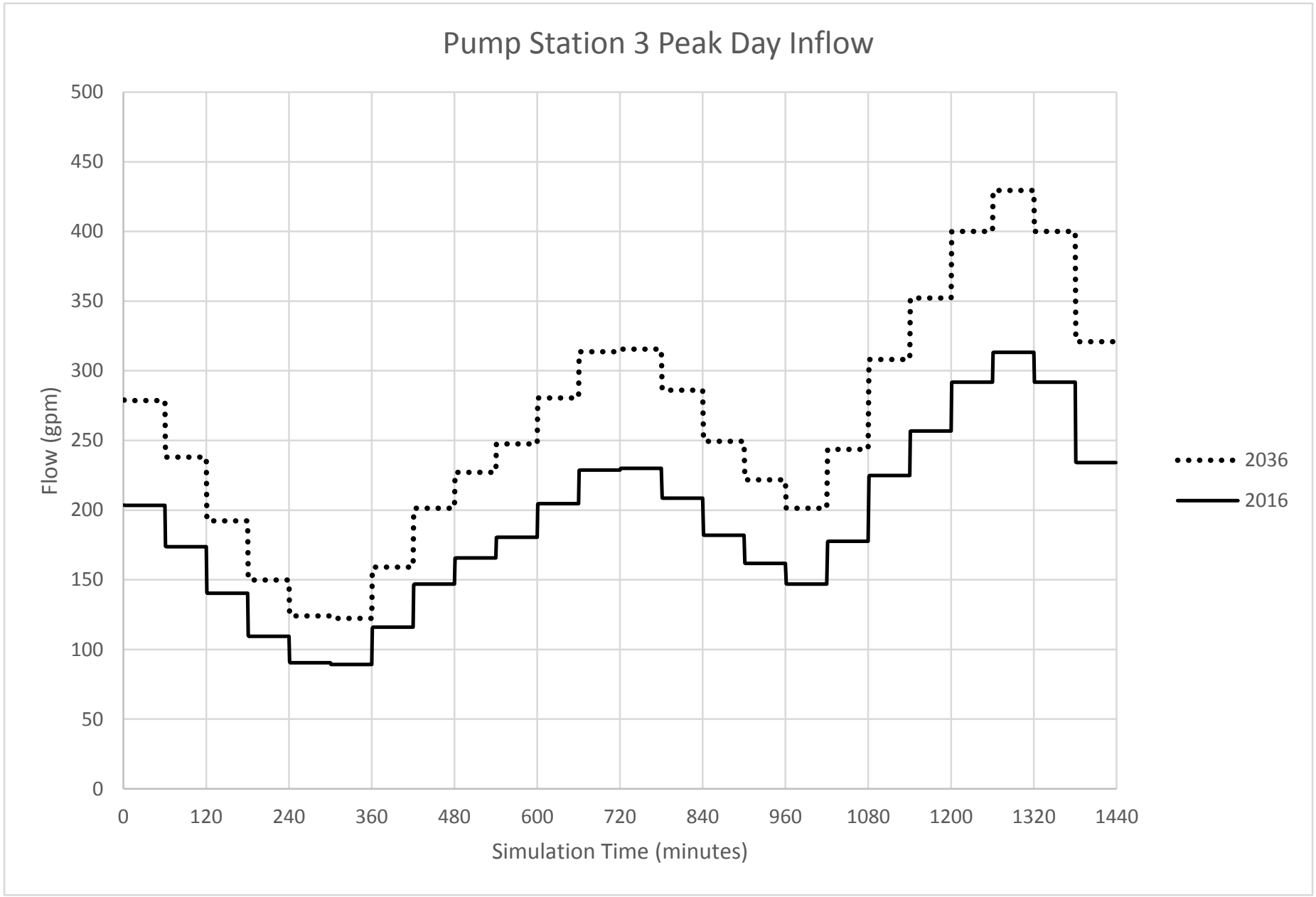
20-Year Peak Hour Flow: Shepherd Road Washougal River Main

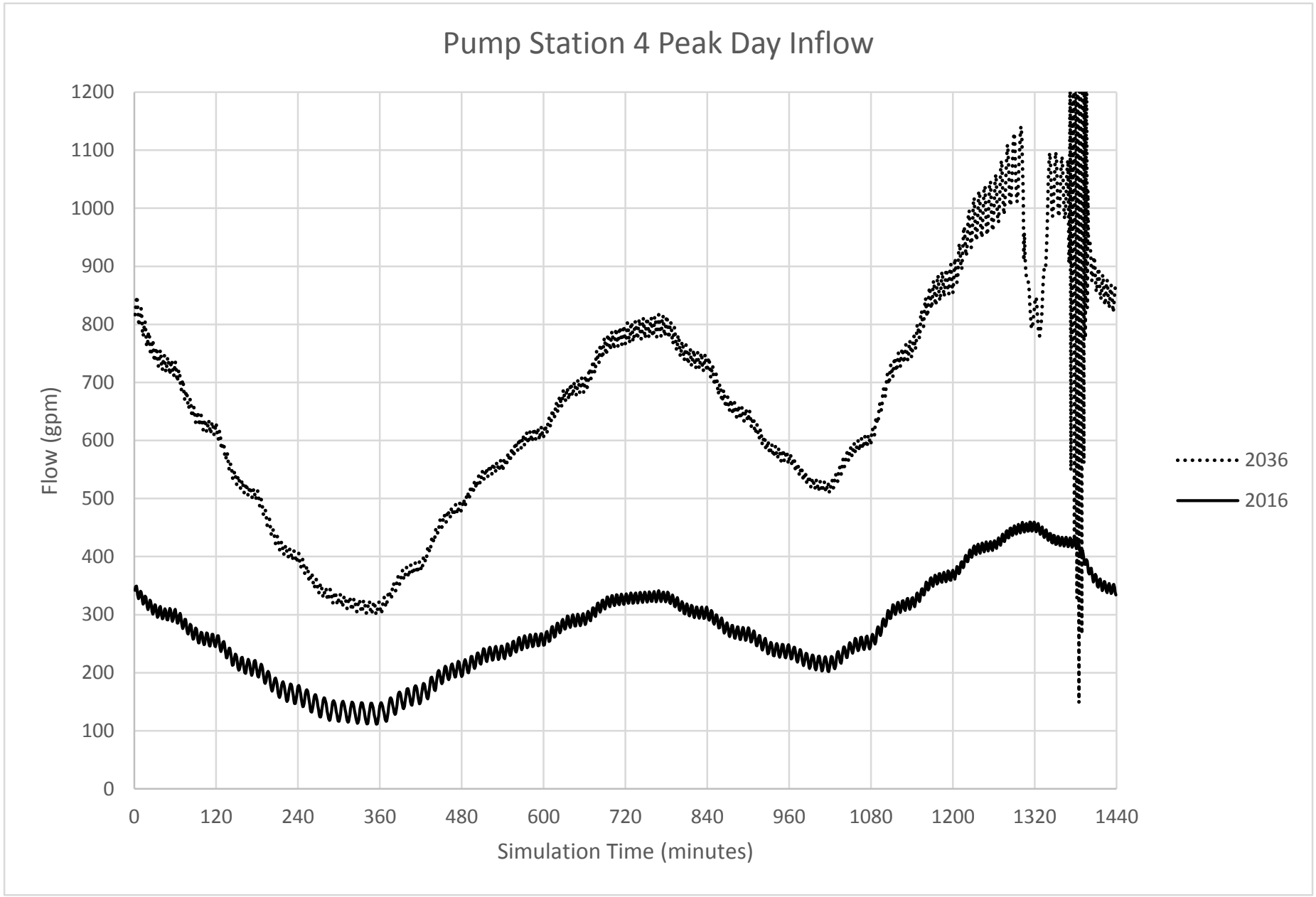


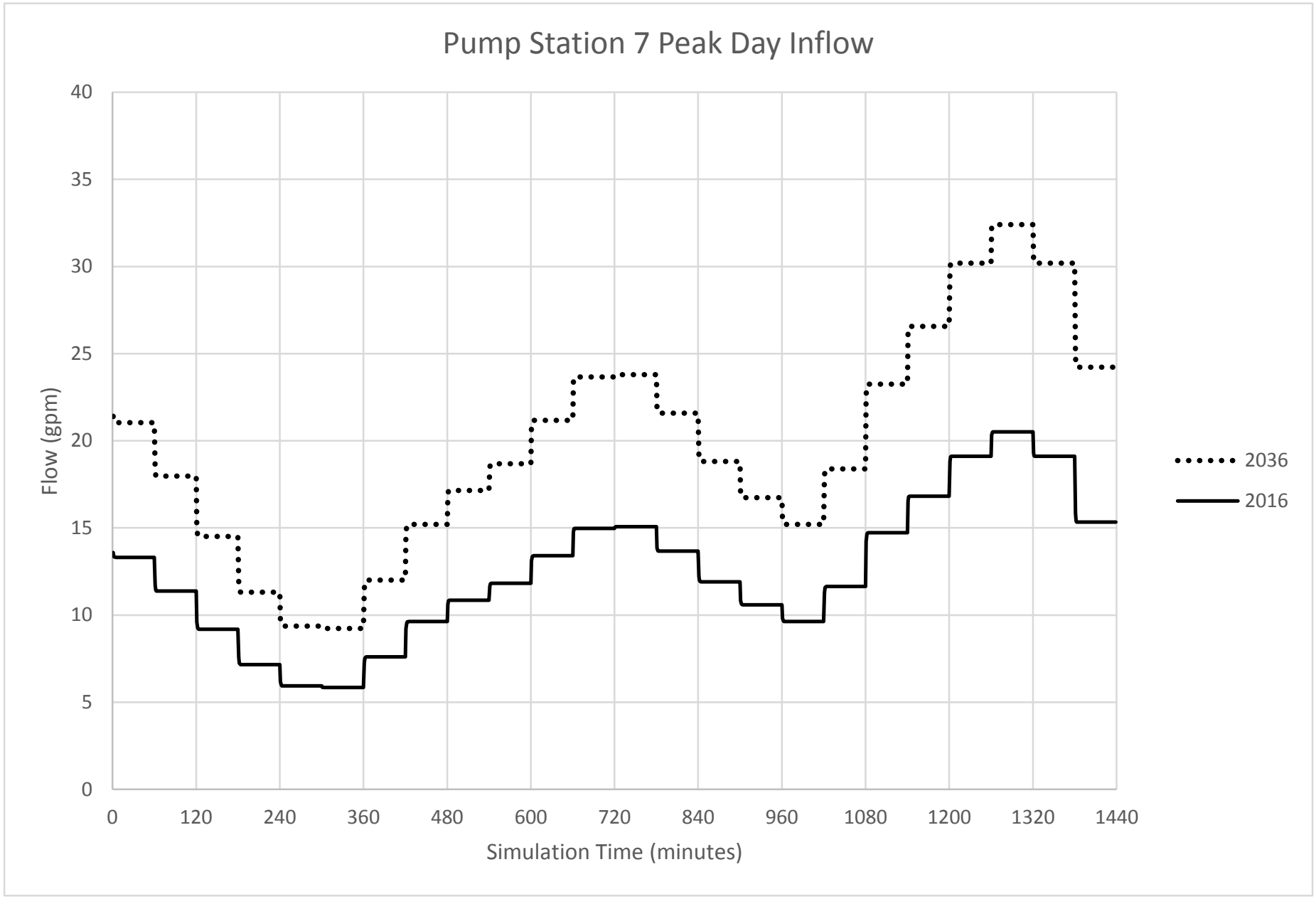
Pump Inflow Hydrographs

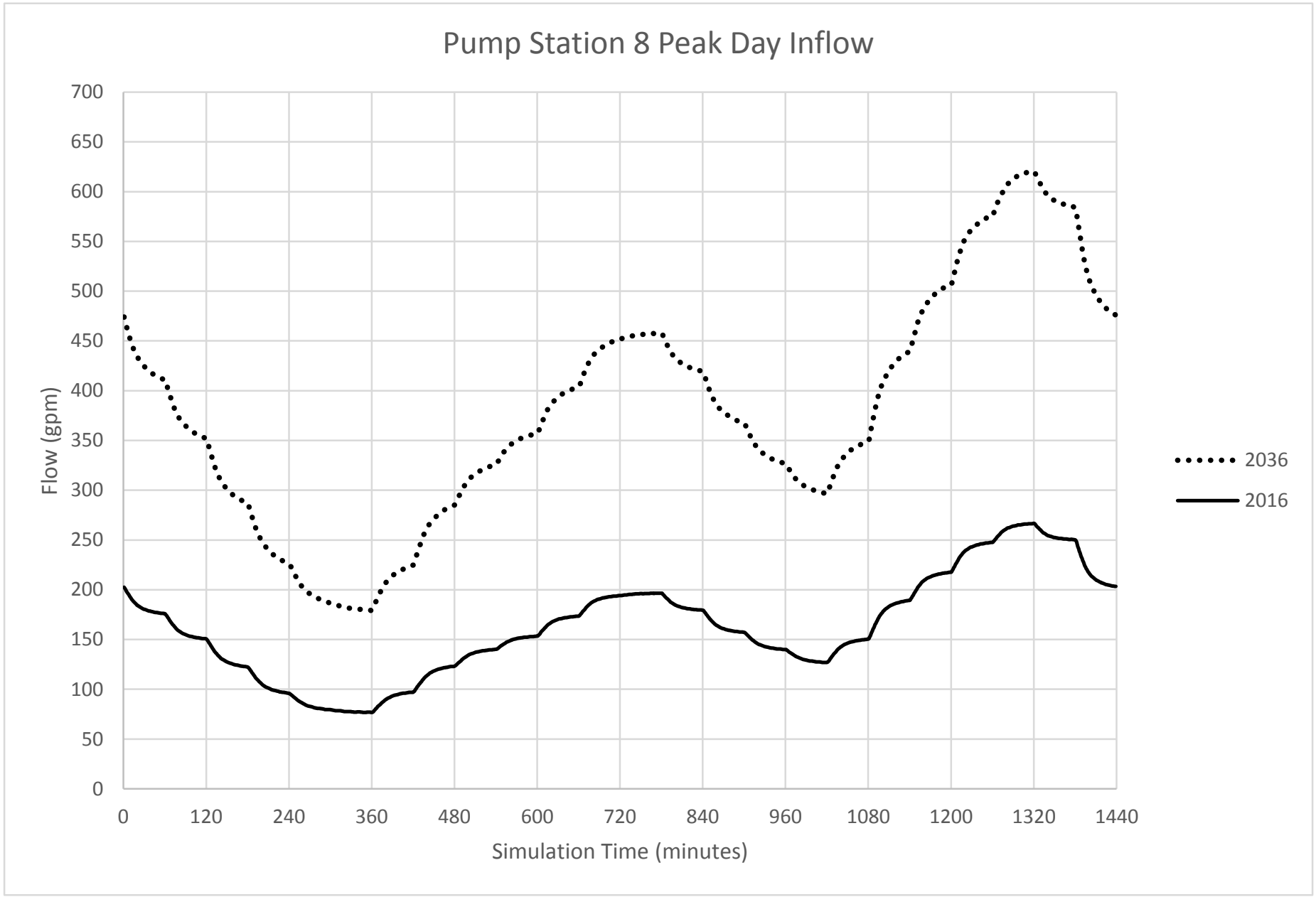

Pump Station 1 Peak Day Inflow
600
550
500
450
400
350
300
250
200
150
100
50
0
Flow (gpm)
0
120
240
360
480
600
720
840
960
1080
1200
1320
1440
Simulation Time (minutes)
2036
2016

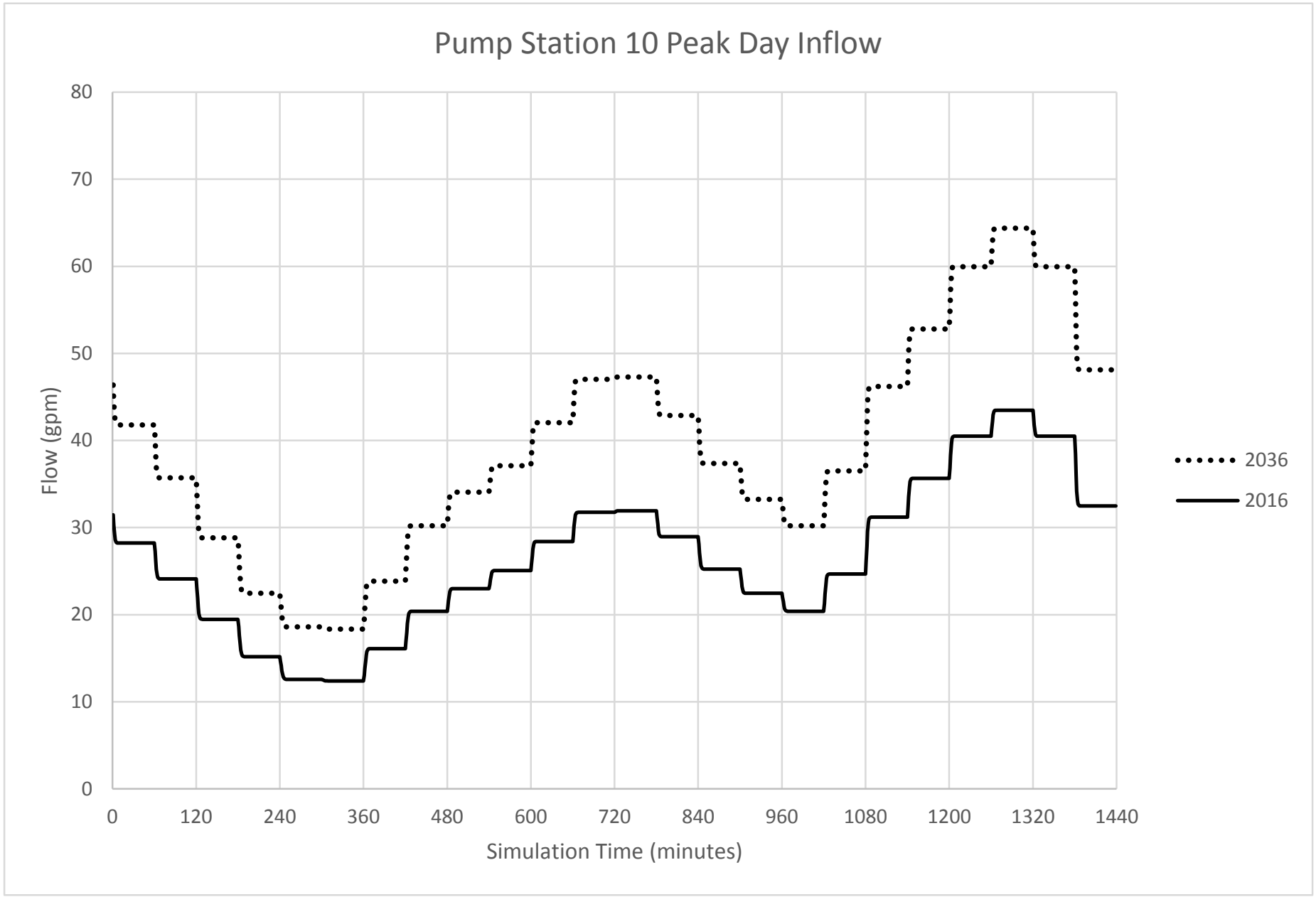

Pump Station 2 Peak Day Inflow
Flow (gpm)
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
0
120
240
360
480
600
720
840
960
1080
1200
1320
1440
Simulation Time (minutes)
2036
2016


Pump Station 3 Peak Day Inflow
Flow (gpm)
500
450
400
350
300
250
200
150
100
50
0
0
120
240
360
480
600
720
840
960
1080
1200
1320
1440
Simulation Time (minutes)
2036
2016


Pump Station 4 Peak Day Inflow
Flow (gpm)
1200
1100
1000
900
800
700
600
500
400
300
200
100
0
0
120
240
360
480
600
720
840
960
1080
1200
1320
1440
Simulation Time (minutes)
2036
2016


Pump Station 7 Peak Day Inflow
Flow (gpm)
0
5
10
15
20
25
30
35
40
0
120
240
360
480
600
720
840
960
1080
1200
1320
1440
Simulation Time (minutes)
2036
2016


Pump Station 8 Peak Day Inflow
Flow (gpm)
700
650
600
550
500
450
400
350
300
250
200
150
100
50
0
0
120
240
360
480
600
720
840
960
1080
1200
1320
1440
Simulation Time (minutes)
2036
2016


Pump Station 10 Peak Day Inflow
Flow (gpm)
80
70
60
50
40
30
20
10
0
0
120
240
360
480
600
720
840
960
1080
1200
1320
1440
Simulation Time (minutes)
2036
2016

APPENDIX H
SEPA Checklist

Washington State Environmental Policy Act (SEPA)
ENVIRONMENTAL CHECKLIST
for
CITY OF WASHOUGAL General Sewer Plan

A. BACKGROUND

1. Name of proposed project, if applicable:

   City of Washougal General Sewer Plan

2. Name of applicant:

   City of Washougal

3. Address and phone number of applicant and contact person.

   Applicant:
   City of Washougal
   Attn: Rob Charles, PE
   1701 'C' Street
   Washougal, WA 98671 **Tel: 360-835-2662**

   Contact Person:
   City of Washougal
   Attn: Rob Charles, P.E.
   1701 'C' Street
   Washougal, WA 98671 **Tel: 360-835-2662**

4. Date checklist prepared:

   April 2, 2016

5. Agency requesting checklist:

   City of Washougal

6. Proposed timing or schedule (including phasing, if applicable):

   The Washougal General Sewer Plan (Plan) will be updated as needed by amendment. The time frame for activities in the Plan is 20 years. The capital improvements outlined in the Plan are anticipated to take place by the year 2036.

7. Do you have any plans for future additions, expansion, or further activity related to or connected with this proposal? If yes, explain.

   Yes. Installation of sanitary sewer main extensions, lift stations, and improvements to the transmission facilities. These projects will be completed as required in order to expand the City's sanitary sewer system. Specific sewer extensions to new service areas will be included in future SEPA checklists addressing the specifics of each individual project.

8. List any environmental information you know about that has been prepared, or will be prepared, directly related to this proposal.

None known.

9. Do you know whether applications are pending for governmental approvals of other proposals directly affecting the property covered by your proposal? If yes, explain.

No applications pending at this time.

10. List any government approvals or permits that will be needed for your proposal, if known.

Washington State Department of Ecology approval.

11. Give brief, complete description of your proposal, including the proposed uses and the size of the project and site. There are several questions later in this checklist that ask you to describe certain aspects of your proposal. You do not need to repeat those answers on this page.

This General Sewer Plan provides a comprehensive long-range plan for the orderly development of facilities necessary to provide adequate sanitary sewer service to the City of Washougal's Urban Growth Area (UGA). The Plan has been developed to meet the requirements of WAC 173-240-050, requirements for General Sewer Plans for domestic wastewater facilities. The system currently serves a population of approximately 15,932. The service area in the year 2036 is projected to serve 22,725.

12. Location of the proposal.

The study area for the Plan includes the area within the existing Washougal incorporated City Limits and the Urban Growth Area (UGA) designed in 2007. A vicinity map (Exhibit A) for the study area is attached which highlights the UGA and proposed major system components. The project lies within Section 1, 4-10 of T1N R4E W.M.

B. ENVIRONMENTAL ELEMENTS

1. Earth

a. General description of the site: Flat, rolling, hilly, steep slopes, mountainous, other.

The topography of the area is dominated by the Columbia and Washougal Rivers. The City Core is bordered by the two rivers, the Columbia to the south and the Washougal to the north. In general, this area is characterized by gentle slopes. The area to the south (where the WWTP is located) is very flat and used to lie within the Columbia River Floodplain until the construction of a dike by the Army Corps of Engineers.

North of the City core the topography is divided by the Washougal River, which flows in the southerly direction. The areas near the Washougal River are characterized by steep slopes extending down towards the river. In general, the rest of the area north of the City slopes upward to the north with moderate to steep slopes, rising near the 600 foot elevation.

A significant issue in relation to the topography is the fact that the northerly limits of the UGA extend beyond the top of the hills on each side of the Washougal River. The area north of these two hilltops extends downhill to the north drainageways which flow into the Washougal River.

b. What is the steepest slope on the site (approximate percent slope)?

Woodburn Hill has slopes of approximately 60%.

c. What general types of soils are found on the site (for example, clay, sand, gravel, peat, muck)? If you know the classification of agricultural soils, specify them and note any prime farmland.

Soils in the study area fall into two categories. In the lower flatlands and flood plains upon which the older parts of the City was developed, soils are comprised of alluvial deposits composed of sand, gravels, and silts. The soils in the hills at the northern portions of the study area are comprised of a relatively shallow layer of silt and clay over bedrock.

d. Are there surface indications or history of unstable soils in the immediate vicinity? If so, describe.

The Washougal Critical Areas Ordinance has identified areas of potential unstable slopes. Future projects will address the potential for unstable soils on a site specific basis.

e. Describe the purpose, type, and approximate quantities of any filling or grading proposed. Indicate source of fill.

The Plan does not include any specific filling or grading. Projects identified in the plan will require their own SEPA checklist.

f. Could erosion occur as a result of clearing, construction, or use? If so, generally describe.

Projects associated with the Plan could result in erosion. All projects will follow Best Management Practices (BMPs) as set forth by the City of Washougal Stormwater Control Ordinance, as applicable.

g. About what percent of the site will be covered with impervious surfaces after project construction (for example, asphalt or buildings)?

This checklist is applicable only to the Plan. Future projects recommended within the plan include the construction of sanitary collection and pumping systems. The amount of new impervious area will depend on the individual project.

h. Proposed measures to reduce or control erosion, or other impacts to the earth, if any:

Projects associated with the Plan will follow BMPs for erosion control. Erosion control plans for projects will be required, as applicable.

2. Air

a. What types of emissions to the air would result from the proposal (i.e., dust, automobile, odors, industrial wood smoke) during construction and when the project is completed? If any, generally describe and give approximate quantities if known.

The Plan will not affect emission into the air.

b. Are there any off-site sources of emissions or odor that may affect your proposal? If so, generally describe.

Does not apply.

c. Proposed measures to reduce or control emissions or other impacts to air, if any:

Does not apply.

3. Water

a. Surface:

1) Is there any surface water body on or in the immediate vicinity of the site (including year-round and seasonal streams, saltwater, lakes, ponds, wetlands)? If yes, describe type and provide names. If appropriate, state what stream or river it flows into.

The main surface water features in the Washougal UGA are Campen Creek and the Washougal River. Campen Creek enters the northeast corner of the UGA and flows north-south, through the City and into Steigerwald Wildlife Refuge. The Washougal River originates to the north corner of the UGA and flows from north to southeast, eventually discharging into the Columbia River.

2) Will the project require any work over, in, or adjacent to (within 200 feet) the described water? If yes, please describe and attach available plans.

Some of the general projects contained in the plan include construction near the above waterways. Specific construction activities will be determined during design and covered by SEPA project evaluations.

3) Estimate the amount of fill and dredge material that would be placed in or removed from surface water or wetlands and indicate the area of the site that would be affected. Indicate the source of fill material.

Every effort will be made to avoid fill or dredging in sensitive areas. Should specific projects require construction activities in or adjacent to water or wetlands, the impacts and mitigation measures will be addressed in separate SEPA checklists prepared specifically for the project.

4) Will the proposal require surface water withdrawals or diversions? Give general description, purpose, and approximate quantities if known.

No

5) Does the proposal lie within a 100-year flood plain? If so, note location on the site plan.

The only 100-year flood plain located within the Plan area is along Washougal, which runs through the center of the City in a north-southwest direction and the Columbia River which borders the City to the south.

6) Does the proposal involve any discharges of waste materials to surface waters? If so, describe the type of waste and anticipated volume of discharge.

The Plan describes expansion of the existing sanitary sewer collection system which discharges to a secondary wastewater treatment plant before release to the Columbia River. It is anticipated that the volume of wastewater will increase from a maximum month flow of 1.91 MGD in 2016 to a maximum month flow of approximately 2.88 MGD in 2036.

b. Ground Water:

1) Will ground water be withdrawn, or will water be discharged to ground water? Give general description, purpose, and approximate quantities if known.

No

2) Describe waste material that will be discharged into the ground from septic tanks or other sources, if any (for example: Domestic sewage; industrial, agricultural; etc.). Describe the general size of the system, the number of such systems, the number of houses to be served (if applicable), or the number of animals or humans the system(s) are expected to serve.

Does not apply.

c. Water Runoff (including stormwater):

1) Describe the source of run-off (including stormwater) and method of collection and disposal, if any (include quantities, if known). Where will this water flow? Will this water flow into other waters? If so, describe.

Does not apply.

2) Could waste materials enter ground or surface waters? If so, generally describe.

Does not apply.

d. Proposed measures to reduce or control surface, ground, and run-off water impacts, if any:

Projects associated with the Plan will follow BMPs for erosion control. Erosion control plans for projects will be required as applicable.

4. Plants

a. Check or circle types of vegetation found on the site.
__X__ deciduous tree: alder, maple, aspen, other
__X__ evergreen tree: fir, cedar, pine, other
__X__ shrubs:
__X__ grasses:
__X__ pasture:
__X__ crop or grain:
__X__ wet soil plants: cattail, buttercup, bullrush, skunk cabbage, other
__X__ water plants: water lily, eelgrass, milfoil, other
__X__ other types of vegetation:

b. What kind and amount of vegetation will be removed or altered?

Construction identified in the Plan will require removal of vegetation. All efforts will be taken to replace vegetation following construction to a level equal to or better than the original condition wherever possible. Some sites may require installation of a gravel access road to provide for maintenance access.

c. List threatened or endangered species known to be on or near the site.

None known.

d. Proposed landscaping, use of native plants, or other measures to preserve or enhance vegetation on the site, if any;

Construction sites will be restored following construction, as appropriate.

5. Animals

a. Circle any birds and animals which have been observed on or near the site or are known to be on or near the site:

X birds: **hawks, heron, eagle, songbirds, sparrows, other**
X Mammals: **deer**, bear**,** elk, **beaver**, **other**
X fish: bass, **salmon**, **trout**, herring, shellfish, other

b. List any threatened or endangered species known to be on or near the site.

None known

c. Is the site part of a migration route? If so, explain.

There are no major migration routes known in the area.

d. Proposed measures to preserve or enhance wildlife, if any:

Does not apply.

6. Energy and Natural Resources

a. What kinds of energy (electric, natural gas, oil, wood stove, solar) will be used to meet the completed project's energy needs? Describe whether it will be used for heating, manufacturing, etc.

Electricity will be used to operate lift station pumps located within the planned service area. Oil and lubricants are used as needed to maintain the pumps, in accordance with their operation and maintenance instructions.

b. Would your project affect the potential use of solar energy by adjacent properties? If so, generally describe.

Does not apply.

c. What kinds of energy conservation features are included in the plans of this proposal? List other proposed measures to reduce or control energy impacts, if any:

The plan attempted to limit the number of sanitary lift stations which would also limit the amount of energy required for collection system operations.

7. Environmental Health

a. Are there any environmental health hazards, including exposure to toxic chemicals, risk of fire and explosion, spill, or hazardous waste that could occur as a result of this proposal? If so, describe.

Specific lift station projects could involve the possibility of overflows. The system has been designed to minimize the number of lift stations as their operation is dependent on the availability of electricity.

1) Describe special emergency services that might be required.

The public works staff is trained to respond to emergency situations arising from operation of the sanitary collection system.

2) Proposed measures to reduce or control environmental health hazards, if any:

Measures to reduce or eliminate the possibility of lift station overflows will be included in the design of these facilities. Specific measures include appropriately designed wet well volume, high level

b. Noise.

1) What types of noise exist in the area which may affect your project (for example: traffic, equipment, operation, other)?

None

2) What types and levels of noise would be created by or associated with the project on a short-term or a long-term basis (for example: traffic, construction, operation, other)? Indicate what hours noise would come from the site.

This Plan will not result in specific noise but short-term noise will be generated by construction equipment operation from 8 a.m. - 5 p.m., Monday through Friday, for projects constructed in accordance with the Plan. Long-term noise generated by the projects identified within this plan will be limited to low-level noise from sanitary lift station pumps.

3) Proposed measures to reduce or control noise impacts, if any:

Pumps will be installed inside lift stations.

8. Land and Shoreline Use

a. What is the current use of the site and adjacent properties?

The Plan affects numerous areas with a variety of uses including undeveloped, residential, commercial, industrial, and public right-of-way.

b. Has the site been used for agriculture? If so, describe.

See Item a. above.

c. Describe any structures on the site.

See Item a. above.

d. Will any structures be demolished? If so, what?

No

e. What is the current zoning classification of the site?

The Plan area includes a wide range of zoning classification including open space, residential, commercial, industrial, and public right-of-way.

f. What is the current comprehensive plan designation of the site?

See Item e. above.

g. If applicable, what is the current shoreline master program designation of the site?

The City contains shoreline management areas along both the Washougal and Columbia Rivers.

h. Has any part of the site been classified as an "environmentally sensitive" area? If so, specify.

There are wetlands throughout the service area.

i. Approximately how many people would reside or work in the completed project?

The population of the City is currently 15,932 and is projected to be approximately 22,725 in 2036.

j. Approximately how many people would the completed project displace?

Does not apply.

k. Proposed measures to avoid or reduce displacement impacts, if any:

Does not apply.

l. Proposed measures to ensure the proposal is compatible with existing and projected land uses and plans, if any:

Existing and projected land use has been evaluated in the development of this Plan to assure the level of sanitary sewer service is consistent with current land use plans and policies.

9. Housing

a. Approximately how many units would be provided, if any? Indicate whether high, middle, or low-income housing.

Not applicable.

b. Approximately how many units, if any, would be eliminated? Indicate whether high, middle, or low-income housing.

Not applicable.

c. Proposed measures to reduce or control housing impacts, if any:

Not applicable

10. Aesthetics

a. What is the tallest height of any proposed structure(s), not including antennas; what is the principal exterior building material(s) proposed?

The tallest proposed structure would be surface components of sanitary lift stations. These would typically be less than ten feet in height.

b. What views in the immediate vicinity would be altered or obstructed?

This would depend on the selection of lift station sites.

c. Proposed measures to reduce or control aesthetic impacts, if any:

The lift stations would be designed with appearance as a criterion, and will be as attractive as practical. Structures will be buried and otherwise designed to blend with the existing site to as great an extent as possible. Natural vegetation will be preserved on the site whenever possible.

11. Light and Glare

a. What type of light or glare will the proposal produce? What time of day would it mainly occur?

Does not apply.

b. Could light or glare from the finished project be a safety hazard or interfere with views?

Does not apply.

c. What existing off-site sources of light or glare may affect your proposal?

Does not apply.

d. Proposed measures to reduce or control light and glare impacts, if any:

Does not apply.

12. Recreation

a. What designated and informal recreational opportunities are in the immediate vicinity?

Does not apply.

b. Would the proposed project displace any existing recreational uses? If so, describe.

No.

c. Proposed measures to reduce or control impacts on recreation, including recreation opportunities to be provided by the project or applicant, if any:

None.

13. Historic and Cultural Preservation

a. Are there any places or objects listed on, or proposed for, national, state, or local preservation registers known to be on or next to the site? If so, generally describe.

There are no known historic or culturally significant sites that will be impacted by the projects identified in this plan.

b. Generally describe any landmarks or evidence of historic, archaeological, scientific, or cultural importance known to be on or next to the site.

None known.

c. Proposed measures to reduce or control impacts, if any:

Development of work identified in the Plan will be sensitive to historic areas and will strive to avoid their locations. Measures will be taken to ensure that historic areas are preserved should they be identified during design or encountered during construction. If artifacts are encountered during construction, the City will have the work stopped and the appropriate agencies will be notified.

14. Transportation

a. Identify public streets and highways serving the site, and describe proposed access to the existing street system. Show on site plans, if any.

Public streets and highways are identified in exhibits in the Plan and attached for reference.

b. Is site currently served by public transit? If not, what is the approximate distance to the nearest transit stop?

Not applicable.

c. How many parking spaces would the completed project have? How many would the project eliminate?

Not applicable.

d. Will the proposals require any new roads or streets, or improvements to existing roads or streets, not including driveways? If so, generally describe (indicate whether public or private).

Access roads to sanitary lift stations and along some sewer line routes may be required.

e. Will the project use (or occur in the immediate vicinity of) water, rail, or air transportation? If so, generally describe.

Does not apply.

f. How many vehicular trips per day would be generated by the completed project? If known, indicate when peak volumes would occur.

Does not apply.

g. Proposed measures to reduce or control transportation impacts, if any:

Does not apply.

15. Public Services

a. Would the project result in an increased need for public services (for example: fire protection, police protection, health care, schools, other)? if so, generally describe.

The construction projects identified in the Plan will require an increase in the City of Washougal public works staff. Direct impacts on other services listed above will be negligible.

b. Proposed measures to reduce or control direct impacts on public services, if any.

Implementation of the Plan will provide for construction of an orderly and efficient sanitary

collection system that should minimize the impact on the public works staff.

16. Utilities

a. Utilities currently available at the site are: **electricity, natural gas, water, refuse service, telephone, sanitary sewer, septic system, other**

Most areas within the Plan area presently have access to electricity, refuse service, telephone, sanitary sewer or septic system, and other utilities.

b. Describe the utilities that are proposed for the project, the utility providing the service, and the general construction activities on the site or in the immediate vicinity, which might be needed.

This Plan describes the sanitary sewer collection facilities needed to serve the anticipated development in the Washougal Urban Growth Area. New power lines may be required to provide electricity for lift station pumps.

C. SIGNATURE

The above answers are true and complete to the best of my knowledge. I understand that the lead agency is relying on them to make its decision.

Signature Date Submitted