November 2013 Amendment

Sanitary Sewer Master Plan – Final May 31, 2013

This amendment was prepared to provide an update to the final master plan to reflect the City Council's adoption resolution that removed two sewer extension projects: Southeast Jackson Park Road and East Historic Columbia River Highway Extensions.

Since the production of the final master plan, the City received extensive public feedback against these specific projects, including a recommendation from the Troutdale Planning Commission to remove the projects from the final master plan. All references to the Southeast Jackson Park Road and East Historic Columbia River Highway extension projects shall be removed from the final master plan.

With the removal of these two extension projects, the new total estimated cost of the capital improvements is $11,850,000. Table ES-1 is amended as follows:

Table ES-1. Required Future 2040 Improvements	
Description of improvement	**Estimated cost of improvements, dollars[a]**
Sewer upgrades	4,817,000
Pump station upgrades	3,900,000
Sewer extensions	3,133,000
Total	11,850,000

[a]*Estimated costs include a 50 percent allowance for construction contingencies, engineering, and overhead.*

Table ES-4 is amended as follows:

Table ES-1. Required Future 2040 Improvements	
Description of improvement	**Estimated cost of improvements, dollars[a]**
TRIP area	3,133,000
Total all sewer extensions	3,133,000

[a]*Estimated costs include a 50 percent allowance for construction contingencies, engineering, and overhead.*

The financial analysis in the original plan document incorporated the Southeast Jackson Park Road and East Historic Columbia River Highway extension projects and will have to be adjusted to account for their removal in subsequent User Fee and System Development Charge rate calculations.

Sanitary Sewer Master Plan

Prepared for
City of Troutdale, Oregon
May 31, 2013

Sanitary Sewer Master Plan

Prepared for

City of Troutdale, Oregon

May 31, 2013

REGISTERED PROFESSIONAL ENGINEER
13,681
OREGON
JULY 16, 1987
JAMES R. HANSEN

EXPIRES 06-30-13

5/30/13 Signed

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List of Abbreviations

C	commercial
City	City of Troutdale
DLCD	Oregon Department of Land Conservation and Development
F	Fahrenheit
FOG	fats, oil, and grease
GIS	geographic information system
gpad	gallons per acre per day
gpcd	gallons per capita per day
gpm	gallons per minute
HDR	high-density residential
HGL	hydraulic grade line
I	industrial
I-84	Interstate 84
LDR	low-density residential
lf	linear feet
MDR	medium-density residential
mgd	million gallons per day
PACP	Pipeline Assessment and Certification Program
RDII	rainfall derived infiltration/inflow
SCS	Soil Conservation Service
SDC	system development charge
SSMP	Sanitary Sewer Master Plan
SWMM	Stormwater Management Model
UGB	urban growth boundary
USGS	U.S. Geological Survey
WPCF	Water Pollution Control Facility

Executive Summary

The City of Troutdale (City) provides sanitary sewer collection and treatment services to over 16,000 people spread across an area of approximately 5.2 square miles. There are over 4,600 current users of the sanitary sewer collection system including residential, commercial, and industrial customers. To provide sanitary service to these customers, the City owns and maintains the following infrastructure: over 53 miles of gravity pipelines, ranging in size from approximately 4 to 30 inches in diameter; 1,340 manholes; ten pump stations; and about 4 miles of sanitary force mains.

The City commissioned this Sanitary Sewer Master Plan (SSMP) to provide guidance on capital improvement projects (CIPs) required to provide reliable and effective conveyance of wastewater from various sources to the Troutdale Water Pollution Control Facility (WPCF). The projects identified by this SSMP will enable the City to satisfy the sanitary sewer service needs of all its customers under a future fully built-out planning condition. It is expected that the City's growth may reach a full build-out population of approximately 18,000 people by 2040.

To understand the hydraulic needs of the sanitary sewer collection system, the City's trunk lines were modeled using Bentley SewerGEMS V8i SELECTseries 3 hydraulic modeling software. The model simulates flows in the sanitary sewer collection system for existing and future flow conditions. It was calibrated based on flow monitoring information collected at the WPCF by the City. The calibration helps to ensure that the model accurately depicts flows over dry and wet weather conditions. The modeling identified 42 pipes and four pump stations that will be undersized for conveying the future sanitary flows.

This Sanitary Sewer Master Plan (SSMP) identifies over $16 million in capital improvements that will be required to meet the future sanitary service demand. The projects include upgrades to existing sewers and pump stations and expansion (extension) of the collection system into areas not currently serviced or under serviced. Table ES-1 summarizes costs for the required improvements.

Table ES-1. Required Future 2040 Improvements

Description of improvement	Estimated cost of improvements, dollars[a]
Sewer upgrades	4,817,000
Pump station upgrades	3,900,000
Sewer extensions	7,333,000
Total	16,050,000

[a]*Estimated costs include a 50 percent allowance for construction contingencies, engineering, and overhead.*

In addition, this SSMP recommends the development and implementation of a sewer rehabilitation and replacement program. While the City's sewers are relatively new and in good condition compared to many other Oregon cities, structural and operational defects will become prevalent in the pipes and manholes as the sewer collection system ages. If these defects are not addressed, catastrophic failures (i.e., collapses, sinkholes, and sanitary sewer overflows and backups) could occur. Sewer and manhole rehabilitation or replacement will be required to prevent further degradation and to keep the sewers in good operating condition. The City will need to develop and implement inspection and condition assessment activities to support the rehabilitation and replacement program. Sewer inspection is the primary tool for assessing and documenting the condition of sewers and manholes.

Table ES-2 lists the recommended CIPs for the sewer collection system as required to meet the future growth needs of the City. Table ES-3 lists the costs of future pump station and force main improvements and Table ES-4 lists the costs associated with providing sewer extensions as required for future growth. Figure ES-1 shows the locations of the required improvements.

Table ES-2. Recommended CIPs: Sewer Improvements

Project name	Estimated project cost, dollars[a]
South Buxton Road	501,000
Lower Beaver Creek No. 1	414,000
Lower Beaver Creek No. 2	452,000
Lower Beaver Creek No. 3	450,000
Lower Beaver Creek No. 4	578,000
Lower Beaver Creek No. 5	411,000
Troutdale Road No. 1	1,112,000
Airport/Graham Road	646,000
PS #9 Trunk	253,000
Total all sewer improvements	4,817,000

[a] *Estimated costs include a 50 percent allowance for construction contingencies, engineering, and overhead.*

Table ES-3. Recommended CIPs: Pump Station and Force Main Improvements

Pump station	Description of improvement	Estimated cost of improvements, dollars[a]
PS #1	New pump station and force main (8-inch, 3,560 feet)	2,690,000
PS #2	Pumps, controls, and wetwell improvements	369,000
PS #5	Replacement pumps (2,500 gallons per minute [gpm]/ 3.6 million gallons per day [mgd])	454,000
PS #7	Replacement pumps (400 gpm/0.58 mgd)	145,000
PS #9	Replacement pumps (450 gpm/0.65 mgd)	242,000
Total all pump station and force main improvements		3,900,000

[a]*Estimated costs include a 50 percent allowance for construction contingencies, engineering, and overhead.*

Table ES-4. Recommended CIPs: Sewer Extensions

Description of improvement	Estimated cost of improvements, dollars[a]
TRIP area	3,133,000
Southeast Jackson Park Road	950,000
East Historic Columbia River Highway	3,250,000
Total all sewer extensions	7,333,000

[a]*Estimated costs include a 50 percent allowance for construction contingencies, engineering, and overhead.*

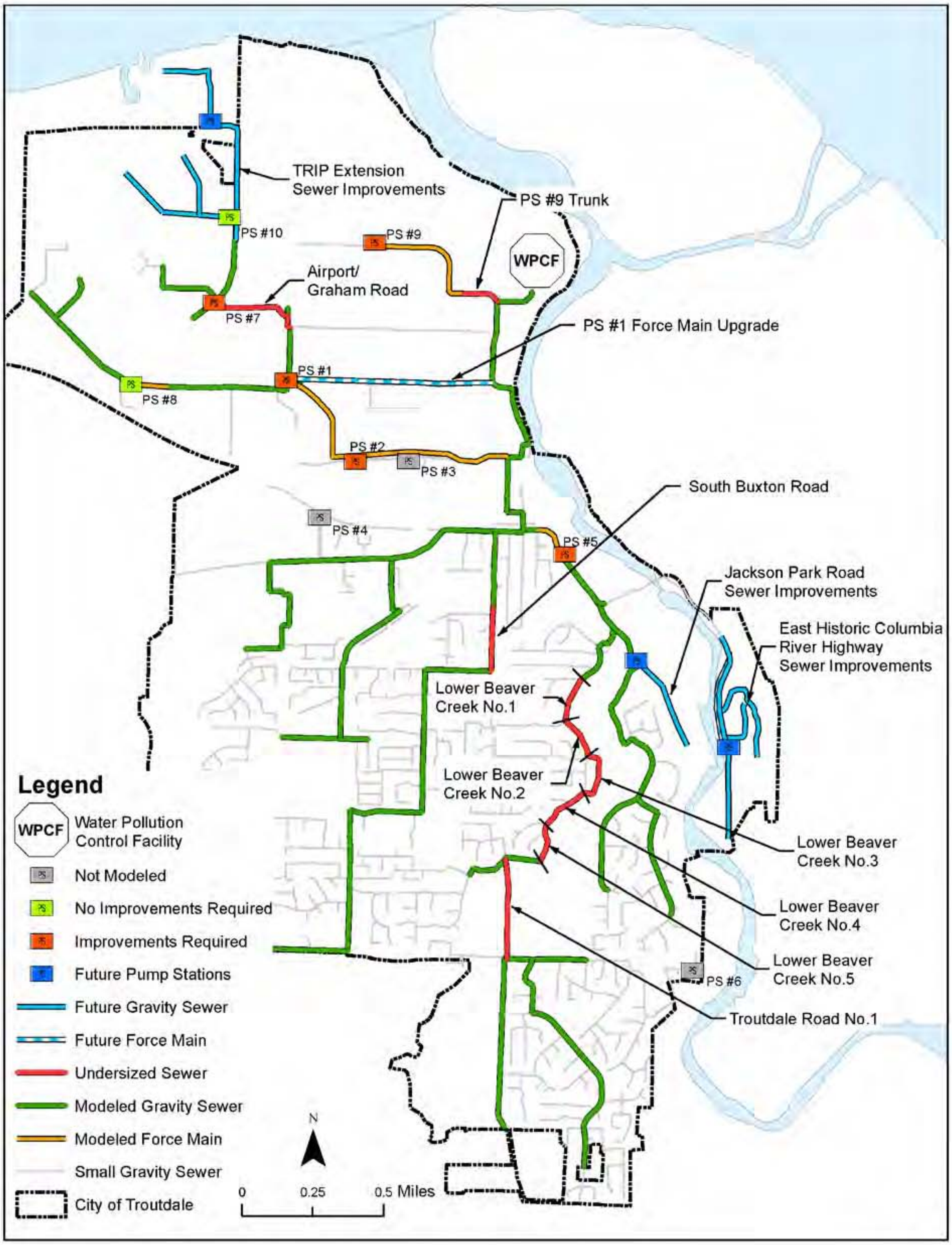


Figure ES-1. Required future capital improvements

Section 1

Introduction

The City of Troutdale (City) provides sanitary sewer collection services to over 16,000 people spread across an area of approximately 5.2 square miles. Current users of the sanitary sewer collection system include over 4,600 total connections, including 4,476 residential connections, approximately 120 commercial connections, and 35 industrial connections. The City owns the following infrastructure: over 53 miles of gravity pipelines, ranging in size from approximately 4 inches to 30 inches in diameter; 1,340 manholes; ten lift stations; and about 4 miles of sanitary force mains. The City commissioned this Sanitary Sewer Master Plan (SSMP) to provide guidance on capital improvement projects required to provide for the safe and efficient conveyance of wastewater from its sources to the Troutdale Water Pollution Control Facility (WPCF). This chapter describes the purpose and scope of work for the master planning project.

1.1 Need for the Plan

The installation of the sanitary sewer system dates back to the late 1960s. This SSMP represents the first sanitary sewer master plan for the City. The City developed a hydraulic model of the sanitary collection system in the early 2000s, but the findings of the model were not documented in a master planning level document. The City recognizes that changes have occurred in the population, the area available for development, and land uses since the development of the original model. An updated model and guidance on the capital improvement needs of the collection system are required as part of prudent planning for the future and for continued reliable and effective sanitary service to the community.

The current population of Troutdale is approximately 16,000. At full build-out to the current Urban Growth Boundary, the population will grow to approximately 18,000. The service area will grow as well with 94 acres of new land identified for future expansion of the City limits that is in addition to the 541 acres of undeveloped land currently within the City. The SSMP is required to provide up-to-date recommendations for maintaining and expanding the sanitary sewer collection system.

1.2 Plan Objectives

The objectives of the SSMP include the following:

- Coordinate with stakeholders.
- Evaluate the current and future flows and system conveyance capacity.
- Identify capital improvements and their costs as required to convey current and future flows.
- Provide comment on system condition.
- Discuss anticipated regulatory requirements and changes.
- Identify probable future condition and serviceability of the system due to aging.
- Analyze the City's user fee and system development charge (SDC) structure and make recommendations.
- Document the above activities in a new contemporary SSMP.

1.3 Approach

In general, the following approach was used for the project:

- Acquisition and review of the geographic information system data with respect to land use, zoning, and the layout of the sanitary sewer system
- Acquisition and review of the existing Bentley SewerCAD hydrologic/hydraulic model of the sanitary sewer system
- Identification of data gaps and a request to the City to fill the gaps
- Development of an updated SewerCAD model
- Calibration on the model based on available flow information from the Troutdale WPCF.
- Identification of existing (current) system deficiencies and the improvements required to address the hydraulic deficiencies
- Identification of future system deficiencies and the improvements required to address the hydraulic deficiencies
- Documentation of sanitary sewer system operational and structural deficiencies based on City experience
- Description of regulatory changes that could impact sanitary sewer system management
- Description of the major elements of a sewer rehabilitation program and why such a program is important for long-term collection system management success
- Analysis of existing user fees and SDCs and their basis
- Recommendations on user fees, SDCs and their basis
- Development of the SSMP documenting all of the above

1.4 Plan Organization

The SSMP is organized as follows:

Executive Summary

Section 1 Introduction: defines why the SSMP was developed and its purpose

Section 2 Basis of Planning: documents the primary elements that formulate the basis of the planning effort

Section 3 Flow Projections and Modeling: documents the flow projections used in the modeling and the modeling process

Section 4 Hydraulic Analysis: identifies hydraulic deficiencies for the existing and future planning scenarios

Section 5 Capital Improvement Plan: identifies capital improvements and their costs associated with existing and future planning scenarios

Appendices A through I provide supporting information for Sections 1 through 5

Section 2

Basis of Planning

This section includes an overview of study area characteristics including location, topography, soils, land use, rainfall, and sanitary sewer collection system conditions.

2.1 Background and History

The first documented knowledge of the area that would become the City of Troutdale (City) occurred in 1792 when a British exploratory expedition found the confluence of the Sandy and Columbia Rivers. The first permanent settlers to the Troutdale area were in the early 1850s. The railroad was built through the city in the early 1880s with the platting of city streets and blocks occurring at about the same time. The City of Troutdale (City) incorporated in 1907. Later that year, a disastrous fire burned through most of the city with few buildings surviving. In 1916, the Columbia River Highway was built through the city helping to advance commerce in the area. Another fire in 1925 destroyed most of the business district. Traffic on the Columbia River Highway was reduced significantly with the completion of Interstate 84 (I-84) in the 1950s. The city did not see much growth until the 1960s when people started to leave Portland in search of a more suburban style of living.

Prior to the early 1960s, wastewater was disposed via private septic systems. The earliest public sewers were constructed starting in 1967 with over one-half of the current collection system constructed by 1980. More information on sewer construction including age and sewer pipe material is provided later in this section.

Along with the construction of the public sewers, the original wastewater treatment facility was completed in 1968. The treatment facility was upgraded in 1978 and a new facility constructed at a new location in 2002. The design capacity of the current Water Pollution Control Facility (WPCF) is as follows:

- dry weather average day– 2.4 million gallons per day (mgd)
- wet weather maximum day– 6.3 mgd
- peak hour– 9.4 mgd

The current WPCF has not had any major expansions or changes since its construction in 2002.

2.2 City Location

Troutdale is located within the eastern portion of the Portland Area Metropolitan Service District's urban growth boundary (UGB) in Multnomah County. Figure 2-1 shows the City's location within the region.

Troutdale is approximately 15 miles east of downtown Portland along I-84 and is bordered by the cities of Wood Village and Fairview to the west, the City of Gresham to the south, the Sandy River to the east, and the Columbia River to the north. The city is approximately 5.2 square miles in size based on the current city limits.

Figure 2-1. Vicinity map

2.3 Service Area Description

The City provides wastewater collection and treatment services to its residents, commercial establishments, institutional customers, and a number of industries. Sewer service is provided only to customers within the city limits. Figure 2-2 is a general map of the collection system. Also shown, is an area along Jackson Park Road with approximately 20 residences that have their own sanitary septic systems. Several homes located on the east side of the Sandy River are connected via a septic tank effluent pump system to the City sanitary sewer system at the west end of the historic Columbia River Highway bridge. Approximately 27 other residences on the east side of the Sandy River are on privately-owned sanitary septic systems.

2.4 Topography

The topography of Troutdale influences how the sanitary sewer system was constructed. Gravity sewers convey the flow down hills and toward the Troutdale Water Pollution Control Facility. Pump stations convey flows up hills and over divides, ultimately discharging into the gravity sewers where physically possible.

The topography in the southern end of the city is influenced by the Beaver Creek and Sandy River drainages. Burlingame Creek joins Beaver Creek near Mt. Hood Community College at the intersection of Southeast Stark Street and South Troutdale Road. From the college, Beaver Creek flows through Troutdale in a northeasterly direction. Beaver Creek flows through a steep canyon to its confluence with the Sandy River at Depot City Park near the Historic Columbia River Highway. The Sandy River runs near the eastern boundary of Troutdale.

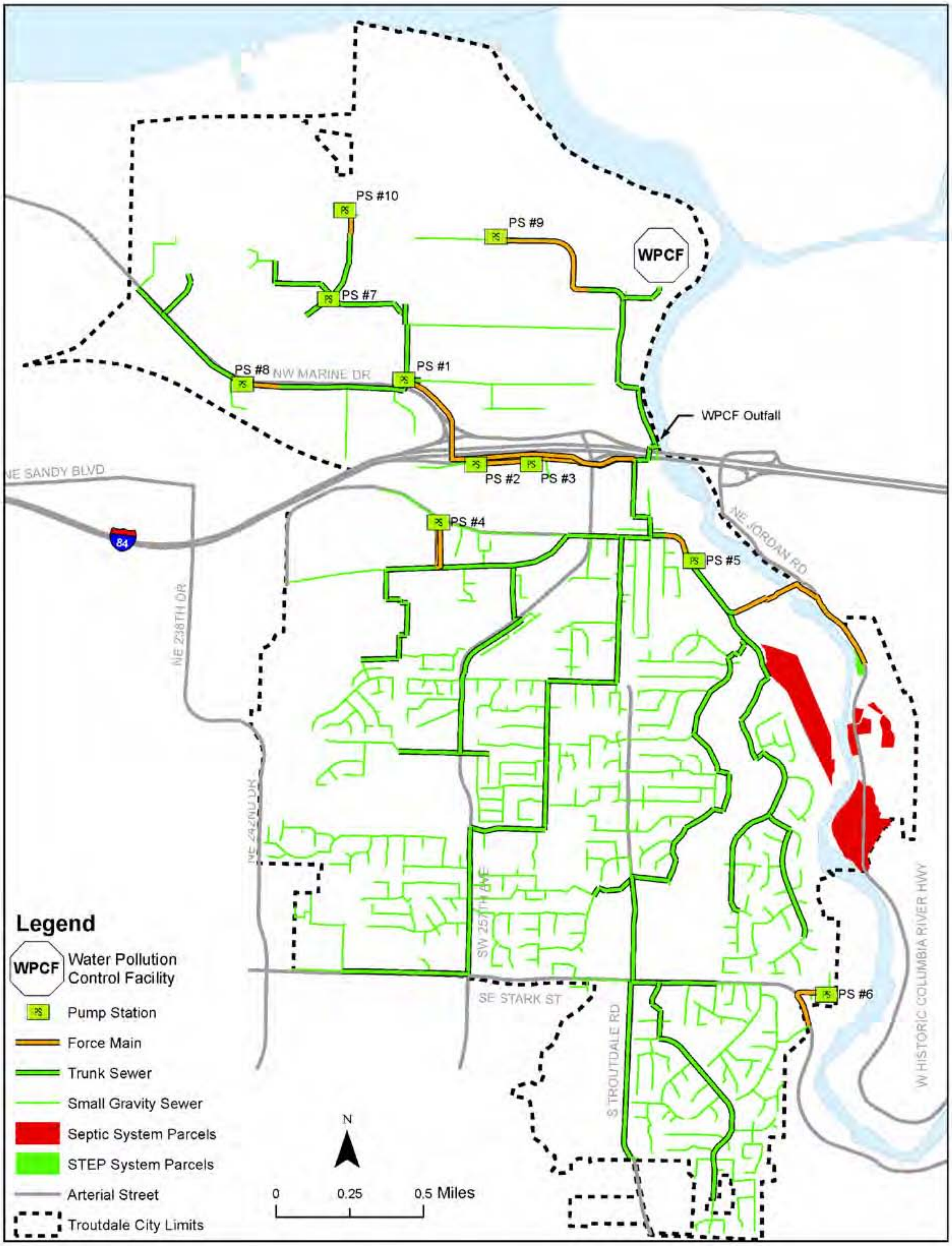


Figure 2-2. Collection system map

The upland area west of the Beaver Creek canyon extends from the western city limits east to the canyon. Slopes typically range from less than 1 percent to 20 percent in this area. The steeper slopes are located near Troutdale Road between Southeast Stark Street and Cherry Park Road and to the north of Cherry Park Road. The upland area east of the Beaver Creek canyon, between the Sandy River and Beaver Creek, is relatively flat, with most slopes typically ranging from less than 1 percent to 5 percent. This area extends from Southeast Strebin Road at the southern city boundary to Southeast Evans Loop. The area located within the Sandy River floodplain near the Sandy River confluence with Beaver Creek is relatively flat. The area west of the Sandy River and north of the Historic Columbia River Highway is a flood plain of the Columbia River with little topographic relief.

2.5 Climate and Rainfall

Troutdale experiences a similar temperate climate to the surrounding Portland metropolitan area, with relatively warm dry summers and mild wet winters. Winter temperatures average 40 degrees Fahrenheit (F) and summer temperatures average 65 degrees F.

The majority of rainfall occurs during the months of November through April. The driest months are July and August, which typically average approximately 1 inch of monthly rainfall. The average annual precipitation in Troutdale is 44 inches.

2.6 Population

Populations associated with the two planning horizons are listed in Table 2-1. The current population was estimated based on land use, dwelling units per acre for the given land use, and an assumed 2.8 people per dwelling unit. The future population was calculated in a similar way but used 2.57 people per dwelling unit as recommended by City staff. In general, low-, medium- and high-density residential had an assumed 4.4, 9.0, and 16.5 dwelling units per acre, respectively.

Table 2-1. Current and Future Populations

Land use classification	Total population	
	Current[a]	Future, 2040[b]
Low-density residential (LDR)	9,431	9,873
Medium-density residential (MDR)	3,220	4.696
High-density residential (HDR)	3,519	3,906
Total	16,170	18,475

[a] *Source: Troutdale Comprehensive Plan, page 41. The total population estimated using the above approach is roughly equal to the 2011 census (16,244).*

[b] *The City of Troutdale's Community Development Director suggests that the build-out population will be 17,820 at a vacancy rate of 4 percent. This SSMP calculates a future population of 17,736 at a 4 percent vacancy rate based on the land use information provided by the City. For the purposes of the modeling, a vacancy rate of 0 percent is used.*

2.7 Land Use and Zoning

Land use provides the basis for developing unit wastewater flows and overall wastewater flow projections. Understanding the nature and distribution of the various land use classifications is important for accurate identification of wastewater flow rates and the phasing of required improvements. This section describes both the existing and proposed future land uses for the study area.

Land use and zoning are largely governed by the local topography and by decisions made by the City, its citizens, and the Oregon Department of Land Conservation and Development (DLCD). Expansion of the UGB must be approved by DLCD before such actions can be adopted.

The primary commercial districts extend between the railroad tracks and I-84 and to the north of Southwest Stark Street west of Southwest 257th Avenue. Most of the commercial establishments are service-oriented. The area to the north of I-84 is primarily industrial. Much of the remainder of the city is low density residential with pockets of medium and high density residential located near major street systems. A number of open spaces have been designated throughout the city with many located in stream corridors.

Information on current and future land use was obtained from geographic information system (GIS) coverage provided by the City. The locations of the various land use classifications used in the modeling are shown in Figure 2-3 for the existing and in Figure 2-4 for the 2040 planning scenario. The areas associated with each planning scenario are listed in Table 2-2. However, the basis of the acres listed is different for the current and future conditions. The areas shown for the current scenario do not include streets or open spaces. The areas shown for the future scenario are gross areas with streets and open spaces not removed. The modeling did account for the streets and open spaces.

Table 2-2. Current and Future Land Use Acreage

Land use classification	Total acres	
	Current	Future, 2040
LDR	721	886
MDR	154	197
HDR	101	121
Commercial (C)	219	286
Industrial (I)	556	1,231

Note: *Total acres do not add up to total area of Troutdale since several smaller land use classifications are not listed.*

The City's buildable lands inventory was used to determine the residential units planned for each lot since each lot may not be developed to its maximum density.

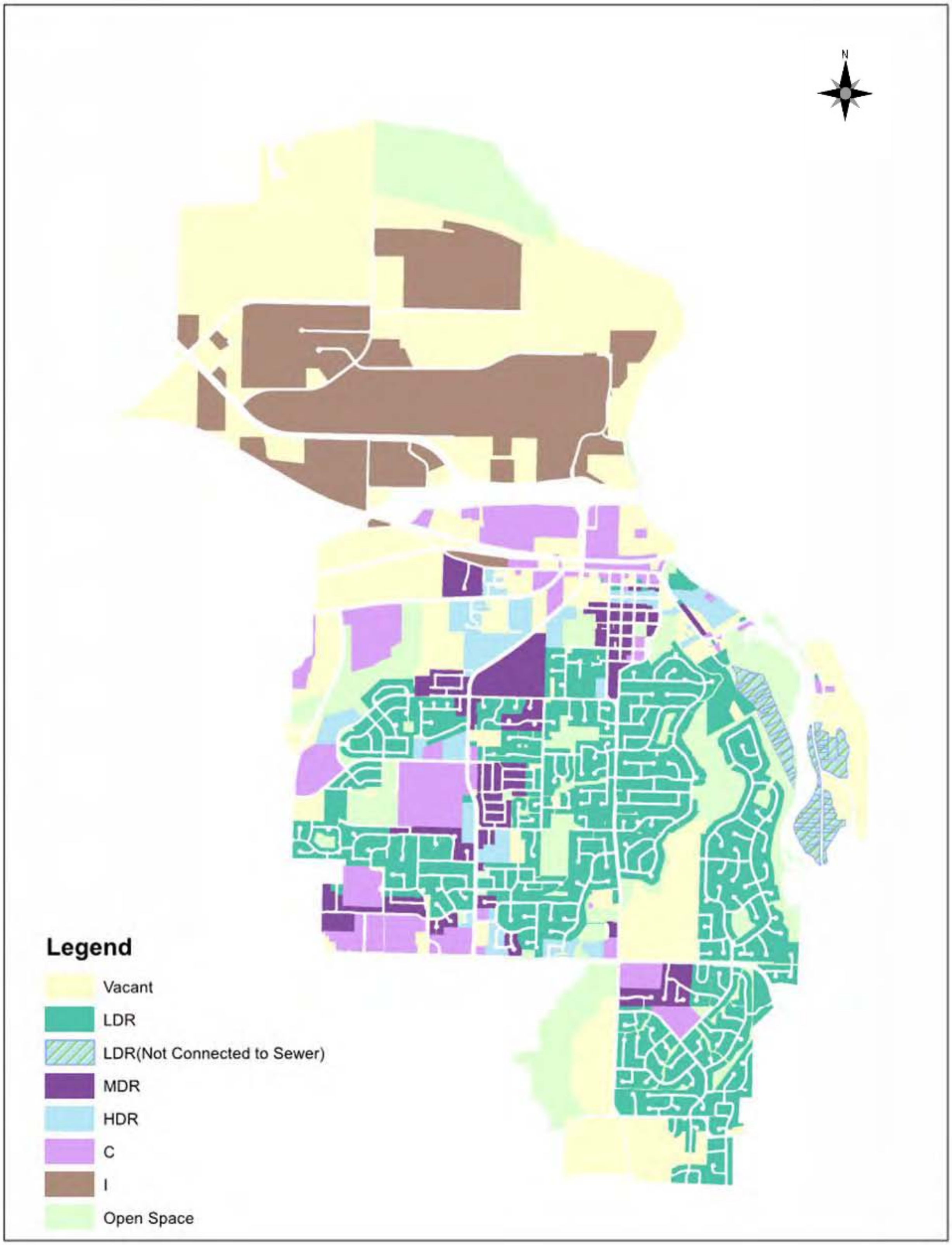


Figure 2-3. Existing land use classifications

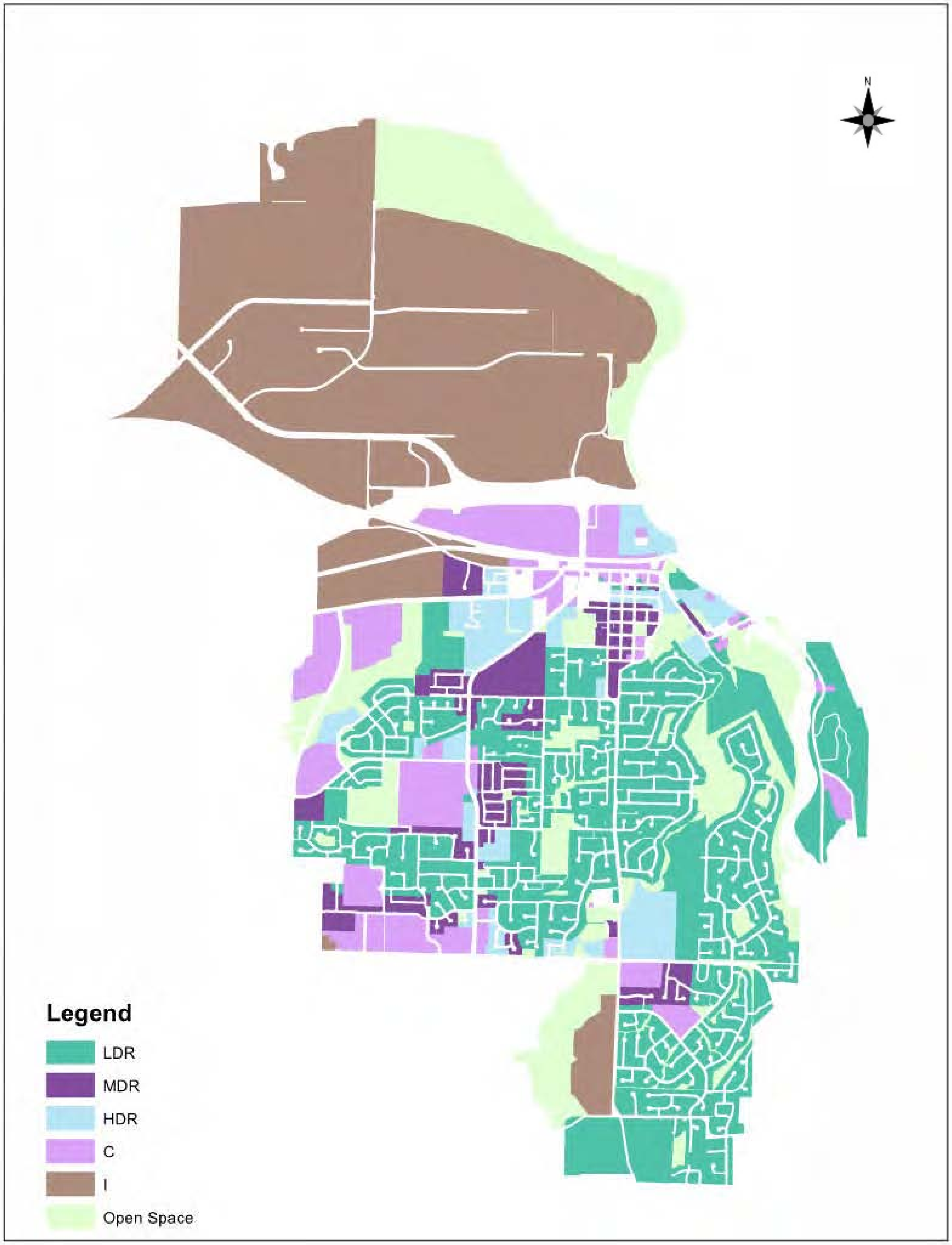


Figure 2-4. 2040 planning scenario land use classifications

2.8 Description of Existing Facilities

According to the City's GIS, the sanitary collection system includes over 53 miles of sanitary sewers, 4 miles of force mains, nearly 1,340 manholes, and ten pump stations. Figure 2-2 shows the locations of the pump stations and other major components of the sanitary collection system. The number of service connections or laterals is estimated to be about 4,600. The City does not maintain the laterals. Laterals are the responsibility of the property owner all the way up to the main line. Cleanouts are required by code, but not all laterals have cleanouts and the City does not have a value for the number of cleanouts in the system.

Approximately 53 percent of the City's sanitary sewer system was constructed between 1967 and 1980 according to the GIS information. As shown in Figure 2-5, growth continued during the 1980s, 1990s, and early 2000s.

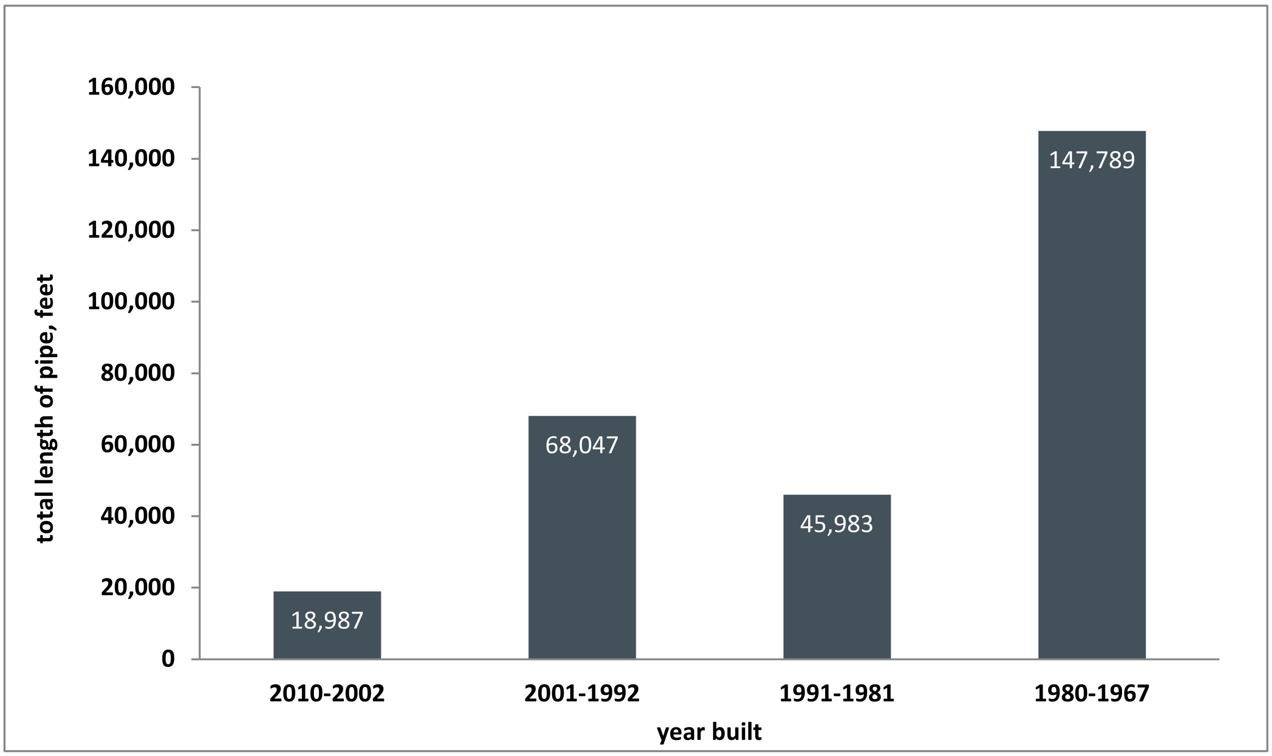


Figure 2-5. Pipe age distribution

Compared to other Oregon cities, Troutdale's system is relatively new. Only about 27,000 linear feet (lf) of the total sewer collection system (281,000 lf) is older than 40 years. As would be expected for a sewer system that is not very old, City staff report that the condition of the sewers are in relatively good condition.

The size distribution of pipes within the sanitary collection system is shown in Figure 2-6. Approximately 80 percent of the system consists of pipes 8 inches in diameter or less.

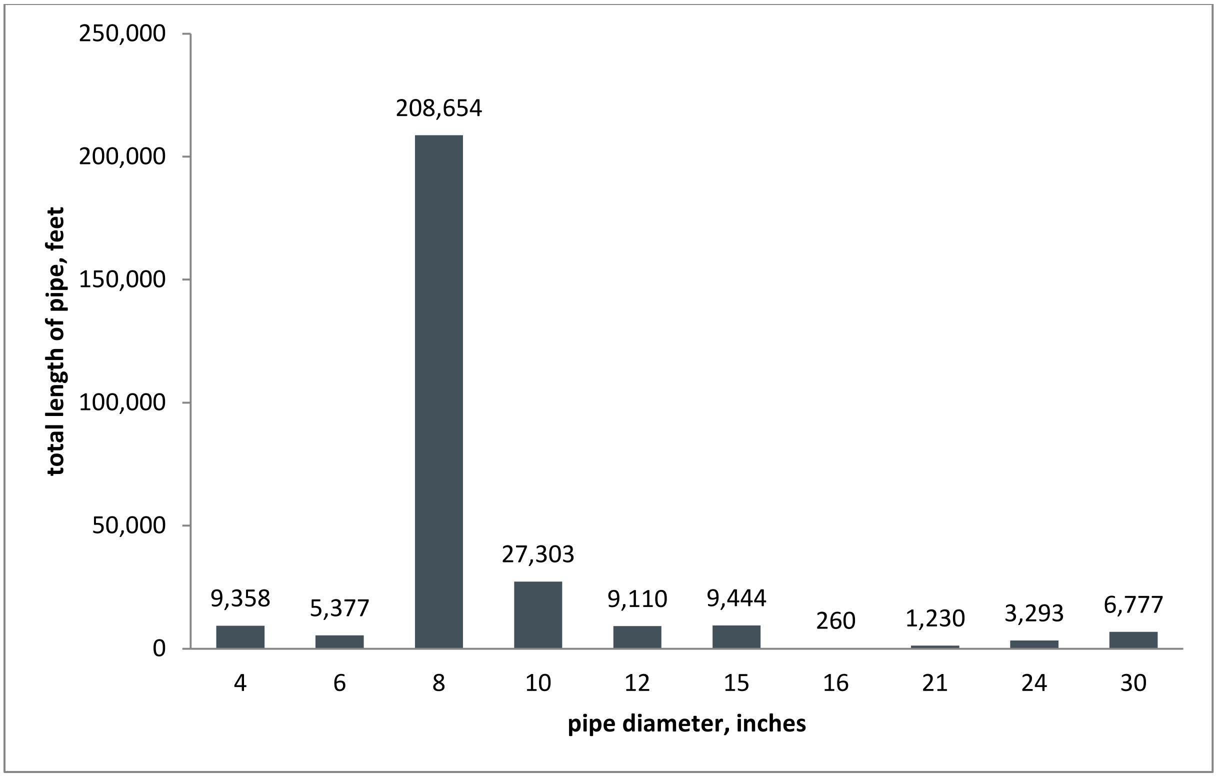


Figure 2-6. Pipe size distribution

The distribution of pipe materials is shown in Figure 2-7. This figure includes the footage of force mains and gravity sewers. The most widely represented pipe material is concrete sewer pipe. Most new construction has been made using poly-vinyl chloride pipe as the pipe material of choice. Most, if not all, of the cast iron and ductile iron pipe that are included in the inventory are used for force mains.

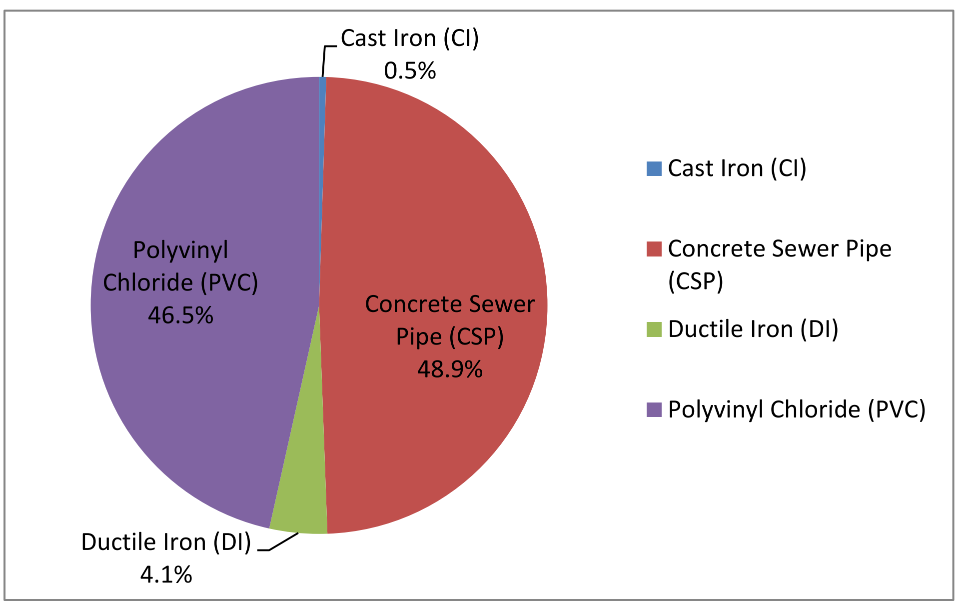


Figure 2-7.Pipe material distribution

2.9 Condition of Existing Sewers

To define sewer condition, City maintenance staff were interviewed so that sewers with operational and/or structural deficiencies could be identified. The City does not currently have a sewer inspection program for performing routine periodic inspections and assessing the condition of the sanitary collection system. Consequently, the City does not have sewer condition documented in either a database or computerized maintenance management system. Sewer deficiencies that were identified are based on the recollection of City staff gained from years of experience maintaining the collection system.

Deficiencies that were identified are shown in the Figure 2-8 and summarized in Table 2-3. The deficiencies consist entirely of operational defects, including infiltration/inflow; fats, oil, and grease (FOG); roots; and sediment, gravel, and debris accumulations. No structural deficiencies were reported by City staff.

Table 2-3. Known Sewer Deficiencies

Location			Type of defect
Pipe identification	From manhole	To manhole	
B135	124	122	FOG
B136	125	124	FOG
C212	209	208	Debris, gravel
C347	11	209	Debris
C213	210	11	Debris
C214	211	210	Debris
C215	212	211	Debris
A217	211	212	Roots
A218	212	213	Roots
A219	213	214	Roots
A220	214	215	Roots
A221	215	216	Roots
A222	216	217	Roots

Note: Sewer deficiencies are based on City staff observations.

City staff report that the above sewers are monitored and that routine cleaning is performed as needed.

Since sewer condition is such an important element of managing collection system assets, Section 5 of this sewer collection system master plan recommends that the City develop and implement a sewer inspection program to provide this vital information. Please refer to Section 5 for more information on this recommendation and to see how this information would support a sewer rehabilitation and replacement program. This latter activity will be particular important as the sewer system ages and as sewer condition problems become more frequent. In addition, Appendix D provides information on sewer rehabilitation technologies that are available to the City to address sewer condition problems that may be revealed by the sewer inspection program.

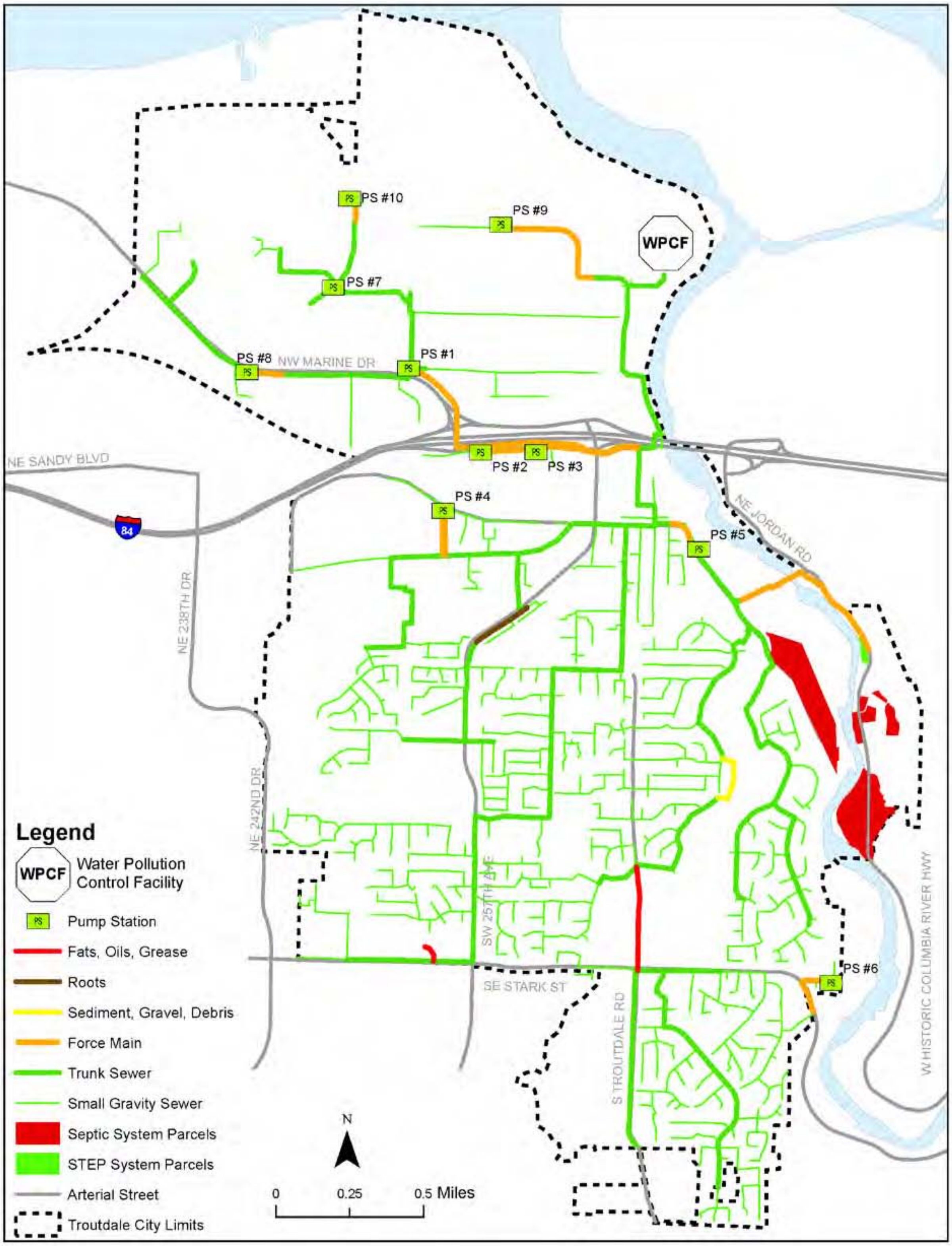


Figure 2-8. Sewer system operational deficiencies

2.10 Description of Pump Stations

The City has ten pump stations as shown in Figure 2-2. A summary of each station's pumping capability and general information is provided in Table 2-4.

Table 2-4. Pump Station Summary

Pump station, #	Current pumping rated capacity[a], gallons per minute	No. of pumps	Force main size, inches	Force main length, feet	Year constructed[b]	Year upgraded[c]
1	300 Low Speed/600 High Speed	2	8	5,120	1966	1978
2	350	2	6	1,000	1972	1988
3	500	2	4	1,850 approx.	1979	1988
4	659	2	4 and 6	900 feet and 900	1974	2003
5	1,900	2	12	734	1971	1995
6	165	2	4	1,175	2002	Not applicable
7	270	2	6	100	1991	Not applicable
8	300	2	6	680	1991	Not applicable
9	350	2	6	2,365	2009	Not applicable
10	160	2	4	505	2009	Not applicable

[a] *The rated pumping capacity is based on one pump operation without the use of the second (redundant) pump. Use of all the pumps at a pump station, does not provide pumping redundancy as per Oregon Department of Environmental Quality/U.S. Environmental Protection Agency requirements.*

[b] *Year constructed is based on force main pipe GIS data if record drawings were unavailable.*

[c] *Year upgraded is based on information provided by City staff. Pump configuration and sizes and force main geometries are shown for current conditions.*

Section 3

Flow Projections and Modeling

Hydraulic modeling of the City of Troutdale's trunk sewer system was performed to identify hydraulic capacity deficiencies in the existing wastewater sewer collection system for both existing and future planning scenarios. This section documents the modeling process that was performed.

As part of the modeling effort, an existing City model was converted to a newer more sophisticated version. Base wastewater flows and rainfall derived infiltration/inflow (RDII) were loaded into the model and calibrated. A capacity analysis was performed to determine hydraulic capacity issues during a regulatory design storm for current and future development planning scenarios.

3.1 Existing Model Update

The existing Bentley SewerCAD hydraulic model provided by the City was updated to the Bentley SewerGEMS V8i SELECT series 3 hydraulic modeling software. The following updates were performed on the existing model:

- Physical data such as manhole location and elevations were compared with geographic information system (GIS) data provided by the City. Sewers constructed in the last few years were added to the model.
- Small tributary sewers and several of the small lift stations were removed from the model to shorten and simplify calibration and analysis.
- Manhole rim elevations were not included in the existing model. Rim elevations for the new model were estimated by using LiDAR data provided by the City.
- Pipe elevation profiles of the trunk sewers were reviewed for continuity error and adverse pipe slope.
- The major pump stations modeled as flow-through elements in the old model were modified to reflect actual pumping capabilities based on known pump curve information.

3.2 Model Extents

The model includes all major trunk lines and the larger pump stations. A more detailed analysis was performed in the industrial area north of Interstate 84 to address ongoing and future development planning questions. Figure 3-1 shows the model extents. See Appendix A for a more detailed sewer map of modeled sewers.

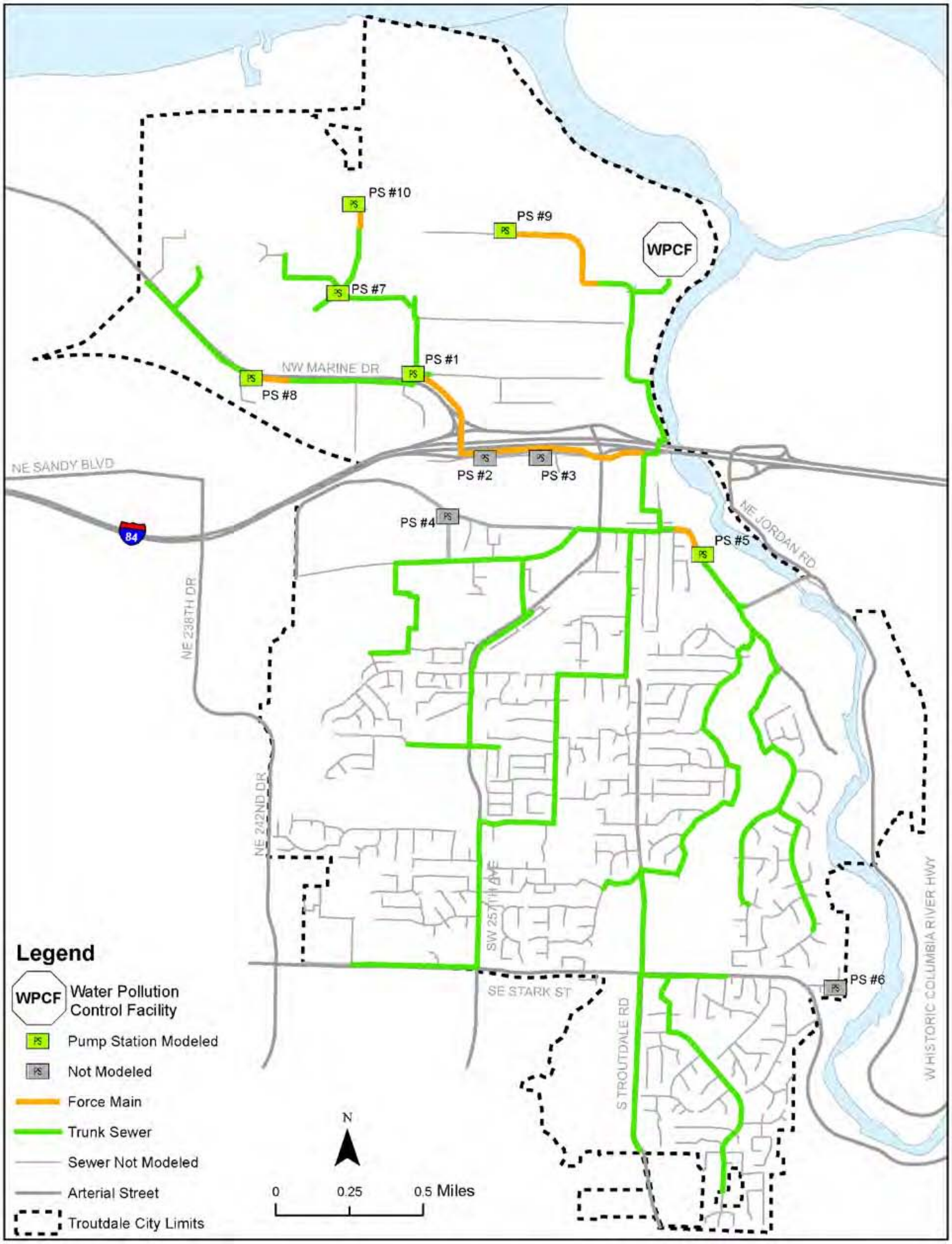


Figure 3-1. Model extents

3.3 Troutdale WPCF Flow Meter and Model Calibration

Data collected from the effluent flow meter at the Troutdale WPCF was used to calibrate the model and develop the weekday diurnal pattern for the City. The flow data included 5-minute averages for a range of conditions including several large storm events and periods of extended dry weather. The flow meter is located on the WPCF effluent pump station header piping. Data from this flow meter can be used to approximate flows coming into the plant during periods of dry or moderate wet weather.

WPCF operations including use of additional secondary treatment units, power outages, or pump failures can cause the recorded effluent flow to differ from flows entering the plant. Therefore, the modeled flows may differ from recorded flows especially during wet weather events. The model was generally calibrated to match the average pumped flows which can vary as much as 1,500 gallons per minute (gpm) within a 10-minute period.

The location of the flow meter and the effect of unknown plant operations produce some uncertainty in the flow data. For this reason, the hydraulic model was constructed and calibrated to produce wet weather flows that conservatively estimate WPCF flows. Prior to another major modeling effort, it is recommended that the City perform a comprehensive flow monitoring study to quantify and delineate flows from sub-basins within the collection system. This will increase model accuracy. In addition, flow metering of the collection system will allow the City to target areas for infiltration/inflow reduction (although not a significant issue at this time).

3.4 Base Flows

Base sanitary sewer flows were developed from monthly winter potable water use data. The data was used to estimate the magnitude of base flows in the system and distribute base flow throughout the model. Water use data measured during the winter was used because only potable water generates base wastewater flow during wet winter months and potable water is not typically used for irrigation in the winter. The City provided data for January 2012, a representative winter month for estimating the base sanitary flows.

Base flows from the constructed model were compared with WPCF flow meter data collected during an extended period of dry weather that occurred in September 2012. The results indicated that the average flows generated by the water use data were approximately 300 gpm lower than the WPCF flow meter data. To account for the discrepancy, an additional 300 gpm was added to the model and distributed evenly among all active manholes. The modeled base flows calibrated to WPCF flow meter data are presented in Figure 3-2. With the flow adjustment, the model correlates well with the WPCF data. The many minor fluctuations shown in the WPCF data reflect the impacts of the pump stations on the flow regime.

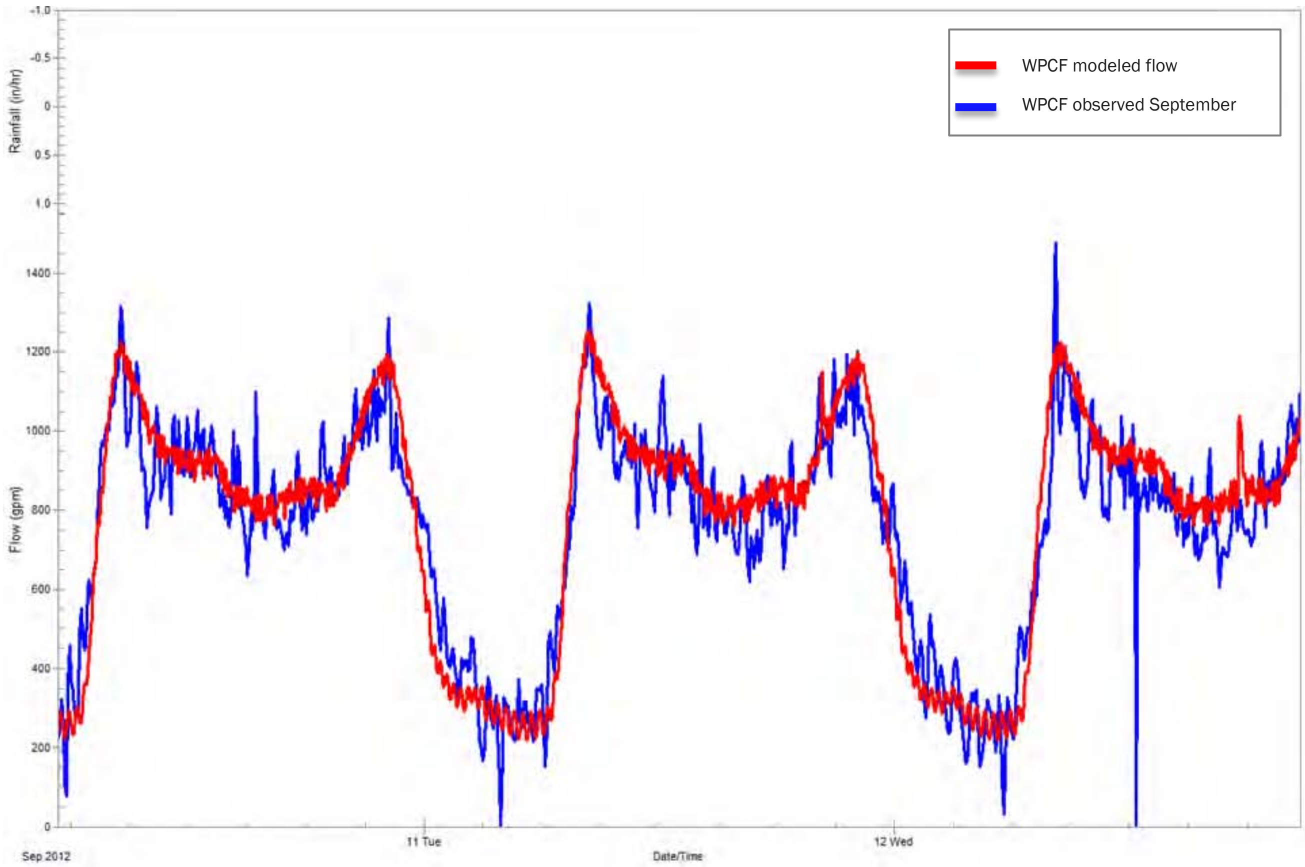


Figure 3-2. Modeled base flows calibrated to WPCF flow meter data

3.5 Wet Weather Flows

RDII sewer flow was developed through the RTK method. A significant January 2012 storm was used to calibrate the RTK parameters and compare modeled flows to observed flows. Data from the WPCF flow meter were used for the analysis so the same RTK parameters were used for the entire collection system. Once calibrated, the model was used to simulate the regulatory design storm and determine capacity deficiencies in the system for both current and future development planning scenarios.

3.5.1 RTK Method

The RTK method uses a set of triangular unit hydrographs to generate flows. The hydrograph shapes are described by three parameters, R, T and K, described as follows:

- R is the fraction total precipitation that enters the sewer system as RDII
- T is the time to peak of the hydrograph
- K is the ratio of the recession time to time to peak

A typical hydrograph is shown in Figure 3-3.

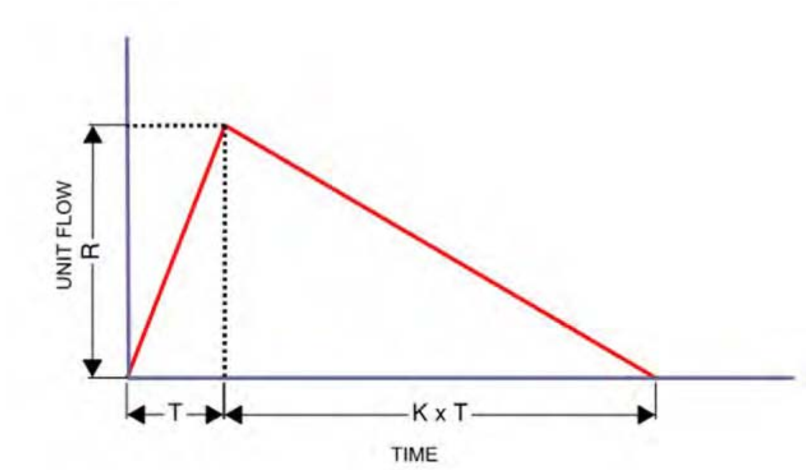


Figure 3-3. RTK unit hydrograph

Actual RDII hydrographs do not look like the simple triangular plot shown above since they are influenced by several different phenomena including inflow from rainfall sources, rainfall derived infiltration, and direct infiltration from groundwater sources. To model this varied phenomenon, the RTK analysis is represented by three unit hydrographs corresponding to rapid inflow, moderate groundwater infiltration, and slow groundwater infiltration. Figure 3-4 depicts all three unit hydrographs combined into one that can be used to approximate RDII flows in a sewer system.

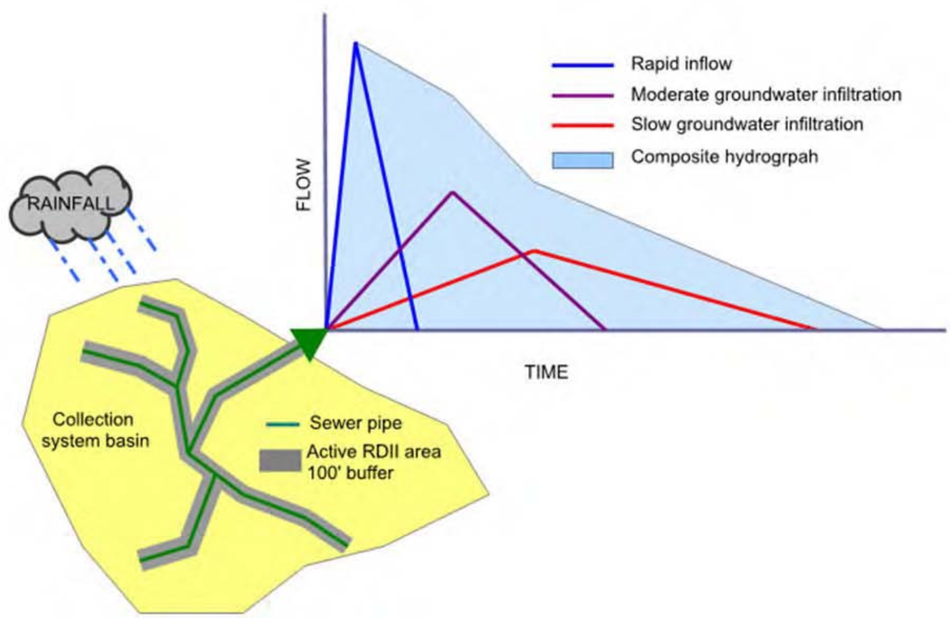


Figure 3-4. RTK method schematic

3.5.2 Precipitation Data

To calculate the R parameter for the RTK analysis, precipitation data are required that closely correlate to actual rainfall that is contributing to RDII in the sewer system. Rainfall data sets were obtained from the following sources and compared. Figure 3-5 includes rain gauge locations.

- *USGS Gresham Rain Gauge*: The U. S. Geological Survey (USGS) rain gauge is operated as part of the City of Portland's HYDRA Network. The gauge is located at the Gresham Fire Department, 1333 Northwest Eastman Parkway in Gresham. Uncorrected provisional data from June 3, 1998 to present can be obtained at the following website:

  http://or.water.usgs.gov/non-usgs/bes/gresham.rain

- *Troutdale Airport Rain Gauge:* The Port of Portland operates a rain gauge at the Troutdale Airport. Precipitation data were downloaded from the Weather Underground website:

  http://www.wunderground.com/history/airport/KTTD

While the USGS Gresham rain gauge is not the closest gauge to the City, it was selected as the preferred gauge for the analysis because its data can be obtained easily and it has good correlation with data gathered within the city limits.

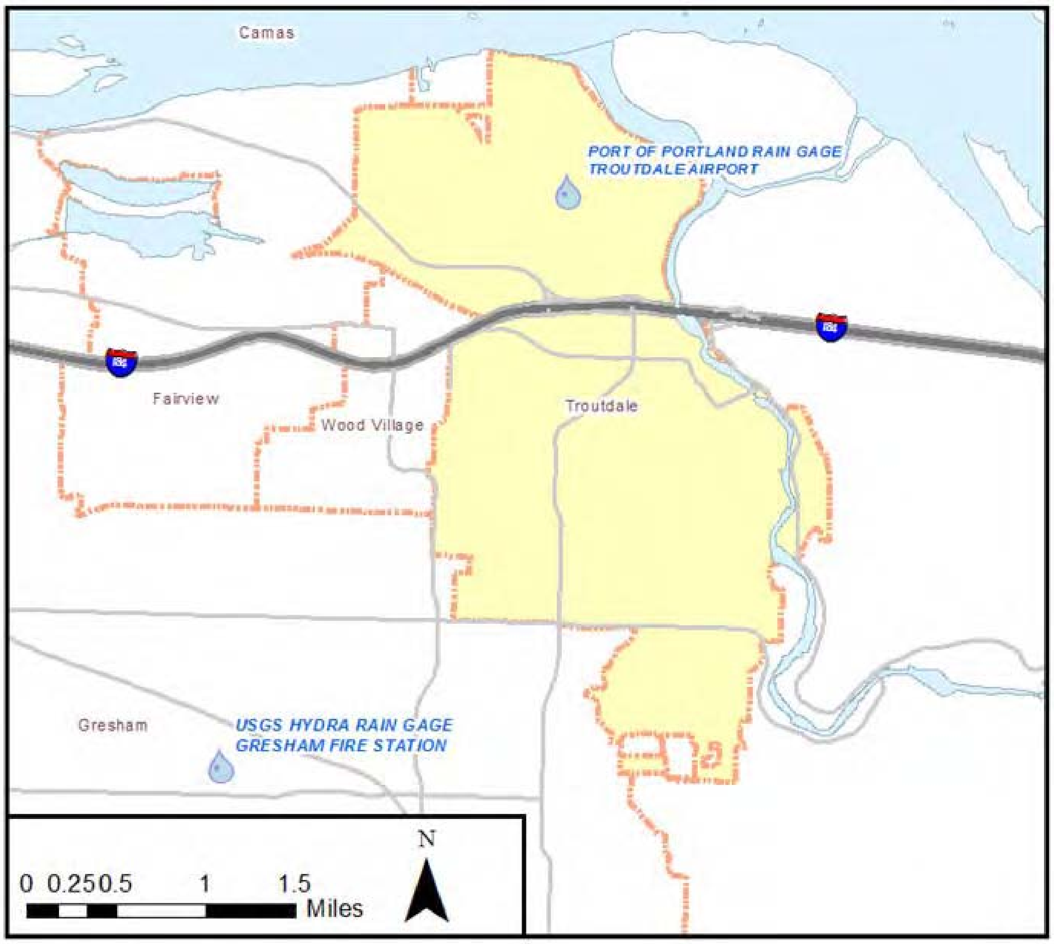


Figure 3-5. Rain gauge locations

3.5.3 Area Contributing to RDII

As shown in Figure 3-6, only a portion of a sewer basin contributes to RDII in the sewer system. This portion of the overall area was estimated by applying a 100-foot buffer to all active sanitary mainline sewers in the system. This buffer area was then diagrammed by the Theissen Polygon Method and distributed among all of the active model manholes using GIS.

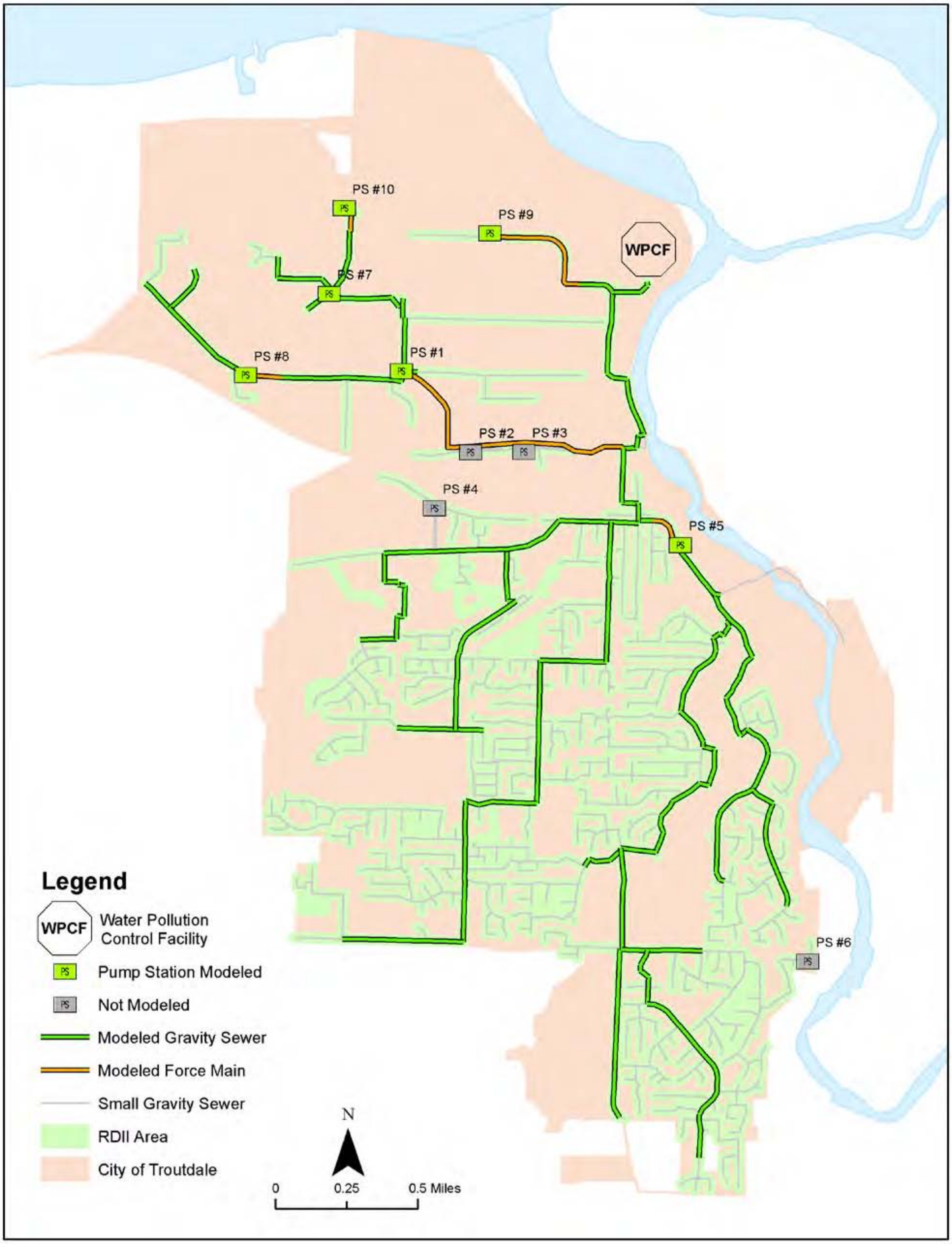


Figure 3-6. RDII contribution

3.5.4 Wet Weather Model Calibration

To calibrate the model for wet weather conditions, the wet weather flow prediction capabilities of the model were verified against actual recorded flows. Calibration of a model involves applying calibrated base flows and selecting RTK parameters that match RDII occurring during a storm event that approximates a design storm. Confidence in the prediction capabilities of the model are then increased by applying the parameters to other storm events in the flow record.

Of the WPCF flow records provided, only one storm event from mid-January 2012 had a continuous record that recorded a peak flow after a significant rainfall event. The calibration for this storm is shown in Figure 3-7.

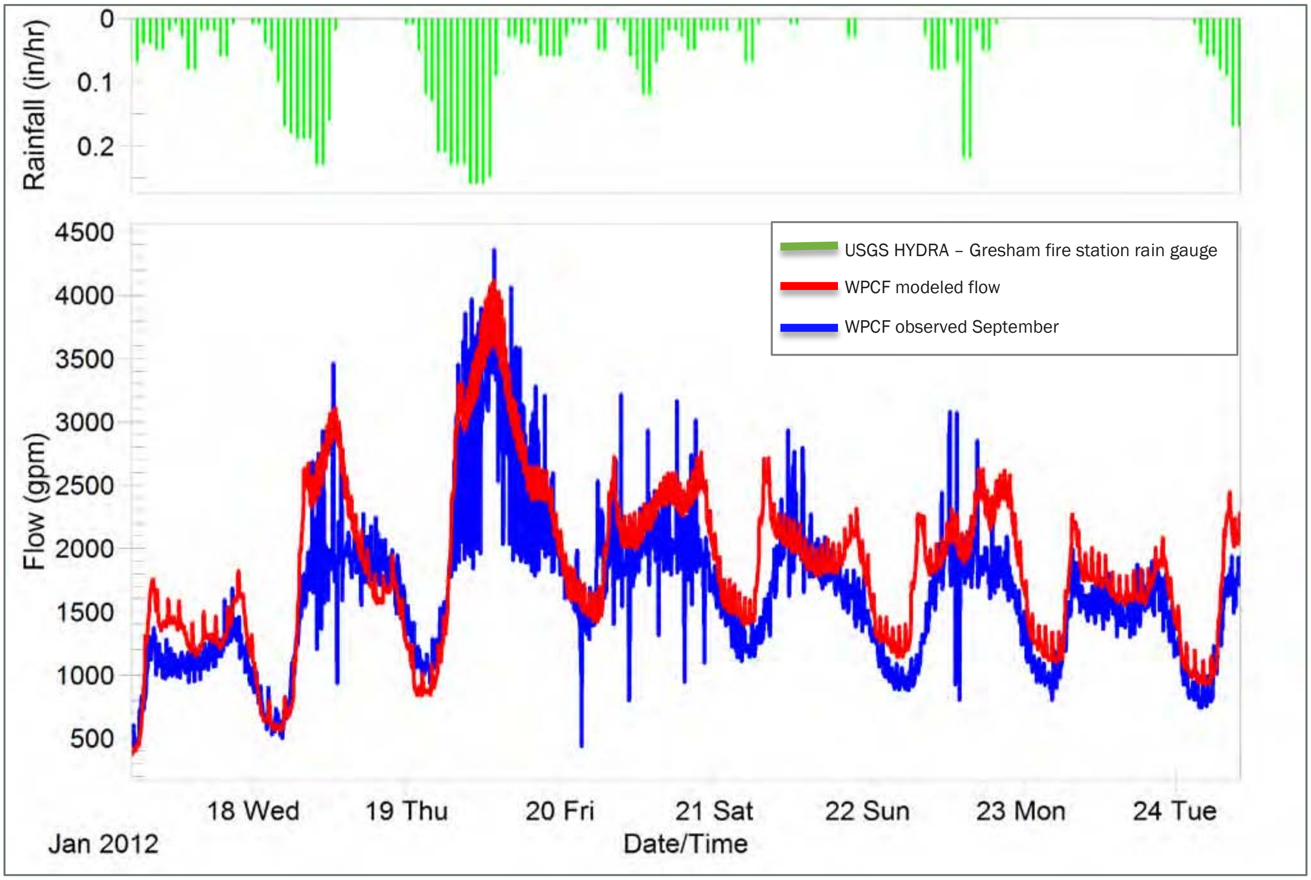


Figure 3-7. January 2012 storm calibration

Other events of similar or lesser magnitude were not useful for calibration due to anomalies in the data suspected to be caused by WPCF operation or gaps in the data. Because of this, the model was calibrated to be slightly higher than recorded flows.

3.5.5 Regulatory Design Storm

To evaluate the ability of the system to handle flows under both current and future flow scenarios, a design storm was loaded and run through the calibrated model. A 3.5-inch storm was used for the design storm depth as specified in the Oregon Department of Environmental Quality's *Internal Management Directive for Sanitary Sewer Overflows (SSOs)*, November 2010.

Typically a Soil Conservation Service (SCS) Type 1A storm is used as the design event hyetograph shape. This high-intensity, short-duration storm is not representative of the storms that typically occur during the winter months in the Pacific Northwest. An alternative to the SCS Type 1A storm was developed for the Portland area that is more representative of typical storms experienced by the City and will produce more realistic modeled flow predictions. The design storm and the SCS Type 1A are compared in Figure 3-8.

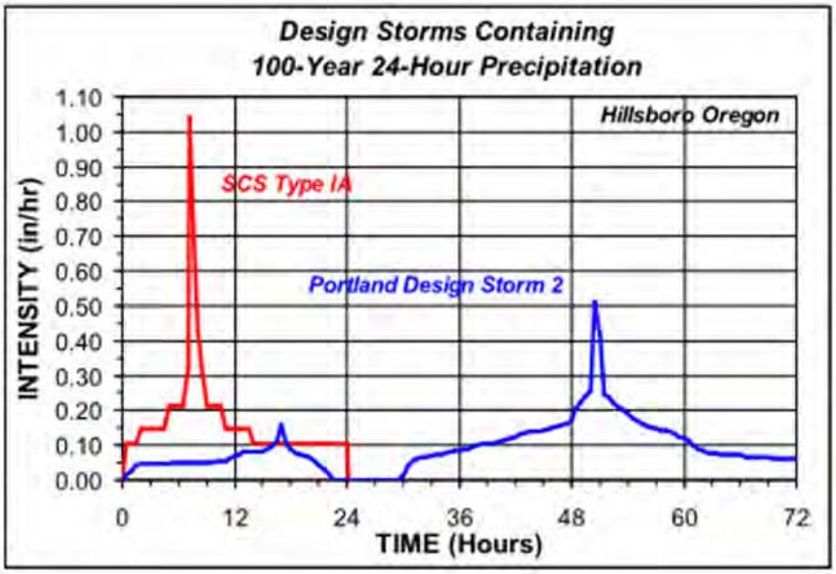


Figure 3-8. Portland design storm and SCS Type 1A storm comparison

3.6 Future Flows

Base flows and RDII from future developments were estimated and routed through the model to determine capacity deficiencies in the trunk sewer system.

3.6.1 Future Base Flows

Future average daily base flows were estimated from industry standard rates for each land use designation. Table 3-1 lists the rates used to develop future base flows.

Table 3-1. Future Sewer Base Flow Unit Rates

Land use	Unit type	Unit flow
Residential[a,b]	Gallons per capita per day (gpcd)	70
Commercial[c]	Gallons per acre per day (gpad)	1,000
Industrial[c,d]	gpad	5,000

[a]An average of 2.57 people per household was assumed as per guidance provided by City of Troutdale's Community Development Director (email).

[b]The buildable lands inventory completed by the City in 2010 was used to determine the number of future residential units in the City. Where buildable lands data was unavailable, development densities specified in the Comprehensive Plan were used to determine the number of dwellings per acre. LDR = 5 dwellings per acre, MDR = 8.5 dwellings per acre, HDR = 21 dwellings per acre.

[c]Unit flow rates for commercial and industrial areas were used per the City of Portland Storm and Sanitary Sewer drainage manual. It should be noted that these are conservative estimates and actual developments will likely produce less flow.

[d]It was assumed that only 50 percent of a parcel available for industrial development will be improved for industrial uses.

3.6.2 Future Wet Weather Flows

RDII from future areas was calculated by estimating the amount of future sewered area and applying the same RTK parameters that were applied to the existing system. This conservatively assumes that new sewers will leak at that same rate as existing sewers. Also, it assumes that ongoing operation and maintenance efforts will focus on RDII so that the existing RDII does not get worse.

Sewered area actively contributing to RDII flows was estimated by GIS analysis. Based on this, Table 3-2 summarizes the percentage of parcel area by land use contributing to RDII flows.

Table 3-2. Land Use and Sewered Area

Land use	Area contributing to RDII, percent
Low-density residential	75
Medium-density residential or mixed use	95
High-density residential	70
Commercial	40
Industrial[a]	10

[a]It was assumed that only 50 percent of a parcel available for industrial development will be improved for industrial uses.

Section 4

Hydraulic Analysis

This section documents the results of the hydraulic analysis used to evaluate the existing collection system under existing and future flow conditions.

4.1 Assessment Criteria

This section discusses the criteria used to determine the adequacy of existing and future collection system infrastructure.

Two criterion are used to evaluate if pipes are too small to convey the design flow. The ratio of maximum predicted flow (Q) to pipe capacity (Qm) is one parameter used to identify undersized sewers. The Q/Qm index compares the calculated peak flow in each pipe with the theoretical pipe capacity according to Manning's equation, which assumes unpressurized flow (no surcharging). A ratio greater than one indicates that the pipe is carrying more flow than is theoretically possible for unpressurized flow for a given pipe slope, diameter, and internal roughness. A Q/Qm ratio of greater than 1.0 is an indication of a surcharged pipe.

Unfortunately, the Q/Qm ratio cannot be used alone for determining pipe capacity due to the way that Stormwater Management Model (SWMM)-based models report their data. In some situations, the peak flows that are reported by the model only exist for extremely short periods of time, sometimes seconds. Consequently, some of these "peak" flows should not be used for the basis of replacing pipe. The second criterion, d/D, the ratio of depth of water to pipe diameter is often more reliable. Use of the d/D ratio is described in more detail in the following paragraph.

In an unpressurized pipe, or a pipe with open-channel flow characteristics, the hydraulic grade line (HGL) is the elevation of the water surface within the pipe, or the "d" value. In a pipe that is surcharged (pressurized flow), the HGL is defined by the elevation to which water would rise in an open pipe, or manhole, as shown in Figure 4-1. In hydraulic terms, the HGL is equal to the pressure head measured above the crown of the pipe.

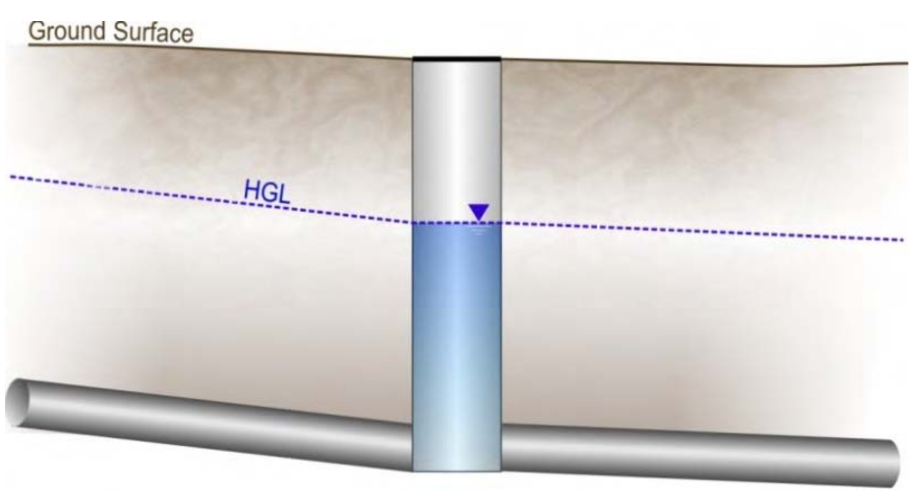


Figure 4-1. HGL for surcharged condition

In general, the pipe replacement criterion for this SSMP is to consider replacing all surcharged pipes with larger pipes, or to recommend other alternatives such that the HGL is contained within the pipe. However, consideration should be made as to the amount and frequency of surcharging. For example, if minor (less than 1 to 2 feet) of surcharging were to occur only during the large storm events, such as the 1 in 5-year design storm, City staff should consider holding off on upsizing this pipe until the amount or frequency of surcharging were to increase. Pipes that surcharge frequently should be upsized since frequent surcharging has the potential to reduce the structural stability of a pipeline due to loss of pipe support from fine grain soils washing into the sewer. Similarly, if the amount of surcharging is more than 1 or 2 feet, City staff should consider the amount of remaining freeboard (i.e., distance between water surface in manhole and ground surface, or to the elevation of basements in the area) in regards to the risk of sanitary sewer overflows or basement backups. This approach will help ensure that the City has adequate capacity for conveying the design flows without spending more capital dollars than necessary.

Some pipes with minor surcharging are identified for replacement even though their d/D ratio is less than 1 foot. The upsizing of these pipes will help reduce more significant surcharging in the upstream system.

The existing capacities of the pump stations are based on the available wet well and pump operational data. Recommendations to upsize pumping capacity are made when influent flows to the wet well exceeded existing stated capacities.

Force mains are identified as being undersized when flow velocities exceed 7 feet per second (fps). Oregon Department of Environmental Quality (DEQ) recommends that force main velocities be kept in the 3.5 to 8.0 fps range (Oregon Standards for Design and Construction of Wastewater Pump Stations, May, 2001.) Brown and Caldwell recommends a lower maximum velocity than DEQ due to the significant increase in energy costs associated with higher flow rates.

4.2 Current Collection System Modeling Results

In summary, the existing collection system can safely convey the current flows without any serious concern regarding surcharging or sanitary sewer overflows. Highlights of the modeling results are discussed below. The detailed results (i.e., all modeled sewers) for the current (existing) conditions planning scenario are shown in Appendix F.

4.2.1 Gravity Sewers

The modeling of the current planning scenario did not reveal any undersized sewers. As shown in Appendix F, two sewers show the existing flow greater than the capacity of the pipe (q/Q>1), but the d/D ratio of these pipes is less than 1, and a review of the hydraulic profile confirms that the d/D ratios are correct. As noted above, the SWMM engine (within the SewerGems software) used to perform the hydraulic calculations is known to experience numerical instabilities under certain conditions that result in spikes in the flow for potentially very short time periods of time (~ seconds).

4.2.2 Pump Stations and Force Mains

None of the modeled pump stations were found to be undersized for conveying the existing peak flows. Pump station flow statistics are listed in Table 4-1.

Table 4-1. Flows to Pump Stations				
Pump station, #	Current pumping rated capacity[a], gallons per minute (gpm)	No. of pumps	Estimated current peak flow, gpm	Estimated 2040 peak flow, gpm
1	300 low speed/600 high speed	2	275	1,056
2	350	2	80	130
3	500	2	80	130
4	659	2	70	223
5	1,900[b]	2	1,758	2,380
6	165	2	UNK	UNK
7	270	2	95	540
8	300	2	61	260
9	350	2	22	427
10	160	2	–[c]	200

[a] *The rated pumping capacity is based on one pump operation without the use of the second (redundant) pump. Use of all the pumps at a pump station does not provide pumping redundancy as per DEQ/EPA requirements.*

[b] *Based on pump curve information not rated capacity of pump.*

[c] *No flow currently to PS #10.*

4.3 Future Collection System Modeling Results

The results of the future 2040 modeling are described in this section. The detailed results (i.e., all modeled sewers) for the future conditions planning scenario are provided in Appendix F. Refer to Chapter 5 for capital improvement recommendations.

4.3.1 Gravity Sewers

Existing undersized gravity sewers for the 2040 peak flows are listed in Table 4-2 and shown in Figure 4-2. Only the sewers that have both the Q/Qm and d/D ratios greater than one are listed in this table. The detailed results are shown in Appendix F for the 2040 planning scenario. Please keep in mind that Appendix F (2040 planning horizon) should be consulted for selecting pipe sizes.

Table 4-2. Hydraulic Modeling Results Future (2040) Planning Scenario									
Pipe ID	Length, feet	Rounded depth, feet	Existing pipe diameter, inches	Existing capacity, gpm	Peak flow, gpm	Future conditions/existing sewers			Replace pipe?
						Percent capacity used[a]	d/D	Predicted surcharging, feet	
Basin B – Interceptor									
B110	71.0	10.0	10	871	779	92	1.27	< 1	N
B115	324.0	14.0	10	581	725	129	1.04	< 1	N
B116	279.0	14.0	10	676	685	105	1.26	< 1	N
B122	57.0	10.0	10	655	661	105	1.27	< 1	N
B123	444.0	10.0	10	718	658	95	1.31	< 1	N
B270	123.0	10.0	10	726	760	108	1.24	< 1	N
B347	108.0	10.0	10	797	758	98	1.12	< 1	N
B351	127.0	14.0	10	671	714	110	1.22	< 1	N
B44	128.0	10.0	8	1,008	973	97	1.38	< 1	Y
B46	244.0	10.0	8	972	918	94	1.47	< 1	Y

Table 4-2. Hydraulic Modeling Results Future (2040) Planning Scenario									
Pipe ID	Length, feet	Rounded depth, feet	Existing pipe diameter, inches	Existing capacity, gpm	Peak flow, gpm	Future conditions/existing sewers			Replace pipe?
						Percent capacity used[a]	d/D	Predicted surcharging, feet	
B47	397.0	10.0	8	842	913	108	2.70	> 1 and < 2	Y
B48	417.0	14.0	8	808	907	112	6.35	> 3 and < 4	Y
B92	400.0	10.0	10	682	855	125	1.22	< 1	N
B98	263.0	10.0	10	845	817	97	1.46	< 1	N
Basin C – Upper Beaver Creek Interceptor									
C187	491.0	10.0	15	1334	1,737	130	1.09	< 1	Y
C188	290.0	10.0	15	1394	1,708	122	1.30	< 1	Y
C189	47.0	14.0	15	730	1,702	233	1.36	< 1	Y
C20	152.0	14.0	15	1104	1,460	132	2.30	> 1 and < 2	Y
C209	359.0	14.0	15	1272	1,610	127	1.54	< 1	Y
C210	354.0	10.0	15	1132	1,544	136	1.58	< 1	Y
C211	92.0	10.0	15	1129	1,541	136	1.78	< 1	Y
C212	219.0	10.0	15	1222	1,498	123	1.88	> 1 and < 2	Y
C213	220.0	10.0	15	1382	1,494	108	2.10	> 1 and < 2	Y
C214	325.0	10.0	15	1475	1,483	101	2.09	> 1 and < 2	Y
C215	171.0	14.0	15	1386	1,483	107	2.08	> 1 and < 2	Y
C216	200.0	14.0	15	1122	1,461	130	2.17	> 1 and < 2	Y
C235	252.0	14.0	15	1125	1,459	130	2.44	> 1 and < 2	Y
C236	111.0	14.0	15	1374	1,443	105	2.52	> 1 and < 2	Y
C237	232.0	10.0	15	1110	1,443	130	2.44	> 1 and < 2	Y
C293	159.0	10.0	15	1126	1,440	128	2.41	> 1 and < 2	Y
C297	161.0	10.0	15	1141	1,435	126	2.34	> 1 and < 2	Y
C298	179.0	14.0	15	1125	1,434	127	2.28	> 1 and < 2	Y
C299	213.0	14.0	15	1105	1,432	130	2.24	> 1 and < 2	Y
C347	136.0	10.0	15	1084	1,494	138	2.01	> 1 and < 2	Y
Basin C – Troutdale Road Trunk									
C338	563.0	10.0	12	984	1,125	125	1.38	< 1	Y
C339	239.0	14.0	12	902	1,121	160	2.22	> 1 and < 2	Y
C340	515.0	14.0	12	701	970	114	3.05	> 2 and < 3	Y
C341	537.0	18.0	12	853	272	17	2.39	> 1 and < 2	Y

[a]The percent capacity used is equivalent to the Q/Qm ratio.

[b]N = it is not anticipated that this pipe will require replacement in future; however, City should monitor the flows in this sewer to assure that potential future surcharging is not too frequent or too high in elevation.

Y = replace pipe when surcharging becomes too frequent or too high in elevation.

4.3.2 Pump Stations and Force Mains

Peak flow statistics for the pump stations are listed in Table 4-1.

As indicated in Table 4-1, four pump stations may require upgrading to convey the future flows. If and when these stations will need upgrading will depend upon the timing and type of future development. The City should monitor the flows to these stations and periodically assess the need to provide increased pumping capacity.

Under the future peak flows, Pump Station No. 1 will not have the pumping capacity to convey the future flows. The existing capacity of the pump station is 300 gpm (low speed) and 600 gpm (high speed). The future 2040 modeling shows 860 gpm coming into the pump station during the design storm event. Upgrades to this pump station and/or force main may be required.

The modeling shows that for Pump Station Nos. 5, 7, and 9, use of both pumps (i.e., the duty and redundant pump) would convey the future flow. However, the City should not rely on this strategy for conveying the future flows since it does not comply with the redundant pump requirements specified by DEQ.

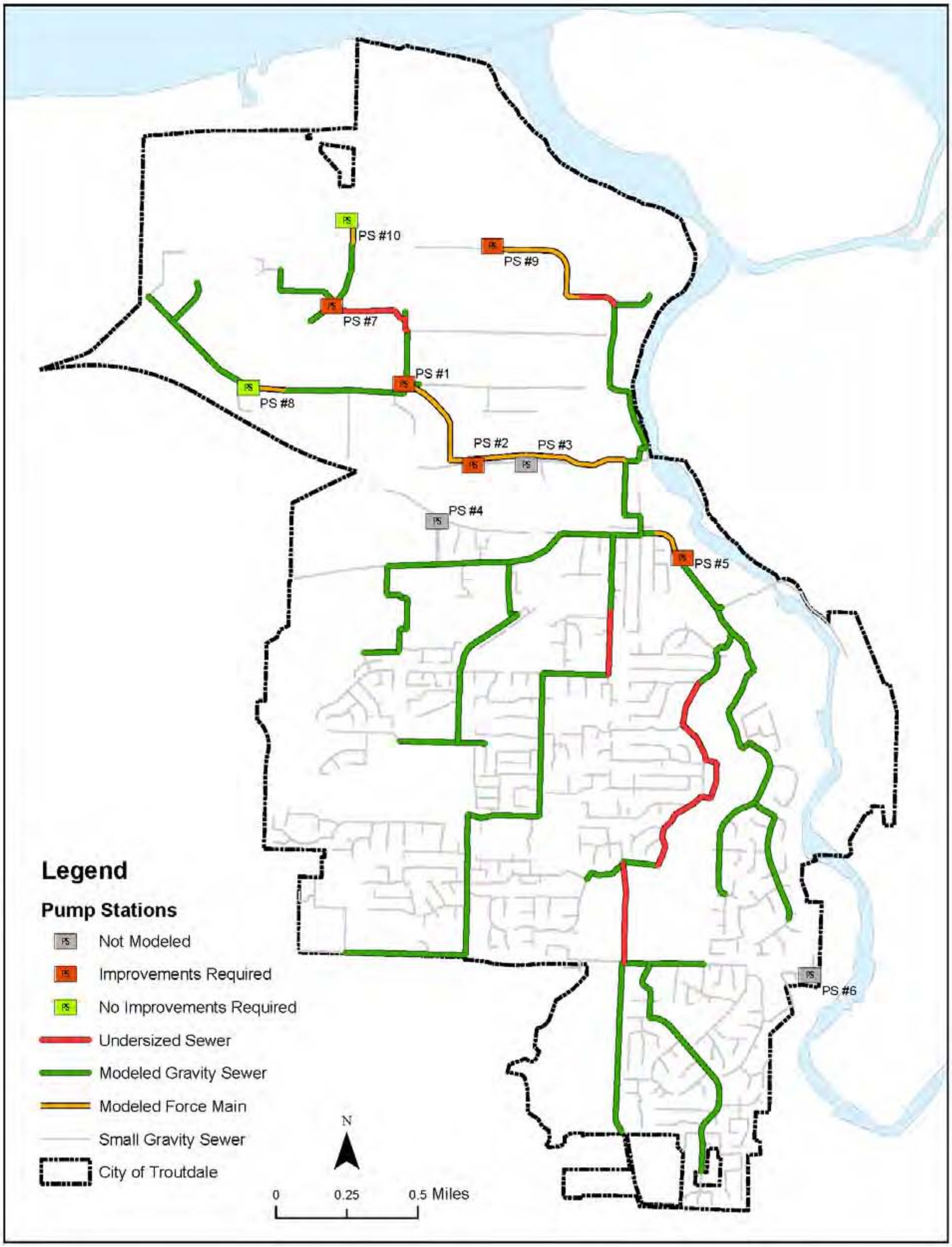


Figure 4-2. Undersized gravity sewers

Section 5

Capital Improvement Plan

This section presents the recommended projects the City of Troutdale (City) should consider for inclusion in its capital improvement plan for the sanitary sewer collection system. The recommendations address existing deficiencies in the system and provide guidance for expanding the system to meet the City's future growth needs.

Capital improvements have been developed for two planning scenarios: existing and full-build out (2040). Nearly $8.72 million in capital improvements are required to upgrade the collection system so that it can convey the planned future flows. Approximately $7.33 million in capital improvements will be required to extend the collection system into areas that do not currently have sewer service.

This section recommends capital projects and presents a priority ranking of the projects to facilitate annual budgeting and scheduling. The recommendations contained in the tables and figures herein should be updated, as required, to address future conditions that may differ from conditions used to develop this Sanitary Sewer Master Plan (SSMP).

5.1 Project Development and Evaluation

Most of the recommendations presented in this SSMP are based on replacing existing undersized pipe with pipe sized to convey the projected 2040 flows. This is the preferred alternative for most undersized pipe conditions. In some situations, other alternatives may be available, including basin (gravity and pumping) transfers, and the use of parallel pipes. The latter approaches were not used in this SSMP, but may be considered during predesign.

5.2 Capital Improvement Recommendations

This section identifies the required capital improvement recommendations for the existing and 2040 planning horizons.

5.2.1 Existing System Deficiencies

The existing condition planning scenario serves two general purposes:

- *Project Prioritization*—This scenario identifies existing deficiencies in the sanitary collection system. In general, existing deficiencies should be addressed before those associated with future conditions.
- *Rate/System Development Charges (SDCs)*—As part of SSMP development, a financial analysis was performed to determine future sewer rates and SDCs. The analysis depends in part on the cost of addressing the existing problems.

The existing scenario modeling did not reveal any hydraulic deficiencies with the existing sanitary sewer collection system. All of the sewer and pump station improvements that will be required are associated with future growth.

As part of the sanitary sewer master planning effort, Brown and Caldwell was asked to evaluate the City's biosolids program and to make recommendations that would enable the program to keep pace with actual biosolids production. Details and documentation of this evaluation are provided in Appendix G.

The Water Pollution Control Facility generates approximately 225 to 230 dry tons (DT) of anaerobically digested biosolids on an annual basis. Biosolids are transferred to a 3.5 million gallon (MG) facultative lagoon at the plant, and removed seasonally (typically July, August, and September) for Class B application to local farm land. Slurry is dredged from the lagoon at approximately 2 percent solids and hauled in 4,000 gallon loads to the cooperating farms. Approximately 70 to 75 DT of biosolids have been hauled in this manner, typically, with the balance accumulating in the lagoon. The lagoon is currently very full and has limited capacity for additional storage.

As part of the biosolids program, the City operates a successful land application program. But due to the local climate, only a short window exists for hauling and spreading. Typically, land is available after the first hay cutting in early July until early October when fall rains commence. The purchase of a second 4,000-gallon tank truck will increase operational capacity for hauling in this time window. However, the availability of sufficient land within the customary haul distance is uncertain. Trip time for each load affects the productivity and cost of the program on a unit basis. Longer haul distances may limit the quantity of solids that each truck can effectively haul in a season. The current list of approved land application sites needs to be expanded, and operating experience will be required to determine the quantity of biosolids that can be hauled reliably.

The combination limited lagoon storage capacity and limited land available for beneficial use dictates consideration of an alternative approach for biosolids management. While the existing program is successful, it has not succeeded in keeping pace with biosolids production. Options include the following alternatives:

1. Expand existing slurry-based land application program
2. Implement biosolids dewatering to facilitate longer cost-effective haul distances and storage
3. Implement thermal drying to produce a Class A product
4. Contract removal (periodic or scheduled) of lagoon inventory to renew storage capacity

A summary of these alternatives and their unit cost ranges is presented in Table 5-1.

Table 5-1. Summary of Alternatives and Cost Ranges

Alternative	Unit cost per DT biosolids	Annual cost[a]
1. Expand the existing land application program	$450-600	$112,500-150,000
2. Implement biosolids dewatering	$550-700	$137,500-175,000
3. Implement thermal drying to produce a Class A product	$700-900	$175,000-225,000
4. Initiate periodic contract removal of lagoon inventory	$550-600	$137,500-150,000

[a]*Based on 250 DT/year.*

The City is considering the above alternatives but has not yet made a final decision. In the short term, removing solids from the lagoon to renew storage capacity will buy time for determining the success of the slurry-based program and further evaluation of dewatering feasibility. For budgeting purposes, this SSMP assumes $175,000 will be spent annually on the modified biosolids program.

5.2.2 2040 System Deficiencies and Sewer Extensions

The 2040 planning scenario identifies sewers and pump stations undersized to convey the future full build-out condition. As identified in Section 4, not all of the sewers experiencing surcharging require replacement. Only those sewers and pump stations identified as requiring replacement are included in the capital improvement plan. In addition, future sewer extensions are included in the capital improvement plan. The sewer extensions will provide sewer service to areas currently not served, or underserved by sewer service, including: Southeast Jackson Park Road, East Historic Columbia Highway, and the Troutdale Reynolds Industrial Park (TRIP).

A summary of the costs associated with the required 2040 improvements is listed in Table 5-2. The locations of the required improvements are shown in Figure 5-1. Sewer extensions are not shown in this figure. The primary pipe replacements are located in South Buxton Road, South Troutdale Road, and Southeast Beavercreek Lane. In addition, future growth in the TRIP will require upgrades to several pump stations, one force main, and to segments of the gravity sewer system.

Table 5-2. Required Future 2040 Improvements

Description of improvement	Estimated cost of improvements, dollars[a]
Sewer upgrades	4,817,000
Pump station upgrades	3,900,000
Sewer extensions	7,333,000
Total	16,050,000

[a]*Estimated costs include a 50 percent allowance for construction contingencies, engineering, and overhead.*

5.2.2.1 Sewer Improvements

The sewer improvements identified in this section are based on the hydraulic modeling as required to convey the future full build-out condition. City staff are encouraged to monitor the flow in the sewers that may need replacement to determine if, and when, the improvements are required since future growth patterns may differ from what was assumed for modeling purposes.

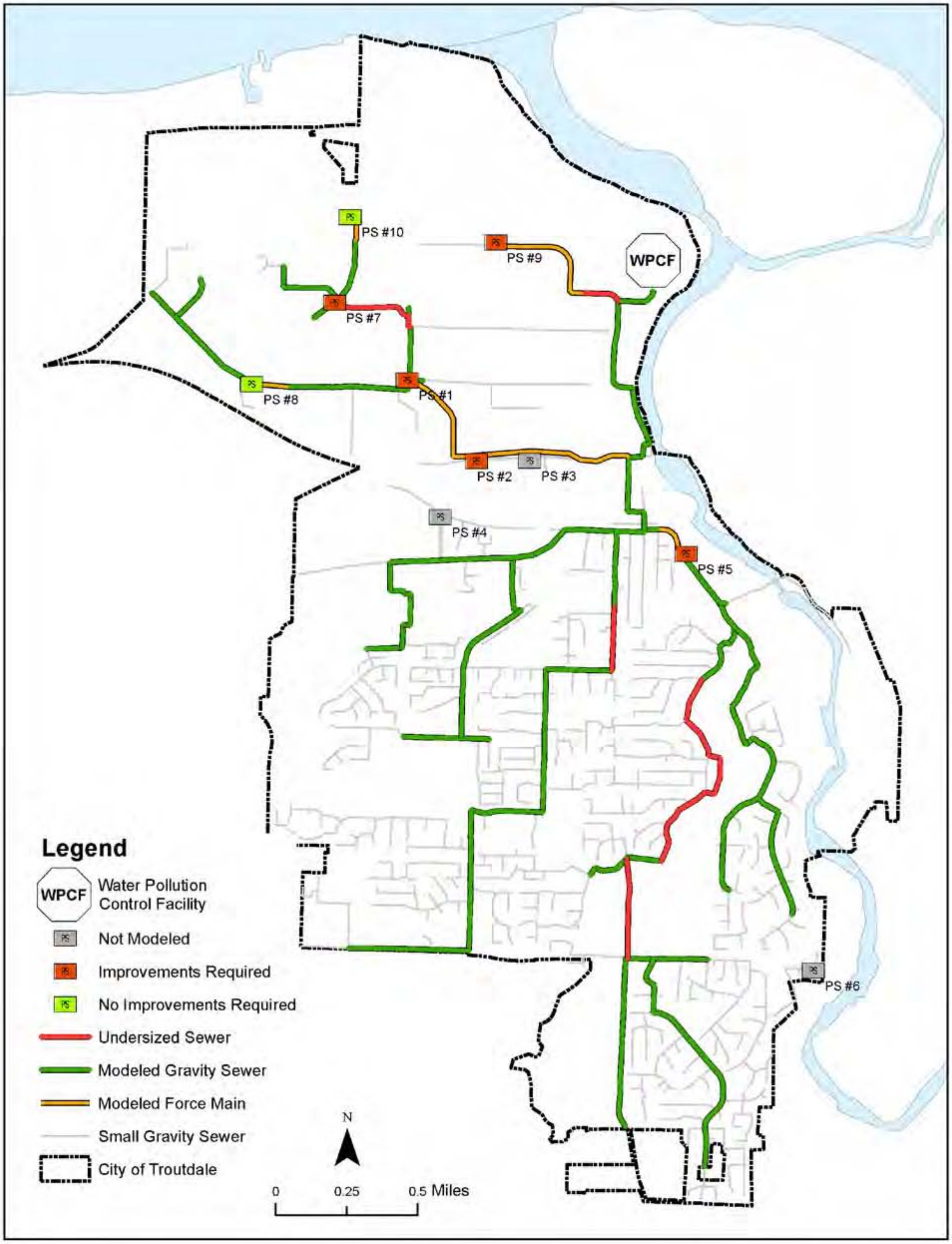


Figure 5-1. Required future improvements recommendations

5.2.2.2 PS #1

Future flows to this pump station will exceed its pumping capacity. PS #1 has a current pumping capacity of 600 gallons per minute (gpm). Potential future flows in the area could reach approximately 1,056 gpm. To convey this increase in flow the pump station will require upgrades in its pumping capacity.

The City has several alternatives available for providing the required increased capacity to PS #1. Choice of the best alternative depends on several factors, primary of which is the physical and operational condition of the existing pump station and force main. The most likely alternatives include the following:

- replace the force main
- replace the pumps
- replace the entire pump station
- build a new pump station and force main

Each of these alternatives is described below.

Replace the force main. The installation of a new force main along a new alignment would allow the existing pump station and pumps to be utilized. The shorter and potentially, larger diameter force main, will result in lower friction head such that the existing pumps may be able to convey the flow. Since the force main was installed in 1966, it is approaching 50 years of service. Its condition may be degraded and require replacement in the not too distant future regardless of all other decisions. Force mains are not expected to last as long as non-pressurized gravity sewers.

A new force main alignment is desired since the existing alignment was based on conveying flows to the old treatment plant location. A more desirable alignment would take the flow on a more direct route toward the new Troutdale Water Pollution Control Facility and avoid working in the Northwest Frontage Road/Interstate 84 corridor.

The preferred alignment would follow the existing small diameter gravity sewer along the south side of the airport and discharge into the existing gravity sewer in Northwest Graham Road. This alignment is shown in Figure 5-2. Approximate cost for a new force main is $895,000.

An alternate alignment could follow the existing gravity sewer north of the pump station up to Perimeter Way where it would follow the existing alignment of the gravity sewer over to Northwest Graham Road. This alternative was not considered further since it would require construction across the Troutdale Airport runway and represents a somewhat longer route.

Replace the pumps. If larger pumps can be installed in the existing wet well, then the existing force main could be kept in use. If upgrades in the electrical systems are required to support the larger pumps, then the cost of both of these improvements would be similar to the cost of the new force main.

Replace the entire pump station. This would be considered if all of the existing facility were in need of an upgrade. A complete replacement would be appropriate if a new wet well is required and if the existing electrical control/genset building is too small for the required upgrades (approximately $1.5 to $1.8 million).

Build a new pump station and force main. This option addresses age/condition issues associated with both the existing pump station and force main. It provides an opportunity for new equipment and wet well design that will result in fewer operational issues and energy savings (approximately $2.7 million). For budgeting purposes, the $2.7 million is included in the recommended capital program.

The City should evaluate if the existing pumping station can be refurbished to provide the required increase in capacity. If the existing pumping station can be refurbished, significant cost savings can be realized over replacing the entire pump station.

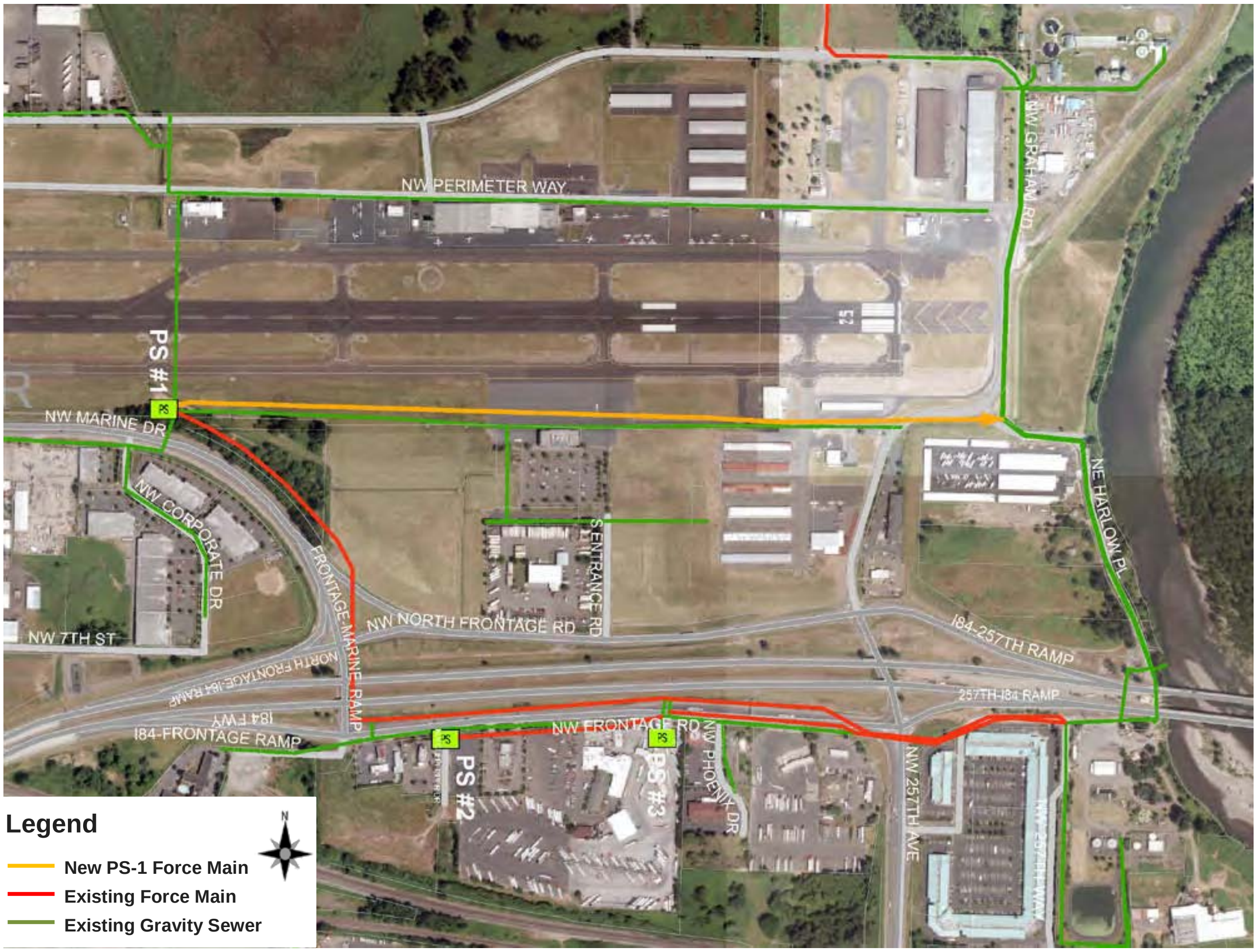


Figure 5-2. PS #1 new force main alignment

5.2.2.3 PS #2

City staff have identified that upgrades to this pump station are required to improve performance. The required upgrades include: larger pumps and motors, larger wet well, and enhanced motor controls.

5.2.2.4 PS #5

Future flows to this pump station will exceed its pumping capacity. PS #5 has a current pumping capacity of 1,900 gpm. Potential future flows in the area could reach approximately 2,400 gpm. To convey this increase in flow the pump station will require upgrades in its pumping capacity. Capacity upgrades to the pump station are assumed to be limited to the installation of larger pumps.

5.2.2.5 PS #7 and PS #9

Future flows to these two pump stations will exceed their existing pumping capacities. PS #7 has a pumping capacity of 270 gpm. Potential future flows in the area could reach approximately 540 gpm. PS #9 has a current pumping capacity of 350 gpm. Potential future flows in the area could reach approximately 427 gpm. To convey these increases in flow the pump stations will require upgrades in their pumping capacities. Capacity upgrades to these pump stations are assumed to be limited to the installation of larger pumps.

5.2.2.6 Troutdale Reynolds Industrial Park Extensions

Approximately 50 percent of the TRIP is undeveloped. Future flows from this area will depend on the specific number and type of industries that move into the TRIP. Modeled flow rates were based on accepted industry standards for light to medium industrial development; however, actual flow rates may vary considerably depending on the nature of the industrial activity. City staff should compare projected flow rates from prospective new industries wanting to move into the TRIP with observed flow rates in the downstream piped system to monitor percent of hydraulic capacity used and remaining capacity. This information should be used to identify when new facilities (i.e., sewers and pump stations) should be upgraded or expanded.

The improvements shown in Table 5-3 and Figures 5-3 and 5-4 will provide sewer service to a portion of the TRIP not currently with sewer service.

Table 5-3. TRIP Area Extensions

Description of improvement	Estimated cost of improvements, dollars[a]
IND-DEV-3 area, sewer	1,021,000
IND-DEV-3 area, pump station	700,000
IND-DEV-3 area, force main	327,000
IND-DEV-4 area, sewer	1,085,000
Total	3,133,000

[a]*Estimated costs include a 50 percent allowance for construction contingencies, engineering, and overhead.*

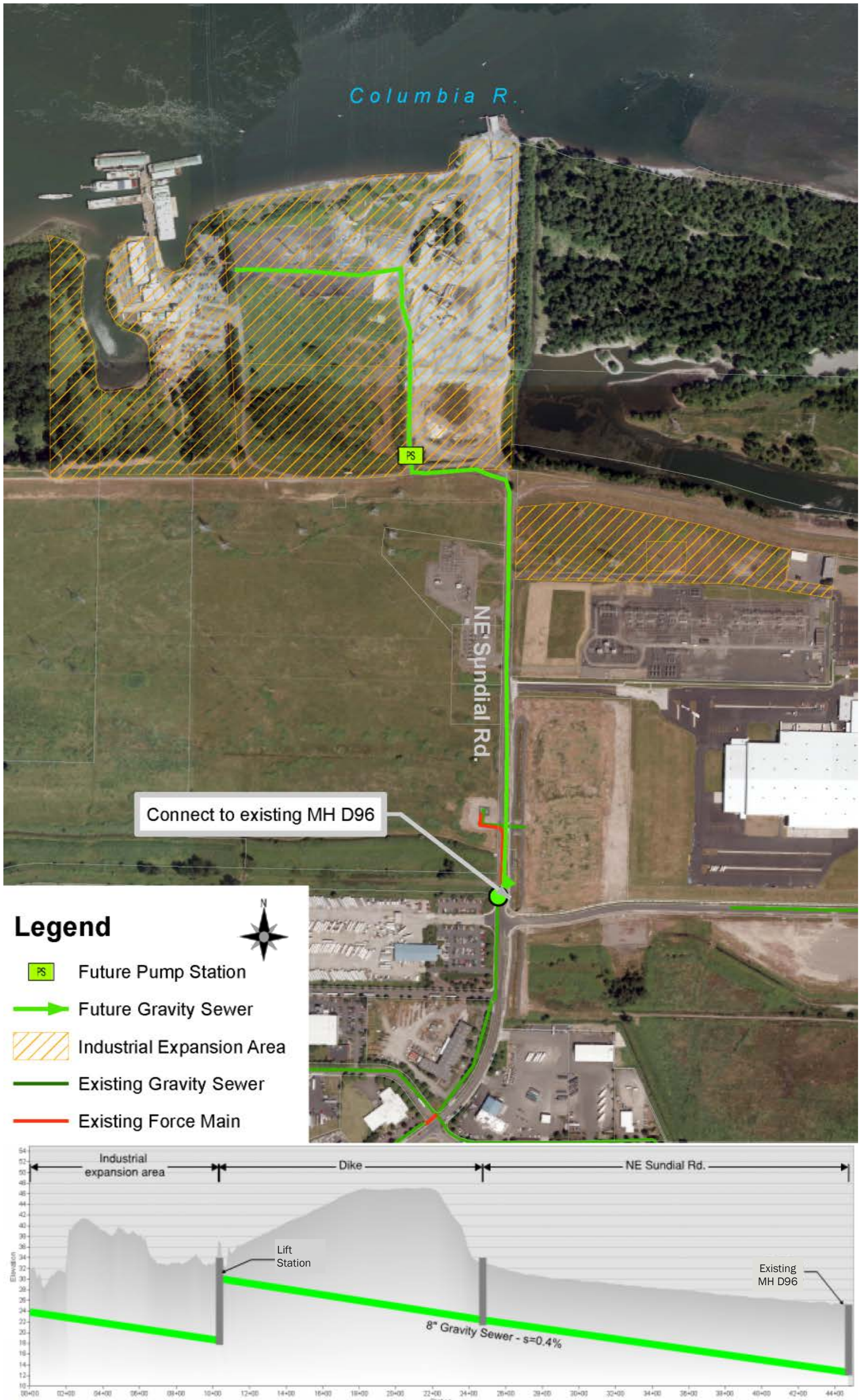
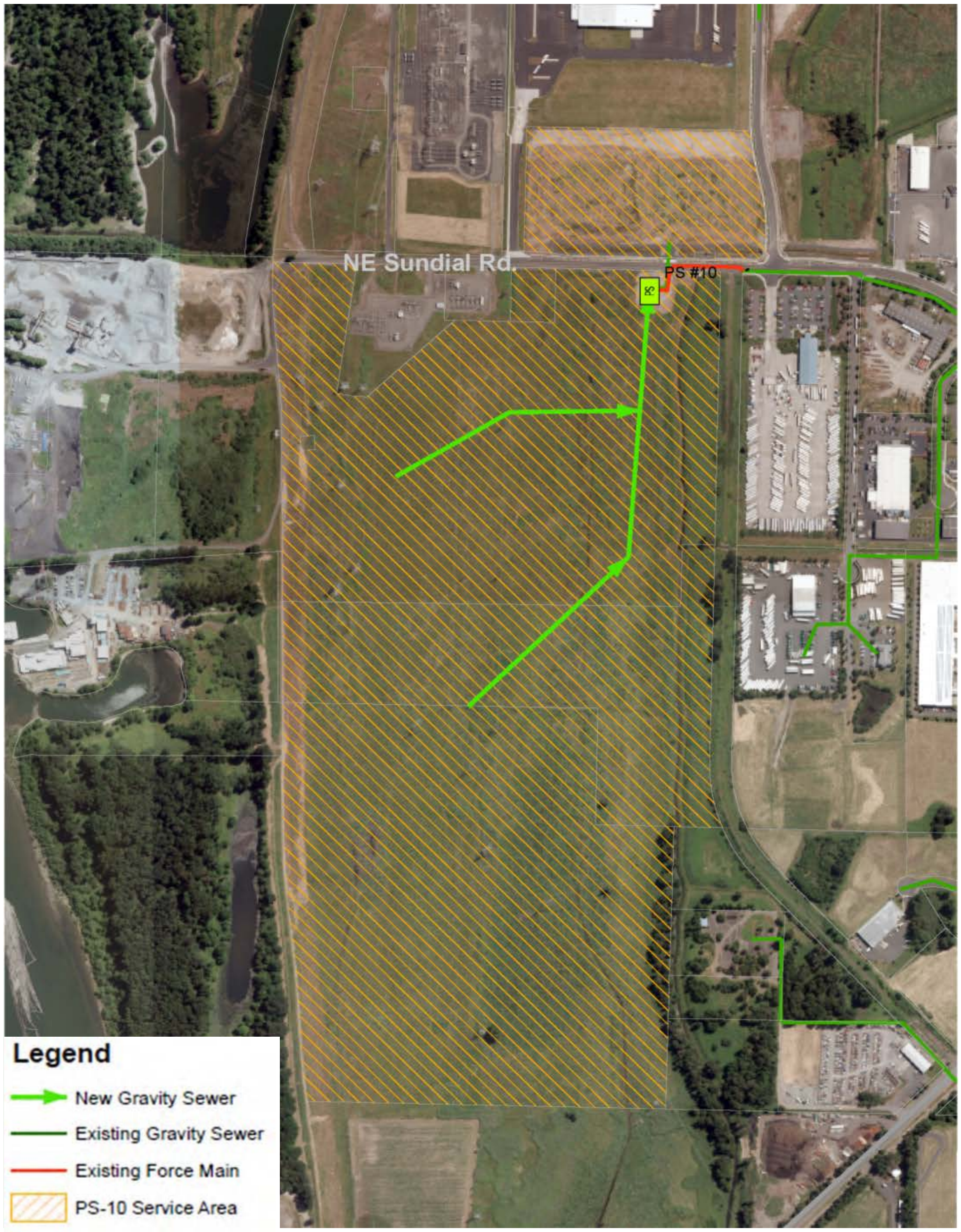


Figure 5-3. TRIP sewer extensions to IND-DEV-4



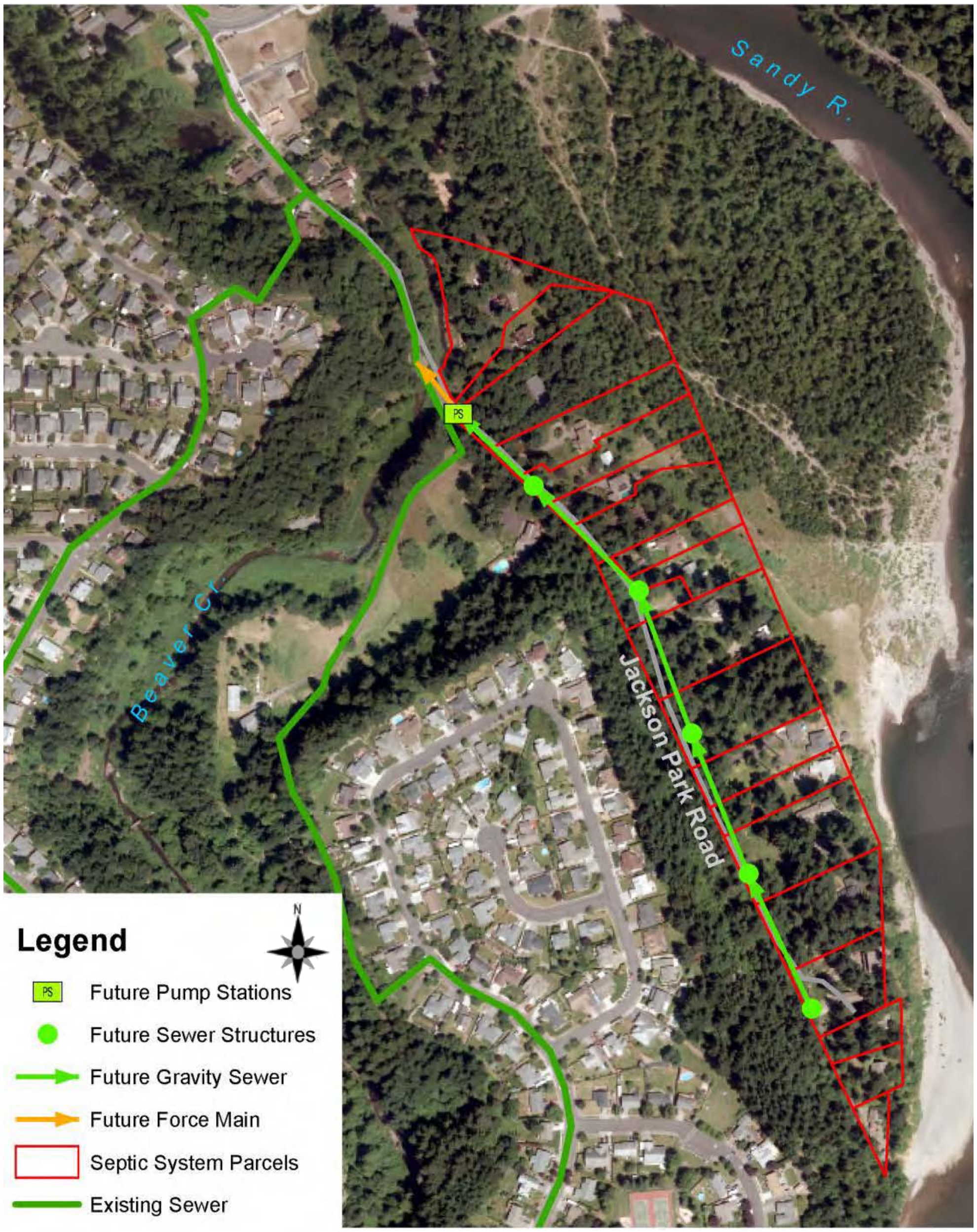
Notes:

1. *Gross PS #10 service area shown. Actual service area, estimated to be 77.6 acres, is less than shown due to the presence of wetlands.*
2. *Total footage of sewers is approximately 3,450 feet.*
3. *See the PS #10 (Sundial Pump Station) pre-design report for additional details.*

Figure 5-4. TRIP sewer extensions to IND-DEV-3

5.2.2.7 Southeast Jackson Park Road Extensions

The Southeast Jackson Park Road improvements would extend the existing sanitary sewer system farther south along this road to an area that is currently unsewered. The estimated cost for these new sewers is $950,000 (includes a 50 percent allowance for construction contingencies, engineering, and overhead). The location of the proposed improvements is shown in Figure 5-5.



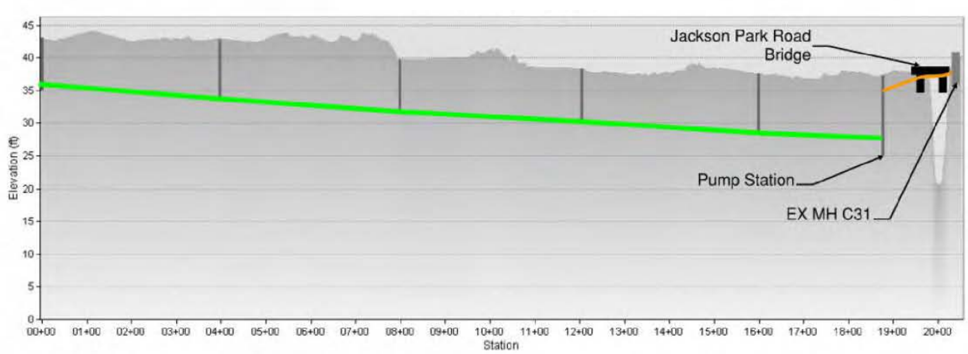


Figure 5-5. Southeast Jackson Park Road extensions

There are challenges in providing sewer service to this area. The proposed plan is to construct a gravity sewer along Jackson Park Road. A small pump station and short force main will be required to pump the collected flow across Beaver Creek to the Beaver Creek Trunk Sewer. Residents will be responsible for connecting to the sewer. Some of the homes may require a grinder pump system to transport flow to the sewer since it appears that they may be below the sewer's elevation. Aligning a new sewer at the back of each lot (i.e., away from the road) was considered infeasible due to access, environmental permitting, and easement-related challenges. Resident connection costs are not included in the estimate.

5.2.2.8 East Historic Columbia River Highway Extensions

The East Historic Columbia River Highway improvements would eliminate the existing septic tank effluent pressure system and private septic systems for the existing residences located in this area. At full build-out, 68 residences are planned for this area. A gravity sewer would be installed along the East Historic Columbia River Highway. A small pump station would be constructed at Southeast Woodard Road and convey the flow via a 4-inch force main.

The estimated cost for these improvements is $3.25 million (includes a 50 percent allowance for construction contingencies, engineering, and overhead). The locations of the proposed improvements are shown in Figure 5-6.

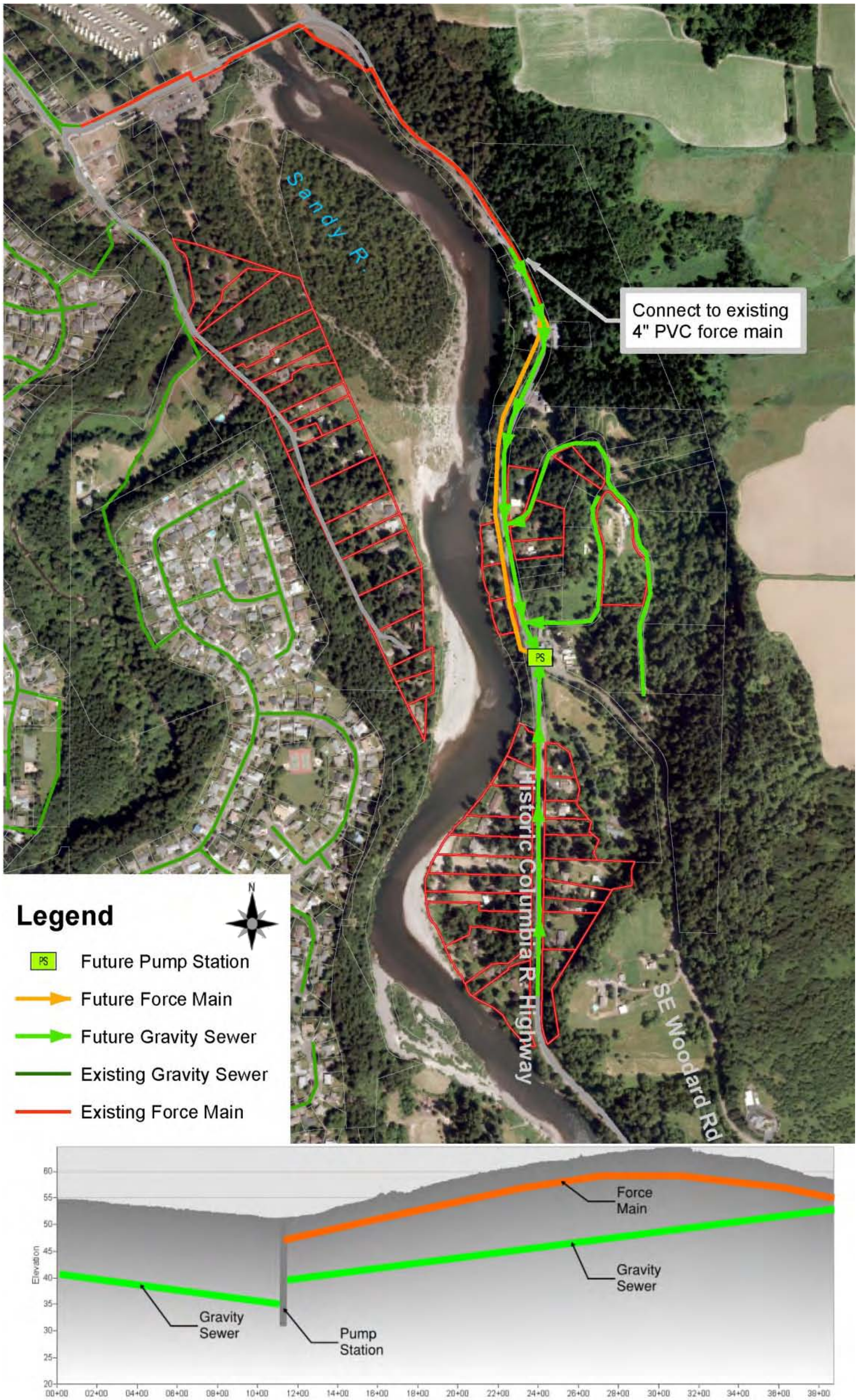


Figure 5-6. Historic Columbia River Highway improvements

5.3 Capital Improvement Projects

The individual improvements recommended in the previous sections are combined into projects to expedite design and construction-related activities. Typically, each project consists of one or more pipe segments and/or other collection system improvements.

Tables 5-4, 5-5, and 5-6 list the recommended projects. The primary criteria used for grouping the individual recommendations were pipe location and the priority ranking. In general, contiguous pipes and those with a similar ranking were combined into projects. Project sizes were limited so no single project would be too large for funding and bidding purposes. The project locations are shown in Figure 5-7.

Table 5-4. Recommended CIPs: Sewer Improvements

Pipe ID	Length, feet	Existing diameter, inches	Required diameter, inches	Estimated cost, dollars	Project Name	Estimated project cost, dollars
B44	128	8	10	48,000	South Buxton Road	501,000
B46	244	8	10	91,000	South Buxton Road	
B47	397	8	10	148,000	South Buxton Road	
B48	417	8	10	214,000	South Buxton Road	
C187	491	15	18	241,000	Lower Beaver Creek No. 1	414,000
C188	290	15	18	142,000	Lower Beaver Creek No. 1	
C189	47	15	18	31,000	Lower Beaver Creek No. 1	
C209	359	15	18	233,000	Lower Beaver Creek No. 2	452,000
C210	354	15	18	174,000	Lower Beaver Creek No. 2	
C211	92	15	18	45,000	Lower Beaver Creek No. 2	
C212	219	15	18	87,000	Lower Beaver Creek No. 3	450,000
C347	136	15	18	54,000	Lower Beaver Creek No. 3	
C213	220	15	18	88,000	Lower Beaver Creek No. 3	
C214	325	15	18	129,000	Lower Beaver Creek No. 3	
C215	171	15	18	92,000	Lower Beaver Creek No. 3	
C216	200	15	18	130,000	Lower Beaver Creek No. 4	578,000
C20	152	15	18	98,000	Lower Beaver Creek No. 4	
C235	252	15	18	164,000	Lower Beaver Creek No. 4	
C236	111	15	18	72,000	Lower Beaver Creek No. 4	
C237	232	15	18	114,000	Lower Beaver Creek No. 4	
C293	159	15	18	78,000	Lower Beaver Creek No. 5	411,000
C297	161	15	18	79,000	Lower Beaver Creek No. 5	
C298	179	15	18	116,000	Lower Beaver Creek No. 5	
C299	213	15	18	138,000	Lower Beaver Creek No. 5	
C338	563	12	15	249,000	Troutdale Road No. 1	1,112,000
C339	239	12	15	142,000	Troutdale Road No. 1	
C340	515	12	15	307,000	Troutdale Road No. 1	
C341	537	12	15	414,000	Troutdale Road No. 1	

Table 5-4. Recommended CIPs: Sewer Improvements						
Pipe ID	Length, feet	Existing diameter, inches	Required diameter, inches	Estimated cost, dollars	Project Name	Estimated project cost, dollars
D47	45.0	8	10	21,000	Airport/Graham Road	646,000
D48	210.0	8	10	98,000	Airport/Graham Road	
D50	75.0	8	10	35,000	Airport/Graham Road	
D51	160.0	8	10	75,000	Airport/Graham Road	
D52	500.0	8	10	174,000	Airport/Graham Road	
D53	440.0	8	10	153,000	Airport/Graham Road	
D54	50.0	8	10	17,000	Airport/Graham Road	
D55	50.0	8	10	17,000	Airport/Graham Road	
D56	56.0	8	10	19,000	Airport/Graham Road	
D57	107.0	8	10	37,000	Airport/Graham Road	
D156	149.5	8	10	52,000	PS #9 Trunk	253,000
D155	300.7	8	10	104,000	PS #9 Trunk	
D154	60.6	8	10	21,000	PS #9 Trunk	
D153	95.0	8	10	44,000	PS #9 Trunk	
Total all sewer improvements						4,817,000

Table 5-5. Recommended CIPs: Existing Pump Station and Force Main Improvements		
Pump station	Description of improvement	Estimated cost of improvements, dollars[a]
PS #1	New pump station and force main (8-inch, 3,560 feet)	2,690,000
PS #2	Pump, controls, and wetwell improvements	369,000
PS #5	Replacement pumps (2,500 gpm/3.6 million gallons per day [mgd])	454,000
PS #7	Replacement pumps (400 gpm/0.58 mgd)	145,000
PS #9	Replacement pumps (450 gpm/0.65 mgd)	242,000
Total all pump station and force main improvements		3,900,000

[a]*Estimated costs include a 50 percent allowance for construction contingencies, engineering, and overhead.*

Table 5-6. Recommended CIPs: Sewer Extensions	
Description of improvement	Estimated cost of improvements, dollars[a]
TRIP area	3,133,000
Southeast Jackson Park Road	950,000
East Historic Columbia River Highway	3,250,000
Total all sewer extensions	7,333,000

[a]*Estimated costs include a 50 percent allowance for construction contingencies, engineering, and overhead.*

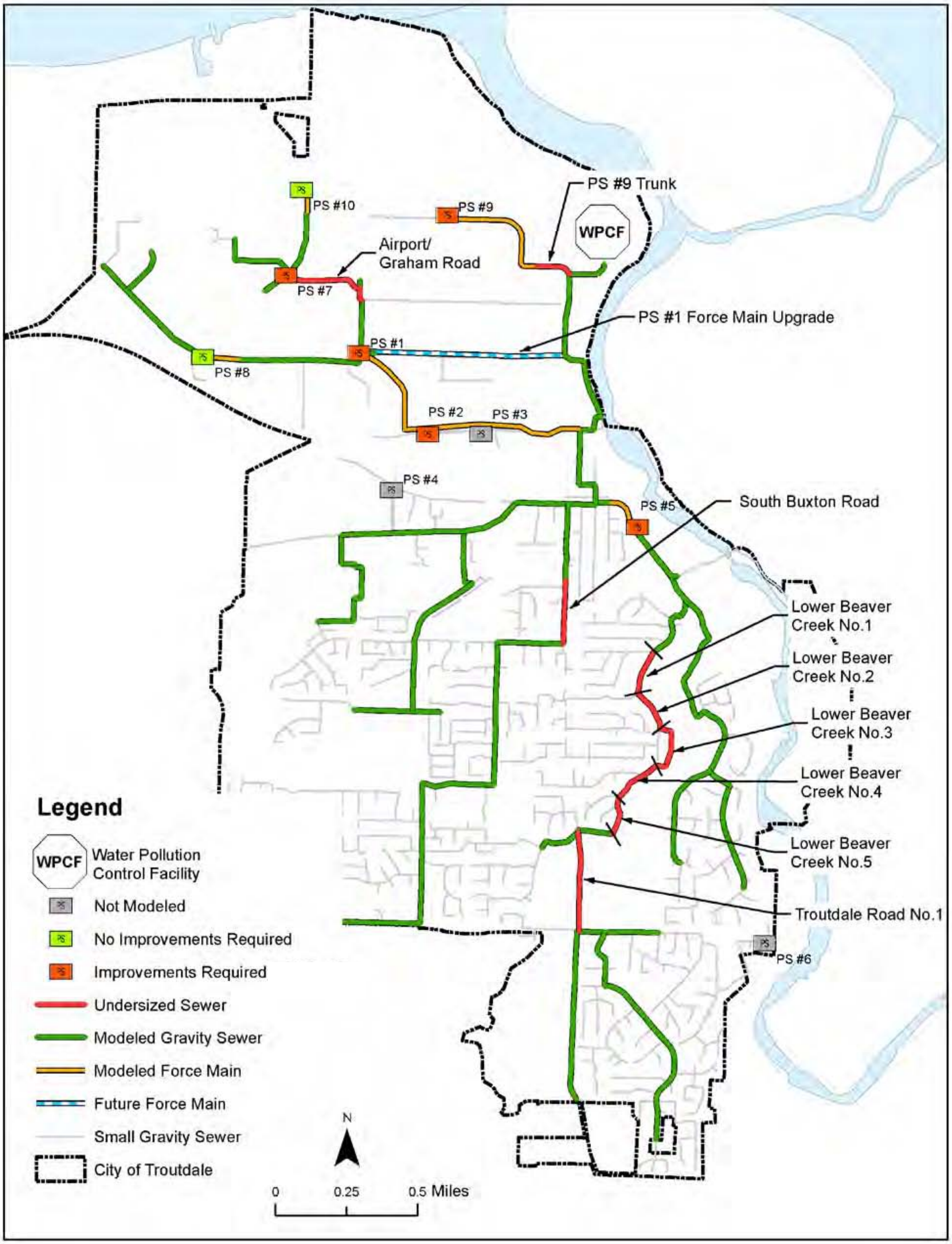


Figure 5-7. Recommended project locations

5.4 Rehabilitation and Replacement (R&R) Program

As a collection system ages, the structural and operational condition of the sewer system will decline as the number and type of defects in the piped system increase. If unattended, the severity and number of defects will increase along with an increased potential of sewer failure. Sewer failure is defined as an inability of the sewer to convey the design flow. Sewer failure is manifested by hydraulic and/or structural failure modes. Hydraulic failures can result from inadequate hydraulic capacity in the sewer. Loss of hydraulic capacity can result from a reduction of pipe area due to accumulations of sediment, gravel, debris, roots, fats, oil, and grease, and structural failure. Also, loss of hydraulic capacity can be a result of excessive infiltration/inflow or a lack of planning for growth that results in flows in excess of pipe capacity. Structural defects left unattended can lead to catastrophic failures such as pipe collapses and sanitary sewer overflows. Structural failures may start from common structural defects such as cracks, fractures, holes, corrosion, and joint separations, to name a few. Both hydraulic and structural failures can have a significant negative impact on the community and the environment.

An R&R program is required to reduce the potential for sewer failures and to extend the useful life of the collection system. A proactive R&R program rehabilitates sewers prior to the sewers failing. Such a program extends the useful life of assets at minimum cost since the cost of rehabilitation is typically one third to one half the cost of pipe replacement, and even more economically when compared with the cost of fixing a failed sewer.

The City should develop and implement a R&R program. The program should include a sewer inspection program and procedures to assess sewer and manhole condition. A priority ranking system should be established and implemented. Although it is not anticipated at this time that very many sewers require rehabilitation now would be a good time to set up the program so that as the collection system degrades with age, the City has a program in place for identifying problems early when least expensive to address and for prioritizing rehabilitation and maintenance decisions.

5.4.1 Inspection/Condition Assessment Program

The foundation of an R&R program is built on knowing the structural and operational condition of the collection system. The U.S. Environmental Protection Agency's proposed Capacity, Management, Operation, and Maintenance requirements identify a sewer inspection program as being an essential element of a proactive maintenance program and its complimentary R&R program.

While most of the City's sewers are relatively new, it is recommended that inspection program be implemented to develop a baseline for sewer condition and to identify sewers that require rehabilitation before they degrade to a point where replacement is the only remedy. For a city without an existing inspection program, several options exist for starting one.

- purchase equipment and perform inspections in-house
- hire inspection vendor (contractor) to perform the inspections
- inspect with a combination of the two above approaches

To perform the inspections in-house, the City would need to purchase an inspection van and video equipment. Prices can vary considerably, based on the vehicle and equipment choices, but a typical unit will cost between $150,000 and $180,000 (2013 dollars). In addition, a two-person crew is required to operate and maintain the inspection equipment. The crew should be trained in sewer defect identification so that the grading can be consistent and reproducible. A recommended standardized sewer defect and grading system is the National Association of Sewer Service Companies' Pipeline Assessment and Certification Program (PACP). PACP provides guidance for identifying the type and severity of sewer defects. The City's inspection crew would need to attend a 2- to 3-day training class to become certified in the process and to gain the rights to use the PACP coding.

In the Northwest, many cities and utilities have a 7- to 10-year goal for inspecting their entire sewer systems. To inspect the entire collection system on a 7-year cycle, approximately 42,000 feet of sewer would need to be inspected annually. Since the City's assets are not that old, a less frequent (~10-year, 29,200 feet per year) inspection cycle may be appropriate for the next 10 to 20 years, or until the collection system becomes more deteriorated. Cost of labor for a 10-year inspection cycle is approximately $16,400 per year (based on production of 1,000 feet per day, 2-person crew, and $35 per hour loaded costs).

Alternatively, an outside vendor can be hired to perform the inspections. There are a number of inspection contractors in the Portland metropolitan area that can provide this service. Consequently, there is very good competition and good pricing for these services. Currently, sewer inspection vendors in the metropolitan area can perform small sewer (less than 24 inches in diameter) inspections for as little as $0.80 to $1 per foot. Costs will vary based on footage of pipe to be inspected, sewer access conditions, and amount of flow in the pipe. For sewers larger in diameter than 24 inches, the inspection costs can range from approximately $2 to $3 per foot.

Since it could take 7 to 10 years for a city to inspect its entire collection system based on the above inspection cycles, some municipalities have opted to have an outside vendor perform an initial inspection of the entire collection system, thereby providing a complete baseline of sewer condition for a given year. Subsequent inspections would be performed by the City with its own equipment and crews.

Initial and annual costs for the first and second inspection options are listed in Table 5-7.

Table 5-7. Costs for Inspection Strategies

Inspection strategy	Initial capital costs	Annual inspection costs[a], dollars
City-performed (CCTV)	$180,000	16,400[b]
Vendor-performed (CCTV)	NA	29,200[c]

[a]*Engineering and contract administrative costs associated with an inspection program are not shown.*

[b]*Does not include amortized cost of capital equipment or vehicle operation costs.*

[c]*Based on $1 per linear foot of pipe.*

Although there are a number of inspection and investigative technologies currently on the market, closed-circuit television (CCTV) inspection is still one of the most economic and versatile inspection technologies available. Some of the other investigative technologies are best applied for specialized conditions not addressed by basic CCTV inspection.

5.4.2 Condition Assessment

Once a sewer has been inspected, the observed defect information is used to assess both the structural and operational condition of the sewer. Both categories are important since a failure in either category can lead to sewer failure if the proper maintenance, repairs, and/or rehabilitation are not performed in a timely manner. For most sewer inspection and condition assessment processes, each observed defect is given a score or grade. For the PACP process, each defect is assigned a grade ranging from 1 to 5, with 5 being the worst grade as shown in Table 5-8. Then, PACP offers several ways of rating the condition of a sewer:

- *Defect grade*–the worst defect observed is used to grade the entire pipe. A pipe with one grade 5 defect would be given a grade 5 condition grade for either the structural or operational condition.

- *Segment grade*–the number of occurrences of each defect grade is multiplied by the value of the defect grade. For example, a sewer with two Grade 5 defects, and four Grade 4 defects, and no other defects would have a segment grade of 26. Some municipalities would then create a look-up table that converted the total conditional grade score into a 1 to 5 scale as listed in Table 5-8. Total grades would be established for both the structural condition and operational condition.
- *Pipe Rating Index (PRI)*–the segment grade is divided by the number of defect occurrences. Using the above example, the PRI would be 4.3 (26 divided by 6).

Table 5-8. Structural and Operational Condition Grades for Sewers

Condition grade	Grade description	Defect description	Structural condition grade implication	Operational condition grade implication
5	Immediate attention	Sewers requiring immediate attention	Collapsed or collapse imminent	Unacceptable infiltration or blockages Surcharging of pipe during high flow with possible overflows
4	Poor	Severe defects that will continue to degrade with likely failure in 5 to 10 years	Collapse likely in 5 to 10 years	Pipe at near surcharge condition during high flow; overflows still possible at high flows
3	Fair	Moderate defects that will continue to deteriorate	Collapse unlikely in near future; further deterioration likely	Surcharge or overflows unlikely but increased maintenance required
2	Good	Minor and few moderate defects	Minimal near-term risk of collapse, potential for further deterioration	Routine maintenance only
1	Excellent	No defects, condition like new	Good structural condition	Good operational condition

This information should be managed by the City's computerized maintenance management system and/or geographic information system so that the information can be readily available to both engineering and maintenance staff. This information can be used for making informed decisions on the amount and type of maintenance and the rehabilitation that are required for maintaining the performance and condition of the collection system.

List of Appendices

Appendix A: Hydrologic/Hydraulic Model Network Development

This DVD contains GIS data and other information used to develop the hydrologic/hydraulic model network. The DVD includes ArcReader software that may be used to view the GIS information.

Appendix B: WPCF Flow Statistics

Explanation of the Analysis:

1. Table 1 shows the results of analyzing the latest 4-years data for flow at the WPCF. Also shown are the projected flow statistics for full build-out of the service area based on two analysis approaches: using the average peaking factors based on the historic record, and using the 2012 peaking factors. Rational for using the latest record is that the data suggests that flows are increasing annually.
2. Table 2 shows the Build-Out Base Flow as projected by the Sanitary Sewer Master Plan modeling (2013). The Build-Out Base Flow represents the Dry Weather Average Daily Flow.
3. Table 3 calculates the "peaking factors" for each flow statistic for each year of the historic record using Dry Weather Average Daily Flow as the base. The peaking factors are then used to calculate the flow statistics shown in Table 1 for the build-out scenarios.

Table 1. City of Troutdale Sanitary Sewer Flow Rates (Units: mgd)

Year	Average Annual Flow	Dry Weather Average Daily Flow[a]	Dry Weather Monthly Maximum Average Daily Flow	Dry Weather Maximum Daily Flow	Wet Weather Average Daily Flow	Wet Weather Monthly Maximum Average Daily Flow	Wet Weather Maximum Daily Flow	Peak Hour Flow Rate, mgd
2009	1.30	1.14	1.20	1.41	1.42	1.59	2.08	--[b]
2010	1.47	1.27	1.65	2.12	1.62	2.03	2.76	--[b]
2011	1.50	1.23	1.42	1.52	1.70	2.18	2.75	--[b]
2012	1.55	1.23	1.47	1.63	1.78	2.12	2.88	--[b]
Buildout (average)	3.07	2.57	3.02	3.51	3.44	4.17	5.51	9.21[c]
Buildout (from 2012)	3.24	2.57	3.06	3.41	3.72	4.44	6.02	9.21[c]

a. Dry weather months are June 1 to October 31 and wet weather is November 1 to May 31.
b. Existing peak hourly flow rate cannot be measured by flow meter at WPCF since it is located on the discharge pipe of the effluent pump station. Flows will not exceed maximum flow from pumps.
c. Maximum Peak Hour Flow Rate is based on the model prepared for the Sanitary Sewer Master Plan. The flows from the model are based on a 1 in 5 year, 24-hour storm event. All other flow statistics are based on a Base Flow of 2.57 mgd as calculated from the model and escalated based on historic peaking factors.

Table 2. Calculating Base Flow for Buildout

Parameter	Units	Value
Commercial	gpm	104
Industrial	gpm	506
Residential	gpm	977
GW Infiltr.	gpm	200
Buildout Base Flow	MGD	2.57

Source: Brown and Caldwell hydrologic/hydraulic model

Table 3. Calculating Peaking Factors Based on Historic Dry Weather Average Daily Flow (Units: mgd)

Year	Dry Weather Monthly Maximum Average Daily Flow	Dry Weather Maximum Daily Flow	Wet Weather Average Daily Flow	Wet Weather Monthly Maximum Average Daily Flow	Wet Weather Maximum Daily Flow
2009	1.05	1.24	1.24	1.39	1.82
2010	1.30	1.67	1.27	1.59	2.17
2011	1.15	1.24	1.38	1.77	2.23
2012	1.19	1.32	1.45	1.73	2.34
Average	1.17	1.37	1.34	1.62	2.14

Peaking factors were calculated by dividing each category by the Dry Weather Average Daily Flow

Table from CH2M-Hill, Troutdale Water Pollution Control Facility Predesign Report, June 1999. (for comparison, although many of the assumptions have changed since this report was prepared)

Table 1. WPCF Design Flow Rates

Condition	Average Daily Flow Rate, mgd	Maximum Month Flow rate, mgd	Maximum Day Flow rate, mgd	Peak Hour Flow Rate, mgd
Dry Season	2.4	3	3.7	NA
Wet Season	3.1	4.1	6.3	9.4

Notes (Table 1):
1. This is based on a buildout: population of 19,150 people (~2.4 MGD)
2. Addtl flow is 2,000 gpd from McMenamins Edgefield, 63,000 gpd for additional McMenamins development, 288,000 gpd for 175 industrial zoned acres, 100,000 gpd for variation in land use, and 125,000 gpd for variation in dwelling density

Appendix C: Overview of Current and Proposed Regulations

Appendix C

Overview of Current and Proposed Regulations

This section provides an overview of current and proposed regulations that impact the City of Troutdale's (City) management of the sanitary sewer collection system and provides recommendations for compliance.

Background

The Clean Water Act (CWA) prohibits discharges of pollutants to waters of the U.S. unless authorized by a National Pollutant Discharge Elimination System (NPDES) permit. Unpermitted discharges from the sanitary sewer system to the waters of the U.S. constitute a violation of the CWA. For many utilities and cities, their NPDES permits identify requirements for operating and maintaining the municipal wastewater conveyance and treatment systems. The current City NPDES permit (expiration date July 31, 2013) has only two specific requirements regulating the operation and maintenance (O&M) of the sanitary collection system. The stated provisions are as follows:

- There is a prohibition on all overflows
- Utilities must prepare an Emergency Response and Public Notification Plan

Additional legislation has been proposed that could significantly increase compliance requirements included in future NPDES permits. Many of these requirements are a part of the proposed sanitary sewer overflow (SSO) regulations, specifically, the capacity, management, operation, and maintenance (CMOM) provisions. When, and if enacted, the new requirements will dictate more of the day-to-day operation of the conveyance system than those currently in place. The next section describes them in more detail.

CMOM

In 2001, the U.S. Environmental Protection Agency (USEPA) proposed legislation to significantly reduce the number and volume of SSOs throughout the U.S. The USEPA determined that such actions were required to improve water quality. The proposed requirements would improve the performance of sanitary sewer systems such that there would be fewer and smaller SSO events. In short, the proposed requirements would affect nearly all aspects of sanitary sewer management and operation. As proposed, each permit holder would be required to develop a CMOM plan comprised of the nine primary elements described in Table C-1. The activities are primarily a best management practice approach to controlling SSOs. When implemented, each permit holder's CMOM plan would improve the performance of the collection system resulting in much reduced number and volume of SSOs, fewer customer complaints, improved efficiency of O&M activities, and increased longevity of the collection system infrastructure.

Table C-1. CMOM Program Elements		
Element	**Purpose**	**Description**
Goals	To provide direction on all aspects of managing the collection system.	Goals should be specific, realistic, achievable, and measureable. • Determine linear footage of sewers to be inspected annually. • Determine number of manholes to be upgraded annually. • Upgrade maintenance management system. • Develop Fats, Oils, and Grease (FOG) Program. • Set limits on number of sanitary sewer overflows per year.
Organization	To structure the organization for efficient operation and management of the collection system.	• Write organization and governing body description. • Prepare organization chart. • Write job descriptions. • Define lines of communications.
Legal authority	To establish the legal authority allowing the City to direct all critical aspects of sanitary sewer management.	The City has the legal authority to do the following: • Control rates. • Regulate the volume and strength of discharges. • Manage FOG. • Maintain and replace service laterals.
O&M activities	To operate and maintain the sanitary sewer collection system in a way that achieves optimum sewer performance.	• Identify the O&M activities required to maintain, sewers, manholes, pump stations, force mains, and service laterals. • Establish frequencies for performing the required activities that optimize sewer performance.
Design and performance provisions	To establish minimum requirements for collection system design, construction, inspection, and final acceptance.	• Determine minimum requirements for design. • Determine minimum requirements for construction materials. • Clearly define inspection requirements and train inspectors.
Overflow Emergency Response Plan	To establish response capabilities for responding to sewer emergencies.	• Clearly define emergency procedures. • Provide equipment and personnel training. • Install operating alarm system. • Create public notification plan.
Capacity assurance	To identify where hydraulic deficiencies may occur in the sanitary sewer collection system.	• Map collection system completely and accurately. • Model the collection system including sewers and pump stations. • Identify potential hydraulic deficiencies and create a plan for addressing the deficiencies. • Identify potential operational problem areas and create a schedule for cleaning affected sewers. • Create action plan for addressing areas with excessive I/I.
Annual self auditing	To evaluate where improvements are required in managing the sanitary collection system through annual auditing.	• Compare collection system performance with goals established to identify where improvements may be required. • Conduct annual self-evaluation and practice continuous improvement.

The USEPA's promulgation of the CMOM requirements has stalled; however, elements of the proposed requirements have made their way into NPDES permits and environmental programs throughout the country. Within USEPA Region 10, some of the CMOM requirements have been written into recently renewed NPDES permits. California has adopted many of the CMOM provisions and they are being included in renewed NPDES permits. In Oregon, only a few of the provisions have shown up in recent permit updates. For example, the City of Salem's permit requires the following activities related to sanitary sewer management:

- A plan for reducing inflow.
- Identification of all potential overflow points associated with a 5-year storm event.
- Establishment of legal authority as required to control inflow.
- Requirement to establish a Salem Management, Operation, and Maintenance Program with similar requirements to those that have been defined for a CMOM program.

It is understood that the City of Salem's requirements may be a special case. It is believed that the Oregon Department of Environmental Quality (DEQ) added these additional requirements to help the City of Salem address specific deficiencies in its collection system. At this time, these additional requirements are not being added to all new permits being issued, but DEQ could implement them if cities/utilities are having problems with SSOs.

USEPA on SSOs

The USEPA's interpretation of the CWA is that any SSO is a violation and exceptions are not allowed. According to the USEPA, the exceptions written into many of the NPDES permits issued by DEQ are not allowed, including defining SSO exceptions based on storm events (i.e., 5-year, 24-hour winter storm event). DEQ's position has been that eliminating all SSOs is "technologically impracticable because even well-designed and operated systems can experience SSOs" (excerpt from DEQ letter to USEPA, November 29, 2011). Furthermore, DEQ's "alternate approach" suggested that the number and volume of SSOs can be reduced and water quality improved without requirements that place municipalities in violation of their permits and exposure to third-party suits. In 2012, the alternate approach suggested by DEQ was rejected by USEPA. Consequently, DEQ has withdrawn the "alternate approach" concept and now is promoting USEPA's "Integrated Approach."

DEQ on SSOs

In late 2010, DEQ issued the *Internal Management Directive Sanitary Sewer Overflows (SSOs)*, November 2010 (*IMD*). The *IMD* provides direction to DEQ staff on what enforcement action to take when an NPDES permit holder experiences a SSO. The *IMD* lays out enforcement procedures based on the following premises:

1. All SSOs are violations.
2. Since not all SSO violations are equally culpable or injurious to public health, enforcement discretion can be used to address less culpable violations.

In addition, the *IMD* helps clarify certain permit requirements, including the following:

- Revised SSO reporting requirements, 2009
- SSO reporting follow-up requirements
- Emergency Response and Public Notification Plans
- Taking enforcement action

The *IMD's* instructions on SSO enforcement focus on if the SSO event was "beyond the reasonable control of the permittee." If the SSO event were beyond the reasonable control of the permittee, a warning letter would be issued. Otherwise, the permittee could receive a pre-enforcement notice (PEN). A PEN notifies the violator that it is being referred for formal enforcement action. Table C-2 is an excerpt from the *IMD* that clarifies "reasonable control."

Table C-2. SSO Reasonable Control Criteria
An SSO is (to) be considered to be beyond reasonable control if Any of the following are true:
1. The event was caused by a force majeure event. Force majeure events are those events which can be neither anticipated nor controlled. They include war, sabotage, unusual vandalism, and extremes act of nature.
2. The SSO was caused by a storm event larger than what the system was designed to handle, as per Oregon Administrative Rules (OAR) 340-041-0009(6) and (7).
3. The SSO was caused by hydrologic conditions that exceeded those described in a bacteria management plan approved by the Oregon Environmental Quality Commission , as per OAR 340-041-0009(6) and (7).
4. The SSO was caused by an act of vandalism that could not have been reasonably anticipated or prevented by ordinary measures such as a padlock, cover ,or fence.
5. The SSO was the result of an act or omission of a third party not acting as an agent of the permittee.
6. The SSO occurred despite the fact that the permittee is implementing a good CMOM program. DEQ has not developed guidance on what constitutes a good CMOM program, and therefore permit staff are directed to USEPA's guidance on the subject.
Alternatively, an SSO is considered to be beyond reasonable control if All of the following are true:
1. The system had an adequate level of redundancy against breakdowns and power failures. Appendix F lists examples of the level of redundancy that DEQ expects permittees to design for and maintain.
2. The SSO was not the result of an action or actions initiated by the permittee such as pipe cleaning, pipe repair, or reservoir cleaning.
3. The SSO was not the result of an action or actions by contractors working for the permittee. Examples include pump-around failures or plugs left in lines. Such actions are avoidable.
4. The SSO was not the result of poor or lagging maintenance, or an unreasonable failure to inspect. Examples of such SSOs include those caused by grease plugs, root intrusion, or debris occurring in lines that have not been adequately inspected or cleaned.

Notes: The above excerpt is from the DEQ's IMD.

Implementing a good CMOM program can provide a "beyond reasonable control" defense for an SSO event. Conversely, not having a good CMOM program, such as for inspection and cleaning, may void the "beyond reasonable control" defense.

USEPA's Integrated Approach

The USEPA has embraced an integrated planning approach to stormwater and wastewater management. The purpose of this new approach is to assist municipalities with meeting all of their regulatory requirements by having each develop a plan that prioritizes activities and programs for maximum efficiency of water quality improvement and regulatory compliance. Also, the integrated approach places a strong emphasis on sustainable solutions, such as green infrastructure that will protect human health, improve water quality, and support other activities that will enhance the community. The integrated approach does not reduce regulatory requirements or water quality standards. Instead, it is intended to assist municipalities with prioritizing focus for regulatory compliance. The integrated approach is voluntary and may not be the best approach for every municipality, but the USEPA believes that it will most help those communities with many competing regulatory challenges.

The USEPA's overarching principles for implementing the integrated approach are as follows:

1. *This effort will maintain existing regulatory standards that protect public health and water quality.*
2. *This effort will allow a municipality to balance CWA requirements in a manner that addresses the most pressing public health and environmental protection issues first.*

3. *The responsibility to develop an integrated plan rests with the municipality that chooses to pursue this approach. Where a municipality has developed an initial plan, EPA and/or the State will determine appropriate actions, which may include developing requirements and schedules in enforceable documents.*
4. *Innovative technologies, including green infrastructure, are important tools that can generate many benefits, and may be fundamental aspects of municipalities' plans for integrated solutions.*

The above text is from the USEPA document Integrated Municipal Stormwater and Wastewater Planning Approach Framework, May, 2012.

Brown and Caldwell (BC) recommends that the City investigate how adopting an integrated approach to regulatory planning would benefit the community. Since the City does not have pressing SSO-related problems, BC does not believe that adoption of an integrated approach would offer much benefit or would provide much impact on how the City manages and operates the wastewater collection system. The integrated approach may offer value in addressing other regulatory requirements.

BC recommends that the City consider implementing some of the CMOM principles since they can lead to improved sanitary collection system performance and lengthen the service life of infrastructure investments. In this way, the CMOM principles fully support sustainability concepts.

Developing a CMOM Program

Table C-1 identifies the eight proposed components of a well-structured CMOM program. BC recommends that the City consider adoption of some of the most pertinent CMOM concepts since they will improve the performance of the sanitary sewer collection system. Several work sessions could be held with key stakeholders to evaluate the strengths and weaknesses of current sanitary sewer collection system management practices with regard to the recommended CMOM activities. Then, a CMOM strategy development team could identify the new activities to be adopted and the estimated costs for implementing the identified activities. Finally, the list could be prioritized based on benefit and cost considerations. The cost to develop and implement these components will vary considerably depending on the City's interest and focus.

At a minimum, the City should develop and implement a sewer inspection/condition assessment program. This program will help the City stay informed on the structural and operational condition of the sewer system and provide a basis for making sound business decisions regarding maintenance and sewer rehabilitation decisions.

Appendix D: Rehabilitation and Replacement Technologies

Appendix D

Rehabilitation and Replacement Technologies

A variety of corrective action technologies are available for application to the City of Troutdale's sewer rehabilitation and replacement needs. Appendix D describes the various technologies and presents cost information on those that are most appropriate for City use.

Open-Cut Pipe Materials

A number of pipe materials can be used to replace the City's existing sewers. Many of the structural defects observed in municipal sewers are due to a poor choice of pipe materials, corrosion, and/or poor construction techniques. Brown and Caldwell (BC) recommends that candidate pipe materials satisfy the following criteria:

- are resistant to corrosive gases found in sanitary sewers
- are resistant to erosion due to the conveyance of sand and grit
- have structural support adequate to support the expected design loads
- have joints that are watertight as required to prevent infiltration and the resulting loss of bedding and backfill material
- are readily available commercially

Based on these criteria, several materials are recommended for the rigid and flexible classes of pipe.

Rigid Pipe Materials

Three rigid pipe materials meet the above criteria for replacement pipe.

- reinforced concrete pipe (RCP) with plastic corrosion-resistant liner
- vitrified clay pipe (VCP) with fiberglass joints and rubber gaskets
- polymer concrete pipe

Flexible Pipe Materials

Three flexible pipe materials meet the above criteria for replacement pipe.

- high-density polyethylene (HDPE) pipe
- poly-vinyl chloride (PVC) pipe, ≤ 24 inches in diameter
- centrifugally cast fiberglass reinforced polymer mortar pipe, or Hobas®.

All of the above are suitable options for the City. The selection of the preferred pipe material should be made during the predesign phase of the project.

Rehabilitation Technologies

A number of technologies are available for rehabilitating gravity sewers. Rehabilitation technologies can be fully structural (i.e., even if the existing pipe lost all structural strength, the rehabilitation method could still support all live and dead loads on the pipe) or non-structural (i.e., the existing host pipe must bear all structural loads). Some non-structural rehabilitation techniques extend the pipe's remaining life by stabilizing the pipe, either internally or externally.

The following paragraphs describe technologies for full pipe segment rehabilitation, point repair rehabilitation, and non-structural (stabilization) rehabilitation.

Full Pipe Segment Rehabilitation Technologies

Full pipe segment rehabilitation technologies are considered when the existing defects are located extensively throughout the pipe such that point or spot repairs are not feasible. Technologies that were considered for City use include cured-in-place pipe (CIPP), pipe bursting, spiral pipe renewal (SPR), sliplining, and pipe wrap.

CIPP

CIPP is a technology that has been in use in North America for almost 40 years. Rehabilitation is done by installing an uncured tube that is saturated with resin into an existing pipe. The existing pipe is used as a form as the tube is expanded against it and the resin is cured. All CIPP liners have four essential components: a flexible tube, a thermosetting resin that impregnates the tube, a method to install and expand the impregnated tube, and a method to cure (i.e., harden) the resin. The end result is a corrosion-resistant, jointless pipe that conforms to the geometry of the existing host pipe. CIPP can be installed with little to no excavation and it can be a fully structural repair or a non-structural repair, depending on design parameters. Of the various trenchless rehabilitation techniques, CIPP generally results in the least amount of internal diameter reduction due to its thin-walled, tight-fit nature.

Installation of CIPP can be performed in difficult locations on almost any size pipe. However, pipes greater than 27 to 30 inches in diameter require the removal of the manhole top slab or cone to be rehabilitated with CIPP. Typical vehicle access requirements include large box trucks, boiler trucks, and possibly scaffolding constructed directly over the manhole. The pipe must be dry during installation, so bypass pumping is required. Installation time could take from a few hours to a week, depending on location and size. Figure D-1 shows examples of CIPP installation.

This technology is recommended for City consideration in the rehabilitation of sewers with adequate sewer capacity.

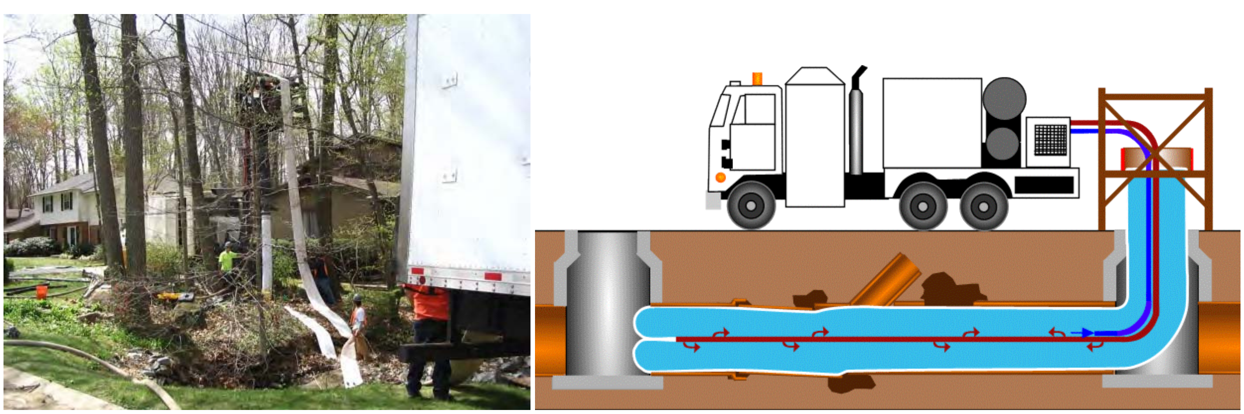


Figure D-1. Examples of CIPP installation

Pipe Bursting

Pipe bursting is a technology that involves the pulling of a bursting head to break apart or slice the existing pipe. As the head is pulled through the host pipe, a continuously-fused HDPE or PVC pipe is fed into the pipe directly behind the bursting head. The new pipe can be either the same size or slightly larger than the original. The end result is a fully structural, corrosion-resistant, jointless pipe that replaces the existing host pipe. Figure D-2 shows examples of pipe bursting installation.

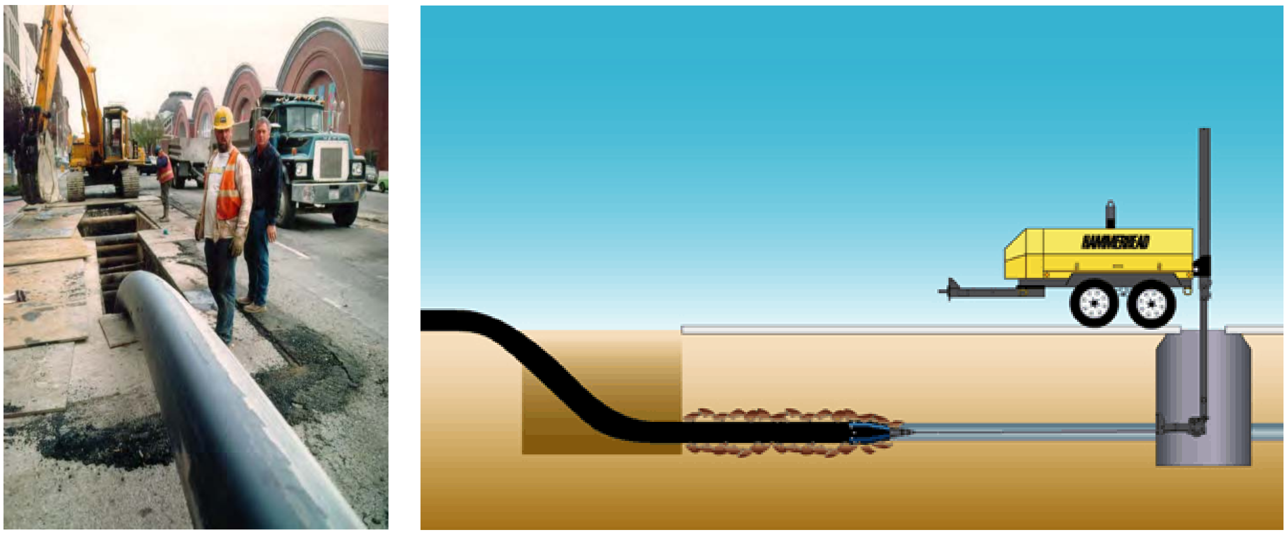


Figure D-2. Examples of pipe bursting installation

Pipe bursting requires some excavation and vehicle access. The new pipe must be inserted at one end using an excavated insertion pit, normally at the upstream manhole, which allows the new pipe to be pulled into the existing pipe without exceeding the HDPE or PVC pipe bending radii. The technology is generally limited to existing pipes 24 inches in diameter or smaller. In addition, the entire length of new pipe must be fully fused and laid out prior to insertion of the pipe, meaning that a long laydown area immediately adjacent to the insertion pit is required. The pipe must be dry during installation, so bypass pumping is required. Installation can take from a few hours to several days, depending on location and size.

This technology is recommended for City consideration in the rehabilitation of sewers with adequate sewer capacity.

Spiral Pipe Renewal (SPR)

SPR is a trenchless technology that involves the winding of a continuous strip of PVC or HDPE within an existing pipe. It can be performed on a wide range of existing pipe sizes, since the existing host pipe is used as a form for the wound pipe. The strips are interlocked and because SPR is not a tight-fit technology, the resulting annulus is filled with grout. Concerns regarding the structural capability of the PVC product have resulted in the development of HDPE with embedded steel reinforcement. The HDPE product is welded together in the field, whereas the PVC product uses a mechanical joint. The HDPE product has a thicker profile and reduces the internal diameter significantly more than does the PVC product. In general, use of SPR results in a much larger loss of hydraulic capacity than do some other techniques such as CIPP. However, the end result is a corrosion-resistant pipe that replaces the existing host pipe and can be installed with little excavation.

The winding machine is of significant size and requires the removal of a manhole at one end for larger pipes. The grout and pumps must be in the vicinity for filling the annular space between the newly wound pipe and host pipe. One major benefit of SPR is the ability to install the pipe during live conditions. However, the newer more structurally sound HDPE material requires field welding, so bypass pumping is recommended. Installation can take from a few hours to several days, depending on location and size. Figure D-3 shows examples of SPR installation.

While the SPR technique may used in limited areas of the country, BC is not aware of its use Oregon or the Northwest. Consequently, it is unlikely that contractors within the metropolitan area are experienced in its application. This technology is not recommended for City consideration for rehabilitating sewers at this time. In the future, if contractor experience is found or developed within the area, the City should consider this technology as one of the rehabilitation alternatives.

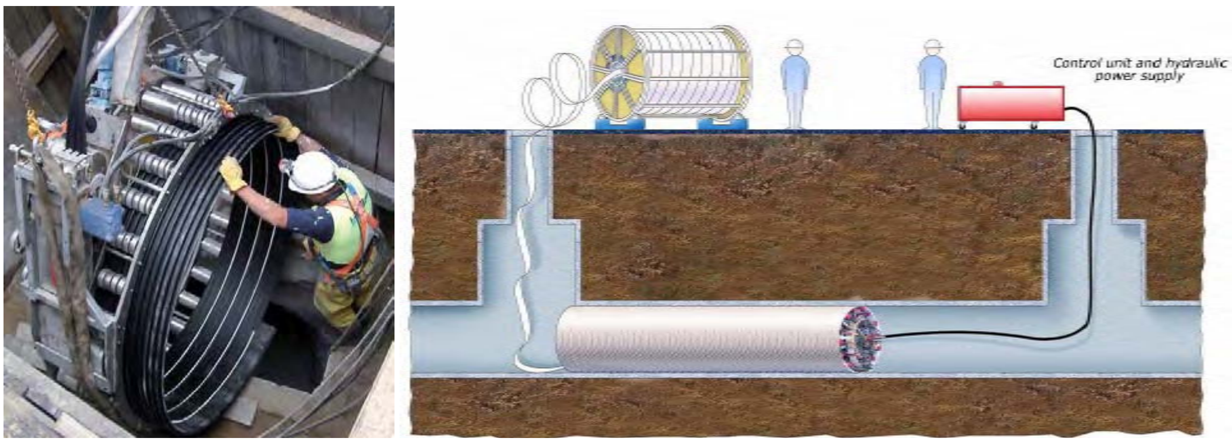


Figure D-3. Examples of SPR installation

Sliplining

Sliplining is a technology that involves the jacking or pulling of a smaller pipe inside the existing pipe. The pipe that is either jacked or pulled through the existing pipe must be able to withstand the forces exerted during the installation process. Common pipe materials used are fusible HDPE or PVC, fiberglass-reinforced pipe such as Hobas, and VCP. Because sliplining is not a tight-fit technology, the resulting annulus is filled with grout. Sliplining generally reduces the internal diameter of the pipe more than any other rehabilitation technology. The end result is a fully structural corrosion-resistant pipe that replaces the existing host pipe and can be installed with limited excavation.

Excavation is limited to an insertion pit that is required at one end of the pipe slated for rehabilitation. The grout and pumps must be in the vicinity for filling the annular space between the newly inserted pipe and host pipe. In addition, a laydown area must be provided for the new pipe and jacking/pulling equipment. Except in low flow cases, bypass pumping is required. Installation can take from a few hours to a week, depending on location and size. Figure D-4 shows examples of sliplining installation.

This technology is recommended for City consideration in the rehabilitation of sewers with adequate sewer capacity.

Figure D-4. Examples of sliplining installation

Pipe Wrap

Pipe wrap is a new technology based on a technique used to reinforce above-grade structures such as bridges and building walls. A thin carbon-fiber-reinforced fabric is saturated with corrosion-resistant epoxy resin and is glued to the interior of the pipe. Existing pipe surface preparation and primer are required to obtain a bond between the resin-saturated fabric and the existing pipe. Man-entry is required for installation of pipe wrap; consequently, its use is limited to sewers 48 inches in diameter and larger. The resin fabric is less than 0.1 inch thick and therefore limits the flow capacity only slightly.

Given the workability of the material and the man-entry installation, no excavation is required. Because the fabric is saturated with resin in the field, a small setup area is required to wet the fabric strips. The pipe must be dry during installation, so bypass pumping is required. Installation can take from a few days to several weeks, depending on location and size. However, given the unproven nature of the product and the lack of successful installations in the Northwest, pipe wrap is not recommended for City consideration at this time. This technology may become more viable in the future. Figure D-5 shows examples of pipe wrap installation.

Figure D-5. Examples of pipe wrap installation

Point Repair Rehabilitation Technologies

Spot or point repairs are recommended where defects are localized or not distributed throughout long sections of the sewer. All of the technologies presented in this section are recommended for City consideration in repairing sewers.

Cured-in-Place Point Repair

Spot or point repairs can be made using the same cured-in-place technology that is used for entire pipe segment rehabilitation. A flexible tube is impregnated with resin and inserted into the host pipe, but with point repairs the tube is shorter in length. Point repairs benefit from their trenchless nature, but because they are shorter and require significantly less material than full-length pipe segment CIPP, construction equipment and materials are greatly reduced. Bypass pumping is still required. Figure D-6 shows examples of cured-in-place point repair.

Figure D-6. Examples of cured-in-place point repair

Mechanical Point Repair (Link Pipe)

Spot or point repairs can be made using a stainless steel or PVC sleeve that results in a close-fitting repair. For smaller diameter trunk lines (i.e., less than 30 inches) a stainless steel sleeve is used. The sleeve is positioned into place and the annular space is filled with grout. O-rings seal each end of the sleeve to the host pipe with ports located in the center of the sleeve used for filling the grout. For larger diameter trunk lines (i.e., 36 inches or greater) a hinged PVC repair is used. Hydraulic jacks are used to expand the PVC sleeve and O-rings are used to seal the edges. Grout is pumped into the annular space.

The end result is a structural, corrosion-resistant repair that can be installed with little to no excavation. Construction access involves the box truck, closed-circuit television (CCTV) truck, and potentially heavy equipment for the larger diameter repairs that require manhole cone or top slab removal. In all but the largest of pipe diameters, bypass pumping is not required. Figure D-7 shows examples of link pipe installation.

Figure D-7. Examples of link-pipe installation

(left and middle: PVC link-pipe; right: stainless steel sleeve)

Non-Structural (Stabilization) Rehabilitation Technologies

Non-structural rehabilitation technologies focus on slowing or preventing further degradation of the pipe. Applicable technologies include injection grouting for stabilizing pipe bedding and backfill against soil loss and magnesium hydroxide application to slow hydrogen sulfide degradation.

Test and Seal (Injection Grouting)

Sewers with high levels of infiltration risk the loss of pipe bedding and backfill due to soil piping of the surrounding soil into the pipe. Loss of pipe bedding can lead to pipe settlement and a resulting increase in pipe and joint cracks, fractures, and breaks. The characteristics of the soil are critical to the degree of soil loss experienced. Silts and fine sands experience the greatest amount of degradation. If not detected early, soil loss can lead to catastrophic failures, as shown in Figure D-8. The test and seal technology helps to locate and then seal leaky sewers.

The basic principle of grouting pipe lines is to test the joints by hydraulically applying a positive pressure to the joints, monitoring the pressure in the void, and monitoring the test medium flow rate. The test medium is usually air. The intent of joint testing is to identify sewer pipe joints that are not watertight and that can be sealed successfully by injecting chemical grout into the soils encompassing the pipe joint. Chemical grouts have little to no structural strength. They provide stabilization of pipe bedding and prevention of infiltration and the potential loss of fine-grained soils through leaking pipe joints.

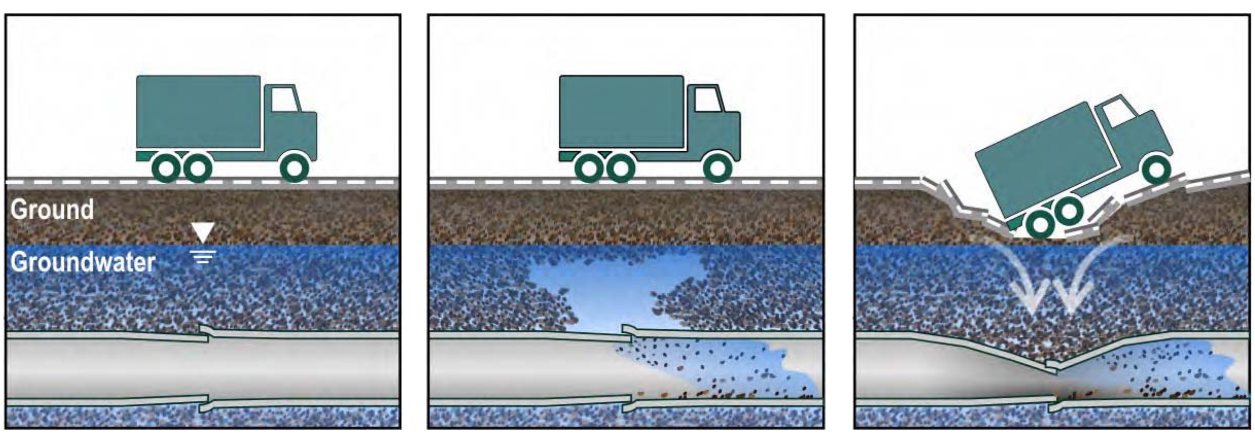


Figure D-8. Structural failure mechanism caused by infiltration at joints

Injection of grout is most effective when it is applied from an internal packer device that is placed inside the sewer pipe. The major support equipment includes a box truck that contains the hoses, chemical grout, air compressor, and CCTV equipment. Normally, the pipe can receive limited flow during this operation, such that bypass pumping may not be required except when flows are above the camera lens. In large diameter pipes, the size of the required packers is too large for standard manhole frame openings. In this case, the packers can be disassembled and then reassembled in the manhole if manhole component removal is undesirable.

Similarly, heavy infiltration can occur at manholes and cause loss of bedding around the manhole structure and influent/effluent pipes. This infiltration can be addressed via man-entry into the manhole, drilling a small hole into the manhole wall, and injecting chemical grout. Heavy vehicle access or excavation is not required, and the work can be done in live sewers with no bypass pumping. Figure D-9 depicts typical packer injection grouting installation.

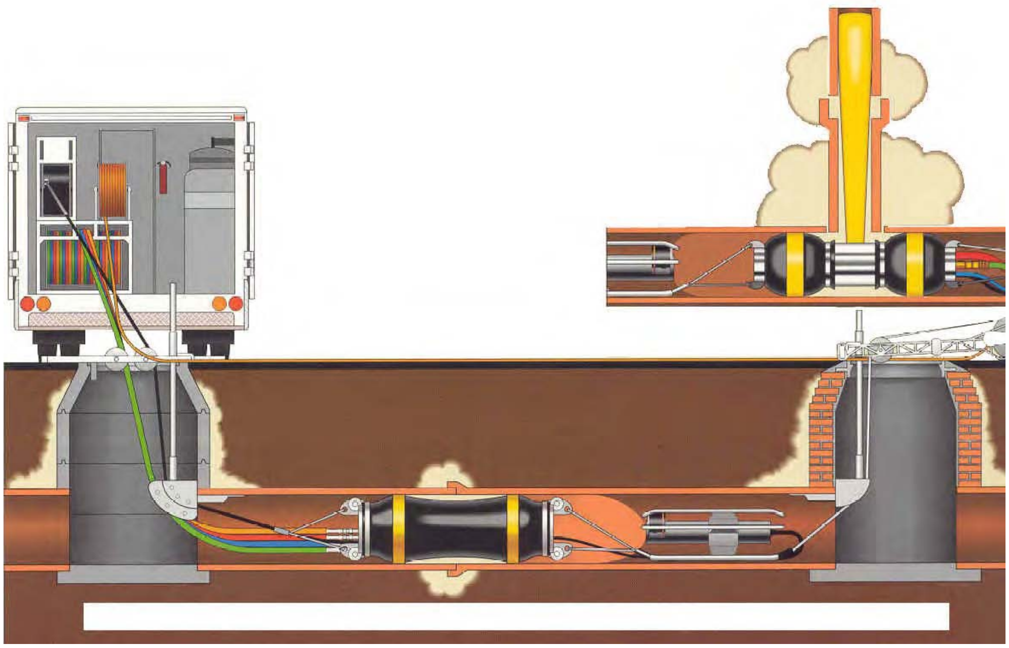


Figure D-9. Typical packer injection grouting installation

Magnesium Hydroxide Spraying

For corrosion issues, one way to slow the rate of corrosion is repeated magnesium hydroxide spraying on the exposed portions of the concrete sewer pipe. Magnesium hydroxide neutralizes acids that corrode the concrete and greatly slows the rate of corrosion, resulting in increased pipe life. Magnesium hydroxide should be applied at times of lowest flow to maximize the surface area exposed to corrosive gases. For City sewers, that would mean nighttime flows during the driest summer months. Magnesium hydroxide is spray-applied from a boat or crawler in the pipe, depending on flow conditions. No bypass pumping is required, and access to the upstream pipe manhole is preferable. A box truck similar in size to a grout truck is the only access required. Magnesium hydroxide spraying has been used successfully in other municipalities such as Phoenix and Los Angeles for recurring maintenance to extend pipe life. However, this technology has seen limited use in the Northwest. Therefore, there may not be contractors in this area familiar with its application. BC does not recommend consideration of this technology for use at this time. Figure D-10 illustrates the rate of corrosion as impacted by surface pH.

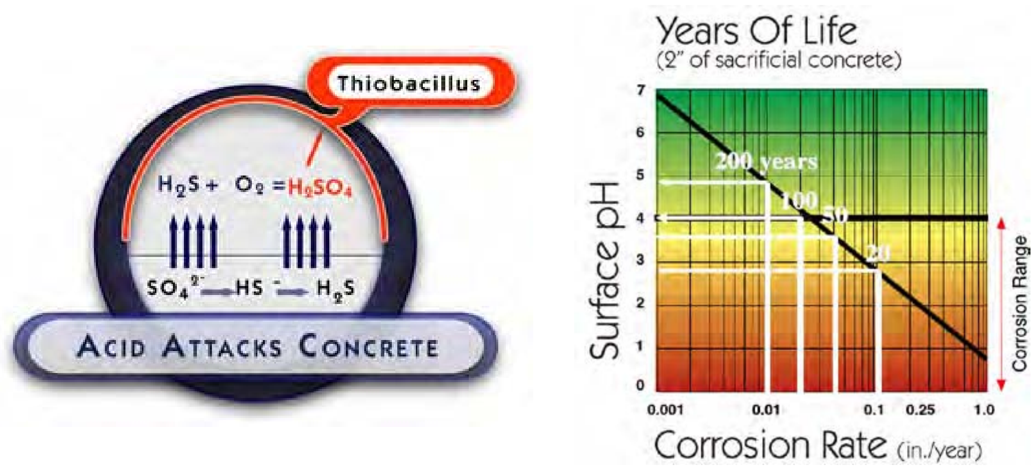


Figure D-10. Rate of corrosion as impacted by surface pH

Other Maintenance Activities

Regular maintenance is a proven way to extend pipe life. Accumulation of debris, roots, and grease can lead to hydraulic restrictions which can cause surcharging and stress on the pipe. Surcharging of older clay and concrete pipes that do not have watertight joints can lead to disturbance of the surrounding soils, potential loss of bedding and pipe support, and further deterioration.

Summary of Rehabilitation Technologies

Table D-1 summarizes the various options available for full pipe segment, pipe repair, and non-structural corrective actions.

Table D-1. Rehabilitation Options

Technology	Available pipe diameters	Structural	Bypass pumping required	Excavation required	Local contractors	Loss of hydraulic capacity	Appropriate for City sewers
Open-cut	All	Y	Y	Major	Y	N	Y
CIPP	All	Y	Y	Minor	Y	Minor	Y
Pipe bursting	≤ 24 inches	Y	Y	Moderate	Y	N	Y
SPR	All	Y	N	Minor	N	Moderate	N
Sliplining	All	Y	Y	Moderate	Y	Major	Y
Pipe wrap	≥ 48 inches	Unknown	Y	N	N	Minor	N
Link-pipe	All	Y	N	N	Y	Minor	Y
Magnesium hydroxide	All	N	N	N	Y	N	N
Test and seal	All (limited packer availability in > 42 inches)	N	N	N	Y	N	Y

Many of the above-described rehabilitation technologies are available as candidates for use on the City's sewers. For smaller diameter sewers (≤ 24 inches), sliplining and pipe bursting are the most frequently used and least costly technologies currently available. In addition, sewer capacity often influences rehabilitation and replacement decisions. The Sanitary Sewer Master Plan should be referenced during the predesign phase of a project to ensure that the hydraulic capacity of a given sewer is considered as part of an informed rehabilitation and replacement decision-making process.

Other Inspection/Evaluation Technologies

While CCTV inspection is the primary technology used by most municipalities to inspect the sewer system, a number of other technologies exist that can be used to augment a CCTV inspection program. Typically, these would be used for specialized inspections where CCTV inspections do not perform well. Examples include the following: laser profiling, sonar, and ground-penetrating radar. The focus of this discussion will be on laser profiling.

Laser profiling is recommended in pipes where an accurate measurement of the pipe's internal diameter and shape are critical to the rehabilitation decision-making and design process. Although it is a relatively new technology, laser profiling has a number of practical applications in assessing sewer condition, including accurately determining the location and geometry of defects, verifying the level of deformation in flexible and non-flexible pipes, and determining the size of cracks in rigid pipes.

Figures D-11 through D-13 show images from a laser profiling inspection performed on a cast-in-place RCP. The pipe was constructed in the 1910s and is approximately 25 feet deep. As shown in Figure D-11, the pipe looks deformed, but it is difficult to assess the degree of deformity. In this case, information on the true dimensions of the pipe was critical since sliplining rehabilitation was being considered.

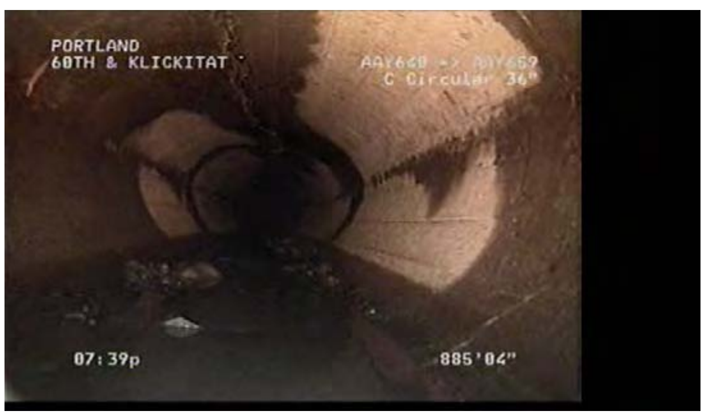


Figure D-11. Video image from laser profile inspection

Figure D-12 shows the laser projection on the wall of the pipe as captured by the inspection equipment's video camera. As shown on the screen capture, the true diameter of the pipe is determined for both the X and Y axes.

As shown in Figure D-13, the actual profile of the pipe is projected against the original shape. At one location on this pipeline, the 36-inch internal diameter pipe had only a 30-inch vertical (Y-axis) dimension.

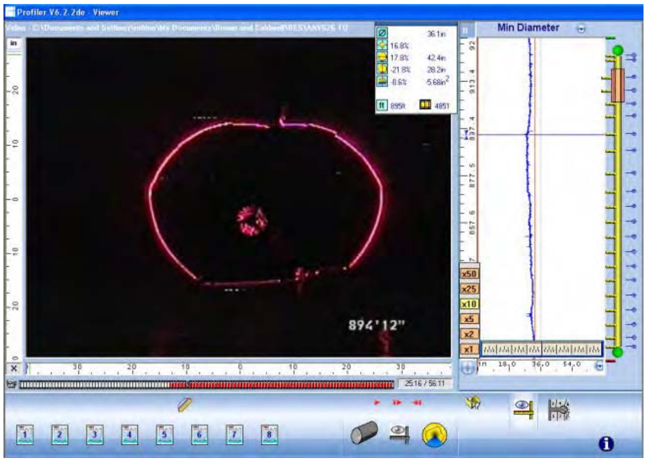


Figure D-12. Laser projection from laser profile inspection

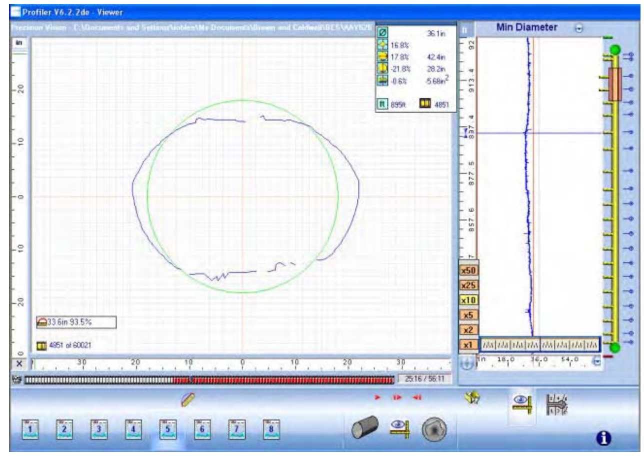


Figure D-13. Laser profile inspection results

For the City, use of laser profile technology is primarily recommended for flexible pipe (i.e., PVC) to establish a baseline for existing deformation and determining the rate of deformation.

Appendix E: Basis of Costs

Appendix E

Basis of Costs

This appendix describes how the costs were estimated for developing the budgets of capital improvements. The total capital investment necessary to perform a project (i.e., engineering through construction) consists of expenditures for engineering services, construction, contingencies, and overhead items such as legal, contract administration, and financing. The various components of the capital costs are described below.

Cost Index

A good indicator of changes over time in construction costs is the *Engineering News Record (ENR)* 20-city Construction Cost Index (CCI), which is computed from prices of construction materials and labor, and is based on a value of 100 in 1913. Cost data in this report are based on an *ENR* CCI of 9418, representing costs in January 2013. The costs provided in this Sanitary Sewer Master Plan (SSMP) should be adjusted based on the *ENR* CCI at the time that a project is being planned.

Construction Costs

Construction costs were prepared for improvements identified by the hydraulic modeling and the limited sewer condition assessment information. Construction costs presented below represent preliminary estimates of the materials, labor, and services necessary to construct the proposed projects. The cost estimates were prepared to be indicative of the cost of construction in the study area. It is important to recognize that changes during design and future changes in the cost of materials, labor, and equipment, will cause comparable changes in the estimated costs. Unit costs used in this SSMP were obtained from a review of pertinent sources of reliable construction cost information. Construction cost data given in this report are not intended to represent the lowest prices that can be achieved, but rather are intended to represent planning level estimates for budgeting purposes.

Engineering, Overhead, and Contingencies

Engineering and overhead are assumed to be 21 percent of the construction cost. Engineering services associated with typical projects include preliminary investigations and reports, site and route surveys, geotechnical explorations, preparation of drawings and specifications, construction services, surveying and staking, and sampling and testing of materials. These costs can vary considerably depending on the nature and complexity of the project. Additional engineering costs could be realized if additional geotechnical investigations are required and if environmental permitting and public involvement and notification activities are required. Also, these activities could impact the engineering and construction schedule.

Overhead charges cover items such as legal fees, financing expenses, administrative costs, and interest during construction.

The construction contingency used in this SSMP is 30 percent. The contingency is added after inclusion of the engineering and overhead costs. It is appropriate to allow for this degree of uncertainty due to the limited information available during the master planning level development of projects. Factors such as unknown geotechnical and groundwater conditions, utility relocation, and alignment changes are a few of the items that can increase project cost, for which it is wise to make allowance in preliminary estimates.

This SSMP used three pricing schedules for sewer construction. Each schedule is described as follows:

- *Price Condition No. 1: Off-street construction.* This condition includes pipe, pipe installation, excavation, import of all fill, hauling of all excavated material, manholes, trench safety, sump dewatering, and traffic control. In general, this condition is for the construction of sewers in future streets with no street restoration.
- *Price Condition No. 2: In-street construction, street restoration required*. This condition includes pipe, pipe installation, excavation, import of all fill, hauling of all excavated material, manholes, existing utilities, trench safety, sump dewatering, street restoration, and traffic control.
- *Price Condition No. 3: In-street construction, with significant dewatering required.* This condition is the same as Condition No. 2 with the inclusion of well point dewatering required to keep the trench dry for construction of the sewer. Actual dewatering costs can vary significantly with site conditions.

Tables G-1 through G-3 present unit costs for a range of pipe sizes and depths for the three construction condition schedules. Specialized construction techniques, such as pipe jacking or pipe boring work, are not included in any of the estimates. Most of the SSMP recommended improvements will be to replace sewers in existing streets; therefore, the Condition No. 2 pricing schedule is used accordingly unless other information is available for selecting one of the other pricing schedules.

Table G-1. Cost Per Foot of Installed Pipe

Price Condition No. 1				
Size, inches	Depth of cover, feet			
	6	10	14	18
8	$171	$274	$398	$544
10	$186	$293	$420	$568
12	$205	$314	$445	$596
15	$237	$353	$490	$648
18	$277	$398	$540	$703
21	$305	$442	$599	$766
24	$353	$504	$675	$851
27	$391	$536	$700	$882
30	$420	$570	$738	$925
36	$485	$648	$830	$1,030
42	$564	$744	$936	$1,147
48	$655	$844	$1,045	$1,266

Table G-2. Cost Per Foot of Installed Pipe				
Price Condition No. 2				
Size, inches	Depth of cover, feet			
	6	10	14	18
8	$234	$352	$491	$650
10	$251	$372	$514	$677
12	$272	$396	$541	$706
15	$309	$443	$596	$771
18	$353	$491	$649	$829
21	$383	$537	$711	$895
24	$437	$607	$797	$993
27	$478	$642	$824	$1,026
30	$510	$678	$865	$1,071
36	$587	$773	$978	$1,202
42	$671	$874	$1,090	$1,325
48	$771	$985	$1,212	$1,459

Table G-3. Cost Per Foot of Installed Pipe				
Price Condition No. 3				
Size, inches	Depth of cover, feet			
	6	10	14	18
8	$330	$446	$582	$740
10	$348	$466	$606	$766
12	$368	$490	$632	$796
15	$402	$531	$680	$851
18	$446	$579	$733	$908
21	$476	$625	$795	$974
24	$544	$704	$885	$1,072
27	$584	$739	$913	$1,105
30	$616	$776	$954	$1,151
36	$686	$859	$1,051	$1,262
42	$810	$1,000	$1,202	$1,424
48	$910	$1,111	$1,325	$1,559

As the collection system ages, upgrades to existing lift stations may be required to improve reliability and expand hydraulic capacity. Costs to rehabilitate or replace an existing lift station vary considerably depending on the specific needs of each station. These needs were not established as part of SSMP development other than identifying if hydraulic improvements are required. Costs included in the capital improvement program are based on a hydraulic upgrade only unless otherwise noted.

Bypass Pumping Cost Tables

The replacement of an existing sewer will require bypass pumping in most cases. Bypass pumping costs are not included in the per foot construction costs listed above. These costs must be calculated separately and are based on the flow rates in the sewer and the amount of time that pumping is required. Guidelines for these costs are listed in Table G-4. Several vendors are located within the study area that can provide current quotes if requested.

Table G-4. Bypass Pumping Costs

Diameter, inches	Size of pump(s), inches[a]	Assumed flow rate, gallons per minute[b]	Approximate pumping capacity, gallons per minute	Monthly rate[c]
8 – 12	4	200 – 600	600	$7,000
15 – 18	6	1000 – 1,600	1,600	$10,500
18 – 24	12	1,600 – 3,600	3,800	$19,000
>24	Consider combinations of above sized pumps based on known flow rates in project pipes.			

[a]A variety of pump sizes most likely will be used for projects to accommodate actual flows. Pump sizes shown are based on 1/2 pipe full conditions. Full pipe and/or work during wet weather periods could require much larger pumps.

[b]Flow rates shown are based on ½ pipe full conditions and average pipe slope. Assumed pipe flow in 18-inch pipe is slightly less than 1/2 pipe full conditions.

[c]Costs were provided by Rain for Rent (Portland) and based on a 28-day (monthly cycle). Actual costs will vary depending on site conditions.

Appendix F: Existing and Future Conditions Modeling Results

City of Troutdale: SSMP Pipes and Cost Table						Existing Sewers w/ Existing Flows				Existing Sewer - Buildout Peak Flows				Upsized Sewer - Buildout Peak Flows					TOTAL COST (in 2013 dollars) = $ 4,817,000					
Pipe ID	Length (ft)	Avg Pipe Depth (ft)	Rounded Depth	Existing Pipe Dia (in)	Existing Capacity (gpm)	Peak Flow (gpm)	Current % Capacity Used	Current d/D	Current Conditions Notes	Peak Flow (gpm)	Future % Capacity Used Existing Sewers	Future d/D - Existing Sewers	Future Conditions Notes	Upsize Diam (in)	Peak Flow (gpm)	Future % Capacity Upsized Sewer	Future d/D Upsized Sewer	Future Upsize Conditions Notes	Upsize Required Now?	Cost Condition (See Cost Sheet)	Upsize in future?	Unit Cost ($/ft)	Total Cost ($)	Notes
Basin A - East Trunk																								
A1	297.1	6.3	10.0	12	1,583	783	50%	0.51		1,377	87%	0.80			1,345	65%	0.71		NO					
A2	420.2	7.8	10.0	12	1,317	758	58%	0.52		1,352	103%	0.81	Hydr. Grade OK		1,322	100%	0.88	Hydr. Grade OK	NO					
A213	34.8	10.1	14.0	8	1,600	220	14%	0.16		249	16%	0.20			249	16%	0.20		NO					
A214	141.6	6.3	10.0	8	601	261	43%	0.22		289	48%	0.25			290	48%	0.25		NO					
A215	137.0	3.7	6.0	8	2,155	264	12%	0.24		290	13%	0.26			291	14%	0.26		NO					
A216	89.1	4.8	6.0	8	1,846	275	15%	0.13		301	16%	0.14			302	16%	0.14		NO					
A217	121.1	4.5	6.0	8	1,902	279	15%	0.23		303	16%	0.25			304	16%	0.25		NO					
A218	222.8	4.1	6.0	8	1,939	282	15%	0.12		306	16%	0.15			307	16%	0.15		NO					
A219	81.4	4.1	6.0	8	1,319	285	22%	0.15		308	23%	0.16			309	23%	0.16		NO					
A220	297.2	4.0	6.0	8	1,686	289	17%	0.14		311	18%	0.14			312	19%	0.14		NO					
A221	203.2	6.6	10.0	8	1,754	298	17%	0.14		319	18%	0.14			319	18%	0.14		NO					
A222	170.8	8.7	10.0	8	1,946	301	15%	0.13		321	17%	0.14			322	17%	0.14		NO					
A224	142.6	15.2	18.0	8	1,844	309	17%	0.26		328	18%	0.31			329	18%	0.31		NO					
A36	99.5	16.5	18.0	10	2,700	379	14%	0.13		465	17%	0.34			465	17%	0.34		NO					
A37	84.6	13.1	14.0	8	1,522	376	25%	0.16		463	30%	0.19			464	30%	0.19		NO					
A38	315.9	9.7	10.0	8	1,626	372	23%	0.31		460	28%	0.37			460	28%	0.37		NO					
A39	470.9	16.4	18.0	8	1,242	361	29%	0.34		450	36%	0.40			451	36%	0.40		NO					
A4	412.0	12.9	14.0	15	1,332	750	56%	0.49		1,329	100%	0.78			1,318	99%	0.89		NO					
A48	95.0	12.2	14.0	8	956	214	22%	0.28		244	26%	0.32			244	26%	0.32		NO					
A5	119.2	16.0	18.0	15	1,840	729	40%	0.42		1,279	70%	0.65			1,281	70%	0.66		NO					
A6	230.3	15.0	18.0	15	1,761	726	41%	0.43		1,277	73%	0.63			1,279	73%	0.63		NO					
A67	360.7	12.6	14.0	10	1,963	170	9%	0.10		184	9%	0.10			185	9%	0.10		NO					
A7	384.9	15.4	18.0	15	1,362	722	53%	0.47		1,274	94%	0.70			1,276	94%	0.70		NO					
A81	48.7	10.2	14.0	10	2,101	166	8%	0.09		181	9%	0.10			181	8%	0.10		NO					
A87	148.9	10.3	14.0	10	1,157	154	13%	0.21		170	15%	0.24			170	15%	0.23		NO					
A88	354.1	10.8	14.0	10	1,263	136	11%	0.22		153	12%	0.26			153	12%	0.26		NO					
A89	408.5	11.5	14.0	10	997	133	13%	0.16		150	15%	0.19			151	15%	0.19		NO					
A90	259.9	13.0	14.0	10	915	80	9%	0.15		94	10%	0.18			94	10%	0.18		NO					
A91	412.1	12.8	14.0	10	847	75	9%	0.10		91	11%	0.11			91	11%	0.11		NO					
A92	423.0	12.4	14.0	10	895	70	8%	0.12		87	10%	0.16			87	10%	0.16		NO					
B36	244.3	7.2	10.0	12	1,406	797	57%	0.51		1,448	103%	0.82	Hydr. Grade OK		1,413	100%	0.80	Hydr. Grade OK	NO					
Basin A - West Trunk																								
A10	483.7	11.9	14	12	882	291	33%	0.29		629	71%	0.51			630	71%	0.51		NO					
A11	389.8	11.6	14.0	10	749	219	29%	0.36		407	54%	0.61			407	54%	0.61		NO					
A12	334.7	11.9	14.0	10	701	215	31%	0.34		404	58%	0.51			405	58%	0.51		NO					
A170	223.3	14.6	18.0	8	448	84	19%	0.13		127	28%	0.23			127	28%	0.23		NO					
A171	224.8	16.3	18.0	8	446	102	23%	0.16		145	32%	0.25			145	33%	0.25		NO					
A172	224.1	18.3	18.0	8	447	114	26%	0.16		156	35%	0.20			156	35%	0.20		NO					
A173	178.0	8.7	10.0	8	1,436	128	9%	0.09		188	13%	0.12			188	13%	0.12		NO					
A174	175.0	5.8	6.0	8	2,692	131	5%	0.07		189	7%	0.14			190	7%	0.15		NO					
A175	128.7	8.0	10.0	10	813	133	16%	0.13		191	23%	0.16			191	24%	0.17		NO					
A176	278.1	10.4	14.0	10	3,352	136	4%	0.07		193	6%	0.08			193	6%	0.08		NO					
A177	300.1	12.8	14.0	10	4,582	140	3%	0.07		196	4%	0.12			196	4%	0.12		NO					
A178	130.4	14.0	18.0	10	815	143	18%	0.15		197	24%	0.22			198	24%	0.22		NO					
A179	57.8	13.0	14.0	10	806	145	18%	0.16		199	25%	0.22			199	25%	0.22		NO					
A180	255.4	13.1	14.0	10	812	147	18%	0.14		200	25%	0.17			200	25%	0.17		NO					
A181	298.4	12.4	14.0	10	2,846	150	5%	0.09		202	7%	0.13			203	7%	0.13		NO					
A182	232.1	11.1	14.0	10	933	154	17%	0.13		205	22%	0.16			205	22%	0.16		NO					
A185	215.4	10.8	14.0	8	372	18	5%	0.08		14	4%	0.08			14	4%	0.08		NO					
A186	99.5	8.4	10.0	8	245	14	6%	0.09		11	5%	0.08			11	5%	0.08		NO					
A183	71.4	15.7	18.0	8	1,042	117	11%	0.20		157	15%	0.26			157	15%	0.26		NO					
A187	192.5	11.6	14.0	10	808	211	26%	0.31		401	50%	0.47			401	50%	0.47		NO					
A192	122.6	6.3	10.0	8	398	7	2%	0.05		6	1%	0.05			6	1%	0.05		NO					
A193	81.4	7.4	10.0	8	234	10	4%	0.08		8	4%	0.08			8	4%	0.08		NO					
A8	476.9	16.0	18.0	12	841	339	40%	0.48		806	96%	0.81			807	96%	0.82		NO					
A9	405.1	14.0	14.0	12	2,075	334	16%	0.31		801	39%	0.56			802	39%	0.57		NO					
Basin B - Interceptor																								
B1	114.1	15.5	18	15	7,478	3,684	49%	0.24		5,560	74%	0.32			5,573	75%	0.28		NO					
B110	71.4	8.7	10.0	10	871	651	75%	0.65		785	90%	1.48	< 1' surcharge		767	88%	1.18	< 1' surcharge	NO					
B115	324.2	11.2	14.0	10	581	606	104%	0.67	Hydr. Grade OK	735	127%	1.36	< 1' surcharge		750	129%	0.96		NO					
B116	278.8	10.8	14.0	10	676	566	84%	0.71		680	101%	1.68	< 1' surcharge		694	103%	1.37	< 1' surcharge	NO					
B122	57.1	9.6	10.0	10	655	552	84%	0.68		648	99%	1.68	< 1' surcharge		662	101%	1.37	< 1' surcharge	NO					
B123	444.1	9.9	10.0	10	718	547	76%	0.75		645	90%	1.70	< 1' surcharge		659	92%	1.39	< 1' surcharge	NO					
B124	136.5	9.4	10.0	10	1,418	544	38%	0.21		657	46%	0.24			657	46%	0.24		NO					
B129	360.4	8.4	10.0	10	1,478	532	36%	0.41		647	44%	0.47			647	44%	0.47		NO					
B130	339.2	9.4	10.0	10	748	524	70%	0.38		639	86%	0.48			639	86%	0.48		NO					
B131	240.1	10.3	14.0	10	541	467	86%	0.65		554	102%	0.79	Hydr. Grade OK		555	103%	0.79	Hydr. Grade OK	NO					
B133	253.0	10.9	14.0	10	691	458	66%	0.63		547	79%	0.76			548	79%	0.76		NO					
B135	501.7	12.5	14.0	10	675	448	66%	0.50		537	80%	0.61			538	80%	0.61		NO					
B136	221.9	12.6	14.0	10	520	444	85%	0.64		534	103%	0.79	Hydr. Grade OK		535	103%	0.79	Hydr. Grade OK	NO					
B196	279.3	12.3	14.0	10	520	287	55%	0.59		323	62%	0.72			324	62%	0.72		NO					
B197	268.8	12.5	14.0	8	381	230	60%	0.48		267	70%	0.58			268	70%	0.58		NO					
B2	49.0	11.1	14.0	15	2,808	1,722	61%	0.28		2,514	90%	0.37			2,523	90%	0.37		NO					
B216	150.2	12.7	14.0	8	203	198	98%	0.64		228	113%	0.75	Hydr. Grade OK		229	113%	0.75	Hydr. Grade OK	NO					
B234	79.9	13.0	14.0	8	411	168	41%	0.58		188	46%	0.67			188	46%	0.67		NO					
B235	212.0	13.0	14.0	8	387	139	36%	0.42		160	41%	0.47			160	41%	0.47		NO					
B250	290.6	13.2	14.0	8	305	110	36%	0.41		123	40%	0.44			123	40%	0.44		NO					

City of Troutdale: SSMP Pipes and Cost Table						Existing Sewers w/ Existing Flows				Existing Sewer - Buildout Peak Flows				Upsized Sewer - Buildout Peak Flows					TOTAL COST (in 2013 dollars) = $ 4,817,000					
Pipe ID	Length (ft)	Avg Pipe Depth (ft)	Rounded Depth	Existing Pipe Dia (in)	Existing Capacity (gpm)	Peak Flow (gpm)	Current % Capacity Used	Current d/D	Current Conditions Notes	Peak Flow (gpm)	Future % Capacity Used Existing Sewers	Future d/D - Existing Sewers	Future Conditions Notes	Upsize Diam (in)	Peak Flow (gpm)	Future % Capacity Upsized Sewer	Future d/D Upsized Sewer	Future Upsize Conditions Notes	Upsize Required Now?	Cost Condition (See Cost Sheet)	Upsize in future?	Unit Cost ($/ft)	Total Cost ($)	Notes
B252	497.9	12.5	14.0	8	344	104	30%	0.40		117	34%	0.42			118	34%	0.42		NO					
B253	114.1	11.6	14.0	10	677	100	15%	0.17		114	17%	0.19			114	17%	0.20		NO					
B254	351.3	10.2	14.0	10	675	97	14%	0.26		112	17%	0.28			112	17%	0.28		NO					
B255	350.9	9.7	10.0	10	676	93	14%	0.25		109	16%	0.28			109	16%	0.28		NO					
B256	398.7	11.7	14.0	10	1,235	85	7%	0.20		102	8%	0.23			102	8%	0.23		NO					
B257	399.4	12.0	14.0	10	1,852	80	4%	0.15		98	5%	0.17			98	5%	0.17		NO					
B258	410.1	10.7	14.0	10	1,278	75	6%	0.14		94	7%	0.17			94	7%	0.17		NO					
B259	341.6	10.1	14.0	10	1,208	71	6%	0.16		91	7%	0.19			91	8%	0.19		NO					
B269	195.9	9.4	10.0	8	1,963	843	43%	0.47		965	49%	0.51			1,002	51%	0.53		NO					
B270	123.0	8.6	10.0	10	726	632	87%	0.68		767	106%	1.46	< 1' surcharge		749	103%	1.12	Hydr. Grade OK	NO					
B33	258.4	7.3	10.0	15	2,974	1,667	56%	0.54		2,422	81%	0.71			2,430	82%	0.71		NO					
B34	254.4	7.9	10.0	15	2,452	1,660	68%	0.55		2,416	99%	0.74			2,425	99%	0.74		NO					
B347	108.1	9.7	10.0	10	797	629	79%	0.62		765	96%	1.34	< 1' surcharge		750	94%	0.92		NO					
B35	280.6	7.2	10.0	8	1,603	857	53%	0.67		973	61%	0.90			1,013	63%	0.91		NO					
B350	106.1	10.6	14.0	10	832	734	88%	0.71		891	107%	0.90	Hydr. Grade OK		875	105%	0.86	Hydr. Grade OK	NO					
B351	126.9	11.7	14.0	10	671	595	89%	0.80		725	108%	1.64	< 1' surcharge		739	110%	1.32	< 1' surcharge	NO					
B37	223.4	6.1	10.0	8	1,681	854	51%	0.50		973	58%	0.55			1,010	60%	0.56		NO					
B38	146.6	7.6	10.0	8	1,768	849	48%	0.49		970	55%	0.53			1,007	57%	0.55		NO					
B39	181.3	10.2	14.0	8	1,741	841	48%	0.24		964	55%	0.26			1,000	57%	0.27		NO					
B41	123.9	9.0	10.0	8	2,097	836	40%	0.46		961	46%	0.50			996	48%	0.51		NO					
B43	263.2	6.6	10.0	8	1,635	832	51%	0.48		957	59%	0.52			993	61%	0.53		NO					
B44	127.6	6.8	10.0	8	1,008	828	82%	0.65		955	95%	1.27	< 1' surcharge	10	990	42%	0.46		NO	2	YES	372	47,508	
B46	244.3	8.5	10.0	8	972	780	80%	0.73		886	91%	1.36	< 1' surcharge	10	921	40%	0.44		NO	2	YES	372	90,958	
B47	396.6	9.9	10.0	8	842	774	92%	0.73		881	105%	2.21	< 1' surcharge	10	916	46%	0.47		NO	2	YES	372	147,662	
B48	416.7	10.4	14.0	8	808	768	95%	0.74		876	108%	4.82	> 2' and < 3' surcharge	10	910	48%	0.46		NO	2	YES	514	214,160	
B49	443.5	9.2	10.0	8	906	747	83%	0.35		897	99%	0.41			883	98%	0.40		NO					
B50	287.9	9.1	10.0	10	865	739	85%	0.53		891	103%	0.67	Hydr. Grade OK		877	101%	0.65		NO					
B51	390.2	12.2	14.0	10	861	730	85%	0.71		891	104%	0.88	Hydr. Grade OK		875	102%	0.85		NO					
B81	465.7	11.4	14.0	10	863	713	83%	0.63		871	101%	0.80	Hydr. Grade OK		855	99%	0.77		NO					
B92	399.5	8.4	10.0	10	682	689	101%	0.77		848	124%	1.30	< 1' surcharge		831	122%	1.21	< 1' surcharge	NO					
B98	262.7	8.1	10.0	10	845	667	79%	0.76		807	96%	1.64	< 1' surcharge		789	93%	1.43	< 1' surcharge	NO					
Basin C - Lower Beaver Creek Interceptor																								
C1	53.4	9.6	10.0	21	14,031	1,760	13%	0.61		2,720	19%	1.57	< 1' surcharge		2,805	20%	1.47		NO					
C14	117.6	8.9	10.0	21	4,728	1,737	37%	0.42		2,281	48%	0.50			2,328	49%	0.50		NO					
C15	199.0	11.9	14.0	15	2,826	1,735	61%	0.31		2,282	81%	0.42			2,328	82%	0.42		NO					
C16	301.8	13.6	14.0	15	2,802	1,733	62%	0.41		2,285	82%	0.52			2,330	83%	0.53		NO					
C2	288.1	9.7	10.0	21	6,436	1,743	27%	0.33		2,350	37%	0.71			2,413	37%	0.63		NO					
C3	387.1	9.7	10.0	21	4,943	1,739	35%	0.39		2,350	48%	0.44			2,411	49%	0.45		NO					
C4	319.3	8.9	10.0	21	4,692	1,739	37%	0.42		2,369	50%	0.50			2,420	52%	0.50		NO					
Basin C - Upper Breaver Creek Interceptor																								
C17	69.2	8.9	10.0	12	3,147	1,359	43%	0.23		1,833	58%	0.27			1,869	59%	0.27		NO					
C18	86.7	9.6	10.0	12	5,229	1,358	26%	0.18		1,834	35%	0.24			1,869	36%	0.24		NO					
C187	491.4	6.8	10.0	15	1,334	1,225	92%	0.75		1,699	127%	1.13	< 1' surcharge	18	1,732	80%	0.73		NO	2	YES	491	241,033	
C188	289.7	9.4	10.0	15	1,394	1,206	87%	0.71		1,666	119%	1.40	< 1' surcharge	18	1,703	75%	0.64		NO	2	YES	491	142,099	
C189	47.4	12.1	14.0	15	730	1,205	165%	0.68	Hydr. Grade OK	1,665	228%	1.47	< 1' surcharge	18	1,704	N/A	0.62	Hydr. Grade OK	YES	2	YES	649	30,759	
C19	192.8	13.0	14.0	10	8,875	1,356	15%	0.28		1,834	21%	0.34			1,869	21%	0.34		NO					
C209	358.7	10.5	14.0	15	1,272	1,113	88%	0.73		1,573	124%	1.67	< 1' surcharge	18	1,615	78%	0.66		NO	2	YES	649	232,767	
C210	353.9	7.4	10.0	15	1,132	1,065	94%	0.64		1,492	132%	1.72	< 1' surcharge	18	1,536	83%	0.59		NO	2	YES	491	173,589	
C211	92.3	6.0	10.0	15	1,129	1,065	94%	0.80		1,489	132%	1.92	> 1' and < 2' surcharge	18	1,539	84%	0.72		NO	2	YES	491	45,273	
C212	219.5	6.9	10.0	15	1,222	1,026	84%	0.76		1,450	119%	2.03	> 1' and < 2' surcharge	18	1,502	76%	0.69		NO	1	YES	398	87,418	
C347	135.8	7.4	10.0	15	1,084	1,024	94%	0.73		1,448	134%	2.15	> 1' and < 2' surcharge	18	1,502	85%	0.67		NO	1	YES	398	54,084	
C213	220.2	8.1	10.0	15	1,382	1,023	74%	0.70		1,446	105%	2.24	> 1' and < 2' surcharge	18	1,502	67%	0.65		NO	1	YES	398	87,697	
C214	324.5	9.7	10.0	15	1,475	1,011	69%	0.62		1,435	97%	2.23	> 1' and < 2' surcharge	18	1,492	62%	0.58		NO	1	YES	398	129,235	
C215	170.7	10.3	14.0	15	1,386	1,010	73%	0.61		1,433	103%	2.22	> 1' and < 2' surcharge	18	1,492	66%	0.58		NO	1	YES	540	92,158	
C216	200.4	11.7	14.0	15	1,122	983	88%	0.66		1,395	124%	2.30	> 1' and < 2' surcharge	18	1,454	80%	0.63		NO	2	YES	649	130,043	
C20	151.6	11.9	14.0	15	1,104	981	89%	0.70		1,394	126%	2.42	> 1' and < 2' surcharge	18	1,453	81%	0.67		NO	2	YES	649	98,376	
C235	252.3	11.9	14.0	15	1,125	977	87%	0.71		1,391	124%	2.55	> 1' and < 2' surcharge	18	1,450	79%	0.67		NO	2	YES	649	163,722	
C236	111.4	12.4	14.0	15	1,374	958	70%	0.67		1,373	100%	2.64	> 2' and < 3' surcharge	18	1,432	64%	0.64		NO	2	YES	649	72,290	
C237	232.1	9.9	10.0	15	1,110	955	86%	0.59		1,371	124%	2.55	> 1' and < 2' surcharge	18	1,430	79%	0.57		NO	2	YES	491	113,846	
C293	159.2	8.6	10.0	15	1,126	950	84%	0.60		1,367	121%	2.51	> 1' and < 2' surcharge	18	1,426	78%	0.58		NO	2	YES	491	78,088	
C297	161.5	8.8	10.0	15	1,141	942	83%	0.58		1,361	119%	2.44	> 1' and < 2' surcharge	18	1,419	77%	0.57		NO	2	YES	491	79,216	
C298	179.4	10.3	14.0	15	1,125	939	84%	0.58		1,359	121%	2.37	> 1' and < 2' surcharge	18	1,417	77%	0.57		NO	2	YES	649	116,416	
C299	213.3	11.5	14.0	15	1,105	936	85%	0.59		1,357	123%	2.33	> 1' and < 2' surcharge	18	1,415	79%	0.58		NO	2	YES	649	138,414	
C301	399.1	9.5	10.0	15	4,226	932	22%	0.16		1,398	33%	0.20			1,411	33%	0.20		NO					
C303	257.1	9.5	10.0	15	5,352	924	17%	0.25		1,392	26%	0.33			1,405	26%	0.34		NO					
C304	40.8	10.7	14.0	15	6,093	831	14%	0.18		1,254	21%	0.24			1,266	21%	0.25		NO					
C305	279.4	8.8	10.0	8	645	135	21%	0.39		131	20%	0.43			132	20%	0.44		NO					
C306	266.4	8.0	10.0	8	1,261	131	10%	0.11		128	10%	0.11			128	10%	0.11		NO					
C307	130.0	8.5	10.0	8	946	128	14%	0.12		126	13%	0.12			126	13%	0.12		NO					
C308	158.8	12.6	14.0	8	347	109	31%	0.19		108	31%	0.19			108	31%	0.20		NO					
C557	173.9	8.4	10.0	15	1,390	1,251	90%	0.42		1,717	124%	0.54	Hydr. Grade OK		1,748	126%	0.54	Hydr. Grade OK	NO					
C559	145.2	12.1	14.0	15	2,382	1,333	56%	0.52		1,802	76%	0.64			1,836	77%	0.65		NO					
C560	71.4	11.1	14.0	15	1,546	1,334	86%	0.39		1,801	117%	0.48	Hydr. Grade OK		1,836	119%	0.48	Hydr. Grade OK	NO					
C561	116.4	12.4	14.0	15	8,635	1,297	15%	0.32		1,771	21%	0.40			1,804	21%	0.40		NO					
C562	122.7	12.1	14.0	15	2,635	1,294	49%	0.30		1,769	67%	0.37			1,802	68%	0.37		NO					
C563	127.5	13.9	14.0	15	2,691	1,292	48%	0.41		1,770	66%	0.52			1,803	67%	0.52		NO					
C564	100.1	15.4	18.0	15	2,663	1,283	48%	0.41		1,757	66%	0.51			1,789	67%	0.51		NO					
C568	133.4	12.7	14.0	15	7,702	1,281	17%	0.30		1,759	23%	0.38			1,790	23%	0.38		NO					

City of Troutdale: SSMP Pipes and Cost Table						Existing Sewers w/ Existing Flows				Existing Sewer - Buildout Peak Flows				Upsized Sewer - Buildout Peak Flows					TOTAL COST (in 2013 dollars) = $					4,817,000
Pipe ID	*Length (ft)*	*Avg Pipe Depth (ft)*	*Rounded Depth*	*Existing Pipe Dia (in)*	*Existing Capacity (gpm)*	*Peak Flow (gpm)*	*Current % Capacity Used*	*Current d/D*	*Current Conditions Notes*	*Peak Flow (gpm)*	*Future % Capacity Used Existing Sewers*	*Future d/D - Existing Sewers*	*Future Conditions Notes*	*Upsize Diam (in)*	*Peak Flow (gpm)*	*Future % Capacity Upsized Sewer*	*Future d/D Upsized Sewer*	*Future Upsize Conditions Notes*	*Upsize Required Now?*	*Cost Condition (See Cost Sheet)*	*Upsize in future?*	*Unit Cost ($/ft)*	*Total Cost ($)*	*Notes*
Basin C - Troutdale Road Trunk																								
C338	562.8	9.9	10.0	12	984	693	70%	0.32		1,120	114%	0.71	> 1' and < 2' surcharge	15	1,132	49%	0.25		NO	2	YES	443	249,049	
C339	238.7	10.3	14.0	12	902	688	76%	0.63		1,117	124%	1.56	> 1' and < 2' surcharge	15	1,128	69%	0.54		NO	2	YES	596	142,336	
C340	515.4	11.3	14.0	12	701	683	97%	0.73		1,113	159%	2.52	> 1' and < 2' surcharge	15	1,124	88%	0.70		NO	2	YES	596	307,330	
C341	537.0	14.0	18.0	12	853	650	76%	0.72		931	109%	3.42	> 2' and < 3' surcharge	15	941	61%	0.66		NO	2	YES	771	414,178	
C346	45.6	13.7	14.0	8	1,606	101	6%	0.42		269	17%	2.67	> 1' and < 2' surcharge		270	17%	0.53		NO					
C348	501.2	10.6	14.0	10	1,068	81	8%	0.10		232	22%	0.16			233	22%	0.16		NO					
C349	527.9	10.1	14.0	10	1,887	74	4%	0.16		226	12%	0.27			227	12%	0.28		NO					
C350	474.8	9.5	10.0	10	2,412	67	3%	0.06		219	9%	0.16			220	9%	0.16		NO					
C351	498.7	8.4	10.0	10	2,455	53	2%	0.05		207	8%	0.14			207	8%	0.14		NO					
C352	594.9	10.8	14.0	10	2,063	26	1%	0.08		180	9%	0.20			180	9%	0.20		NO					
C353	208.2	12.4	14.0	10	2,801	10	0%	0.06		37	1%	0.14			37	1%	0.14		NO					
C354	80.7	12.1	14.0	10	668	8	1%	0.07		36	5%	0.13			36	5%	0.13		NO					
C355	82.9	9.7	10.0	10	688	6	1%	0.08		35	5%	0.17			35	5%	0.17		NO					
C356	202.0	7.6	10.0	10	673	4	1%	0.06		34	5%	0.16			34	5%	0.16		NO					
Basin C - Stark St. Trunk																								
C22	249.0	11.9	14.0	12	895	195	22%	0.28		222	25%	0.33			222	25%	0.33		NO					
C346	45.6	13.7	14.0	8	1,606	101	6%	0.42		269	17%	2.67	arged by downstream restriction		270	17%	0.53		NO					
C359	470.2	13.3	14.0	12	1,058	544	51%	0.25		665	63%	0.30			667	63%	0.30		NO					
C460	403.8	11.0	14.0	12	707	220	31%	0.34		243	34%	0.40			244	34%	0.40		NO					
C461	130.0	11.6	14.0	12	887	216	24%	0.31		241	27%	0.34			242	27%	0.34		NO					
C466	237.8	11.7	14.0	12	664	199	30%	0.34		224	34%	0.39			225	34%	0.39		NO					
C477	109.9	12.1	14.0	12	699	188	27%	0.17		215	31%	0.20			215	31%	0.20		NO					
Basin C - Lower Sandee Palisades																								
C25	99.0	12.2	14.0	15	1,129	374	33%	0.84		461	41%	0.96			465	41%	0.96		NO					
C26	96.5	10.9	14.0	15	1,105	373	34%	0.66		462	42%	0.78			465	42%	0.79		NO					
C27	100.0	8.6	10.0	15	1,123	372	33%	0.49		464	41%	0.62			466	42%	0.62		NO					
C28	64.9	6.5	10.0	15	1,138	370	33%	0.38		466	41%	0.48			467	41%	0.48		NO					
C29	136.2	5.9	6.0	15	1,138	368	32%	0.35		466	41%	0.42			467	41%	0.42		NO					
C30	67.5	5.2	6.0	15	1,059	366	35%	0.35		465	44%	0.40			466	44%	0.40		NO					
C31	267.7	4.3	6.0	16	1,530	363	24%	0.31		432	28%	0.36			433	28%	0.36		NO					
C32	149.4	8.5	10.0	12	1,206	360	30%	0.29		430	36%	0.33			431	36%	0.33		NO					
C33	48.4	12.4	14.0	12	1,149	358	31%	0.33		429	37%	0.37			430	37%	0.37		NO					
C34	273.8	10.9	14.0	12	1,143	356	31%	0.33		427	37%	0.38			428	37%	0.38		NO					
C35	211.5	10.6	14.0	12	1,077	352	33%	0.34		425	39%	0.38			426	40%	0.38		NO					
C36	60.5	8.0	10.0	8	925	350	38%	0.21		424	46%	0.24			424	46%	0.24		NO					
C37	179.0	9.2	10.0	8	2,200	348	16%	0.35		422	19%	0.39			423	19%	0.39		NO					
C38	149.2	34.0	18.0	8	1,908	345	18%	0.28		421	22%	0.32			422	22%	0.32		NO					
C39	99.0	52.6	18.0	8	2,614	343	13%	0.26		420	16%	0.30			420	16%	0.30		NO					
C40	154.8	30.6	18.0	8	2,176	303	14%	0.25		367	17%	0.28			368	17%	0.28		NO					
C41	213.3	8.1	10.0	8	1,808	298	17%	0.27		364	20%	0.30			365	20%	0.30		NO					
C42	134.8	9.1	10.0	8	391	296	76%	0.52		362	93%	0.61			363	93%	0.61		NO					
C43	179.8	14.3	18.0	8	343	293	85%	0.38		361	105%	0.47	Hydr. Grade OK		361	105%	0.47	Hydr. Grade OK	NO					
C56	124.8	13.0	14.0	8	343	287	84%	0.36		355	103%	0.44	Hydr. Grade OK		356	104%	0.44	Hydr. Grade OK	NO					
C57	146.0	9.4	10.0	8	342	285	83%	0.64		354	104%	0.80	Hydr. Grade OK		355	104%	0.80	Hydr. Grade OK	NO					
C58	137.7	9.5	10.0	8	343	282	82%	0.62		352	103%	0.80	Hydr. Grade OK		353	103%	0.80	Hydr. Grade OK	NO					
C59	104.1	9.6	10.0	8	340	277	82%	0.61		348	102%	0.78	Hydr. Grade OK		349	103%	0.79	Hydr. Grade OK	NO					
C60	104.3	9.8	10.0	8	340	275	81%	0.60		347	102%	0.76	Hydr. Grade OK		348	102%	0.78	Hydr. Grade OK	NO					
C72	149.0	9.8	10.0	8	347	258	74%	0.50		331	95%	0.68			332	96%	0.69		NO					
C73	462.3	9.9	10.0	8	343	255	74%	0.56		328	96%	0.76			329	96%	0.76		NO					
C74	127.8	10.2	14.0	8	343	251	73%	0.56		325	95%	0.74			326	95%	0.74		NO					
Basin C - Upper Sandee Palisades East Trunk																								
C109	235.1	11.8	14.0	8	245	81	33%	0.23		69	28%	0.20			70	28%	0.21		NO					
C113	195.8	12.2	14.0	8	344	70	20%	0.23		60	17%	0.20			60	17%	0.21		NO					
C114	135.2	12.6	14.0	8	343	68	20%	0.24		58	17%	0.22			59	17%	0.22		NO					
C115	109.9	12.7	14.0	8	339	62	18%	0.23		54	16%	0.21			54	16%	0.21		NO					
C124	137.7	12.7	14.0	8	340	57	17%	0.14		50	15%	0.14			50	15%	0.14		NO					
C125	136.1	12.7	14.0	8	378	51	13%	0.20		44	12%	0.18			45	12%	0.18		NO					
C126	165.9	12.7	14.0	8	342	46	13%	0.25		40	12%	0.23			40	12%	0.23		NO					
C131	246.8	12.8	14.0	8	347	39	11%	0.12		34	10%	0.11			34	10%	0.11		NO					
C133	244.1	11.0	14.0	8	320	30	9%	0.11		26	8%	0.10			26	8%	0.10		NO					
C134	177.7	9.7	10.0	8	371	26	7%	0.09		24	6%	0.09			24	6%	0.09		NO					
C135	114.1	10.6	14.0	8	341	24	7%	0.09		22	6%	0.09			22	7%	0.09		NO					
C137	112.6	11.4	14.0	8	908	21	2%	0.05		20	2%	0.05			20	2%	0.05		NO					
C75	150.3	10.0	10.0	8	346	139	40%	0.37		150	43%	0.48			150	43%	0.48		NO					
C76	312.4	10.6	14.0	8	343	86	25%	0.32		74	22%	0.32			74	22%	0.32		NO					
Basin C - Upper Sandee Palisades West Trunk																								
C100	89.6	12.9	14.0	8	389	47	12%	0.12		46	12%	0.12			46	12%	0.12		NO					
C80	110.4	10.2	14.0	8	342	109	32%	0.40		174	51%	0.56			175	51%	0.56		NO					
C81	205.8	10.2	14.0	8	342	107	31%	0.30		173	50%	0.44			173	51%	0.44		NO					
C82	125.5	10.2	14.0	8	346	82	24%	0.29		74	21%	0.35			74	21%	0.35		NO					
C83	144.7	10.4	14.0	8	343	80	23%	0.27		72	21%	0.25			72	21%	0.25		NO					
C87	138.7	10.5	14.0	8	342	76	22%	0.19		69	20%	0.17			69	20%	0.17		NO					
C88	171.0	10.7	14.0	8	345	72	21%	0.25		66	19%	0.24			66	19%	0.24		NO					
C89	305.5	11.2	14.0	8	341	68	20%	0.24		64	19%	0.23			64	19%	0.23		NO					
C96	338.4	11.8	14.0	8	344	57	17%	0.15		53	16%	0.14			54	16%	0.14		NO					
C97	334.4	12.5	14.0	8	342	53	15%	0.20		50	15%	0.20			50	15%	0.20		NO					
C98	138.1	12.9	14.0	8	336	50	15%	0.20		48	14%	0.20			48	14%	0.20		NO					

City of Troutdale: SSMP Pipes and Cost Table						Existing Sewers w/ Existing Flows				Existing Sewer - Buildout Peak Flows				Upsized Sewer - Buildout Peak Flows					TOTAL COST (in 2013 dollars) = $ 4,817,000					
Pipe ID	Length (ft)	Avg Pipe Depth (ft)	Rounded Depth	Existing Pipe Dia (in)	Existing Capacity (gpm)	Peak Flow (gpm)	Current % Capacity Used	Current d/D	Current Conditions Notes	Peak Flow (gpm)	Future % Capacity Used Existing Sewers	Future d/D - Existing Sewers	Future Conditions Notes	Upsize Diam (in)	Peak Flow (gpm)	Future % Capacity Upsized Sewer	Future d/D Upsized Sewer	Future Upsize Conditions Notes	Upsize Required Now?	Cost Condition (See Cost Sheet)	Upsize in future?	Unit Cost ($/ft)	Total Cost ($)	Notes
Basin C - Sweetbriar Trunk																								
C366	339.4	9.8	10.0	12	1,333	272	20%	0.30		366	27%	0.37			367	28%	0.37		NO					
C379	132.5	9.7	10.0	12	1,011	247	24%	0.21		336	33%	0.28			337	33%	0.28		NO					
C380	142.8	9.5	10.0	12	1,583	244	15%	0.29		335	21%	0.36			335	21%	0.36		NO					
C381	129.1	9.1	10.0	10	994	242	24%	0.19		334	34%	0.26			334	34%	0.26		NO					
C382	344.0	9.3	10.0	10	873	238	27%	0.32		330	38%	0.41			331	38%	0.41		NO					
C405	258.0	10.0	14.0	10	1,652	167	10%	0.28		234	14%	0.34			235	14%	0.34		NO					
C406	233.5	9.7	10.0	10	2,102	164	8%	0.20		232	11%	0.24			232	11%	0.24		NO					
C409	305.1	10.0	10.0	10	624	156	25%	0.28		224	36%	0.34			225	36%	0.35		NO					
C416	194.0	10.5	14.0	10	1,824	144	8%	0.09		213	12%	0.11			214	12%	0.11		NO					
C417	112.5	9.2	10.0	10	499	141	28%	0.28		212	42%	0.35			212	43%	0.35		NO					
C418	89.0	7.6	10.0	10	552	139	25%	0.36		211	38%	0.46			211	38%	0.46		NO					
C419	294.9	7.6	10.0	10	496	136	28%	0.35		209	42%	0.45			209	42%	0.45		NO					
C430	136.6	6.4	10.0	12	1,467	108	7%	0.24		182	12%	0.31			182	12%	0.31		NO					
C433	213.2	7.8	10.0	8	1,048	102	10%	0.10		177	17%	0.19			177	17%	0.19		NO					
C434	37.8	16.2	18.0	8	743	75	10%	0.22		153	21%	0.37			154	21%	0.37		NO					
C528	59.1	6.2	10.0	8	577	107	19%	0.28		182	31%	0.38			182	32%	0.38		NO					
C529	59.7	12.2	14.0	8	224	78	35%	0.25		155	69%	0.38			156	70%	0.38		NO					
C530	123.9	8.3	10.0	8	1,943	80	4%	0.07		156	8%	0.10			157	8%	0.10		NO					
C636	191.3	13.6	14.0	8	525	52	10%	0.10		59	11%	0.11			59	11%	0.11		NO					
C637	268.4	8.5	10.0	8	1,312	24	2%	0.05		31	2%	0.05			31	2%	0.05		NO					
C638	249.6	6.5	10.0	8	825	20	2%	0.06		29	3%	0.07			29	3%	0.07		NO					
C668	166.8	8.2	10.0	12	1,328	279	21%	0.28		372	28%	0.34			373	28%	0.34		NO					
C669	190.8	7.3	10.0	12	1,934	282	15%	0.25		374	19%	0.31			375	19%	0.31		NO					
C670	99.3	8.9	10.0	12	1,794	284	16%	0.27		376	21%	0.32			376	21%	0.32		NO					
C671	229.8	9.3	10.0	12	1,658	287	17%	0.27		377	23%	0.31			378	23%	0.31		NO					
C672	80.3	9.6	10.0	12	1,962	290	15%	0.38		380	19%	0.45			380	19%	0.45		NO					
Basin D - WPCF Interceptor																								
D108	302.3	7.4	10.0	30	14,436	3,685	26%	0.29		5,077	35%	0.37			4,711	33%	0.35		NO					
D109	302.0	8.2	10.0	30	15,272	3,683	24%	0.30		4,862	32%	0.38			4,557	30%	0.36		NO					
D110	447.0	7.7	10.0	30	18,839	3,618	19%	0.29		4,743	25%	0.38			4,591	24%	0.37		NO					
D111	258.1	8.5	10.0	30	13,323	3,484	26%	0.35		4,663	35%	0.45			4,604	35%	0.42		NO					
D112	249.9	8.0	10.0	30	12,111	3,677	30%	0.36		5,500	45%	0.45			4,762	39%	0.41		NO					
D116	229.9	12.1	14.0	30	5,234	3,440	66%	0.54		5,514	105%	0.64	Hydr. Grade OK		4,771	91%	0.57		NO					
D117	303.9	14.0	14.0	30	7,519	3,475	46%	0.50		5,504	73%	0.59			4,747	63%	0.52		NO					
D118	299.4	13.2	14.0	30	7,576	3,590	47%	0.50		5,493	73%	0.58			4,722	62%	0.52		NO					
D119	258.4	12.8	14.0	30	7,591	3,699	49%	0.48		5,480	72%	0.56			4,693	62%	0.50		NO					
D120	262.4	16.3	18.0	30	7,533	3,799	50%	0.49		5,460	72%	0.57			4,655	62%	0.53		NO					
D121	131.1	17.7	18.0	30	7,535	3,851	51%	0.47		5,445	72%	0.55			4,639	62%	0.56		NO					
D122	326.0	15.0	18.0	30	7,614	3,924	52%	0.51		5,419	71%	0.59			5,608	74%	0.63		NO					
D123	353.1	14.0	14.0	30	7,535	3,992	53%	0.51		5,386	71%	0.59			5,603	74%	0.63		NO					
D124	293.1	13.5	14.0	30	7,528	4,026	53%	0.50		5,357	71%	0.58			5,618	75%	0.64		NO					
D125	265.6	12.6	14.0	30	7,631	4,038	53%	0.50		5,335	70%	0.58			5,648	74%	0.65		NO					
D126	280.5	11.8	14.0	30	7,424	4,043	54%	0.48		5,320	72%	0.57			5,692	77%	0.65		NO					
D127	261.0	13.2	14.0	30	7,553	4,079	54%	0.51		5,754	76%	0.60			6,213	82%	0.68		NO					
D128	262.3	15.4	18.0	30	7,535	4,082	54%	0.50		5,761	76%	0.59			6,282	83%	0.66		NO					
D129	178.0	14.4	18.0	30	7,609	4,078	54%	0.42		5,788	76%	0.49			6,383	84%	0.55		NO					
D130	65.5	12.6	14.0	30	15,081	4,080	27%	0.37		5,793	90%	0.67			6,398	42%	0.67		NO					
D2	40.4	8.4	10.0	21	15,017	3,689	25%	0.33		5,416	36%	0.49			5,201	35%	0.42		NO					
D3	49.5	5.6	6.0	21	4,951	3,692	75%	0.31		5,375	109%	0.44	Hydr. Grade OK		5,086	103%	0.37	Hydr. Grade OK	NO					
D687	241.3	3.4	6.0	30	15,174	3,590	24%	0.44		5,497	36%	0.54			4,764	31%	0.48		NO					
D688	45.0	3.4	6.0	30	5,047	3,528	70%	0.54		5,492	109%	0.66	Hydr. Grade OK		4,756	94%	0.59		NO					
D689	63.3	8.3	10.0	30	9,021	3,504	39%	0.55		5,490	61%	0.67			4,753	53%	0.59		NO					
Basin D - Marine Drive Sewer																								
D10	340.0	14.4	18.0	8	372	146	39%	0.43		384	103%	8.99	Surcharged by PS1		350	94%	0.91		NO					
D21	55.0	24.5	18.0	10	751	62	8%	0.10	PS 8 WW surcharg	259	35%	0.20			260	35%	0.20		NO					
D22	190.0	16.5	18.0	8	372	126	34%	0.21		398	107%	9.31	Surcharged by PS1		390	105%	0.49	Hydr. Grade OK	NO					
D23	340.0	15.8	18.0	8	372	133	36%	0.22		384	103%	8.86	Surcharged by PS1		368	99%	0.67		NO					
D24	340.0	12.8	14.0	8	372	137	37%	0.41		384	103%	9.13	Surcharged by PS1		356	96%	0.79		NO					
D26	400.0	21.1	18.0	10	639	62	10%	0.14		259	41%	0.37			260	41%	0.37		NO					
D27	400.0	19.7	18.0	10	639	62	10%	0.21		259	41%	0.45			260	41%	0.45		NO					
D28	400.0	16.2	18.0	10	688	62	9%	0.20		259	38%	0.43			260	38%	0.43		NO					
D29	390.0	12.6	14.0	10	530	59	11%	0.23		259	49%	0.49			260	49%	0.49		NO					
D30	400.0	10.9	14.0	10	639	59	9%	0.22		259	41%	0.47			259	41%	0.47		NO					
D31	285.0	9.5	10.0	10	638	59	9%	0.20		259	41%	0.44			259	41%	0.44		NO					
D34	340.0	9.4	10.0	8	403	120	30%	0.37		384	95%	9.09	Surcharged by PS1		381	94%	0.71		NO					
D35	400.0	7.4	10.0	8	372	100	27%	0.33		384	103%	9.06	Surcharged by PS1		403	109%	0.73	Hydr. Grade OK	NO					
D36	400.0	7.0	10.0	8	372	72	19%	0.30		308	83%	8.76	Surcharged by PS1		354	95%	0.76		NO					
Basin D - Airport/ Graham Road Sewer																								
D47	45.0	7.2	10.0	8	446	193	43%	0.41		256	57%	9.00	Surcharged by PS1	10	592	73%	0.58		NO	3	YES	466	20,980	
D48	210.0	6.7	10.0	8	446	152	34%	0.61		348	78%	8.66	Surcharged by PS1	10	557	69%	0.62		NO	3	YES	466	97,906	
D50	75.0	7.5	10.0	8	446	137	31%	0.59		348	78%	8.33	Surcharged by PS1	10	557	69%	0.61		NO	3	YES	466	34,966	
D51	160.0	7.3	10.0	8	446	124	28%	0.59		348	78%	8.05	Surcharged by PS1	10	557	69%	0.61		NO	3	YES	466	74,595	
D52	500.0	5.9	6.0	8	446	91	20%	0.59		348	78%	7.28	Surcharged by PS1	10	558	69%	0.61		NO	3	YES	348	173,759	
D53	440.0	4.9	6.0	8	446	45	10%	0.60		348	78%	6.17	Surcharged by PS1	10	559	69%	0.61		NO	3	YES	348	152,908	
D54	50.0	4.7	6.0	8	446	32	7%	0.59		348	78%	5.60	Surcharged by PS1	10	559	69%	0.61		NO	3	YES	348	17,376	
D55	50.0	4.4	6.0	8	446	31	7%	0.59		348	78%	5.48	Surcharged by PS1	10	559	69%	0.61		NO	3	YES	348	17,376	
D56	56.0	3.9	6.0	8	442	3	1%	0.57		320	73%	5.34	Surcharged by PS1	10	532	66%	0.60		NO	3	YES	348	19,461	

City of Troutdale: SSMP Pipes and Cost Table						Existing Sewers w/ Existing Flows				Existing Sewer - Buildout Peak Flows				Upsized Sewer - Buildout Peak Flows					TOTAL COST (in 2013 dollars) = $ 4,817,000					
Pipe ID	Length (ft)	Avg Pipe Depth (ft)	Rounded Depth	Existing Pipe Dia (in)	Existing Capacity (gpm)	Peak Flow (gpm)	Current % Capacity Used	Current d/D	Current Conditions Notes	Peak Flow (gpm)	Future % Capacity Used Existing Sewers	Future d/D - Existing Sewers	Future Conditions Notes	Upsize Diam (in)	Peak Flow (gpm)	Future % Capacity Upsized Sewer	Future d/D Upsized Sewer	Future Upsize Conditions Notes	Upsize Required Now?	Cost Condition (See Cost Sheet)	Upsize in future?	Unit Cost ($/ft)	Total Cost ($)	Notes
D57	107.0	3.4	6.0	10	447	1	0%	0.44		494	111%	4.05	Surcharged by PS1	10	532	119%	0.74	Hydr. Grade OK	NO	3	YES	348	37,184	
D58	40.0	17.7	18.0	12	1,500	275	18%	0.24	PS1 WW surcharge	721	48%	9.14	Surcharged by PS1		1,002	58%	0.63		NO					
D84	55.0	18.5	18.0	10	1,357	95	7%	0.14		511	38%	2.49	Surcharged by PS1		541	40%	1.34	Hydr. Grade OK	NO					
D66	230.0	15.7	18.0	10	1,038	5	0%	0.02		64	6%	6.03	Surcharged by PS1		64	6%	0.08		NO					
D89	275.0	16.2	18.0	10	652	151	23%	0.48		258	40%	10.24			598	92%	0.72		NO					
D90	325.0	15.0	18.0	10	617	160	26%	0.50		258	42%	9.18	Surcharged by PS1		590	96%	0.78		NO					
D91	386.0	11.2	14.0	10	553	188	34%	0.53		258	47%	8.15	Surcharged by PS1		594	107%	0.85	Hydr. Grade OK	NO					
PS9 Sewers																								
D156	149.5	3.5	6.0	8	344	21	6%	0.17		431	125%	2.11	< 1' surcharge	10	452	56%	0.42		NO	3	YES	348	51,954	
D155	300.7	4.6	6.0	8	343	26	8%	0.26		433	126%	1.61	< 1' surcharge	10	454	56%	0.50		NO	3	YES	348	104,499	
D154	60.6	5.9	6.0	8	312	29	9%	0.19		435	140%	1.10	< 1' surcharge	10	456	62%	0.55		NO	3	YES	348	21,060	
D153	95.0	6.7	10.0	8	305	31	10%	0.17		436	143%	0.74		10	457	115%	0.47	Hydr. Grade OK	NO	3	YES	466	44,291	
D152	68.4	9.4	10.0	8	904	33	4%	0.72		437	48%	1.05	< 1' surcharge	10	459	51%	0.97		NO	3	YES	466	31,889	
D148	150.5	15.8	18.0	8	462	23	5%	0.07		427	92%	2.01	< 1' surcharge		427	92%	0.39		NO					
PS 7 Sewers																								
D103	397.0	10.2	14.0	8	457	72	16%	0.11		83	18%	0.14			83	18%	0.14		NO					
D102	229.0	10.5	14.0	8	447	72	16%	0.23		83	18%	0.29			83	19%	0.29		NO					
D63	265.0	11.0	14.0	8	494	72	15%	0.25		83	17%	0.30			83	17%	0.30		NO					
D62	332.0	12.4	14.0	8	365	72	20%	0.26		83	23%	0.49			83	23%	0.31		NO					
D61	297.0	14.1	18.0	8	446	72	16%	0.15		52	12%	1.54	Hydr. Grade OK		83	19%	0.64		NO					
D65	320.0	9.6	10.0	8	446	5	1%	0.08		5	1%	0.10			5	1%	0.10		NO					
D64	250.0	12.3	14.0	8	399	5	1%	0.05		13	3%	0.06			13	3%	0.06		NO					
D82	355.0	10.2	14.0	10	808	17	2%	0.13		497	61%	0.44			495	61%	0.44		NO					
D81	184.0	11.8	14.0	10	811	17	2%	0.16		497	61%	0.46			495	61%	0.46		NO					
D59	450.0	13.9	14.0	10	808	17	2%	0.22		497	61%	0.58			494	61%	0.49		NO					
D60	400.0	15.4	18.0	10	876	17	2%	0.40		469	54%	1.56	Hydr. Grade OK		494	56%	0.91		NO					

Appendix G: Biosolids Management Plan Assessment

Brown AND Caldwell

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Portland, Oregon 97239
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Technical Memorandum

Prepared for: City of Troutdale

Project Title: Sanitary Sewer Master Plan

Project No: 143520-006

Technical Memorandum

Subject: Biosolids Alternatives

Date: January 14, 2013

To: Amy Pepper

From: Steve Wilson, CPSS

Reviewed by: James Hansen, PE

AMERICAN REGISTRY OF CERTIFIED PROFESSIONALS
AGRONOMY CROPS SOILS
ARCPACS
STEVEN A. WILSON
CERTIFIED PROFESSIONAL SOIL SCIENTIST

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Introduction

The City of Troutdale Wastewater Treatment Plant (WWTP) generates approximately 225 to 230 dry tons (DT) of anaerobically digested biosolids on an annual basis. Biosolids are transferred to a 3.5 million gallon (MG) facultative lagoon at the plant, and removed seasonally (typically July, August, and September) for Class B application to local farm land. Slurry is dredged from the lagoon at approximately 2 percent solids and hauled in 4,000 gallon loads to the cooperating farms. Approximately 70 to 75 DT of biosolids have been hauled in this manner, typically, with the balance accumulating in the lagoon. The lagoon is currently very full and capacity for future storage is uncertain. The City included a limited scope for evaluation of the biosolids program in the current Master Planning effort. Issues include managing the existing inventory of stored biosolids in the lagoon, and alternatives for future biosolids processing and management.

Stored Biosolids Inventory

The facultative lagoon has effectively stored 2/3 (net basis) of all biosolids produced since the WWTP was commissioned approximately 10 years ago. The 3.5 MG structure is essentially full and has limited capacity for additional storage. The stored solids have not been quantified, but would contain the equivalent of 1,500 DT of biosolids based on the net amount that has been deposited. Some biological degradation has likely occurred, resulting in loss of additional volatile solids. The best way to determine the amount in storage would be to conduct a survey, collecting representative core samples to measure solids concentration and confirming the thickness of the solids layer. Because solids in the lagoon may have become denser over time, specialized core sampling equipment may be needed to the survey.

Land Application Program

The City has operated a successful land application program for many years. Small farms in the local area are happy to have the free fertilizer. But due to the local climate, only a short window exists for hauling and spreading. Typically, land is available after the first hay cutting in early July until early October when fall rains commence. The purchase of a second 4,000-gallon tank truck will increase operational capacity for hauling in this time window. However, the availability of sufficient land within the customary haul distance is uncertain. Trip time for each load affects the productivity and cost of the program on a unit basis. Longer haul distances may limit the quantity of solids that each truck can effectively haul in a season. The current list of approved land application sites needs to be expanded, and operating experience will be required to determine the quantity of biosolids that can be hauled reliably.

Alternatives to the Current Biosolids Program

The combination limited lagoon storage capacity and limited land available for beneficial use dictates consideration of an alternative approach for biosolids management. While the existing program is successful, it has not succeeded in keeping pace with biosolids production. Options include the following alternatives:

1. Expand existing slurry-based land application program
2. Implement biosolids dewatering to facilitate longer cost-effective haul distances and storage
3. Implement thermal drying to produce a Class A product
4. Contract removal (periodic or scheduled) of lagoon inventory to renew storage capacity.

These alternatives are described in more detail in the sections below.

Alternative 1. Expand the Existing Land Application Program

Farms in the local area are typically small and the land available for biosolids is in grass hay and pasture. In 2011, biosolids were applied to six farms totaling 60 acres. Application occurred on approximately half the acreage (32 acres). To accomplish the task, there were 306 truck trips and 6,689 round trip miles or an average of 22 miles per trip. Applying biosolids to additional land with a second truck will likely extend the haul distance resulting in fewer than two times the typical production for a season. Each trip consists of approximately one third of a dry ton at 2 percent solids concentration. If each trip averages 2 hours (including loading the truck, driving both ways, and getting into the field to spread), operating costs are in the range of $150 to 200 per DT including labor, fuel, and maintenance. This results in a unit cost of approximately $450 to 600 per DT for the current program.

The potential for expanding the available land base and the actual haul distance if this were the case are unknown at this time. Staff are currently working to identify new application sites.

Alternative 2. Implement Biosolids Dewatering

Dewatering biosolids increases the solids concentration by up to a factor of 10. Dewatered biosolids "cake" at 20 percent solids can be hauled and land applied at a lower cost, increasing the feasible distance for land application. Many agencies in the Portland area haul dewatered biosolids to eastern Oregon to increase both the acreage available and the seasonal operating window. Costs for doing this range from $30 to 50 per wet ton, or $150 to 250 per DT (assuming 20 percent solids concentration). Contract operators are used as well as agency staff and equipment. Examples of local agencies with long haul biosolids programs include the City of Portland, Clean Water Services, and Water Environment Services.

While hauling and application are reduced compared with a slurry-based program, there are additional costs for dewatering. The most common approach is to provide mechanical dewatering with a belt press or centrifuge. Mechanical dewatering provides a consistent product with a solids concentration ranging from 15 to 20 percent. Operating costs for dewatering range from $150 to 250 per DT depending on design and throughput. Capital costs may be an additional $100 to 150 per DT. For a smaller agency like Troutdale, total costs could easily be $400 per DT including capital and O&M. There will be additional cost for hauling and land application similar to what is described for the other agencies. For Troutdale operations staff to land apply dewatered biosolids a manure spreader, tractor, and front-end loader will be the minimum equipment required. The spreader can be purchased for a cost in the range of $15,000 to 30,000. A suitable sized tractor and loader can be rented on a seasonal basis or purchased as well. Revisions to the Biosolids Management Plan would be required to address application rates and spreader calibration.

At the City of Gresham, dewatered biosolids are stored in bunkers to facilitate seasonal application to local land. Other agencies produce and haul dewatered product year-round to the more arid farm land on the east side of the state.

To avoid capital costs associated with mechanical dewatering, Troutdale has an operations-scale test program with "Geotube" dewatering. This is a passive dewatering process where solids are mixed with polymer and pumped into geotextile bags. The bags are permeable to water but retain the solids. When free water has stopped exfiltrating, the bags are cut open and dewatered solids are removed. What is left of the bags must be disposed of at a landfill. Each bag accepts 145,000 to 190,000 gallons and costs approximately $6,000 including the cost of the bag and polymer. A bag will effectively dewater 12 to 15 DT assuming 2 percent solids when filled. Dewatering performance with this system is still undetermined. But based on available information, the cost will be $400 to 500 per DT plus transport and disposal or beneficial use. Determination of the actual percent solids achieved with the Geotubes was in progress at the time of this report.

Alternative 3. Implement Thermal Drying To Produce A Class A Product

Thermal drying is a high temperature process that removes additional water from dewatered biosolids to produce a product that is 90 to 95 percent dry matter. The high temperature process meets criteria for further reduction of potential pathogens in biosolids to produce a Class A product that can be distributed for a wider variety of uses. Entities in the Portland area that have implemented thermal drying include the cities of LaCenter and Camas, Washington, and the cities of Wilsonville and Stayton, Oregon.

Thermal drying reduces the volume of biosolids and potentially eliminates handling, storage, and land application cost if a suitable market is developed. For example, a topsoil manufacturer might pick up the dried product as it is produced and minimize post-processing costs to the City. However, capital and operating costs for the system are in the range of $300 to 500 per DT in addition to dewatering. Operating costs are high due to the cost of natural gas to heat the system and evaporate water.

Alternative 4. Initiate Periodic Contract Removal of Lagoon Inventory

The existing biosolids program could continue in its present configuration if capacity for treatment and storage of digested solids could be renewed. This will require removal of a substantial quantity of solids from the lagoon. One approach would be to develop a performance specification and RFP for contract removal of solids. Due to the relative scarcity of available farm land in the local area, the project would likely include dredging, dewatering and hauling to eastern Oregon for land application.

Brown and Caldwell recently facilitated a similar contracted project for the City of Washougal. The cost (including contractor mobilization) was approximately $550 per DT to dredge, dewater, haul, and land apply 850 DT of biosolids. 850 DT was 70 percent of the total lagoon inventory which was measured and characterized prior to issuing the RFP. For Troutdale, the contract RFP could be written to include a single large project or scheduled inventory reduction of a period of several years.

Other variations for contract biosolids management could be conceived to support the existing program. For example, Geotube-dewatered product could be removed under contract or mechanically dewatered product could be produced for contract removal. This would avoid the need for the City to procure special equipment for hauling and application of dewatered product and allow the current slurry-based operation to continue. Abandoning the slurry-based program and applying dewatered cake to local sites is also an option, but available acreage will still be a limitation for a sustainable (preserving storage capacity) operation.

Evaluation

The facultative lagoon provides a critical function with seasonal storage and further stabilization of anaerobically digested sludge. Renewing capacity in the lagoon requires changes to the existing beneficial use program or supplementing the existing program with periodic contract operations. Steps have been taken to increase capacity of the existing program by purchasing a second tank truck and implementing the test program for geotube dewatering. The success of these steps remains to be determined. For slurry land application with two trucks the unknown is land availability. For Geotube dewatering, operating cost is significant and performance is unproven. As a result, this technical memorandum focuses on a broader look at alternatives.

A summary of these alternatives and their unit cost ranges is presented in Table 1.

Table 1. Summary of Alternatives and Unit Cost Ranges		
Alternative	Unit cost per DT biosolids	Annual cost[a]
1. Expand the existing land application program	$450-600	$112,500-150,000
2. Implement biosolids dewatering	$550-700	$137,500-175,000
3. Implement thermal drying to produce a Class A product	$700-900	$175,000-225,000
4. Initiate periodic contract removal of lagoon inventory	$550-600	$137,500-150,000

[a]*Based on 250 DT/year*

The existing slurry-based program has a slight edge as the lowest cost program. However, uncertainty exists regarding land availability and the additional cost associated with longer haul differences. Dewatering costs a bit more but offers flexibility for hauling greater distances. For a continued local program, dewatered cake would have to be stored seasonally and a storage facility will add additional cost of approximately $30 per DT (amortized over 20 years). A storage facility typically consists of a concrete bunker with a roof. Truck loading would take place from an adjacent slab using a front end loader. A storage facility would also provide a staging area for dewatered biosolids generated from lagoon inventory. The existing slurry program could continue simultaneously with dewatering to accommodate surplus solids.

Thermal drying to produce a Class A product is a more expensive approach to biosolids processing but offers flexibility for a wider variety of beneficial uses. Because Class A biosolids are essentially unrestricted, there is potential to have the product taken away by a third party to use as a component of manufactured topsoil or compost. In this case the City would have a net zero cost for post-process product handling.

Contract removal applies to accommodating the lagoon inventory on a periodic or scheduled basis. The lagoon is currently full with limited capacity for further storage. This is a problem because the current land application program has not been able to keep up with yearly digested biosolids production. In addition, 100 percent of biosolids produced currently need to be stored with exception of the limited land application window in the summer and early fall. Contract removal could be done periodically while the current local program continues, or replace the existing program.

As Table 1 shows, costs for alternatives 1, 2, and 4 overlap. Other issues should be considered when deciding the best approach. If the decision is to stick with the current program rather than make capital improvements for mechanical dewatering or thermal drying, additional expenditure is still required to correct the immediate problem of lagoon inventory.

The advantages and disadvantages of each alternative are listed in Table 2.

Table 2. Alternative Advantages and Disadvantages		
Alternative no.	Benefit(s)	Drawback(s)
1	• Serves local agriculture • Avoids capital investment	• Land within an economic haul distance is difficult to find
2	• Provides flexibility to haul longer distances including to farms in eastern Oregon • Dewatered cake can be staged for contract removal • Mechanical dewatering is proven technology	• Adds cost to the program • Extra equipment (spreader, loader, tractor) required for operation • Geotube dewatering may be unreliable
3	Class product that is more marketable	• Generally higher cost
4	• Minimizes the need for capital investment • Can be implemented in a shorter timeframe	• Requires RFP development and bidding • Performance risk

Summary and Recommendations

The biosolids program has been unable to provide sufficient beneficial use of biosolids product to keep up with production. This has not been an issue as long as lagoon storage could accommodate the surplus. Now that the lagoon is full or near full, a solution for modifying or expanding the program is needed. Acquisition of a new tank truck in 2012 may relieve the problem, but the availability of sufficient land for expanding the program is undetermined.

In the short term, removing solids from the lagoon to renew storage capacity will buy time for determining the success of the slurry-based program and further evaluation of dewatering feasibility. Because the evaluation reported here is limited in scope, additional measures are recommended as follows:

- Complete a lagoon inventory as soon as possible to determine quantity and characteristics of stored biosolids inventory
- Develop an RFP for contract removal in Spring 2013 to renew storage capacity
- Undertake a more detailed facility planning process to define preferred equipment cost and program direction
- Test Geotube dewatering performance and reject the technology in favor of mechanical dewatering if percent solids of the product is unsatisfactory

Appendix H: Water Reuse Study

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Technical Memorandum

Prepared for: City of Troutdale, Oregon

Project Title: Water Reuse Evaluation for Troutdale Energy Center

Project No.: 143520.001.001

Technical Memorandum No. 1

Subject: Evaluation of Reuse Options

Date: May 30, 2013

To: Amy Pepper

From: Steve Wilson, C.P.S.S.

Prepared by: David Murray, P.E.

Reviewed by: Jim Hansen, P.E.
Project Manager

REGISTERED PROFESSIONAL ENGINEER
85PE
OREGON
July 22, 1977
DAVID STUART MURRAY

EXPIRES: 12/31/2014

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Limitations:

This document was prepared solely for City of Troutdale in accordance with professional standards at the time the services were performed and in accordance with the contract between City of Troutdale and Brown and Caldwell dated November 2, 2012. This document is governed by the specific scope of work authorized by City of Troutdale 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 City of Troutdale and other parties and, unless otherwise expressly indicated, have made no independent investigation as to the validity, completeness, or accuracy of such information.

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Section 1: Summary

The City of Troutdale, Oregon operates the Troutdale Water Pollution Control Facility (WPCF) which discharges treated wastewater to the Sandy River upstream of its confluence with the Columbia River. A proposal has been made by the Troutdale Energy Center, LLC (TEC) to use effluent for industrial cooling water at a new natural gas power plant located near the WPCF. TEC requires an estimated 3 to 5 million gallons per day (mgd) for operations. The WPCF could provide a significant portion of the flow through a new 24-inch recycled water line constructed by TEC. The City requested an evaluation by Brown and Caldwell (BC) to determine the feasibility of using existing infrastructure including effluent pumps and disinfection equipment to provide recycled water for the purpose of providing industrial cooling water, such as proposed by TEC and/or irrigation of the industrial properties in this area.

Oregon Department of Environmental Quality (DEQ) policy for Recycled Water (Internal Management Directive, June 19, 2009) and OAR 340 Div. 55 allow beneficial use of recycled water with Class C quality for industrial cooling. WPCF effluent does not meet Class C quality at the present time, but with minor improvements in disinfection this is possible. A constant flow of approximately 1.5 mgd can be delivered using effluent pumps with appropriate piping modifications. The peak pumping capacity would be at least 6 mgd if needed in the future. A sodium hypochlorite system can be added to ensure that disinfection standards for Class C water are met using the new pipeline to provide contact time. Filtration would be required to meet Class A water standards for the provision of recycled water for irrigation purposes. The sections below provide details.

Section 2: Background Information

2.1 Troutdale Water Pollution Control Facility

The WPCF is a conventional activated sludge plant with disinfection provided by ultraviolet (UV) disinfection. The WPCF is located approximately 2,800 feet north of Interstate 84 along the Sandy River within a flood control dike.

The design flow rates for the WPCF taken from the Predesign Report[1] are summarized in Table 1.

Table 1. WPCF Design Flow Rates

Condition	Average daily flow rate, mgd	Maximum month flow rate, mgd	Maximum day flow rate, mgd	Peak hour flow rate, mgd
Dry season	2.4	3.0	3.7	NA
Wet season	3.1	4.1	6.3	9.4

Flow rates in Table 1 were based on a buildout population of 19,150 people plus adjustments for variability in dwelling density and industrial/commercial uses. BC is currently evaluating the collection system for a sanitary sewer master plan and has developed flow projections that are somewhat lower. This is due to a lower projected buildout population and a lower per-capita water use rate.

The WPCF design was based on effluent discharge requirements listed in Table 2.

[1] CH2M-Hill, Troutdale Water pollution Control Facility Predesign Report, June 1999.

Table 2. WPCF Effluent Discharge Requirements					
Criteria	**Units**	**BOD, monthly**	**BOD, weekly**	**TSS, monthly**	**TSS, weekly**
Dry season	mg/L	10	15	10	15
Wert season	mg/L	30	45	30	45

BOD = Biochemical oxygen demand.

TSS = Total suspended solids.

Disinfection requirements include a maximum of *126 E. coli* per 100 mL on a 7 day geometric mean basis and a single sample maximum value of 406 *E. coli* per 100 mL.

2.2 Water Quality Information

This section discusses the impact of water quality data on the evaluation of reuse potential. WPCF performance reports from January 2009 to January 2013 were reviewed. The geometric mean of all reported *E. coli* values in the range was 3 to 6 organisms per 100 mL. The highest *E. coli* value was 315 organisms per 100 mL. This indicates that the system met permit disinfection requirements for the period. The WPCF has collected total coliform data for the past several weeks to compare to the *E. coli* values. This information is provided in Table 3.

Table 3. Recent Total Coliform Bacterial Data			
Date sample collected	**Total coliform per 100 mL**	***E. coli* per 100 mL**	**Ratio, TC to *E. coli***
February 20, 2013	156.5	3.1	50.5
February 25, 2013	122.4	3	40.8
March 5, 2013	20.1	1	20.1
March 13, 2013	146.4	<1	>146.4
April 1, 2013	101.7	13.5	7.5
Median	122.4	*3*	
Geometric Mean	89.4	2.6	

The limited amount of total coliform data indicate that the disinfection will not meet Class C performance criteria as currently designed and operated (as shown in Section 3.1). A typical total coliform to *E. coli* ratio for wastewater is around 3:1. The higher ratios reported may indicate that some portion of the total coliform bacteria are particle associated.

Current flow rates based on data collected from January 2009 to December 2012 show average daily flow rates of 1.52 mgd, minimum daily flow rates of 0.95 mgd, and maximum daily flow rates of 3.02. Dependable annual flow delivery will run from 1 mgd to 1.5 mgd. Peak instantaneous flows up to approximately 7.9 mgd were recorded (April 23, 2009).

Section 3: Recycled Water Evaluation

This section discusses the potential for reuse of recycled water for the TEC project.

3.1 Water Reuse Regulations

The DEQ has established water quality criteria for the reuse of water for a variety of beneficial uses. These criteria are summarized in Table 4.

Table 4. Recycled Water Disinfection Requirements

Class	Treatment prior to disinfection	Criteria	7-day median or mean	30 day maximum	Sampling frequency
A	Oxidized and filtered	Total coliform/100 mL	2.2	23	Daily
B	Oxidized	Total coliform/100 ml	2.2	23	3/week
C	Oxidized	Total coliform/100 mL	23	240	1/week
D	Oxidized	*E. coli*	126	406	1/week
Nondisinfected	oxidized	None	NA	NA	NA

It is expected that Class C water will be required for delivery to the TEC project under the category of industrial cooling. Other uses of reclaimed water, such as for landscape irrigation in an office park setting, would require Class A recycled water.

3.2 Off-Site Pumping

The WPCF has an effluent pump station with design criteria as listed in Table 5. Disinfected secondary effluent flows by gravity from the UV disinfection system into the effluent pump station wet well. There are four identical submersible pumps with one being a standby unit. Each pump has the ability to pump about 3.5 mgd to the outfall. The pumps are valved such that any one pump or combination of pumps can be used to convey disinfected effluent from the WPCF to the river. A separate pipe runs to the sludge storage lagoon. A magnetic flow meter is installed in the pump discharge system.

Table 5. Effluent Pump Station Design Criteria

Pump no.	Horsepower	Capacity at TDH, mgd	TDH, feet	Operating condition	Type
1	32	3.56	33	Service	Submersible with AFD
2	32	3.56	33	Service	Submersible with AFD
3	32	3.56	33	Service	Submersible with AFD
4	32	3.56	33	Standby	Submersible with AFD

A schematic diagram of the existing effluent pump station is provided as Figure 1.

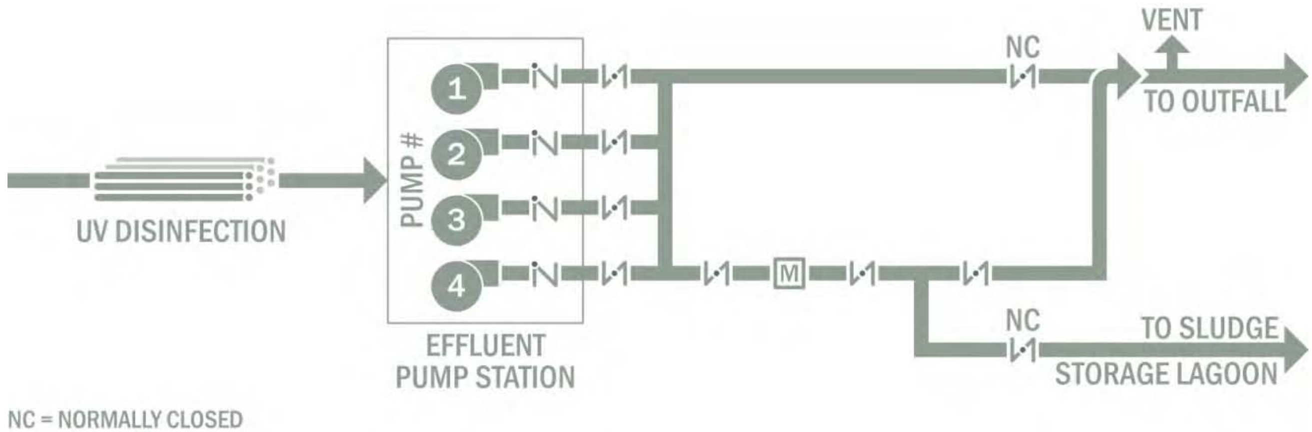

Figure 1. Existing effluent pump station schematic

Figure 2 shows the recommended pumping system following modifications in blue. The modified effluent pump station would include a pipe tied into the pressurized discharge pipe and feeding the force main to the TEC facility. The force main would have a modulating valve and flow meter to control the amount of water delivered to the TEC. Modulating valves of the pipelines leading to the WPCF outfall are also required to maintain adequate flow capacity to the TEC. The proposed modifications are all to the effluent pump station piping. The pumps are adequate and do not require any modifications. A sodium hypochlorite feed point in the force main feeding the TEC is required to provide a chlorine residual or additional disinfection as discussed below.

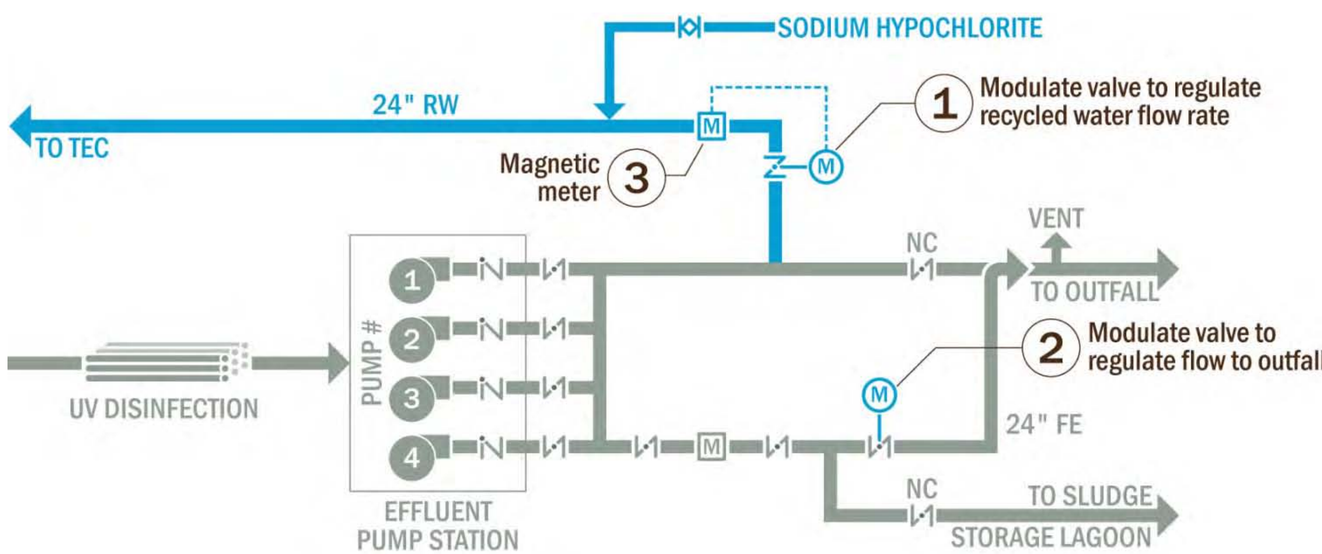

Figure 2. Modified effluent pumping system

The effluent pump station is suitable for use to convey recycled water to the TEC project area provided piping and control system modifications are made. The conveyance pipeline will be approximately 1,800 feet long. The pipeline will be relatively flat between the WPCF and the TEC. Assuming about 15 feet of static lift between the effluent pump station and the TEC water treatment facility, friction and minor hydraulic losses should be kept to about 5 feet in the system.

The TEC Predesign Report identifies two cases for using recycled WPCF effluent. Both cases indicate a peak flow demand of 1.5 mgd for Troutdale effluent. This flow rate needs to be confirmed since other information indicates that the TEC could uses larger amounts of flow in the future. The pipeline should be sized for the largest future potential demand so that a second parallel pipeline is not required. Table 6 lists the required pipeline sizes for various flow rates assuming a maximum dynamic head loss of 5 feet.

Table 6. Conveyance Pipeline Sizing

Flow rate, mgd/gpm	Pipeline diameter, inches	Head loss, feet	Pumps in operation
1.5/1,040	12	5.4	1
3.0/2,080	18	2.6	1
4.5/3,120	20	3.4	1
6.0/4,160	24	2.4	2
9.4/6,530	24	5.4	2

The conveyance pipeline to the TEC should be 24 inches in diameter to provide for minimum head loss and increased detention time should hypochlorite feed be required to meet Class C recycled water requirements. This is the diameter of the pipeline recommended in the TEC report. At the 1.5 mgd projected flow rate from the TEC report, the detention time in a 24-inch-diameter pipeline is approximately 40 minutes which should be adequate to meet disinfection needs.

3.3 Disinfection Requirements

The WPCF currently uses a medium pressure lamp UV disinfection system supplied by Trojan Technologies, Inc. This system has the design criteria listed in Table 7.

Table 7. BC UV Disinfection System Design Criteria

Criteria	Units	Value at dry weather flow of 3 mgd	Value at wet weather flow of 9.4 mgd	Notes
UV dose	mW-seconds/cm^2	42.0	26.8	One bank out of service at dry weather flow condition
UV transmittance	percent	55	55	At 254 nm wavelength
Channels	number	1	1	
Banks per channel	number	2	2	
Modules per bank	number	5	5	
Lamps per module	number	4	4	
Lamps, total operating	number	20	40	One bank out of service at dry weather flow condition
Power draw	KVA	56	112	Assumes full lamp power used

3.3.1 Capacity of Existing UV Disinfection System

The current medium pressure UV disinfection system has adequate capacity to disinfect up to 9.4 mgd while meeting the standards for river discharge under the WPCF's National Pollutant Discharge Elimination System (NPDES) permit.[2] The performance data provided supports compliance with the NPDES permit requirements. The system does not currently produce effluent meeting Class C Recycled water standards. There are several potential solutions:

1. Increase the UV dose by adding additional capacity or down rating the system peak flow capacity.
2. Provide upstream filtration to remove particle-associated bacteria.
3. Add sodium hypochlorite downstream of UV disinfection in the water flow sent to the TEC facility.

3.3.2 Filtration Requirements

Filtration would not be needed to meet Class C recycled water criteria requirements for the TEC project. Filtration would be required to meet Class A requirements for unrestricted recycled water application if Class A recycled water use is implemented in the future.

3.3.3 Modifications to WPCF Disinfection System to Meet Class C Requirements

The disinfection system modifications mentioned in paragraph 3.3.1 are discussed below:

The existing UV system is designed for a UV transmittance (UVT) value of 55 percent at a peak flow rate of 9.4 mgd. Since the UVT is higher and the average flow rates are much lower, it may be feasible to operate the existing system at a higher UV dose rate to produce Class C recycled water. This can be determined by performing operating tests on the existing UV system. If feasible, the option would not require additional UV system capacity, but would incur higher power and lamp replacement costs.

If the total coliform values measured are due to particle associated bacteria, filtration upstream of UV may allow the plant to meet Class C recycled water criteria without substantial changes to UV system operations. Bacterial (total coliform) tests on filtered effluent samples would determine if this is feasible. Filtration would involve a substantial capital cost and is not recommended unless the City decides to develop a Class A recycled water program in the future. The cost to provide filtration meeting recycled water standards for Class A reuse or to simply improve UV system performance at a flow rate of 1.5 mgd is estimated at $2.6 million. This cost is a planning level estimate including site work, pumping, mechanical, structural, and electrical and controls. A 30 percent planning level contingency is included.

Addition of sodium hypochlorite downstream of UV disinfection on the effluent stream pumped to TEC is likely to meet Class C requirements. The necessary hypochlorite dose and contact time would need to be determined by bench scale testing prior to design. BC has designed similar reuse facilities using sodium hypochlorite and determined that it is feasible to achieve Class C or better water quality at a concentration-dose product (CT) of 40 to 80. The CT value required is site specific due to water quality considerations, but a hypochlorite dose of 2 to 6 mg/L would likely be needed to produce a CT value of 80 mg/L-min at flow rates up to 4.5 mgd. Daily hypochlorite use amounts would range from 37 pounds to 225 pounds. Figure 3 provides a schematic of a suitable hypochlorite storage and feed system to accomplish this objective. It would be housed in a new structure.

[2] CH2M-Hill, Technical Evaluation Report for the development of an NPDES Permit for the Troutdale Energy Center, Troutdale, Oregon, December 2012.

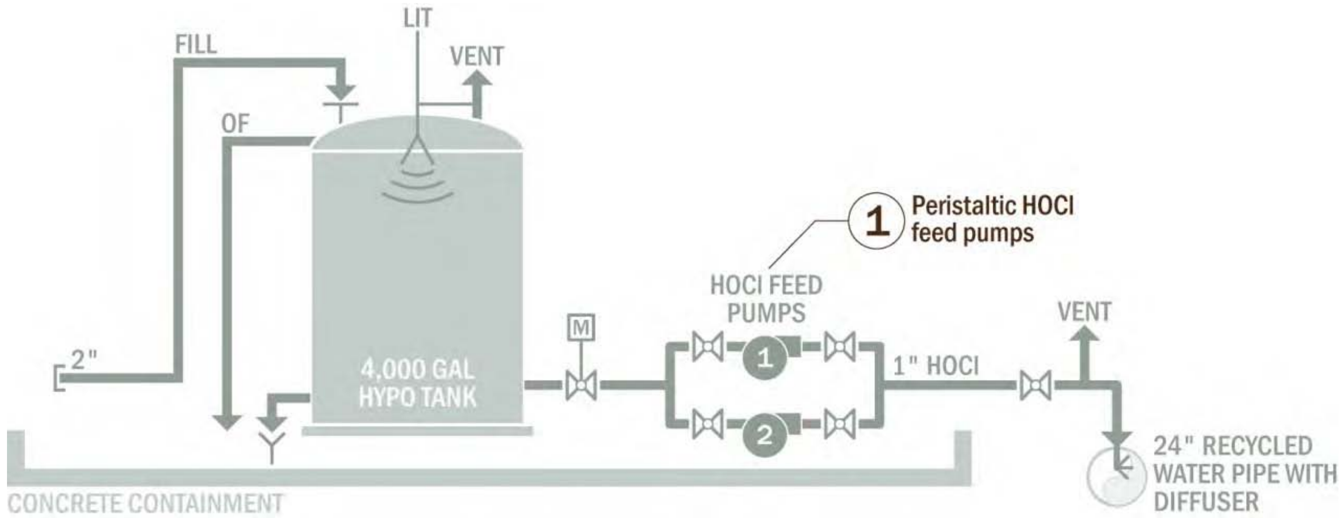

Figure 3. Sodium hypochlorite storage and feed system schematic

Section 4: Conclusions

The Troutdale WPCF can provide recycled water for the TEC project as summarized below:

- Class C quality water is required for recycled water use for industrial cooling. The City has negotiated an agreement with DEQ which allows TEC to receive treated effluent at its current quality level and provide whatever additional on-site treatment is required by DEQ to meet Class C quality requirements. These water quality requirements will be included in the future TEC discharge permit.
- The existing effluent pump station can be modified to transfer recycled water to the TEC facility.
- A 24-inch-pipeline from the WPCF to the TEC is recommended.
- City should continue negotiations to deliver treated effluent at its current quality level with additional treatment to be provided by TEC under its future discharge permit. Alternatively, sodium hypochlorite can be injected at the effluent pump station and utilize conveyance piping to provide contact time. If the City chooses the latter approach, TEC should fund the improvement and provide compensation for operation and maintenance.
- Addition of sodium hypochlorite is the likely most cost effective option to achieve Class C water quality requirements for recycled water. Maintenance of a minimum chlorine residual (0.2 to 0.5 mg/L) is normally required in recycled water for control of regrowth.
- A sodium hypochlorite dose of 2 mg/L to 6 mg/L is expected to meet Class C recycled water criteria given the good quality of the disinfected effluent currently produced at the WPCF.
- Increasing the UV dose by down-rating the UV system capacity is also a possible option.
- The construction cost of the recommended pump station modifications and sodium hypochlorite feed facilities is estimated to be $454,000. See Attachment A for the detailed cost estimate.
- Class A quality water is required for recycled water use for unrestricted irrigation use. To meet Class A quality requirement, filtration would have to be installed.

Appendix I: Financial Plan Report

FINANCIAL PLAN

This chapter provides a financial plan that will allow the City to implement its capital improvement program while meeting its other financial obligations, including policy objectives. The two components of this plan are (1) the computation of a system development charge and (2) a revenue requirement analysis.

SYSTEM DEVELOPMENT CHARGES

System development charges (SDCs) are one-time fees imposed on new and increased development to recover the cost of system facilities needed to serve that growth. This section provides the rationale and calculations for a proposed wastewater SDC.

Methodology

An SDC can include two components: (1) a reimbursement fee and (2) an improvement fee.

Reimbursement Fee

The reimbursement fee is based on the cost of available capacity per unit of growth that such available capacity will serve. In order for a reimbursement fee to be calculated, unused capacity must be available to serve future growth. For facility types that do not have available capacity, no reimbursement fee may be charged.

Improvement Fee

The improvement fee is based on the cost of capacity-increasing capital projects per unit of growth that those projects will serve. In reality, the capacity added by many projects serves a dual purpose of both meeting existing demand and serving future growth. To compute a compliant improvement fee, growth-related costs must be isolated, and costs related to current demand must be excluded.

We have used the “capacity approach” to allocate costs to the improvement fee basis. Under this approach, the cost of a given project is allocated to growth in proportion to the growth-related capacity that projects of a similar type will create.

Growth should be measured in units that most directly reflect the source of demand. For the City’s sanitary sewer utility, growth is measured in equivalent residential units (ERUs). One ERU represents the sanitary sewer service needs of an average single-family residence.

Adjustments

ORS 223.307(5) authorizes the expenditure of SDCs on “the costs of complying with the provisions of ORS 223.297 to 223.314, including the costs of developing system development charge methodologies and providing an annual accounting of system development charge expenditures.” To avoid spending monies for compliance that might otherwise have been spent on growth-related projects, this report includes an estimate of compliance costs in its SDC rates.

A second adjustment is the deduction of existing SDC fund balance(s) from eligible costs. If this adjustment were not made, the City could collect more SDCs than it could legally spend.

Growth

The City's current sanitary sewer customer base is 4,631 customers, or 6,477 ERUs. Based on projected growth rates, the City will add 4,041 ERUs during the planning period. **Exhibit 1** presents the calculations behind this projected growth:

Growth in Customer Units Exhibit 1

Row	Description	Source or Calculation	Value
a	Number of Customers in 2012	Brown & Caldwell	4,631
b	Projected Number of Customers	Brown & Caldwell	7,520
c	Cumulative Growth Rate	(b / a) - 1	62.4%
d	Existing Number of ERUs	City Staff	6,477
e	Future Number of ERUs	d * (1 + c)	10,518
f	Incremental Growth	e - d	4,041
g	Growth's Share	f / e	38.4%

Source: See sources cited above

Eligible Costs

The City has SDC-eligible costs in both its existing sanitary sewer facilities and its planned capital projects.

Reimbursement Fee

Because the City's sanitary sewer infrastructure has excess capacity that is available to serve growth, the City can charge a reimbursement fee as part of its sewer SDC. **Exhibit 2** summarizes the SDC-eligible cost of available capacity:

Reimbursement Fee Exhibit 2

Asset Category	Utility Funded Original Cost	SDC Eligibility	SDC-Eligible Cost
Land	$ 858,378	54.3%	$ 465,977
Land Improvements	90,983	54.3%	49,391
Buildings	438,455	54.3%	238,018
Infrastructure - Manholes	232,087	30.7%	71,362
Infrastructure - Piping	565,318	30.7%	173,825
Infrastructure - Pumps	9,324	54.3%	5,061
Infrastructure - Lift Stations	1,151,803	50.5%	581,253
Infrastructure - WWTP	9,680,019	54.3%	5,254,867
Infrastructure - Scada System	183,566	38.4%	70,522
Equipment	28,868	38.4%	11,090
Vehicles	321,913	38.4%	123,671
TOTAL	**$ 13,560,713**	**25.9%**	**$ 7,045,038**
Incremental Growth in Number of ERUs			4,041
Reimbursement Fee per ERU			**$ 1,743**

Source: City staff, Brown & Caldwell
For furter detail please refer to Technical Appendices

When the SDC-eligible cost of $7,045,038 is divided by the expected growth of 4,041 ERUs, the resulting reimbursement fee is $1,743 per ERU.

Improvement Fee

Based on the capital improvement plan developed by Brown & Caldwell and City staff, the City will construct sanitary sewer facilities with an estimated cost of $17,211,950 over the planning period. It is anticipated that $10,837,950 of this amount will be funded by utility sources (i.e. rate, SDC revenues, and other revenue sources of the utility). The rest is expected to be funded by developer contributions, local improvement districts (LIDs), and other outside funding sources. Most of these projects will not serve growth exclusively. **Exhibit 3** shows the growth-related portion of the planned sanitary sewer projects.

Improvement Fee — **Exhibit 3**

Project	Total Cost	Portion to be Funded by the Utility	SDC Eligibility	SDC-Eligible Cost
Proposed Capital Projects (provided by Brown & Caldwell)				
Sewer Upgrades				
Buxton Road	$ 501,000	$ 501,000	38.4%	$ 192,472
Lower Beaver Creek / Troutdale Road	3,417,000	3,417,000	38.4%	1,312,728
Airport / Graham	646,000	-	0.0%	-
PS-9 Trunk	253,000	-	0.0%	-
Pump Station and Force Main Upgrades				
PS-1, new force main (10-inch, 3,560 feet)	2,690,000	2,690,000	100.0%	2,690,000
PS-2	369,000	369,000	100.0%	369,000
PS-5, new pumps (2,500 gpm / 3.6 mgd)	454,000	454,000	0.0%	-
PS-7, new pumps (400 gpm / 0.58 mgd)	145,000	145,000	0.0%	-
PS-9, new pumps (450 gpm / 0.65 mgd)	242,000	-	0.0%	-
SE Jackson Park Road	950,000	475,000	90.0%	427,500
East Historic Columbia River Highway	3,250,000	1,625,000	95.8%	1,556,338
Troutdale Reynolds Industrial Park (TRIP) Extensions	3,133,000	-	100.0%	-
Additional Capital Projects (provided by City Staff)				
Vehicle Replacement Program	72,000	72,000	0.0%	-
FY 2012-13 Budgeted Capital Improvement Projects				
Funded from Sewer Fund	544,200	544,200	0.0%	-
Funded from Sewer Improvement Fund	30,000	30,000	100.0%	30,000
FY 2013-14 Budgeted Capital Improvement Projects	515,750	515,750	0.0%	-
TOTAL CIP	**$ 17,211,950**	**$ 10,837,950**	**60.7%**	**$ 6,578,038**
Less: Adjustment for Projected Sewer Improvement Fund Balance on June 30, 2013				(74,560)
Net Improvement Fee Cost Basis				**$ 6,503,478**
Incremental Growth in Number of ERUs				4,041
Improvement Fee per ERU				**$ 1,609**

Source: City staff, Brown & Caldwell
For furter detail please refer to Technical Appendices

The resulting total SDC-eligible cost is $6,503,478. Data obtained from City staff indicates that the sewer improvement fund balance at the beginning of the planning period will be $74,560. The projected available fund balance is deducted from the SDC eligible cost to arrive at the net improvement fee cost basis, $6,503,478. When the net improvement fee cost basis of $6,503,478 is divided by the expected growth of 4,041 ERUs, the resulting improvement fee is $1,609 per ERU.

If the City decides to include one or more capacity-increasing sanitary sewer projects in its capital improvement plan that are not listed in **Exhibit 3**, we recommend that the projects be added to the list and that the eligible portion of those projects be added to the improvement fee cost basis. The revised cost basis should then be used to recalculate the SDC.

Recommended System Development Charge

The recommended sanitary sewer SDC is the sum of the reimbursement fee and the improvement fee, adjusted by an administrative cost recovery factor of 1.78%, or $60. The administrative cost recovery factor was derived by dividing annual SDC program accounting and administrative costs, including the amortized cost of this study, by forecasted annual SDC revenues. The resulting recommended SDC is $3,412 per ERU. **Exhibit 4** summarizes the components of the proposed sanitary sewer SDC. The proposed SDC represents a decrease from the current SDC of $4,495 per ERU.

SDC Components — **Exhibit 4**

Description		Amount
Reimbursement Fee		$ 1,743
Improvement Fee		1,609
SDC Subtotal		$ 3,352
plus: Administrative Cost Recovery	1.78%	60
TOTAL SDC per ERU		**$ 3,412**
Current SDC per ERU		$ 4,495
Proposed Change		-24.09%

System Development Charge Credits

A credit is a reduction in the amount of the SDC for a specific development. The Oregon SDC Act requires that credit be allowed for the construction of a "qualified public improvement" which (1) is required as a condition of development approval, (2) is identified in the City's capital improvements program, and (3) either is not located on or contiguous to property that is the subject of development approval, or is located on or contiguous to such property and is required to be built larger or with greater capacity than is necessary for the particular development project.

The credit for a qualified public improvement may only be applied against an SDC for the same type of improvement (e.g., a sanitary sewer improvement can only be used for a credit for a future sanitary sewer SDC), and must be granted only for the cost of that portion of an improvement which exceeds the minimum standard facility size or capacity needed to serve the particular project up to the amount of the improvement fee. For multi-phase projects, any excess credit may be applied against SDCs that accrue in subsequent phases of the original development project.

In addition to these required credits, the City may, if it so chooses, provide a greater credit, establish a system providing for the transferability of credits, provide a credit for a capital improvement not identified in the City's SDC Capital Improvements Plan, or provide a share of the cost of an improvement by other means (i.e., partnerships, other City revenues, etc.).

Indexing System Development Charge for Inflation

Oregon law (ORS 223.304) also allows for the periodic indexing of system development charges for inflation, as long as the index used is

> “(A) A relevant measurement of the average change in prices or costs over an identified time period for materials, labor, real property or a combination of the three;
>
> (B) Published by a recognized organization or agency that produces the index or data source for reasons that are independent of the system development charge methodology; and
>
> (C) Incorporated as part of the established methodology or identified and adopted in a separate ordinance, resolution or order.”

We recommend that the City index its charges to the *Engineering News Record (ENR)* Construction Cost Index (CCI) for the City of Seattle, and adjust its charges annually. There is no comparable Oregon-specific index.

REVENUE REQUIREMENT ANALYSIS

This section presents a financial analysis that reveals how much rate revenue would be required to meet operational and capital needs within contractual and policy constraints over the next ten years.

Criteria

At least two separate conditions must be satisfied in order for rates to be sufficient. First, the sanitary sewer utility must generate revenues adequate to meet cash needs. Second, revenues must satisfy bond coverage requirements (if there are any).

Revenues should be sufficient to satisfy both tests. If revenues are found to be deficient by one or more of the tests, then the greater deficiency drives the rate increase.

Cash Flow

The cash flow test identifies all cash requirements as projected in each given year. Cash requirements include operations and maintenance expenses, debt service payments, policy-driven additions to working capital, and capital improvement costs. These expenses are compared to total projected annual revenues, including interest on fund balances. Shortfalls are then used to estimate the necessary rate increases.

Bond Coverage

The bond coverage test is based on a commitment made by the City when issuing revenue bonds. As a security condition of issuance, the City is required per covenant to agree that the revenue bond debt would have a higher priority for payment (a senior lien) than most other utility expenditures; the only outlays with a higher lien are O&M expenses. Debt service coverage is expressed as a multiplier of the annual revenue bond debt service payment. For example, a 1.0 coverage factor would imply no additional cushion is required. A 1.25 coverage factor means revenues must be sufficient to pay O&M expenses, annual revenue bond debt service payments, plus an additional 25% of annual revenue bond debt service payments. The excess cash flow derived from the added coverage, if any, can be used for any utility purpose, including funding capital projects. The sanitary sewer utility does not have any outstanding revenue bond debt, and for purposes of this analysis, no revenue bond debt is assumed for financing the proposed capital improvement projects.

Projected Financial Performance

Data and Assumptions

A financial model measures the interaction of multiple assumptions over time, and is therefore only as good as those assumptions. The revenue requirement analysis is based on the following data, assumptions, and adjustments:

- The FY2014 budget is used as the basis of the analysis.
- Rate revenues under existing rates are calculated to increase with customer growth. With the concurrence of City staff, annual customer growth rates are assumed to be 0.25% throughout the analysis period.
- Labor costs (i.e. salaries and wages) are escalated annually at 3%.
- Benefit costs are escalated annually at 10%.
- Other operating and maintenance expenses are escalated annually at 3%.
- Per City staff's direction, the following additional O&M expenses are included in the FY2014 baseline budget:
    - $30,000 per year for CCTV inspection, escalated at 3% annually.
    - $250,000 in FY 2014, and $150,000 per year thereafter for biosolids lagoon handling, escalated annually at 3%.
- The City's annual fund interest earnings rate is assumed to be 0.25% in FY2014. From this level, it is assumed to increase by 25 basis points (i.e., 0.25%) every other year, reaching 1.5% in 2021 and remaining at that level for the rest of the analysis period.
- Proposed capital projects are assumed to be implemented over a15-year period, starting in FY2014. Capital costs are escalated annually at 4%.

- SDC revenues are assumed to be entirely used for the utility improvement fund's proportionate share (i.e., 39%) of the debt service payments for the utility's outstanding G.O. bond. Based on City staff's direction, it is assumed that any SDC revenue deficiency with respect to bond payments will be covered by property tax proceeds and there will be no impact on utility finances and rates.
- 28% of the annual debt service payments for the utility's outstanding G.O. bond (approximately $352,000 per year) are assumed to be made by the utility fund (i.e. rates) as originally planned.

Projections

Exhibit 5 summarizes the resulting projected financial performance and rate revenue requirements of the sanitary sewer utility for a ten-year period (i.e. FY2014 through FY2023).

Revenue Requirements — Exhibit 5

	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018	FY 2019	FY 2020	FY 2021	FY 2022	FY 2023
Revenues										
Rate Revenues Under Existing Rates	$ 2,536,560	$ 2,542,901	$ 2,549,259	$ 2,555,632	$ 2,562,021	$ 2,568,426	$ 2,574,847	$ 2,581,284	$ 2,587,737	$ 2,594,207
Non-Rate Revenues	78,750	78,893	78,878	35,638	35,408	36,112	36,703	38,483	38,700	38,915
Total Revenues	**$ 2,615,310**	**$ 2,621,795**	**$ 2,628,136**	**$ 2,591,270**	**$ 2,597,429**	**$ 2,604,537**	**$ 2,611,550**	**$ 2,619,767**	**$ 2,626,437**	**$ 2,633,122**
Expenses										
Cash Operating Expenses	$ 2,260,042	$ 2,241,796	$ 2,332,505	$ 2,428,130	$ 2,529,030	$ 2,627,320	$ 2,731,223	$ 2,841,174	$ 2,957,648	$ 3,081,165
Existing Debt Service	353,736	356,526	357,275	358,904	359,632	-	-	-	-	-
Rate Funded CIP	28,242	71,801	174,564	258,968	283,888	310,646	115,226	-	-	78,676
Total Expenses	**$ 2,642,021**	**$ 2,670,123**	**$ 2,864,344**	**$ 3,046,002**	**$ 3,172,549**	**$ 2,937,966**	**$ 2,846,450**	**$ 2,841,174**	**$ 2,957,648**	**$ 3,159,841**
Annual Rate Adjustment	**0.00%**	**5.25%**	**5.25%**	**5.25%**	**5.25%**	**0.00%**	**0.00%**	**0.00%**	**0.00%**	**0.00%**
Cumulative Rate Adjustment	0.00%	5.25%	10.78%	16.59%	22.71%	22.71%	22.71%	22.71%	22.71%	22.71%
Rate Revenues After Rate Increase	$ 2,536,560	$ 2,676,404	$ 2,823,957	$ 2,979,645	$ 3,143,917	$ 3,151,777	$ 3,159,656	$ 3,167,555	$ 3,175,474	$ 3,183,413
Net Cash Flow After Rate Increase	(26,711)	85,174	38,491	(30,719)	6,776	249,922	349,910	364,865	256,526	62,487
Monthly Rates per ERU	$ 33.04	$ 34.77	$ 36.60	$ 38.52	$ 40.54	$ 40.54	$ 40.54	$ 40.54	$ 40.54	$ 40.54

For furter detail please refer to Technical Appendices

As shown in **Exhibit 5**, revenues under the existing rates are not sufficient to fund projected rate needs. The projected revenue deficiency is primarily due to funding of the proposed capital improvement program and projected inflationary increases in O&M expenses.

It is projected that the City will need to increase its sanitary sewer rates by 5.25% annually in each of the next 4 years (i.e. FY 2015 through FY 2018). It should be noted that the 4% rate adjustment the City has implemented for the FY 2014 is already reflected in the budgeted revenues (i.e. rate revenues under existing rates). The analysis assumes that the rate adjustments would be implemented at the beginning of each fiscal year, and the new rates will be in effect for the entire year.

It is important to note that these projections are based upon current assumptions and the proposed capital program. Circumstances might change over time, causing actual rate adjustment needs to be higher or lower once actual costs are known. It is imperative that the City track its costs as they become available and compare them to assumptions used in the study. If significant changes occur, the City should revisit the analysis and make appropriate changes.

REVENUE CALCULATIONS

City of Troutdale, OR
Wastewater System Financial Plan Update & SDC Study
Summary

Capital Funding	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Total Capital Projects	**$ 947,249**	**$ 710,683**	**$ 725,612**	**$ 768,675**	**$ 784,822**	**$ 831,399**	**$ 848,864**	**$ 899,241**	**$ 918,131**	**$ 972,619**
Other Outside Sources	441,931	459,608	477,992	497,112	516,996	537,676	559,183	581,551	604,813	629,005
Use of SDC Fund Balance	-	-	-	-	-	-	-	-	-	-
Use of Capital Fund Balance	919,007	638,882	551,049	509,707	500,935	520,753	733,637	899,241	918,131	893,943
Direct Rate Funding	28,242	71,801	174,564	258,968	283,888	310,646	115,226	-	-	78,676
Total Funding Sources	**$ 1,389,180**	**$ 1,170,291**	**$ 1,203,604**	**$ 1,265,787**	**$ 1,301,819**	**$ 1,369,075**	**$ 1,408,047**	**$ 1,480,792**	**$ 1,522,944**	**$ 1,601,624**

Revenue Requirements	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Revenues										
Rate Revenues Under Existing Rates	$ 2,536,560	$ 2,542,901	$ 2,549,259	$ 2,555,632	$ 2,562,021	$ 2,568,426	$ 2,574,847	$ 2,581,284	$ 2,587,737	$ 2,594,207
Non-Rate Revenues	78,750	78,893	78,878	35,638	35,408	36,112	36,703	38,483	38,700	38,915
Total Revenues	**$ 2,615,310**	**$ 2,621,795**	**$ 2,628,136**	**$ 2,591,270**	**$ 2,597,429**	**$ 2,604,537**	**$ 2,611,550**	**$ 2,619,767**	**$ 2,626,437**	**$ 2,633,122**
Expenses										
Cash Operating Expenses	$ 2,260,042	$ 2,241,796	$ 2,332,505	$ 2,428,130	$ 2,529,030	$ 2,627,320	$ 2,731,223	$ 2,841,174	$ 2,957,648	$ 3,081,165
Existing Debt Service	353,736	356,526	357,275	358,904	359,632	-	-	-	-	-
New Debt Service	-	-	-	-	-	-	-	-	-	-
Rate Funded CIP	28,242	71,801	174,564	258,968	283,888	310,646	115,226	-	-	78,676
Rate Funded System Reinvestment	-	-	-	-	-	-	-	-	-	-
Additions Req. to Meet Min. Op. Fund B	-	-	-	-	-	-	-	-	-	-
Total Expenses	**$ 2,642,021**	**$ 2,670,123**	**$ 2,864,344**	**$ 3,046,002**	**$ 3,172,549**	**$ 2,937,966**	**$ 2,846,450**	**$ 2,841,174**	**$ 2,957,648**	**$ 3,159,841**
Annual Surplus / (Deficiency)	**$ (26,711)**	**$ (48,328)**	**$ (236,207)**	**$ (454,732)**	**$ (575,121)**	**$ (333,429)**	**$ (234,899)**	**$ (221,407)**	**$ (331,211)**	**$ (526,719)**
Annual Rate Adjustment	**0.00%**	**5.25%**	**5.25%**	**5.25%**	**5.25%**	**0.00%**	**0.00%**	**0.00%**	**0.00%**	**0.00%**
Cumulative Rate Adjustment	*0.00%*	*5.25%*	*10.78%*	*16.59%*	*22.71%*	*22.71%*	*22.71%*	*22.71%*	*22.71%*	*22.71%*
Rate Revenues After Rate Increase	$ 2,536,560	$ 2,676,404	$ 2,823,957	$ 2,979,645	$ 3,143,917	$ 3,151,777	$ 3,159,656	$ 3,167,555	$ 3,175,474	$ 3,183,413
Net Cash Flow After Rate Increase	(26,711)	85,174	38,491	(30,719)	6,776	249,922	349,910	364,865	256,526	62,487
Coverage After Rate Increases	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

Fund Balances	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Operating Fund	$ 278,635	$ 275,563	$ 285,095	$ 254,376	$ 261,152	$ 320,320	$ 332,211	$ 346,668	$ 361,019	$ 376,238
Capital (Reserve) Fund	638,882	551,049	509,707	500,935	520,753	733,637	904,539	950,824	893,943	689,682
SDC Fund	-	-	-	-	-	-	-	-	-	-
Debt Reserve Fund	-	-	-	-	-	-	-	-	-	-
Total	**$ 917,518**	**$ 826,612**	**$ 794,802**	**$ 755,311**	**$ 781,905**	**$ 1,053,958**	**$ 1,236,750**	**$ 1,297,492**	**$ 1,254,962**	**$ 1,065,920**
Combined Minimum Target Balance	$ 468,414	$ 473,472	$ 487,083	$ 502,536	$ 518,029	$ 534,416	$ 550,831	$ 569,462	$ 588,210	$ 608,082

City of Troutdale, OR
Wastewater System Financial Plan Update & SDC Study
Assumptions

	Economic & Financial Factors	Fiscal Year Ending 6/30:	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
1	General Cost Inflation		3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%
2	Construction Cost Inflation		0.00%	4.00%	4.00%	4.00%	4.00%	4.00%	4.00%	4.00%	4.00%	4.00%	4.00%
3	Labor Cost Inflation		3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%
4	Benefit Cost Inflation		10.00%	10.00%	10.00%	10.00%	10.00%	10.00%	10.00%	10.00%	10.00%	10.00%	10.00%
5	General Inflation plus Growth		3.26%	3.26%	3.26%	3.26%	3.26%	3.26%	3.26%	3.26%	3.26%	3.26%	3.26%
6	(Other)		0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
7	(Other)		0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
8	No Escalation		0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	Fund Earnings		0.25%	0.25%	0.50%	0.50%	0.75%	0.75%	1.00%	1.00%	1.50%	1.50%	1.50%
	City Franchise Fee Rate		5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%
9	Customer Growth		0.25%	0.25%	0.25%	0.25%	0.25%	0.25%	0.25%	0.25%	0.25%	0.25%	0.25%
	Cumulative Customer Growth		0.25%	0.50%	0.75%	1.00%	1.26%	1.51%	1.76%	2.02%	2.27%	2.53%	2.78%

City of Troutdale, OR
Wastewater System Financial Plan Update & SDC Study
Assumptions

Accounting Assumptions	Fiscal Year Ending 6/30:	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
FISCAL POLICY RESTRICTIONS												
Min. Op. Fund Balance Target (days of O&M expense)		30	30	30	30	30	30	30	30	30	30	30
Max. Op. Fund Balance (days of O&M expense)		45	45	45	45	45	45	45	45	45	45	45
Minimum Capital Fund Balance Target												
Select Minimum Capital Fund Balance Target	1	**Defined as % of Plant**										
1 - Defined as % of Plant												
Plant-in-Service in 2012	$ 27,318,439											
Minimum Capital Fund Balance - % of plant assets		1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%
2 - Amount at Right ==>												
RATE FUNDED SYSTEM REINVESTMENT												
Select Reinvestment Funding Strategy	4	**System Reinvestment is not Funded**										
Amount of Annual Cash Funding from Rates												
1 - Equal to Annual Depreciation Expense												
2 - Equal to Annual Depreciation Expense less Annual Debt Principal Payments												
3 - Equal to Amount at Right ==>		$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
4 - Do Not Fund System Reinvestment												
System Reinvestment Policy Implementation (%)		100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%

City of Troutdale, OR
Wastewater System Financial Plan Update & SDC Study
Assumptions

Capital Financing Assumptions	Fiscal Year Ending 6/30:	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
SYSTEM DEVELOPMENT CHARGE (SDC) REVENUES												
Select SDC Alternative	1	Current Charge is in use										
1 - User Input (Current Charge)	$ 4,495	per ERU										
2 - Calculated Charge												
Total Residential Customer Equivalents		6,319	6,335	6,351	6,367	6,383	6,399	6,415	6,431	6,447	6,463	6,479
System Development Charge Revenues		$ 10,000	$ 40,000	$ 71,191	$ 71,369	$ 71,547	$ 71,726	$ 71,905	$ 72,085	$ 72,265	$ 72,446	$ 72,627
REVENUE BONDS												
Term (years)		20	20	20	20	20	20	20	20	20	20	20
Interest Only Period (First n years)		0	0	0	0	0	0	0	0	0	0	0
Interest Cost		5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%
Issuance Cost		1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%
Revenue Bond Coverage Requirement	1.50											
LOANS												
Term (years; no more than 20 years)		20	20	20	20	20	20	20	20	20	20	20
Interest Cost		0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%
G.O. BONDS												
Term (years)		20	20	20	20	20	20	20	20	20	20	20
Interest Cost		4.50%	4.50%	4.50%	4.50%	4.50%	4.50%	4.50%	4.50%	4.50%	4.50%	4.50%
Issuance Cost		0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

City of Troutdale, OR
Wastewater System Financial Plan Update & SDC Study
Operating Revenue and Expenditure Forecast

Revenues			Fiscal Year Ending 6/30:	Budget 2013	Budget 2014	Projection 2015	Projection 2016	Projection 2017	Projection 2018	Projection 2019	Projection 2020	Projection 2021	Projection 2022	Projection 2023
Rate Revenues														
04-00-7512	SEWER USAGE CHARGES	9	Customer Growth	$ 2,439,000	$ 2,536,560	$ 2,542,901	$ 2,549,259	$ 2,555,632	$ 2,562,021	$ 2,568,426	$ 2,574,847	$ 2,581,284	$ 2,587,737	$ 2,594,207
	[OTHER]	9	Customer Growth	-	-	-	-	-	-	-	-	-	-	-
	[OTHER]	9	Customer Growth	-	-	-	-	-	-	-	-	-	-	-
	[OTHER]	9	Customer Growth	-	-	-	-	-	-	-	-	-	-	-
	Subtotal Rate Revenues			**$ 2,439,000**	**$ 2,536,560**	**$ 2,542,901**	**$ 2,549,259**	**$ 2,555,632**	**$ 2,562,021**	**$ 2,568,426**	**$ 2,574,847**	**$ 2,581,284**	**$ 2,587,737**	**$ 2,594,207**
Non-Rate Revenues														
04-00-7510	SUBDIVISION PLAN REVIEW FEE	8	No Escalation	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
04-00-7809	INSURANCE REIMBURSEMENT	8	No Escalation	-	-	-	-	-	-	-	-	-	-	-
04-00-7899	MISCELLANEOUS REVENUE	8	No Escalation	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
04-00-7987	SERVICE REIMBURSEMENT - STORM SEWER U	8	No Escalation	31,500	31,500	31,500	31,500	31,500	31,500	31,500	31,500	31,500	31,500	31,500
04-00-7917	LOAN REPAYMENT FROM STORMWATER	8	No Escalation	-	44,000	44,000	44,000	-	-	-	-	-	-	-
	[OTHER]	8	No Escalation	-	-	-	-	-	-	-	-	-	-	-
	[OTHER]	8	No Escalation	-	-	-	-	-	-	-	-	-	-	-
	Subtotal Non-Rate Revenues			**$ 33,500**	**$ 77,500**	**$ 77,500**	**$ 77,500**	**$ 33,500**	**$ 33,500**	**$ 33,500**	**$ 33,500**	**$ 33,500**	**$ 33,500**	**$ 33,500**
TOTAL REVENUES				**$ 2,472,500**	**$ 2,614,060**	**$ 2,620,401**	**$ 2,626,759**	**$ 2,589,132**	**$ 2,595,521**	**$ 2,601,926**	**$ 2,608,347**	**$ 2,614,784**	**$ 2,621,237**	**$ 2,627,707**

Expenditures			Fiscal Year Ending 6/30:	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Personal Services														
04-00-8005	WASTEWATER SUPERINTENDENT	3	Labor Cost Inflation	$ 76,885	$ 80,786	$ 83,210	$ 85,706	$ 88,277	$ 90,925	$ 93,653	$ 96,463	$ 99,357	$ 102,337	$ 105,407
04-00-8025	WASTEWATER LABORER	3	Labor Cost Inflation	-	35,276	36,334	37,424	38,547	39,703	40,895	42,121	43,385	44,687	46,027
04-00-8041	WASTEWATER OPERATOR I	3	Labor Cost Inflation	41,566	44,120	45,444	46,807	48,211	49,657	51,147	52,682	54,262	55,890	57,567
04-00-8042	WASTEWATER OPERATOR II	3	Labor Cost Inflation	41,587	45,891	47,268	48,686	50,146	51,651	53,200	54,796	56,440	58,133	59,877
04-00-8043	WASTEWATER OPERATOR III	3	Labor Cost Inflation	154,098	162,397	167,269	172,287	177,456	182,779	188,263	193,911	199,728	205,720	211,891
04-00-8046	WASTEWATER CHIEF OPERATOR	3	Labor Cost Inflation	63,256	66,457	68,451	70,504	72,619	74,798	77,042	79,353	81,734	84,186	86,711
04-00-8103	SALARY OVERTIME	3	Labor Cost Inflation	9,200	9,200	9,476	9,760	10,053	10,355	10,665	10,985	11,315	11,654	12,004
04-00-8104	BEEPER PAY	3	Labor Cost Inflation	9,200	9,200	9,476	9,760	10,053	10,355	10,665	10,985	11,315	11,654	12,004
04-00-8181	FICA -CITY EXPENSE	4	Benefit Cost Inflation	30,278	34,680	38,148	41,963	46,159	50,775	55,852	61,438	67,582	74,340	81,774
04-00-8183	PERS PENSION PLAN-DB	4	Benefit Cost Inflation	43,188	64,648	71,113	78,224	86,046	94,651	104,116	114,528	125,981	138,579	152,437
04-00-8184	PERS IAP PLAN--DC	4	Benefit Cost Inflation	19,552	26,096	28,706	31,576	34,734	38,207	42,028	46,231	50,854	55,939	61,533
04-00-8185	STATE UNEMPLOYMENT	4	Benefit Cost Inflation	410	2,720	2,992	3,291	3,620	3,982	4,381	4,819	5,301	5,831	6,414
04-00-8186	TRI-MET EXCISE TAX	4	Benefit Cost Inflation	2,584	3,235	3,559	3,914	4,306	4,736	5,210	5,731	6,304	6,935	7,628
04-00-8187	WORKERS COMPENSATION INSURANCE	4	Benefit Cost Inflation	12,000	12,000	13,200	14,520	15,972	17,569	19,326	21,259	23,385	25,723	28,295
04-00-8188	W/C ASSESSMENT EXPENSE	4	Benefit Cost Inflation	210	210	231	254	280	307	338	372	409	450	495
04-00-8191	KAISER MEDICAL	4	Benefit Cost Inflation	31,896	41,938	46,132	50,745	55,819	61,401	67,542	74,296	81,725	89,898	98,888
04-00-8192	DENTAL	4	Benefit Cost Inflation	8,832	10,018	11,020	12,122	13,334	14,667	16,134	17,747	19,522	21,474	23,622
04-00-8194	BLUE CROSS MEDICAL	4	Benefit Cost Inflation	46,676	57,865	63,652	70,017	77,018	84,720	93,192	102,511	112,763	124,039	136,443
04-00-8195	HRA CLAIM EXPENSE	4	Benefit Cost Inflation	8,250	5,250	5,775	6,353	6,988	7,687	8,455	9,301	10,231	11,254	12,379
04-00-8196	LONG TERM DISABILITY INSURANCE	4	Benefit Cost Inflation	1,144	1,144	1,258	1,384	1,523	1,675	1,842	2,027	2,229	2,452	2,697
04-00-8197	GROUP LIFE/AD&D	4	Benefit Cost Inflation	1,133	1,133	1,246	1,371	1,508	1,659	1,825	2,007	2,208	2,429	2,672
	[OTHER]	4	Benefit Cost Inflation	-	-	-	-	-	-	-	-	-	-	-
	[OTHER]	4	Benefit Cost Inflation	-	-	-	-	-	-	-	-	-	-	-
	[OTHER]	4	Benefit Cost Inflation	-	-	-	-	-	-	-	-	-	-	-
Subtotal Personal Services				$ 601,945	$ 714,264	$ 753,958	$ 796,668	$ 842,670	$ 892,261	$ 945,772	$ 1,003,562	$ 1,066,027	$ 1,133,603	$ 1,206,765

City of Troutdale, OR
Wastewater System Financial Plan Update & SDC Study
Operating Revenue and Expenditure Forecast

Materials and Services

04-00-8206	SOFTWARE SUPPORT/UPGRADE	1	General Cost Inflation	$ 15,800	$ 23,000	$ 23,690	$ 24,401	$ 25,133	$ 25,887	$ 26,663	$ 27,463	$ 28,287	$ 29,136	$ 30,010
04-00-8207	COMPUTER REPAIR/PARTS/SUPPLIES	1	General Cost Inflation	3,700	4,600	4,738	4,880	5,027	5,177	5,333	5,493	5,657	5,827	6,002
04-00-8208	SOFTWARE PURCHASES	1	General Cost Inflation	-	-	-	-	-	-	-	-	-	-	-
04-00-8209	HAND TOOLS	1	General Cost Inflation	1,100	1,100	1,133	1,167	1,202	1,238	1,275	1,313	1,353	1,393	1,435
04-00-8210	OFFICE SUPPLIES	1	General Cost Inflation	1,800	2,800	2,884	2,971	3,060	3,151	3,246	3,343	3,444	3,547	3,653
04-00-8211	SPECIAL DEPARTMENT EXPENSE	1	General Cost Inflation	76,050	83,550	86,057	88,638	91,297	94,036	96,857	99,763	102,756	105,839	109,014
04-00-8212	EQUIPMENT UNDER $1,000	1	General Cost Inflation	1,100	800	824	849	874	900	927	955	984	1,013	1,044
04-00-8213	OPERATING SUPPLIES	1	General Cost Inflation	6,100	6,100	6,283	6,471	6,666	6,866	7,072	7,284	7,502	7,727	7,959
04-00-8215	POSTAGE	1	General Cost Inflation	300	300	309	318	328	338	348	358	369	380	391
04-00-8216	UTILITIES & PHONE	1	General Cost Inflation	222,000	222,000	228,660	235,520	242,585	249,863	257,359	265,080	273,032	281,223	289,660
04-00-8217	RENTS & LEASES	1	General Cost Inflation	3,000	3,000	3,090	3,183	3,278	3,377	3,478	3,582	3,690	3,800	3,914
04-00-8218	BUILDING MAINTENANCE	1	General Cost Inflation	3,400	18,100	18,643	19,202	19,778	20,372	20,983	21,612	22,261	22,929	23,616
04-00-8219	MAINT/OPERATION OF EQUIPMENT	1	General Cost Inflation	113,100	110,600	113,918	117,336	120,856	124,481	128,216	132,062	136,024	140,105	144,308
04-00-8220	PROFESSIONAL SERVICES	1	General Cost Inflation	15,000	15,000	15,450	15,914	16,391	16,883	17,389	17,911	18,448	19,002	19,572
04-00-8221	OTHER CONTRACT SERVICES	1	General Cost Inflation	50,600	75,600	77,868	80,204	82,610	85,088	87,641	90,270	92,978	95,768	98,641
04-00-8222	INSURANCE	1	General Cost Inflation	27,000	27,000	27,810	28,644	29,504	30,389	31,300	32,239	33,207	34,203	35,229
04-00-8223	MEMBERSHIP & DUES	1	General Cost Inflation	1,400	1,400	1,442	1,485	1,530	1,576	1,623	1,672	1,722	1,773	1,827
04-00-8224	CONFERENCE/EDUCATION/TRAVEL	1	General Cost Inflation	3,500	3,600	3,708	3,819	3,934	4,052	4,173	4,299	4,428	4,560	4,697
04-00-8235	GROUNDS MAINTENANCE	1	General Cost Inflation	2,100	2,100	2,163	2,228	2,295	2,364	2,434	2,508	2,583	2,660	2,740
04-00-8250	CITY FRANCHISE FEES		*City Franchise Fee Rate*	112,000	126,828	127,145	127,463	127,782	128,101	128,421	128,742	129,064	129,387	129,710
	[OTHER]	1	General Cost Inflation	-	-	-	-	-	-	-	-	-	-	-
	[OTHER]	1	General Cost Inflation	-	-	-	-	-	-	-	-	-	-	-
	[OTHER]	1	General Cost Inflation	-	-	-	-	-	-	-	-	-	-	-
	Subtotal Materials and Services			$ 659,050	$ 727,478	$ 745,815	$ 764,693	$ 784,128	$ 804,138	$ 824,739	$ 845,950	$ 867,788	$ 890,272	$ 913,422

City of Troutdale, OR
Wastewater System Financial Plan Update & SDC Study
Operating Revenue and Expenditure Forecast

Capital Outlay														
	CCTV Inspection	1	General Cost Inflation	$ -	$ 30,000	$ 30,900	$ 31,827	$ 32,782	$ 33,765	$ 34,778	$ 35,822	$ 36,896	$ 38,003	$ 39,143
	Biosolids Lagoon Handling	1	General Cost Inflation	-	250,000	150,000	154,500	159,135	163,909	168,826	173,891	179,108	184,481	190,016
	[OTHER]	1	General Cost Inflation	-	-	-	-	-	-	-	-	-	-	-
	Subtotal Capital Outlay			$ -	$ 280,000	$ 180,900	$ 186,327	$ 191,917	$ 197,674	$ 203,605	$ 209,713	$ 216,004	$ 222,484	$ 229,159
Other														
04-00-8228	ADMINISTRATION	1	General Cost Inflation	$ 238,350	$ 238,350	$ 245,501	$ 252,866	$ 260,451	$ 268,265	$ 276,313	$ 284,602	$ 293,140	$ 301,935	$ 310,993
04-00-8830	INTERFUND LOAN TO STORM	8	No Escalation	132,000	-	-	-	-	-	-	-	-	-	-
04-00-8852	SERVICE REIMB -CODE SPEC	1	General Cost Inflation	1,000	1,000	1,030	1,061	1,093	1,126	1,159	1,194	1,230	1,267	1,305
04-00-8854	SERVICE REIMB -FAC MAINT	1	General Cost Inflation	30,450	30,450	31,364	32,304	33,274	34,272	35,300	36,359	37,450	38,573	39,730
04-00-8871	SERVICE REIMB -EQUIP MAINT	1	General Cost Inflation	75,600	69,000	71,070	73,202	75,398	77,660	79,990	82,390	84,861	87,407	90,029
04-00-8872	SERVICE REIMB -PW MANAGEMENT	1	General Cost Inflation	217,900	199,500	205,485	211,650	217,999	224,539	231,275	238,213	245,360	252,721	260,302
	[OTHER]	1	General Cost Inflation	-	-	-	-	-	-	-	-	-	-	-
	[OTHER]	1	General Cost Inflation	-	-	-	-	-	-	-	-	-	-	-
	[OTHER]	1	General Cost Inflation	-	-	-	-	-	-	-	-	-	-	-
	Subtotal Other			$ 695,300	$ 538,300	$ 554,449	$ 571,082	$ 588,215	$ 605,861	$ 624,037	$ 642,758	$ 662,041	$ 681,902	$ 702,359
Cost of Additional FTEs and Vehicle Maintenance				$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total Cash O&M Expenditures				**$ 1,956,295**	**$ 2,260,042**	**$ 2,235,121**	**$ 2,318,770**	**$ 2,406,930**	**$ 2,499,935**	**$ 2,598,153**	**$ 2,701,983**	**$ 2,811,861**	**$ 2,928,262**	**$ 3,051,705**

[a] Capital outlay to be expensed in current year.

BUDGET ITEMS NOT INCLUDED IN OPERATING EXPENSES

04-00-8301	EQUIPMENT $1,000 AND OVER	$ 7,200	$ 38,750
04-00-8303	MOTOR VEHICLE	360,000	12,000
04-00-8350	PROJECTS	265,000	465,000
04-00-8809	TRANSFER TO DEBT SERVICE FUND	352,424	353,736
04-00-8998	CONTINGENCY	250,000	232,500
04-00-8999	UNAPPROPRIATED	927,411	970,306
	less: Calculated City Franchise Fees		(126,828)

City of Troutdale, OR
Wastewater System Financial Plan Update & SDC Study
Existing Debt Input

Revenue Bonds	Fiscal Year Ending 6/30:	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
TOTAL REVENUE BONDS												
Annual Interest Payment		$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Annual Principal Payment		-	-	-	-	-	-	-	-	-	-	-
Total Annual Payment		$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Use of Debt reserve for Debt Service		-	-	-	-	-	-	-	-	-	-	-
Annual Debt Reserve Target on Existing Revenue Bonds		-	-	-	-	-	-	-	-	-	-	-

Loans	Fiscal Year Ending 6/30:	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
TOTAL LOANS												
Annual Interest Payment		$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Annual Principal Payment		-	-	-	-	-	-	-	-	-	-	-
Total Annual Payment		$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -

City of Troutdale, OR
Wastewater System Financial Plan Update & SDC Study
Existing Debt Input

G.O. BONDS	Fiscal Year Ending 6/30:	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Water Pollution Control Facility - Series 2008 Refunding (28% Sewer Utility Fund)												
Annual Interest Payment		$ 72,424	$ 62,536	$ 51,326	$ 39,475	$ 27,104	$ 13,832	$ -	$ -	$ -	$ -	$ -
Annual Principal Payment		280,000	291,200	305,200	317,800	331,800	345,800	-	-	-	-	-
Total Annual Payment		$ 352,424	$ 353,736	$ 356,526	$ 357,275	$ 358,904	$ 359,632	$ -	$ -	$ -	$ -	$ -
G.O. BOND 2												
Annual Interest Payment		$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Annual Principal Payment		-	-	-	-	-	-	-	-	-	-	-
Total Annual Payment		$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
G.O. BOND 3												
Annual Interest Payment		$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Annual Principal Payment		-	-	-	-	-	-	-	-	-	-	-
Total Annual Payment		$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
TOTAL G.O. BONDS												
Annual Interest Payment		$ 72,424	$ 62,536	$ 51,326	$ 39,475	$ 27,104	$ 13,832	$ -	$ -	$ -	$ -	$ -
Annual Principal Payment		280,000	291,200	305,200	317,800	331,800	345,800	-	-	-	-	-
Total Annual Payment		$ 352,424	$ 353,736	$ 356,526	$ 357,275	$ 358,904	$ 359,632	$ -	$ -	$ -	$ -	$ -

City of Troutdale, OR
Wastewater System Financial Plan Update & SDC Study
Capital Improvement Program

Escalate Project Costs to Base Year:	2013
Number of Years the Total CIP will be Completed:	15

(Project costs are escalated using Construction Cost Inflation assumptions)

(If the project year is left blank, the total project cost will be spread over evenly for the number of years entered)

Cumulative Constructior

					FUNDING OF PROJECT COSTS				SDC ELIGIBILITY			
					% of Funding		$ Funding by Source		% Allocation of Project Costs		$ Allocation of Project Costs	
No	Description	Total Project Cost	Year	Life in Years	Outside Sources	Enterprise Fund	Outside Sources	Enterprise Fund	Existing Needs	SDC Eligible	Existing Needs	SDC Eligible
1	Sewer Upgrades											
2	Buxtom Road	$ 501,000		50	0.0%	100.0%	-	501,000	61.6%	38.4%	308,528	192,472
3	Lower Beaver Creek / Troutdale Road	3,417,000		50	0.0%	100.0%	-	3,417,000	61.6%	38.4%	2,104,272	1,312,728
4	Airport / Graham	646,000		50	100.0%	0.0%	646,000	-	100.0%	0.0%	-	-
5	PS-9 Trunk	253,000		50	100.0%	0.0%	253,000	-	100.0%	0.0%	-	-
6												
7	Pump Station and Force Main Upgrades											
8	PS-1, new force main (10-inch, 3,560 feet)	$ 2,690,000		50	0.0%	100.0%	-	2,690,000	0.0%	100.0%	-	2,690,000
9	PS-2	369,000		50	0.0%	100.0%	-	369,000	100.0%	0.0%	369,000	-
10	PS-5, new pumps (2,500 gpm / 3.6 mgd)	454,000		50	0.0%	100.0%	-	454,000	100.0%	0.0%	454,000	-
11	PS-7, new pumps (400 gpm / 0.58 mgd)	145,000		50	0.0%	100.0%	-	145,000	100.0%	0.0%	145,000	-
12	PS-9, new pumps (450 gpm / 0.65 mgd)	242,000		50	100.0%	0.0%	242,000	-	100.0%	0.0%	-	-
13												
14	SE Jackson Park Road	$ 950,000		50	50.0%	50.0%	475,000	475,000	10.0%	90.0%	47,500	427,500
15	East Historic Columbia River Highway	3,250,000		50	50.0%	50.0%	1,625,000	1,625,000	4.2%	95.8%	68,662	1,556,338
16	Troutdale Reynolds Industrial Park (TRIP) Extensions (2,800 ft 4" pipe & 150 gpm PS	3,133,000		50	100.0%	0.0%	3,133,000	-	0.0%	100.0%	-	-
17												
18	**Additional Capital Projects**											
19	Vehicle Replacement (every other year) - 2015	12,000	2015	10	0.0%	100.0%	-	12,000	100.0%	0.0%	12,000	-
20	Vehicle Replacement (every other year) - 2017	12,000	2017	10	0.0%	100.0%	-	12,000	100.0%	0.0%	12,000	-
21	Vehicle Replacement (every other year) - 2019	12,000	2019	10	0.0%	100.0%	-	12,000	100.0%	0.0%	12,000	-
22	Vehicle Replacement (every other year) - 2021	12,000	2021	10	0.0%	100.0%	-	12,000	100.0%	0.0%	12,000	-
23	Vehicle Replacement (every other year) - 2023	12,000	2023	10	0.0%	100.0%	-	12,000	100.0%	0.0%	12,000	-
24	Vehicle Replacement (every other year) - 2025	12,000	2025	10	0.0%	100.0%	-	12,000	100.0%	0.0%	12,000	-
	FY 2013-14 Budgeted Capital Improvement Projects											
1	Equipment	38,750	2014	10	0.0%	100.0%	-	38,750	100.0%	0.0%	38,750	-
2	Motor Vehicle	12,000	2014	10	0.0%	100.0%	-	12,000	100.0%	0.0%	12,000	-
3	Projects - Biosolids Lagoon Cleaning (was $250,000; funded as an O&M expnse)		2014	10	0.0%	100.0%	-	-	100.0%	0.0%	-	-
4	Projects - Biosolids Pilot Project	35,000	2014	10	0.0%	100.0%	-	35,000	100.0%	0.0%	35,000	-
5	Projects - Blower efficiency project	120,000	2014	10	0.0%	100.0%	-	120,000	100.0%	0.0%	120,000	-
6	Projects - Site preparation GSA	25,000	2014	10	0.0%	100.0%	-	25,000	100.0%	0.0%	25,000	-
7	Projects - Digester Mixer Repair	35,000	2014	10	0.0%	100.0%	-	35,000	100.0%	0.0%	35,000	-
	Total Capital Projects	**$ 16,387,750**					**$ 6,374,000**	**$ 10,013,750**			**$ 3,834,712**	**$ 6,179,038**
	Total Existing Needs Related Projects											
	Total SDC Eligible Projects											
	Projects to be Funded by Outside Funding Sources											
	Projects to be Funded by the Enterprise Fund											

City of Troutdale, OR
Wastewater System Financial Plan Update & SDC
Capital Improvement Program

Escalate Project Costs to Base Year:	Cost Inflation ==>	4.00%	8.16%	12.49%	16.99%	21.67%	26.53%	31.59%	36.86%	42.33%	48.02%
Number of Years the Total CIP will be Completed:											

No	Description	TOTAL ESCALATED COSTS	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
1	Sewer Upgrades											
2	Buxtom Road	695,539	34,736	36,125	37,570	39,073	40,636	42,262	43,952	45,710	47,539	49,440
3	Lower Beaver Creek / Troutdale Road	4,743,828	236,912	246,388	256,244	266,494	277,154	288,240	299,769	311,760	324,230	337,200
4	Airport / Graham	896,843	44,789	46,581	48,444	50,382	52,397	54,493	56,673	58,940	61,297	63,749
5	PS-9 Trunk	351,240	17,541	18,243	18,973	19,732	20,521	21,342	22,195	23,083	24,007	24,967
6												
7	Pump Station and Force Main Upgrades											
8	PS-1, new force main (10-inch, 3,560 feet)	3,734,533	186,507	193,967	201,726	209,795	218,186	226,914	235,990	245,430	255,247	265,457
9	PS-2	512,283	25,584	26,607	27,672	28,779	29,930	31,127	32,372	33,667	35,013	36,414
10	PS-5, new pumps (2,500 gpm / 3.6 mgd)	630,289	31,477	32,736	34,046	35,408	36,824	38,297	39,829	41,422	43,079	44,802
11	PS-7, new pumps (400 gpm / 0.58 mgd)	201,304	10,053	10,455	10,874	11,309	11,761	12,231	12,721	13,230	13,759	14,309
12	PS-9, new pumps (450 gpm / 0.65 mgd)	335,969	16,779	17,450	18,148	18,874	19,629	20,414	21,230	22,080	22,963	23,881
13												
14	SE Jackson Park Road	1,318,887	65,867	68,501	71,241	74,091	77,055	80,137	83,342	86,676	90,143	93,749
15	East Historic Columbia River Highway	4,511,982	225,333	234,347	243,721	253,469	263,608	274,152	285,119	296,523	308,384	320,720
16	Troutdale Reynolds Industrial Park (TRIP) Extensions (2,800 ft 4" pipe & 150 gpm PS	4,349,550	217,221	225,910	234,947	244,344	254,118	264,283	274,854	285,848	297,282	309,174
17												
18	**Additional Capital Projects**											
19	Vehicle Replacement (every other year) - 2015	12,979	-	12,979	-	-	-	-	-	-	-	-
20	Vehicle Replacement (every other year) - 2017	14,038	-	-	-	14,038	-	-	-	-	-	-
21	Vehicle Replacement (every other year) - 2019	15,184	-	-	-	-	-	15,184	-	-	-	-
22	Vehicle Replacement (every other year) - 2021	16,423	-	-	-	-	-	-	-	16,423	-	-
23	Vehicle Replacement (every other year) - 2023	17,763	-	-	-	-	-	-	-	-	-	17,763
24	Vehicle Replacement (every other year) - 2025	19,212	-	-	-	-	-	-	-	-	-	-
	FY 2013-14 Budgeted Capital Improvement Projects											
1	Equipment	40,300	40,300	-	-	-	-	-	-	-	-	-
2	Motor Vehicle	12,480	12,480	-	-	-	-	-	-	-	-	-
3	Projects - Biosolids Lagoon Cleaning (was $250,000; funded as an O&M expnse)	-	-	-	-	-	-	-	-	-	-	-
4	Projects - Biosolids Pilot Project	36,400	36,400	-	-	-	-	-	-	-	-	-
5	Projects - Blower efficiency project	124,800	124,800	-	-	-	-	-	-	-	-	-
6	Projects - Site preparation GSA	26,000	26,000	-	-	-	-	-	-	-	-	-
7	Projects - Digester Mixer Repair	36,400	36,400	-	-	-	-	-	-	-	-	-
	Total Capital Projects	**$ 22,654,228**	**$ 1,389,180**	**$ 1,170,291**	**$ 1,203,604**	**$ 1,265,787**	**$ 1,301,819**	**$ 1,369,075**	**$ 1,408,047**	**$ 1,480,792**	**$ 1,522,944**	**$ 1,601,624**
	Total Existing Needs Related Projects	5,226,819	518,836	265,133	262,240	286,768	283,639	310,169	306,784	335,478	331,818	362,853
	Total SDC Eligible Projects	7,103,717	428,413	445,550	463,372	481,907	501,183	521,230	542,079	563,763	586,313	609,766
	Projects to be Funded by Outside Funding Sources	8,849,037	441,931	459,608	477,992	497,112	516,996	537,676	559,183	581,551	604,813	629,005
	Projects to be Funded by the Enterprise Fund	13,805,190	947,249	710,683	725,612	768,675	784,822	831,399	848,864	899,241	918,131	972,619

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Summary of Expenditures		Fiscal Year Ending 6/30: 2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
SDC Eligible Project Costs		$ -	$ 428,413	$ 445,550	$ 463,372	$ 481,907	$ 501,183	$ 521,230	$ 542,079	$ 563,763	$ 586,313	$ 609,766
Existing Needs Related Project Costs		-	518,836	265,133	262,240	286,768	283,639	310,169	306,784	335,478	331,818	362,853
Subtotal: Project Costs		$ -	$ 947,249	$ 710,683	$ 725,612	$ 768,675	$ 784,822	$ 831,399	$ 848,864	$ 899,241	$ 918,131	$ 972,619
[Other Capital Expenses]												
[Other]	*General Cost Inflation*	-	-	-	-	-	-	-	-	-	-	-
[Other]	*General Cost Inflation*	-	-	-	-	-	-	-	-	-	-	-
[Other]	*General Cost Inflation*	-	-	-	-	-	-	-	-	-	-	-
Subtotal:		$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
TOTAL CAPITAL EXPENDITURES		**$ -**	**$ 947,249**	**$ 710,683**	**$ 725,612**	**$ 768,675**	**$ 784,822**	**$ 831,399**	**$ 848,864**	**$ 899,241**	**$ 918,131**	**$ 972,619**

Capital Financing Plan	Fiscal Year Ending 6/30: 2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Project-Specific Grants / Developer Donations	$ -	$ 441,931	$ 459,608	$ 477,992	$ 497,112	$ 516,996	$ 537,676	$ 559,183	$ 581,551	$ 604,813	$ 629,005
Costs Remaining to be Funded	-	947,249	710,683	725,612	768,675	784,822	831,399	848,864	899,241	918,131	972,619
OTHER FUNDING SOURCES [NOTE A]											
Grants /Outside Sources	-	-	-	-	-	-	-	-	-	-	-
State Loan Proceeds	-	-	-	-	-	-	-	-	-	-	-
Other Debt Proceeds	-	-	-	-	-	-	-	-	-	-	-
Use of SDC Fund Balance	-	-	-	-	-	-	-	-	-	-	-
Use of Capital Fund Balance	-	919,007	638,882	551,049	509,707	500,935	520,753	733,637	899,241	918,131	893,943
Revenue Bond Proceeds [Note B]	-	-	-	-	-	-	-	-	-	-	-
Rates	-	28,242	71,801	174,564	258,968	283,888	310,646	115,226	-	-	78,676
Total	$ -	$ 947,249	$ 710,683	$ 725,612	$ 768,675	$ 784,822	$ 831,399	$ 848,864	$ 899,241	$ 918,131	$ 972,619
TOTAL CAPITAL RESOURCES	**$ -**	**$ 1,389,180**	**$ 1,170,291**	**$ 1,203,604**	**$ 1,265,787**	**$ 1,301,819**	**$ 1,369,075**	**$ 1,408,047**	**$ 1,480,792**	**$ 1,522,944**	**$ 1,601,624**
Info: Capital Contingency Deficit	-	-	-	-	-	-	-	-	-	-	-

Select the Residual Funding Source	1	**Revenue Bond Proceeds**

1 - Revenue Bond Proceeds
2 - Rates

NOTE B: USER INPUT FOR REVENUE BOND PROCEEDS

Select Amount of Bond Proceeds	1	**User Defined**

1 - Amounts at Right ==>	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -

2 - Calculated by the Model

City of Troutdale, OR
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New Debt Computations

Fiscal Year Ending 6/30:	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
REVENUE BONDS											
Amount to Fund	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Issuance Costs	-	-	-	-	-	-	-	-	-	-	-
Reserve Required	-	-	-	-	-	-	-	-	-	-	-
Amount of Debt Issue	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
OTHER LOANS (SRF)											
Amount to Fund	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Issuance Costs	-	-	-	-	-	-	-	-	-	-	-
Amount of Debt Issue	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
PWTF LOAN											
Amount to Fund	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -

Debt Service Summary

Fiscal Year Ending 6/30:	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
EXISTING DEBT SERVICE											
Annual Interest Payments	$ 72,424	$ 62,536	$ 51,326	$ 39,475	$ 27,104	$ 13,832	$ -	$ -	$ -	$ -	$ -
Annual Principal Payments	280,000	291,200	305,200	317,800	331,800	345,800	-	-	-	-	-
Total Debt Service Payments	$ 352,424	$ 353,736	$ 356,526	$ 357,275	$ 358,904	$ 359,632	$ -	$ -	$ -	$ -	$ -
Revenue Bond Payments Only	-	-	-	-	-	-	-	-	-	-	-
NEW DEBT SERVICE											
Annual Interest Payments	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Annual Principal Payments	-	-	-	-	-	-	-	-	-	-	-
Total Debt Service Payments	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Revenue Bond Payments Only	-	-	-	-	-	-	-	-	-	-	-
TOTAL DEBT SERVICE PAYMENTS	**$ 352,424**	**$ 353,736**	**$ 356,526**	**$ 357,275**	**$ 358,904**	**$ 359,632**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**
Total Interest Payments	72,424	62,536	51,326	39,475	27,104	13,832	-	-	-	-	-
Total Principal Payments	280,000	291,200	305,200	317,800	331,800	345,800	-	-	-	-	-
Total Revenue Bond Payments Only	-	-	-	-	-	-	-	-	-	-	-

City of Troutdale, OR
Wastewater System Financial Plan Update & SDC Study
Revenue Requirements Analysis

Cash Flow Sufficiency Test — Fiscal Year Ending 6/30:	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
EXPENSES											
Cash Operating Expenses	$ 1,956,295	$ 2,260,042	$ 2,235,121	$ 2,318,770	$ 2,406,930	$ 2,499,935	$ 2,598,153	$ 2,701,983	$ 2,811,861	$ 2,928,262	$ 3,051,705
Existing Debt Service	352,424	353,736	356,526	357,275	358,904	359,632	-	-	-	-	-
New Debt Service	-	-	-	-	-	-	-	-	-	-	-
Rate-Funded CIP	-	28,242	71,801	174,564	258,968	283,888	310,646	115,226	-	-	78,676
Rate-Funded System Reinvestment	-	-	-	-	-	-	-	-	-	-	-
Additions Required to Meet Minimum Op. Fund Balance	-	-	-	-	-	-	-	-	-	-	-
Total Expenses	$ 2,308,719	$ 2,642,021	$ 2,663,448	$ 2,850,609	$ 3,024,802	$ 3,143,455	$ 2,908,798	$ 2,817,209	$ 2,811,861	$ 2,928,262	$ 3,130,381
REVENUES											
Rate Revenue	$ 2,439,000	$ 2,536,560	$ 2,542,901	$ 2,549,259	$ 2,555,632	$ 2,562,021	$ 2,568,426	$ 2,574,847	$ 2,581,284	$ 2,587,737	$ 2,594,207
Other Revenue	33,500	77,500	77,500	77,500	33,500	33,500	33,500	33,500	33,500	33,500	33,500
Interest Earnings (excluding Capital Fund)	6,000	1,250	1,393	1,378	2,138	1,908	2,612	3,203	4,983	5,200	5,415
Total Revenue	$ 2,478,500	$ 2,615,310	$ 2,621,795	$ 2,628,136	$ 2,591,270	$ 2,597,429	$ 2,604,537	$ 2,611,550	$ 2,619,767	$ 2,626,437	$ 2,633,122
USE OF OPERATING RESERVES	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
NET CASH FLOW (DEFICIENCY)	**$ 169,781**	**$ (26,711)**	**$ (41,653)**	**$ (222,472)**	**$ (433,532)**	**$ (546,026)**	**$ (304,261)**	**$ (205,659)**	**$ (192,093)**	**$ (301,824)**	**$ (497,259)**

Coverage Sufficiency Test — Fiscal Year Ending 6/30:	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
EXPENSES											
Cash Operating Expenses	$ 1,956,295	$ 2,260,042	$ 2,235,121	$ 2,318,770	$ 2,406,930	$ 2,499,935	$ 2,598,153	$ 2,701,983	$ 2,811,861	$ 2,928,262	$ 3,051,705
Maximum Annual Revenue Bond Debt Service	-	-	-	-	-	-	-	-	-	-	-
Revenue Bond Coverage Requirement at 1.5	-	-	-	-	-	-	-	-	-	-	-
Total Expenses	$ 1,956,295	$ 2,260,042	$ 2,235,121	$ 2,318,770	$ 2,406,930	$ 2,499,935	$ 2,598,153	$ 2,701,983	$ 2,811,861	$ 2,928,262	$ 3,051,705
ALLOWABLE REVENUES											
Rate Revenue	$ 2,439,000	$ 2,536,560	$ 2,542,901	$ 2,549,259	$ 2,555,632	$ 2,562,021	$ 2,568,426	$ 2,574,847	$ 2,581,284	$ 2,587,737	$ 2,594,207
Other Revenue	33,500	77,500	77,500	77,500	33,500	33,500	33,500	33,500	33,500	33,500	33,500
Interest Earnings - All Funds	6,000	3,548	4,588	4,133	5,961	5,665	7,819	10,540	18,551	19,462	18,824
Total Revenue	$ 2,478,500	$ 2,617,608	$ 2,624,989	$ 2,630,892	$ 2,595,093	$ 2,601,186	$ 2,609,745	$ 2,618,887	$ 2,633,335	$ 2,640,700	$ 2,646,531
Coverage Realized	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
COVERAGE SURPLUS (DEFICIENCY)	**$ 522,205**	**$ 357,566**	**$ 389,868**	**$ 312,121**	**$ 188,163**	**$ 101,251**	**$ 11,592**	**$ (83,096)**	**$ (178,525)**	**$ (287,562)**	**$ (405,174)**

City of Troutdale, OR
Wastewater System Financial Plan Update & SDC Study
Revenue Requirements Analysis

Maximum Revenue Deficiency

Fiscal Year Ending 6/30:	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Sufficiency Test Driving the Deficiency	*None*	*None*	*Cash*	*Cash*	*Cash*	*Cash*	*None*	*None*	*None*	*None*	*None*
Maximum Deficiency From Tests	$ -	$ 26,711	$ 41,653	$ 222,472	$ 433,532	$ 546,026	$ 304,261	$ 205,659	$ 192,093	$ 301,824	$ 497,259
less: Net Revenue From Prior Rate Increases	-	-	-	(127,144)	(261,616)	(403,820)	(554,183)	(555,569)	(556,958)	(558,350)	(559,746)
Revenue Deficiency	$ -	$ 26,711	$ 41,653	$ 95,328	$ 171,916	$ 142,206	$ -	$ -	$ -	$ -	$ -
Plus: Adjustment for Taxes	-	1,406	2,192	5,017	9,048	7,485	-	-	-	-	-
Total Revenue Deficiency	**$ -**	**$ 28,116**	**$ 43,846**	**$ 100,345**	**$ 180,964**	**$ 149,690**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**

Rate Increases

Fiscal Year Ending 6/30:	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Rate Revenue with no Increase	$ 2,439,000	$ 2,536,560	$ 2,542,901	$ 2,549,259	$ 2,555,632	$ 2,562,021	$ 2,568,426	$ 2,574,847	$ 2,581,284	$ 2,587,737	$ 2,594,207
Revenues from Prior Rate Increases	-	-	-	133,836	275,385	425,074	583,351	584,809	586,271	587,737	589,206
Rate Revenue Before Rate Increase (Incl. previous increases)	2,439,000	2,536,560	2,542,901	2,683,095	2,831,017	2,987,095	3,151,777	3,159,656	3,167,555	3,175,474	3,183,413
Required Annual Rate Increase	0.00%	1.11%	1.72%	3.74%	6.39%	5.01%	0.00%	0.00%	0.00%	0.00%	0.00%
Number of Months New Rates Will Be In Effect	12	12	12	12	12	12	12	12	12	12	12
Info: Percentage Increase to Generate Required Revenue	0.00%	1.11%	1.72%	3.74%	6.39%	5.01%	0.00%	0.00%	0.00%	0.00%	0.00%
Policy Induced Rate Increases	0.00%	0.00%	5.25%	5.25%	5.25%	5.25%					
ANNUAL RATE INCREASE	**0.00%**	**0.00%**	**5.25%**	**5.25%**	**5.25%**	**5.25%**	**0.00%**	**0.00%**	**0.00%**	**0.00%**	**0.00%**
CUMULATIVE RATE INCREASE	**0.00%**	**0.00%**	**5.25%**	**10.78%**	**16.59%**	**22.71%**	**22.71%**	**22.71%**	**22.71%**	**22.71%**	**22.71%**

Impacts of Rate Increases

Fiscal Year Ending 6/30:	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Rate Revenues After Rate Increase	$ 2,439,000	$ 2,536,560	$ 2,676,404	$ 2,823,957	$ 2,979,645	$ 3,143,917	$ 3,151,777	$ 3,159,656	$ 3,167,555	$ 3,175,474	$ 3,183,413
Full Year Rate Revenues After Rate Increase	2,439,000	2,536,560	2,676,404	2,823,957	2,979,645	3,143,917	3,151,777	3,159,656	3,167,555	3,175,474	3,183,413
Additional Taxes/Franchise Fees Due to Rate Increases		-	6,675	13,735	21,201	29,095	29,168	29,240	29,314	29,387	29,460
Net Cash Flow After Rate Increase	169,781	(26,711)	85,174	38,491	(30,719)	6,776	249,922	349,910	364,865	256,526	62,487
Coverage After Rate Increase	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

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Fund Activity

Funds — Fiscal Year Ending 6/30:	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
OPERATING FUND											
Beginning Balance **[a]**		$ 500,000	$ 278,635	$ 275,563	$ 285,095	$ 254,376	$ 261,152	$ 320,320	$ 332,211	$ 346,668	$ 361,019
plus: Net Cash Flow after Rate Increase		(26,711)	85,174	38,491	(30,719)	6,776	249,922	349,910	364,865	256,526	62,487
less: Transfer of Surplus to Capital Fund		(194,654)	(88,246)	(28,960)	-	-	(190,754)	(338,019)	(350,408)	(242,175)	(47,268)
Ending Balance	$ 500,000	$ 278,635	$ 275,563	$ 285,095	$ 254,376	$ 261,152	$ 320,320	$ 332,211	$ 346,668	$ 361,019	$ 376,238
Minimum Target Balance	*160,791*	*185,757*	*183,709*	*190,063*	*197,830*	*205,474*	*213,547*	*221,474*	*231,112*	*240,679*	*250,825*
Maximum Funds to be Kept as Operating Reserves	*241,187*	*278,635*	*275,563*	*285,095*	*296,745*	*308,211*	*320,320*	*332,211*	*346,668*	*361,019*	*376,238*
Info: No of Days of Cash Operating Expenses	*93*	*45*	*45*	*45*	*39*	*38*	*45*	*45*	*45*	*45*	*45*

[a] Beginning cash balance was $1,419,007. Of this amount $500,000 is assumed to be for working capital, the rest is allocated to capital fund.

Funds	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
CAPITAL (RESERVE) FUND											
Beginning Balance		$ 919,007	$ 638,882	$ 551,049	$ 509,707	$ 500,935	$ 520,753	$ 733,637	$ 904,539	$ 950,824	$ 893,943
plus: Rate-Funded System Reinvestment		-	-	-	-	-	-	-	-	-	-
plus: Grants / Developer Donations / Other Outside Sources		441,931	459,608	477,992	497,112	516,996	537,676	559,183	581,551	604,813	629,005
plus: Net Debt Proceeds Available for Projects		-	-	-	-	-	-	-	-	-	-
plus: Direct Rate Funding		28,242	71,801	174,564	258,968	283,888	310,646	115,226	-	-	78,676
plus: Interest Earnings		2,298	3,194	2,755	3,823	3,757	5,208	7,336	13,568	14,262	13,409
plus: Transfer of Surplus from Operating Fund		194,654	88,246	28,960	-	-	190,754	338,019	350,408	242,175	47,268
less: Capital Expenditures		(947,249)	(710,683)	(725,612)	(768,675)	(784,822)	(831,399)	(848,864)	(899,241)	(918,131)	(972,619)
Ending Balance	$ 919,007	$ 638,882	$ 551,049	$ 509,707	$ 500,935	$ 520,753	$ 733,637	$ 904,539	$ 950,824	$ 893,943	$ 689,682
Minimum Target Balance	$ 273,184	$ 282,657	$ 289,764	$ 297,020	$ 304,707	$ 312,555	$ 320,869	$ 329,357	$ 338,350	$ 347,531	$ 357,257

Funds	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
SDC FUND (Expansion Projects Only)											
Beginning Balance		$ 74,560	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
plus: SDC Improvement Fee Proceeds		40,000	71,191	71,369	71,547	71,726	71,905	72,085	72,265	72,446	72,627
plus: Interest Earnings		186	-	-	-	-	-	-	-	-	-
less: Debt Service Payments		(114,746)	(71,191)	(71,369)	(71,547)	(71,726)	(71,905)	(72,085)	(72,265)	(72,446)	(72,627)
Available for Capital		-	-	-	-	-	-	-	-	-	-
Expansion Projects		$ 428,413	$ 445,550	$ 463,372	$ 481,907	$ 501,183	$ 521,230	$ 542,079	$ 563,763	$ 586,313	$ 609,766
less: Use of Reserves for Capital Projects		-	-	-	-	-	-	-	-	-	-
Ending Balance	$ 74,560	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -

Funds	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
DEBT RESERVE											
Beginning Balance	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
plus: Reserve Funding from New Debt	-	-	-	-	-	-	-	-	-	-	-
less: Use of Reserves for Debt Service	-	-	-	-	-	-	-	-	-	-	-
Ending Balance	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Minimum Target Balance	-	-	-	-	-	-	-	-	-	-	-

SDC CALCULATIONS

City of Troutdale, OR

Wastewater System Financial Plan Update & SDC Study

Customer Base

Existing Customer Base (per utility billing system data):

Customer Type	Number of Accounts	Number of ERUs
Residential	4,243	4,036.96
Commercial	144	1,692.94
Community Services	20	490.79
Industrial	36	86.40
Agriculture	1	8.22
None	4	4.00
TOTAL	**4,448**	**6,319.31**
Sewer Reservations Sold Previously		158.00
Total Number of Existing ERUs		**6,477.31**

Per Amy Pepper's email dated April 25, 2013.

Projected Growth Rates (per J. Hansen email dated April 2, 2013):

	Overall		Jackson Park Road		Historic Columbia River Hwy.	
	Number of Customers	Population	Number of Customers	Population	Number of Customers	Population
2012	4,631	16,244	2	51	3	118
Future	7,520	17,820	20	52	71	174
Incremental Growth	2,889	1,576	18	1	68	56
Cumulative Growth Rate	62.4%	9.7%	900.0%	2.0%	2266.7%	47.5%
Growth's Share	38.4%	8.8%	90.0%	1.9%	95.8%	32.2%

Projected Customer Base:

	Number of ERUs
Existing Customer Base	6,477
Projected Cumulative Growth Rate	62.4%
Future Customer Base	10,518
Incremental Growth	4,041
Growth's Share	38.4%

Overall, number of customers

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A/C No	A/C Category	ID	Description	Date Acquired	Original Cost	Unused Capacity (%)	Original Cost of Unused Capacity	Original Cost of Used Capacity	Asset Category	
5300	INFRAS. - SEWER	1057	Infrastructure- Manholes, 19 Ea.	7/1/1967	$ 9,104				4	Infrastructure - Manholes
5300	INFRAS. - SEWER	1058	Infrastructure- Piping, Concrete, 6 Inch, 285 Ft.	7/1/1967	$ 946				5	Infrastructure - Piping
5300	INFRAS. - SEWER	1059	Infrastructure- Piping, Concrete, 8 Inch, 3,799 Ft	7/1/1967	$ 16,186				5	Infrastructure - Piping
5300	INFRAS. - SEWER	1060	Infrastructure- Manholes, 83 Ea.	7/1/1968	$ 41,328				4	Infrastructure - Manholes
5300	INFRAS. - SEWER	1061	Infrastructure- Piping, Polyvinyl Chloride, 10 Inc	7/1/1968	$ 489				5	Infrastructure - Piping
5300	INFRAS. - SEWER	1062	Infrastructure- Piping, Concrete, 21 Inch, 12 Ft.	7/1/1968	$ 126				5	Infrastructure - Piping
5300	INFRAS. - SEWER	1063	Infrastructure- Piping, Concrete, 15 Inch, 1,027 F	7/1/1968	$ 7,063				5	Infrastructure - Piping
5300	INFRAS. - SEWER	1064	Infrastructure- Piping, Concrete, 12 Inch, 1,337 F	7/1/1968	$ 8,491				5	Infrastructure - Piping
5300	INFRAS. - SEWER	1065	Infrastructure- Piping, Concrete, 10 Inch, 1,626 F	7/1/1968	$ 8,957				5	Infrastructure - Piping
5300	INFRAS. - SEWER	1066	Infrastructure- Piping, Concrete, 6 Inch, 381 Ft.	7/1/1968	$ 1,314				5	Infrastructure - Piping
5300	INFRAS. - SEWER	1067	Infrastructure- Piping, Concrete, 8 Inch, 13,741 F	7/1/1968	$ 60,840				5	Infrastructure - Piping
1100	LAND	93	Land- ID#2, State ID#1N3E25BD 400, Asset #L0000	1/1/1969	$ 104,770				1	Land
5300	INFRAS. - SEWER	1068	Infrastructure- Pump, Centrifugal, 710831440, 10hp	6/1/1969	$ 884				6	Infrastructure - Pumps
5300	INFRAS. - SEWER	1069	Infrastructure- Pump, Centrifugal, 400 GPM 10hp, S	6/1/1969	$ 884				6	Infrastructure - Pumps
5300	INFRAS. - SEWER	1070	Infrastructure- Pump, Centrifugal, 47941171, 7 1/2	6/1/1971	$ 1,530				6	Infrastructure - Pumps
5300	INFRAS. - SEWER	1071	Infrastructure- Piping, Ductile Iron, 10 Inch, 384	7/1/1971	$ 6,283				5	Infrastructure - Piping
5300	INFRAS. - SEWER	1072	Infrastructure- Piping, Polyvinyl Chloride, 12 Inc	7/1/1971	$ 825				5	Infrastructure - Piping
5300	INFRAS. - SEWER	1073	Infrastructure- Piping, Concrete, 8 Inch, 2,212 Ft	7/1/1971	$ 11,389				5	Infrastructure - Piping
5300	INFRAS. - SEWER	1074	Infrastructure- Piping, Concrete, 12 Inch, 1,644 F	7/1/1971	$ 12,142				5	Infrastructure - Piping
5300	INFRAS. - SEWER	1075	Infrastructure- Piping, Concrete, 10 Inch, 1,418 F	7/1/1971	$ 9,083				5	Infrastructure - Piping
5300	INFRAS. - SEWER	1076	Infrastructure- Piping, Concrete, 15 Inch, 1,155 F	7/1/1971	$ 9,237				5	Infrastructure - Piping
5300	INFRAS. - SEWER	1077	Infrastructure- Piping, Polyvinyl Chloride, 8 Inch	7/1/1971	$ 2,363				5	Infrastructure - Piping
5300	INFRAS. - SEWER	1078	Infrastructure- Piping, Concrete, 6 Inch, 117 Ft.	7/1/1971	$ 469				5	Infrastructure - Piping
5300	INFRAS. - SEWER	1079	Infrastructure- Manholes, 36 Ea.	7/1/1971	$ 20,845				4	Infrastructure - Manholes
1100	LAND	90	Land- ID#1, State ID#1N3E26AD 200, Asset #L0001	7/31/1971	$ 800				1	Land
5300	INFRAS. - SEWER	1080	Infrastructure- Sewage Lift Station #1, Asset #B02	1/1/1972	$ 5,590				7	Infrastructure - Lift Stations
5300	INFRAS. - SEWER	1081	Infrastructure- Manholes, 112 Ea.	7/1/1972	$ 67,791				4	Infrastructure - Manholes
5300	INFRAS. - SEWER	1082	Infrastructure- Piping, Polyvinyl Chloride, 10 Inc	7/1/1972	$ 14,105				5	Infrastructure - Piping
5300	INFRAS. - SEWER	1083	Infrastructure- Piping, Concrete, 10 Inch, 1,558 F	7/1/1972	$ 10,433				5	Infrastructure - Piping
5300	INFRAS. - SEWER	1084	Infrastructure- Piping, Concrete, 21 Inch, 1,218 F	7/1/1972	$ 15,487				5	Infrastructure - Piping

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A/C No	A/C Category	ID	Description	Date Acquired	Original Cost	Unused Capacity (%)	Original Cost of Unused Capacity	Original Cost of Used Capacity	Asset Category	
5300	INFRAS. - SEWER	1085	Infrastructure- Piping, Concrete, 15 Inch, 2,560 F	7/1/1972	$ 21,402				5	Infrastructure - Piping
5300	INFRAS. - SEWER	1086	Infrastructure- Piping, Concrete, 12 Inch, 3,420 F	7/1/1972	$ 26,403				5	Infrastructure - Piping
5300	INFRAS. - SEWER	1087	Infrastructure- Piping, Concrete, 8 Inch, 10,267 F	7/1/1972	$ 55,259				5	Infrastructure - Piping
5300	INFRAS. - SEWER	1088	Infrastructure- Piping, Polyvinyl Chloride, 8 Inch	7/1/1972	$ 183				5	Infrastructure - Piping
5300	INFRAS. - SEWER	1089	Infrastructure- Piping, Asbestos Cement, 4 Inch, 9	7/1/1972	$ 7,472				5	Infrastructure - Piping
5300	INFRAS. - SEWER	1090	Infrastructure- Piping, Cast Iron, 8 Inch, 1,040 F	7/1/1972	$ 5,178				5	Infrastructure - Piping
5300	INFRAS. - SEWER	1091	Infrastructure- Piping, Concrete, 6 Inch, 257 Ft.	7/1/1972	$ 1,077				5	Infrastructure - Piping
5300	INFRAS. - SEWER	1092	Infrastructure- Manholes, 6 Ea.	7/1/1973	$ 3,995				4	Infrastructure - Manholes
5300	INFRAS. - SEWER	1093	Infrastructure- Piping, Polyvinyl Chloride, 8 Inch	7/1/1973	$ 4,719				5	Infrastructure - Piping
5300	INFRAS. - SEWER	1094	Infrastructure- Pump, Centrifugal, 47931174, 3hp,	6/1/1974	$ 1,892				6	Infrastructure - Pumps
5300	INFRAS. - SEWER	1095	Infrastructure- Manholes, 45 Ea.	7/1/1974	$ 32,675				4	Infrastructure - Manholes
5300	INFRAS. - SEWER	1096	Infrastructure- Piping, Concrete, 10 Inch, 662 Ft.	7/1/1974	$ 5,318				5	Infrastructure - Piping
5300	INFRAS. - SEWER	1097	Infrastructure- Piping, Concrete, 12 Inch, 1,786 F	7/1/1974	$ 16,541				5	Infrastructure - Piping
5300	INFRAS. - SEWER	1098	Infrastructure- Piping, Concrete, 6 Inch, 137 Ft.	7/1/1974	$ 638				5	Infrastructure - Piping
5300	INFRAS. - SEWER	1099	Infrastructure- Piping, Concrete, 8 Inch, 7,246 Ft	7/1/1974	$ 46,785				5	Infrastructure - Piping
5300	INFRAS. - SEWER	1100	Infrastructure- Manholes, 18 Ea.	7/1/1975	$ 14,576				4	Infrastructure - Manholes
5300	INFRAS. - SEWER	1101	Infrastructure- Piping, Concrete, 6 Inch, 54 Ft.	7/1/1975	$ 303				5	Infrastructure - Piping
5300	INFRAS. - SEWER	1102	Infrastructure- Piping, Concrete, 8 Inch, 3,805 Ft	7/1/1975	$ 27,398				5	Infrastructure - Piping
5300	INFRAS. - SEWER	1103	Infrastructure- Pump, Centrifugal, w/Piping, Valve	6/1/1976	$ 1,296				6	Infrastructure - Pumps
5300	INFRAS. - SEWER	1104	Infrastructure- Pump, Centrifugal, w/Piping, Valve	6/1/1976	$ 1,296				6	Infrastructure - Pumps
5300	INFRAS. - SEWER	1105	Infrastructure- Manholes, 45 Ea.	7/1/1976	$ 38,719				4	Infrastructure - Manholes
5300	INFRAS. - SEWER	1106	Infrastructure- Piping, Concrete, 15 Inch, 880 Ft.	7/1/1976	$ 10,458				5	Infrastructure - Piping
5300	INFRAS. - SEWER	1107	Infrastructure- Piping, Concrete, 6 Inch, 59 Ft.	7/1/1976	$ 352				5	Infrastructure - Piping
5300	INFRAS. - SEWER	1108	Infrastructure- Piping, Concrete, 8 Inch, 8,865 Ft	7/1/1976	$ 67,827				5	Infrastructure - Piping
5300	INFRAS. - SEWER	1109	Infrastructure- Manholes, 125 Ea.	7/1/1977	$ 113,250				4	Infrastructure - Manholes
5300	INFRAS. - SEWER	1110	Infrastructure- Piping, Concrete, 10 Inch, 2,511 F	7/1/1977	$ 25,168				5	Infrastructure - Piping
5300	INFRAS. - SEWER	1111	Infrastructure- Piping, Concrete, 15 Inch, 1,795 F	7/1/1977	$ 22,462				5	Infrastructure - Piping
5300	INFRAS. - SEWER	1112	Infrastructure- Piping, Concrete, 8 Inch, 23,002 F	7/1/1977	$ 185,309				5	Infrastructure - Piping
5300	INFRAS. - SEWER	1113	Infrastructure- Pump, Centrifugal, 674868, 15hp, 1	6/1/1978	$ 4,378				6	Infrastructure - Pumps
5300	INFRAS. - SEWER	1114	Infrastructure- Pump, Centrifugal, 439022N, 7 1/2h	6/1/1978	$ 4,100				6	Infrastructure - Pumps

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5300	INFRAS. - SEWER	1115	Infrastructure- Manholes, 123 Ea.	7/1/1978	$ 119,867				4	Infrastructure - Manholes
5300	INFRAS. - SEWER	1116	Infrastructure- Piping, Ductile Iron, 8 Inch, 8,19	7/1/1978	$ 183,162				5	Infrastructure - Piping
5300	INFRAS. - SEWER	1117	Infrastructure- Piping, Ductile Iron, 6 Inch, 100	7/1/1978	$ 1,437				5	Infrastructure - Piping
5300	INFRAS. - SEWER	1118	Infrastructure- Piping, Concrete, 15 Inch, 697 Ft.	7/1/1978	$ 9,382				5	Infrastructure - Piping
5300	INFRAS. - SEWER	1119	Infrastructure- Piping, Ductile Iron, 12 Inch, 40	7/1/1978	$ 1,237				5	Infrastructure - Piping
5300	INFRAS. - SEWER	1120	Infrastructure- Piping, Ductile Iron, 10 Inch, 2,9	7/1/1978	$ 79,891				5	Infrastructure - Piping
5300	INFRAS. - SEWER	1121	Infrastructure- Piping, Concrete, 6 Inch, 788 Ft.	7/1/1978	$ 5,317				5	Infrastructure - Piping
5300	INFRAS. - SEWER	1122	Infrastructure- Piping, Concrete, 8 Inch, 13,315 F	7/1/1978	$ 115,382				5	Infrastructure - Piping
3300	BUILDING IMPROVEMENTS	1042	Building- Lift Station #4	1/1/1979	$ 19,008				3	Buildings
5300	INFRAS. - SEWER	1123	Infrastructure- Sewage Lift Station #4, Asset #B02	1/1/1979	$ 8,830				7	Infrastructure - Lift Stations
5300	INFRAS. - SEWER	1124	Infrastructure- Pump, Centrifugal, 53-035-518-6, 1	6/1/1979	$ 6,192				6	Infrastructure - Pumps
5300	INFRAS. - SEWER	1125	Infrastructure- Pump, Sludge, 1200 RPM w/Piping, V	6/1/1979	$ 2,592				6	Infrastructure - Pumps
5300	INFRAS. - SEWER	1126	Infrastructure- Pump, Sludge, 1200 RPM, 7901-1197	6/1/1979	$ 2,592				6	Infrastructure - Pumps
5300	INFRAS. - SEWER	1127	Infrastructure- Pump, Centrifugal, 52-025-519-6, 4	6/1/1979	$ 6,192				6	Infrastructure - Pumps
5300	INFRAS. - SEWER	1128	Infrastructure- Pump, Water, 39, Asset #Z00143	6/1/1979	$ 1,008				6	Infrastructure - Pumps
5300	INFRAS. - SEWER	1129	Infrastructure- Pump, Centrifugal w/Piping w/25hp	6/1/1979	$ 5,112				6	Infrastructure - Pumps
5300	INFRAS. - SEWER	1130	Infrastructure- Pump, Centrifugal w/Piping 14 3/32	6/1/1979	$ 5,112				6	Infrastructure - Pumps
5300	INFRAS. - SEWER	1131	Infrastructure- Manholes, 60 Ea.	7/1/1979	$ 63,906				4	Infrastructure - Manholes
5300	INFRAS. - SEWER	1132	Infrastructure- Piping, Ductile Iron, 8 Inch, 854	7/1/1979	$ 20,874				5	Infrastructure - Piping
5300	INFRAS. - SEWER	1133	Infrastructure- Piping, Concrete, 15 Inch, 485 Ft.	7/1/1979	$ 7,135				5	Infrastructure - Piping
5300	INFRAS. - SEWER	1134	Infrastructure- Piping, Concrete, 12 Inch, 721 Ft.	7/1/1979	$ 9,795				5	Infrastructure - Piping
5300	INFRAS. - SEWER	1135	Infrastructure- Piping, Polyvinyl Chloride, 8 Inch	7/1/1979	$ 451				5	Infrastructure - Piping
5300	INFRAS. - SEWER	1136	Infrastructure- Piping, Polyvinyl Chloride, 6 Inch	7/1/1979	$ 381				5	Infrastructure - Piping
5300	INFRAS. - SEWER	1137	Infrastructure- Piping, Ductile Iron, 16 Inch, 260	7/1/1979	$ 15,388				5	Infrastructure - Piping
5300	INFRAS. - SEWER	1138	Infrastructure- Piping, Cast Iron, 6 Inch, 155 Ft.	7/1/1979	$ 2,600				5	Infrastructure - Piping
5300	INFRAS. - SEWER	1139	Infrastructure- Piping, Concrete, 8 Inch, 10,424 F	7/1/1979	$ 98,726				5	Infrastructure - Piping
3300	BUILDING IMPROVEMENTS	1043	Building- Lift Station #3	1/1/1980	$ 12,403				3	Buildings
5300	INFRAS. - SEWER	1140	Infrastructure- Sewage Lift Station #3, (6 Ft. Dia	1/1/1980	$ 15,230				7	Infrastructure - Lift Stations
3300	BUILDING IMPROVEMENTS	1044	Building- PTA Sewage Lift Station #1, Asset #B0210	2/1/1980	$ 31,550				3	Buildings
1200	LAND IMPROVEMENTS	1049	Improvement- Fencing, Chain Link w/Gates	6/1/1980	$ 2,418				2	Land Improvements

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5300	INFRAS. - SEWER	1141	Infrastructure- Pump, Centrifugal, 30hp 1800 RPM,	6/1/1980	$ 5,727				6	Infrastructure - Pumps
5300	INFRAS. - SEWER	1142	Infrastructure- Pump, Centrifugal, 30hp 1800 RPM,	6/1/1980	$ 5,727				6	Infrastructure - Pumps
5300	INFRAS. - SEWER	1143	Infrastructure- Pump, 7299404-2, Submersible Motor	6/1/1980	$ 2,822				6	Infrastructure - Pumps
5300	INFRAS. - SEWER	1144	Infrastructure- Pump, 7299404-1, Submersible Motor	6/1/1980	$ 2,822				6	Infrastructure - Pumps
5300	INFRAS. - SEWER	1145	Infrastructure- PTA Sewer Lift Station #1, Asset #	6/1/1980	$ 161,779				7	Infrastructure - Lift Stations
5300	INFRAS. - SEWER	1146	Infrastructure- Manholes, 19 Ea.	7/1/1980	$ 22,259				4	Infrastructure - Manholes
5300	INFRAS. - SEWER	1147	Infrastructure- Lift Station #8	7/1/1980	$ 37,906				7	Infrastructure - Lift Stations
5300	INFRAS. - SEWER	1148	Infrastructure- Lift Station #7	7/1/1980	$ 37,906				7	Infrastructure - Lift Stations
5300	INFRAS. - SEWER	1149	Infrastructure- Piping, Concrete, 6 Inch, 774 Ft.	7/1/1980	$ 6,279				5	Infrastructure - Piping
5300	INFRAS. - SEWER	1150	Infrastructure- Piping, Concrete, 8 Inch, 3,423 Ft	7/1/1980	$ 35,659				5	Infrastructure - Piping
5300	INFRAS. - SEWER	1151	Infrastructure- Sewage Lift Station #2, (6 Ft. Dia	1/1/1981	$ 6,830				7	Infrastructure - Lift Stations
5300	INFRAS. - SEWER	1152	Infrastructure- Manholes, 13 Ea.	7/1/1981	$ 16,803				4	Infrastructure - Manholes
5300	INFRAS. - SEWER	1153	Infrastructure- Piping, Polyvinyl Chloride, 8 Inch	7/1/1981	$ 2,272				5	Infrastructure - Piping
5300	INFRAS. - SEWER	1154	Infrastructure- Piping, Concrete, 8 Inch, 2,552 Ft	7/1/1981	$ 29,332				5	Infrastructure - Piping
5300	INFRAS. - SEWER	1155	Infrastructure- Manholes, 3 Ea.	7/1/1982	$ 4,059				4	Infrastructure - Manholes
5300	INFRAS. - SEWER	1156	Infrastructure- Piping, Concrete, 8 Inch, 589 Ft.	7/1/1982	$ 7,087				5	Infrastructure - Piping
5300	INFRAS. - SEWER	1157	Infrastructure - Husky Pump Station, Asset #Z20060	12/1/1982	$ 41,147				7	Infrastructure - Lift Stations
5300	INFRAS. - SEWER	1158	Infrastructure- Manholes, 2 Ea.	7/1/1983	$ 2,755				4	Infrastructure - Manholes
5300	INFRAS. - SEWER	1159	Infrastructure- Piping, Polyvinyl Chloride, 4 Inch	7/1/1983	$ 1,714				5	Infrastructure - Piping
5300	INFRAS. - SEWER	1160	Infrastructure- Piping, Polyvinyl Chloride, 8 Inch	7/1/1984	$ 35,755				5	Infrastructure - Piping
5300	INFRAS. - SEWER	1161	Infrastructure- Piping, Polyvinyl Chloride, 12 Inc	7/1/1984	$ 1,661				5	Infrastructure - Piping
5300	INFRAS. - SEWER	1162	Infrastructure- Piping, Polyvinyl Chloride, 10 Inc	7/1/1984	$ 75,665				5	Infrastructure - Piping
5300	INFRAS. - SEWER	1163	Infrastructure- Manholes, 63 Ea.	7/1/1984	$ 89,147				4	Infrastructure - Manholes
5300	INFRAS. - SEWER	1164	Infrastructure- Piping, Ductile Iron, 15 Inch, 32	7/1/1984	$ 2,104				5	Infrastructure - Piping
5300	INFRAS. - SEWER	1165	Infrastructure- Piping, Concrete, 6 Inch, 1,708 Ft	7/1/1984	$ 16,735				5	Infrastructure - Piping
5300	INFRAS. - SEWER	1166	Infrastructure- Lift Station Transmitting Unit, As	2/1/1986	$ 6,300				7	Infrastructure - Lift Stations
5300	INFRAS. - SEWER	1167	Infrastructure- Manholes, 2 Ea.	7/1/1986	$ 2,899				4	Infrastructure - Manholes
5300	INFRAS. - SEWER	1168	Infrastructure- Piping, Concrete, 10 Inch, 474 Ft.	7/1/1986	$ 7,602				5	Infrastructure - Piping
5300	INFRAS. - SEWER	1169	Infrastructure- Manholes, 2 Ea.	7/1/1987	$ 2,941				4	Infrastructure - Manholes
5300	INFRAS. - SEWER	1170	Infrastructure- Piping, Polyvinyl Chloride, 8 Inch	7/1/1987	$ 1,222				5	Infrastructure - Piping

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5300	INFRAS. - SEWER	1171	Infrastructure- Piping, Concrete, 8 Inch, 341 Ft.	7/1/1987	$ 4,459				5	Infrastructure - Piping
3300	BUILDING IMPROVEMENTS	1045	Building Improvement-Intrusion Alarm System, Asset	9/1/1987	$ 1,450				2	Land Improvements
1100	LAND	91	Land- ID#67, State ID#1N3E26AD 100, Asset #L203(	6/1/1988	$ 1,500				1	Land
5300	INFRAS. - SEWER	1172	Infrastructure- Piping, Polyvinyl Chloride, 6 Inch	7/1/1990	$ 2,118				5	Infrastructure - Piping
5300	INFRAS. - SEWER	1173	Infrastructure- Manholes, 86 Ea.	7/1/1990	$ 142,665				4	Infrastructure - Manholes
5300	INFRAS. - SEWER	1174	Infrastructure- Piping, Ductile Iron, 8 Inch, 171	7/1/1990	$ 6,510				5	Infrastructure - Piping
5300	INFRAS. - SEWER	1175	Infrastructure- Piping, Polyvinyl Chloride, 8 Inch	7/1/1990	$ 136,132				5	Infrastructure - Piping
5300	INFRAS. - SEWER	1176	Infrastructure- Piping, Polyvinyl Chloride, 4 Inch	7/1/1990	$ 12,048				5	Infrastructure - Piping
4200	VEHICLE	1720	Sewer Tanker Vac-Con - 1FDZW82A8MVA17143	1/31/1991	$ 149,894				11	Vehicles
5300	INFRAS. - SEWER	1177	Infrastructure- Piping, Polyvinyl Chloride, 10 Inc	7/1/1991	$ 41,952				5	Infrastructure - Piping
5300	INFRAS. - SEWER	1178	Infrastructure- Piping, Ductile Iron, 6 Inch, 800	7/1/1991	$ 19,967				5	Infrastructure - Piping
5300	INFRAS. - SEWER	1179	Infrastructure- Manholes, 35 Ea.	7/1/1991	$ 59,229				4	Infrastructure - Manholes
5300	INFRAS. - SEWER	1180	Infrastructure- Piping, Polyvinyl Chloride, 8 Inch	7/1/1991	$ 31,884				5	Infrastructure - Piping
5300	INFRAS. - SEWER	1181	Infrastructure- Piping, Polyvinyl Chloride, 6 Inch	7/1/1991	$ 959				5	Infrastructure - Piping
5300	INFRAS. - SEWER	1182	Infrastructure- Piping, Polyvinyl Chloride, 10 Inc	7/1/1992	$ 3,028				5	Infrastructure - Piping
5300	INFRAS. - SEWER	1183	Infrastructure- Manholes, 44 Ea.	7/1/1992	$ 75,365				4	Infrastructure - Manholes
5300	INFRAS. - SEWER	1184	Infrastructure- Piping, Polyvinyl Chloride, 8 Inch	7/1/1992	$ 82,788				5	Infrastructure - Piping
5300	INFRAS. - SEWER	1185	Infrastructure- Piping, Concrete, 8 Inch, 275 Ft.	7/1/1992	$ 4,188				5	Infrastructure - Piping
5300	INFRAS. - SEWER	1186	Infrastructure- Manholes, 38 Ea.	7/1/1993	$ 66,349				4	Infrastructure - Manholes
5300	INFRAS. - SEWER	1187	Infrastructure- Piping, Polyvinyl Chloride, 8 Inch	7/1/1993	$ 75,989				5	Infrastructure - Piping
5300	INFRAS. - SEWER	1188	Infrastructure- Piping, Polyvinyl Chloride, 10 Inc	7/1/1994	$ 27,297				5	Infrastructure - Piping
5300	INFRAS. - SEWER	1189	Infrastructure- Manholes, 56 Ea.	7/1/1994	$ 100,533				4	Infrastructure - Manholes
5300	INFRAS. - SEWER	1190	Infrastructure- Piping, Polyvinyl Chloride, 8 Inch	7/1/1994	$ 95,780				5	Infrastructure - Piping
5300	INFRAS. - SEWER	1191	Infrastructure- Piping, Ductile Iron, 10 Inch, 228	7/1/1994	$ 11,567				5	Infrastructure - Piping
5300	INFRAS. - SEWER	1192	Infrastructure- Pump Station Beavercreek #5/Contro	4/1/1995	$ 375,700				7	Infrastructure - Lift Stations
5300	INFRAS. - SEWER	1193	Infrastructure- Piping, Polyvinyl Chloride, 15 Inc	7/1/1995	$ 17,570				5	Infrastructure - Piping
5300	INFRAS. - SEWER	1194	Infrastructure- Manholes, 31 Ea.	7/1/1995	$ 57,652				4	Infrastructure - Manholes
5300	INFRAS. - SEWER	1195	Infrastructure- Piping, Polyvinyl Chloride, 8 Inch	7/1/1995	$ 59,486				5	Infrastructure - Piping
5300	INFRAS. - SEWER	1196	Infrastructure- Piping, Polyvinyl Chloride, 8 Inch	7/1/1996	$ 58,046				5	Infrastructure - Piping
5300	INFRAS. - SEWER	1197	Infrastructure- Manholes, 28 Ea.	7/1/1996	$ 52,869				4	Infrastructure - Manholes

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5300	INFRAS. - SEWER	1198	Infrastructure- Piping, Ductile Iron, 8 Inch, 290	7/1/1996	$ 12,566				5	Infrastructure - Piping
4200	VEHICLE	1723	Truck, Pick-Up - 1GCGK24R4VZ218622	5/31/1997	$ 20,243				11	Vehicles
5300	INFRAS. - SEWER	1199	Infrastructure- Piping, Ductile Iron, 8 Inch, 967	7/1/1997	$ 42,577				5	Infrastructure - Piping
5300	INFRAS. - SEWER	1200	Infrastructure- Manholes, 43 Ea.	7/1/1997	$ 82,500				4	Infrastructure - Manholes
5300	INFRAS. - SEWER	1201	Infrastructure- Piping, Polyvinyl Chloride, 8 Inch	7/1/1997	$ 85,268				5	Infrastructure - Piping
5300	INFRAS. - SEWER	1202	Infrastructure- Pump Station Improvements, Asset #	10/1/1997	$ 71,390				7	Infrastructure - Lift Stations
5300	INFRAS. - SEWER	1203	Infrastructure- Manholes, 11 Ea.	7/1/1998	$ 21,287				4	Infrastructure - Manholes
5300	INFRAS. - SEWER	1204	Infrastructure- Piping, Polyvinyl Chloride, 8 Inch	7/1/1998	$ 24,239				5	Infrastructure - Piping
5300	INFRAS. - SEWER	1205	Infrastructure- Piping, Concrete, 8 Inch, 84 Ft.	7/1/1998	$ 1,445				5	Infrastructure - Piping
5300	INFRAS. - SEWER	1206	Infrastructure- Pump Station, Asset #Z22256	9/1/1998	$ 120,472				7	Infrastructure - Lift Stations
5300	INFRAS. - SEWER	1207	Infrastructure- Piping, Polyvinyl Chloride, 30 Inc	7/1/1999	$ 404,212				5	Infrastructure - Piping
5300	INFRAS. - SEWER	1208	Infrastructure- Piping, Polyvinyl Chloride, 24 Inc	7/1/1999	$ 150,809				5	Infrastructure - Piping
5300	INFRAS. - SEWER	1209	Infrastructure- Piping, Polyvinyl Chloride, 10 Inc	7/1/1999	$ 2,932				5	Infrastructure - Piping
5300	INFRAS. - SEWER	1210	Infrastructure- Manholes, 42 Ea.	7/1/1999	$ 81,523				4	Infrastructure - Manholes
4200	VEHICLE	1724	Truck, Sludge - 1HTGLAHT2YH226342	8/31/1999	$ 80,214				11	Vehicles
1100	LAND	92	Land- ID#109, State ID#1N3E24C 1900, Section 24,	3/28/2000	$ 1,448,000				1	Land
5300	INFRAS. - SEWER	1211	Infrastructure- Piping, Polyvinyl Chloride, 8 Inch	7/1/2000	$ 6,832				5	Infrastructure - Piping
5300	INFRAS. - SEWER	1212	Infrastructure- Manholes, 2 Ea.	7/1/2000	$ 3,952				4	Infrastructure - Manholes
5300	INFRAS. - SEWER	1213	Infrastructure- Piping, Polyvinyl Chloride, 8 Inch	7/1/2001	$ 5,454				5	Infrastructure - Piping
5300	INFRAS. - SEWER	1214	Infrastructure- Manhole	7/1/2001	$ 1,993				4	Infrastructure - Manholes
5300	INFRAS. - SEWER	1215	Infrastructure- Piping, Polyvinyl Chloride, 6 Inch	7/1/2001	$ 266				5	Infrastructure - Piping
4200	VEHICLE	1725	Truck, Pick-Up - 1FDXF47S92EC81731	6/30/2002	$ 28,858				11	Vehicles
3300	BUILDING IMPROVEMENTS	1047	Building- Water Pollution Control Facility Mainten	7/1/2002	$ 173,565				3	Buildings
3300	BUILDING IMPROVEMENTS	1048	Building- Water Pollution Control Facility Adminis	7/1/2002	$ 540,590				3	Buildings
1200	LAND IMPROVEMENTS	1050	Improvement- Light Pole, Steel, 20 Ft., 12 Ea. w/F	7/1/2002	$ 23,205				2	Land Improvements
1200	LAND IMPROVEMENTS	1051	Improvement- Fencing, Chain Link, 2,500 Ft., Barbe	7/1/2002	$ 37,328				2	Land Improvements
1200	LAND IMPROVEMENTS	1052	Improvement- Trees, Various Sizes	7/1/2002	$ 54,945				2	Land Improvements
1200	LAND IMPROVEMENTS	1053	Improvement- Sign, Concrete, 36 Sq. Ft.	7/1/2002	$ 409				2	Land Improvements
1200	LAND IMPROVEMENTS	1054	Improvement- Shrubs, Medium, 13 Ea.	7/1/2002	$ 472				2	Land Improvements
1200	LAND IMPROVEMENTS	1055	Improvement- Parking Lot, Asphalt, Spot, 12 Ea.	7/1/2002	$ 12,301				2	Land Improvements

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Assets as of FY Ending 6/30/	2012

A/C No	A/C Category	ID	Description	Date Acquired	Original Cost	Unused Capacity (%)	Original Cost of Unused Capacity	Original Cost of Used Capacity		Asset Category
5300	INFRAS. - SEWER	1216	Infrastructure- Wastewater Treatment Plant, 3.0 MG	7/1/2002	$17,536,684				8	Infrastructure - WWTP
5300	INFRAS. - SEWER	1217	Infrastructure- Piping, Polyvinyl Chloride, 8 Inch	7/1/2002	$ 10,603				5	Infrastructure - Piping
5300	INFRAS. - SEWER	1218	Infrastructure- Manholes, 10 Ea.	7/1/2002	$ 20,048				4	Infrastructure - Manholes
5300	INFRAS. - SEWER	1219	Infrastructure- Piping, Ductile Iron, 4 Inch, 1,30	7/1/2002	$ 34,502				5	Infrastructure - Piping
4000	EQUIPMENT	1792	Hoist, Engine Hydraulic, 1+ Ton	9/30/2002	$ 8,712				10	Equipment
5300	INFRAS. - SEWER	1220	Infrastructure- Piping, Polyvinyl Chloride, 8 Inch	7/1/2003	$ 2,159				5	Infrastructure - Piping
5300	INFRAS. - SEWER	1221	Infrastructure- Pump Station #6 Sandy Heights, Res	12/9/2003	$ 129,308				7	Infrastructure - Lift Stations
5300	INFRAS. - SEWER	1222	Infrastructure- Pump Station Upgrade, Piping, Wate	6/30/2004	$ 262,723				7	Infrastructure - Lift Stations
5300	INFRAS. - SEWER	1223	Infrastructure- Piping, Polyvinyl Chloride, 8 Inch	7/1/2004	$ 102,484				5	Infrastructure - Piping
5300	INFRAS. - SEWER	1224	Infrastructure- Manholes, 40 Ea.	7/1/2004	$ 84,370				4	Infrastructure - Manholes
1200	LAND IMPROVEMENTS	1056	Improvement- Landscape/Fencing/Retaining Wall/Pa	9/22/2004	$ 32,300				2	Land Improvements
5300	INFRAS. - SEWER	1225	Infrastructure- Piping, Polyvinyl Chloride, 8 Inch	2/14/2006	$ 69,562				5	Infrastructure - Piping
5300	INFRAS. - SEWER	1226	Infrastructure- Manholes, 9 Ea., Morgan Meadows Ph	2/14/2006	$ 20,991				4	Infrastructure - Manholes
5300	INFRAS. - SEWER	1227	Infrastructure- Piping, Polyvinyl Chloride, 8 Inch	5/9/2006	$ 24,100				5	Infrastructure - Piping
5300	INFRAS. - SEWER	1228	Infrastructure- Manholes, 2 Ea., Sandy Dell Acres	5/9/2006	$ 9,000				4	Infrastructure - Manholes
5300	INFRAS. - SEWER	1831	06-07 SEWER COLLECTION SCADA SYSTEM	7/1/2006	$ 41,775				9	Infrastructure - Scada System
5300	INFRAS. - SEWER	1838	06-07 INFRAS 257TH PROJECT	7/1/2006	$ 82,686				5	Infrastructure - Piping
2000	CONST. IN PROCESS	1889	NW Grahm Rd Reconst. 07-08	7/1/2007	$ 2,364				5	Infrastructure - Piping
5200	INFRAS. - STORM	1890	Tyson Place Strom Sewer	7/1/2007	$ 56,486				13	Infrastructure - Storm Sewer [g]
5200	INFRAS. - STORM	1891	Sandy Hieghts Storm Sewer Project	7/1/2007	$ 13,536				13	Infrastructure - Storm Sewer [g]
5200	INFRAS. - STORM	1892	Columbia Crest Storm Sewr Project	7/1/2007	$ 3,864				13	Infrastructure - Storm Sewer [g]
4000	EQUIPMENT	1879	Diesel Engine Generator - DGK45C	6/30/2008	$ 20,156				10	Equipment
5300	INFRAS. - SEWER	1903	I-84 Sewer Realingment	7/1/2008	$ 402,278				5	Infrastructure - Piping
5300	INFRAS. - SEWER	1912	Parks & Facilities Bldg-sewer	7/1/2008	$ 17,205				3	Buildings
5300	INFRAS. - SEWER	1929	Riverbend West Res1969-8" PVC sewer main	7/1/2008	$ 101,390				5	Infrastructure - Piping
5300	INFRAS. - SEWER	1935	Sewer SCADA System	7/1/2008	$ 133,033				9	Infrastructure - Scada System
4200	VEHICLE	1948	Chevy colorado Crew Cab	7/1/2009	$ 21,361				11	Vehicles
5300	INFRAS. - SEWER	1957	I-84 Sewer realingment	7/1/2009	$ 7,568				5	Infrastructure - Piping
5300	INFRAS. - SEWER	1966	Sewer SCADA	7/1/2009	$ 8,758				9	Infrastructure - Scada System
4200	VEHICLE	2016	2012 Colorado CREW Cab Pickup	7/1/2011	$ 21,343				11	Vehicles

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Assets as of FY Ending 6/30/	2012

A/C No	A/C Category	ID	Description	Date Acquired	Original Cost	Unused Capacity (%)	Original Cost of Unused Capacity	Original Cost of Used Capacity	Asset Category
Total Plant-in-Service (Fixed Assets)					$27,318,439		$ -	$ -	

City of Troutdale, OR

Wastewater System Financial Plan Update & SDC Study

Plant-in-Service Summary and Detemination of Unused Capacities

Summary of Assets as of FY Ending 6/30/	2012

	Asset Category	Original Cost [a]	Utility Funded Portion	Outside Funding	Notes
1	Land	$ 1,555,070	$ 858,378	$ 696,692	[b, c]
2	Land Improvements	$ 164,828	$ 90,983	$ 73,845	[b, c]
3	Buildings	$ 794,321	$ 438,455	$ 355,866	[b, c]
4	Infrastructure - Manholes	$ 1,547,245	$ 232,087	$ 1,315,158	[d]
5	Infrastructure - Piping	$ 3,768,789	$ 565,318	$ 3,203,471	[d]
6	Infrastructure - Pumps	$ 62,158	$ 9,324	$ 52,834	[d]
7	Infrastructure - Lift Stations	$ 1,281,111	$ 1,151,803	$ 129,308	[e]
8	Infrastructure - WWTP	$ 17,536,684	$ 9,680,019	$ 7,856,665	[c]
9	Infrastructure - Scada System	$ 183,566	$ 183,566	$ -	[f]
10	Equipment	$ 28,868	$ 28,868	$ -	[f]
11	Vehicles	$ 321,913	$ 321,913	$ -	[f]
12	Other	$ -	$ -	$ -	
	TOTAL SEWER UTILITY	**$ 27,244,553**	**$ 13,560,713**	**$ 13,683,840**	
13	Infrastructure - Storm Sewer **[g]**	$ 73,885			
	TOTAL RECORDED ASEETS	**$ 27,318,439**			

[a] Original cost information reflect the fixed asset listing, provided by the City's finance department.

[b] Land, land improvements, and buildings are associated with the new treatment plant, and funded by bond proceeds (per Amy Pepper's email, dated April 25, 2013.

[c] Funding mix of the WWTP and other related asset categories are assumed to follow the sources of repayments, as documented below:

	Sewer Fund	Sewer Improvement Fund	subtotal: Utility Sources	Property Tax (Outside Sources)	TOTAL
Actual / Budgeted Payments through FY 2014	$ 5,296,649	$ 4,548,668	$ 9,845,317	$ 9,084,504	$ 18,929,821
Planned Remaining Payments	$ 1,432,337	$ 1,995,040	$ 3,427,377	$ 1,688,111	$ 5,115,488
TOTAL	**$ 6,728,986**	**$ 6,543,708**	**$ 13,272,694**	**$ 10,772,615**	**$ 24,045,309**
Percentage Shares	28.0%	27.2%	**55.2%**	**44.8%**	100.0%

Source: City's Finance Department; Erich Mueller's email dated April 3, 2013.

NOTE: Per Amy Pepper's email dated April 25, 2013, utility funded portions of these asset categories were as follows:

Land	*$ 1,448,000*
Land Improvements	*$ 160,960*
Buildings	*$ 714,155*
Infrastructure - WWTP	*$ 17,536,684*

[d] These assets are mostly funded by LIDs and developers. Outside funding portion of the original costs is assumed to be around 85% (per Amp Pepper's email dated April 15, 2013).
The remainng 15.0% is assumed to be funded by utility sources such as utility fees, SDC revenues, or debt.

[e] Utility funded portion of lift station costs is provided by Amy Pepper (per her eamil dated April 25, 2013).

[f] Fully funded by utility fees (per Amy Pepper's email date April 25, 2013)

[g] Removed from the sewer utility's fixed asset listing (per Amy Pepper's email dated April 25, 2013)

City of Troutdale, OR
Wastewater System Financial Plan Update & SDC Study
Plant-in-Service Summary and Detemination of Unused Capacities

Unused Capacities in the Existing Plant

	Asset Category	Utility Funded Portion of Original Cost	Unused Capacity (%)	Original Cost of Unused Capacity	Original Cost of Used Capacity	Notes
1	Land	$ 858,378	54.3%	$ 465,977	$ 392,401	[a]
2	Land Improvements	$ 90,983	54.3%	$ 49,391	$ 41,592	[a]
3	Buildings	$ 438,455	54.3%	$ 238,018	$ 200,436	[a]
4	Infrastructure - Manholes	$ 232,087	30.7%	$ 71,362	$ 160,724	[b]
5	Infrastructure - Piping	$ 565,318	30.7%	$ 173,825	$ 391,493	[c]
6	Infrastructure - Pumps	$ 9,324	54.3%	$ 5,061	$ 4,262	[a]
7	Infrastructure - Lift Stations	$ 1,151,803	50.5%	$ 581,253	$ 570,550	[d]
8	Infrastructure - WWTP	$ 9,680,019	54.3%	$ 5,254,867	$ 4,425,151	[a]
9	Infrastructure - Scada System	$ 183,566	38.4%	$ 70,522	$ 113,045	[e]
10	Equipment	$ 28,868	38.4%	$ 11,090	$ 17,778	[e]
11	Vehicles	$ 321,913	38.4%	$ 123,671	$ 198,242	[e]
12	Other	$ -		$ -	$ -	
	TOTAL SEWER UTILITY	**$ 13,560,713**	**25.9%**	**$ 7,045,038**	**$ 6,515,676**	

[a] Unused capacity of the treatment plant and other related asset categories are determined as follows (*information provided by James Hansen*):

Max. daily plant flow capacity		6.30	mgd
Max. daily flow at the plant		2.88	mgd
Used capacity	45.7%	=> 2.88 / 6.3	
Unused capacity	**54.3%**	=> (6.3 - 2.88) / 6.3	

[b] Unused capacity of manholes is assumed to be similar to unused capacity in pipes.

[c] Unused capacity in pipes is determined as follows *(information provided by James Hansen, email dated April 23, 2013)* :

Capacity-Length (gpm-ft) of Full Flow Scenario		139,697,454
Capacity-Length (gpm-ft) of Existing Flow Scenario		48,239,542
Capacity-Length (gpm-ft) of Future Flow Scenario		69,658,174
Used capacity	69.3%	=> 48,239,542 / 69,658,174
Unused capacity	**30.7%**	=> (69,658,174 - 48,239,542) / 69,658,174

[d] Unused capacity in lift stations is determined as follows *(information provided by James Hansen, email dated April 24, 2013)* :

Lift Station No	Estimated Current Peak Flow (gpm)	Estimated 2040 Peak Flow (gpm)
1	308	860
2	80	130
3	80	130
4	70	200
5	1,770	2,500
6	unknown	unknown
7	94	397
8	56	229
9	101	430
10	-	290
Total	**2,559**	**5,166**

Used capacity	49.5%	=> 2559 / 5166
Unused capacity	**50.5%**	=> (5166 - 2559) / 5166

[e] Growth's share in total customer base at the end of the analysis period.

City of Troutdale, OR

Wastewater System Financial Plan Update & SDC Study

Capital Improvement Program

				FUNDING OF PROJECT COSTS				SDC ELIGIBILITY			
				% of Funding		$ Funding by Source		% Allocation of Project Costs		$ Allocation of Project Costs	
No	**Description**	**Total Project Cost (2013 dollars)**	**Construction / Acquisition Year**	**Outside Sources**	**Enterprise Fund**	**Outside Sources**	**Enterprise Fund**	**Existing Needs**	**SDC Eligible**	**Existing Needs**	**SDC Eligible**
	Sewer Upgrades										
1	Buxton Road	$ 501,000		0.0%	100.0%	$ -	$ 501,000	61.6%	38.4%	$ 308,528	$ 192,472
2	Lower Beaver Creek / Troutdale Road	3,417,000		0.0%	100.0%	-	3,417,000	61.6%	38.4%	2,104,272	1,312,728
3	Airport / Graham	646,000		100.0%	0.0%	646,000	-	100.0%	0.0%	-	-
4	PS-9 Trunk	253,000		100.0%	0.0%	253,000	-	100.0%	0.0%	-	-
	Pump Station and Force Main Upgrades										
1	PS-1, new force main (10-inch, 3,560 feet)	$ 2,690,000		0.0%	100.0%	$ -	$ 2,690,000	0.0%	100.0%	$ -	$ 2,690,000
2	PS-2	369,000		0.0%	100.0%	-	369,000	0.0%	100.0%	-	369,000
3	PS-5, new pumps (2,500 gpm / 3.6 mgd)	454,000		0.0%	100.0%	-	454,000	100.0%	0.0%	454,000	-
4	PS-7, new pumps (400 gpm / 0.58 mgd)	145,000		0.0%	100.0%	-	145,000	100.0%	0.0%	145,000	-
5	PS-9, new pumps (450 gpm / 0.65 mgd)	242,000		100.0%	0.0%	242,000	-	100.0%	0.0%	-	-
1	SE Jackson Park Road	$ 950,000		50.0%	50.0%	$ 475,000	$ 475,000	10.0%	90.0%	$ 47,500	$ 427,500
2	East Historic Columbia River Highway	3,250,000		50.0%	50.0%	1,625,000	1,625,000	4.2%	95.8%	68,662	1,556,338
3	Troutdale Reynolds Industrial Park (TRIP) Extensions	3,133,000		100.0%	0.0%	3,133,000	-	0.0%	100.0%	-	-
	Additional Capital Projects										
1	Vehicle Replacement (every other year) - 2015	$ 12,000	2015	0.0%	100.0%	$ -	$ 12,000	100.0%	0.0%	$ 12,000	$ -
2	Vehicle Replacement (every other year) - 2017	12,000	2017	0.0%	100.0%	-	12,000	100.0%	0.0%	12,000	-
3	Vehicle Replacement (every other year) - 2019	12,000	2019	0.0%	100.0%	-	12,000	100.0%	0.0%	12,000	-
4	Vehicle Replacement (every other year) - 2021	12,000	2021	0.0%	100.0%	-	12,000	100.0%	0.0%	12,000	-
5	Vehicle Replacement (every other year) - 2023	12,000	2023	0.0%	100.0%	-	12,000	100.0%	0.0%	12,000	-
6	Vehicle Replacement (every other year) - 2025	12,000	2025	0.0%	100.0%	-	12,000	100.0%	0.0%	12,000	-
	FY 2012-13 Budgeted Capital Improvement Projects										
1	Equipment	$ 7,200	2013	0.0%	100.0%	$ -	$ 7,200	100.0%	0.0%	$ 7,200	$ -
2	Motor Vehicle - Replace Pickup Truck (0.80)	12,000	2013	0.0%	100.0%	-	12,000	100.0%	0.0%	12,000	-
3	Motor Vehicle - Vac Truck (60%)	185,000	2013	0.0%	100.0%	-	185,000	100.0%	0.0%	185,000	-
4	Motor Vehicle - Biosolids truck & Equipment	135,000	2013	0.0%	100.0%	-	135,000	100.0%	0.0%	135,000	-
5	Projects - Sanitary Sewer Master Plan (Utility Fund)	50,000	2013	0.0%	100.0%	-	50,000	100.0%	0.0%	50,000	-
6	Projects - Biosolids Reduction Study	20,000	2013	0.0%	100.0%	-	20,000	100.0%	0.0%	20,000	-
7	Projects - Biosolids Pilot Project	50,000	2013	0.0%	100.0%	-	50,000	100.0%	0.0%	50,000	-
8	Projects - Blower efficiency project	60,000	2013	0.0%	100.0%	-	60,000	100.0%	0.0%	60,000	-
9	Projects - Site preparation GSA	25,000	2013	0.0%	100.0%	-	25,000	100.0%	0.0%	25,000	-
10	Projects - Update Master Plan (Sewer Improvement Fu	30,000	2013	0.0%	100.0%	-	30,000	0.0%	100.0%	-	30,000
	FY 2013-14 Budgeted Capital Improvement Projects										
	Equipment	$ 38,750	2014	0.0%	100.0%	$ -	$ 38,750	100.0%	0.0%	$ 38,750	$ -
	Motor Vehicle	12,000	2014	0.0%	100.0%	-	12,000	100.0%	0.0%	$ 12,000	$ -
	Projects - Biosolids Lagoon Cleaning	250,000	2014	0.0%	100.0%	-	250,000	100.0%	0.0%	$ 250,000	$ -
	Projects - Biosolids Pilot Project	35,000	2014	0.0%	100.0%	-	35,000	100.0%	0.0%	$ 35,000	$ -
	Projects - Blower efficiency project	120,000	2014	0.0%	100.0%	-	120,000	100.0%	0.0%	$ 120,000	$ -
	Projects - Site preparation GSA	25,000	2014	0.0%	100.0%	-	25,000	100.0%	0.0%	$ 25,000	$ -
	Projects - Digester Mixer Repair	35,000	2014	0.0%	100.0%	-	35,000	100.0%	0.0%	$ 35,000	$ -
	Total Capital Projects	**$ 17,211,950**				**$ 6,374,000**	**$ 10,837,950**			**$ 4,259,912**	**$ 6,578,038**

City of Troutdale, OR
Wastewater System Financial Plan Update & SDC Study
SDC Calculation

		Cost Basis	Unit Basis ERUs
Reimbursement Fee			
Original Cost of Plant-in-Service (utility funded portion)		$ 13,560,713	
Unused Capacity		25.9%	
Cost of Unused Capacity		$ 7,045,038	
less: Outstanding Debt Principal	-	-	
Net Reimbursement Fee Cost Basis		**$ 7,045,038**	
Growth to End of Planning Period			4,041
Reimbursement Fee			**$ 1,743**
Improvement Fee			
Total Capital Improvement Projects		$ 17,211,950	
less: Anticipated Outside Funding Sources		$ (6,374,000)	
less: Cost of Existing Deficiencies		(4,259,912)	
Capacity Expanding CIP		$ 6,578,038	
less: Existing SDC Fund Balance		(74,560)	
Net Cost Basis for Improvement Fee		**$ 6,503,478**	
Growth to End of Planning Period (20 years; 2008-2027)			4,041
Improvement Fee			**$ 1,609**
Total System Development Charge			
Reimbursement Fee			$ 1,743
Improvement Fee			$ 1,609
SDC Subtotal			$ 3,352
plus: Administrative Cost Recovery		1.78%	$ 60
Total SDC			**$3,412**
			per ERU

City of Troutdale, OR
Wastewater System Financial Plan Update & SDC Study
Administrative Cost Recovery

Net Annual Administrative Cost related to SDCs (1)	$	10,000
Amortization of SDC Analysis Cost over 5 years (2):	$	2,071
Net Annual SDC Administrative Cost:	**$**	**12,071**

Estimated Annual Proposed SDC Revenues before Admin. Cost:

Estimated Annual Revenue from Sewer SDC	$	677,238
Admin. Cost/Total Annual SDC Revenues		**1.78%**

NOTES:

(1) Per Amy Pepper's email dated April 25, 2013.

(2)

Cost of:	**$8,965**	
at:	**5.0%**	
over:	**5**	years

(3) Study Period **20** years